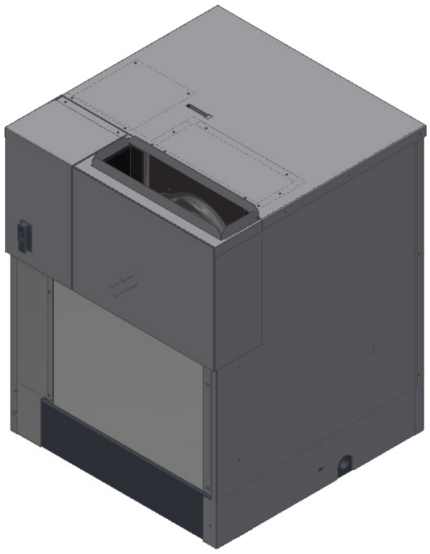
Service Manual

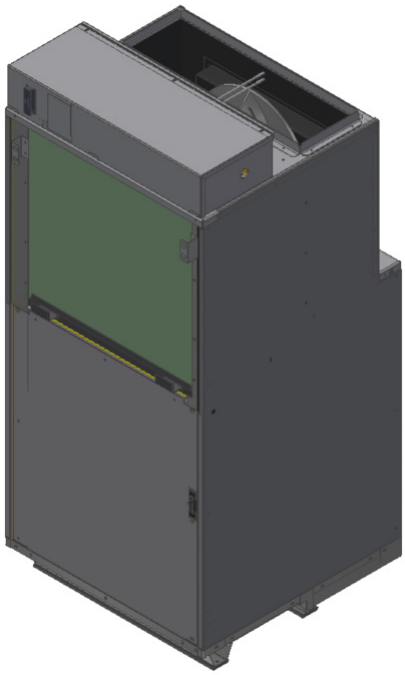
FRIEDRICH

VERT-I-PAK®

Single Package Vertical Heat Pump System

R-32 Refrigerant





9K	**VHA - 09K25RCQ, 09K34RCQ, 09K50RCQ** **VHA - 09R25RCQ, 09R34RCQ, 09R50RCQ**
12K	**VHA - 12K25RCQ, 12K34RCQ, 12K50RCQ** **VHA - 12R25RCQ, 12R34RCQ, 12R50RCQ**
18K	**VHA - 18K25RCQ, 18K34RCQ, 18K50RCQ, 18K75RCQ** **VHA - 18R25RCQ, 18R34RCQ, 18R50RCQ, 18R75RCQ**
24K	**VHA - 24K25RCQ, 24K34RCQ, 24K50RCQ, 24K75RCQ, 24K10RCQ** **VHA - 24R25RCQ, 24R34RCQ, 24R50RCQ, 24R75RCQ, 24R10RCQ**

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INTRODUCTION

Important Safety Information

The information in this manual is intended for use by a qualified technician who is familiar with the safety procedures required for installation and repair, and who is equipped with the proper tools and test instruments required to service this product.

Installation or repairs made by unqualified persons can result in subjecting the unqualified person making such repairs as well as the persons being served by the equipment to hazards resulting in injury or electrical shock which can be serious or even fatal.

Maintenance is the responsibility of the owner. Failure to properly maintain or repair equipment may result in personal injury and/or various types of property damage (fire, flood, etc.).

Safety warnings have been placed throughout this manual to alert you to potential hazards that may be encountered. If you install or perform service on equipment, it is your responsibility to read and obey these warnings to guard against any bodily injury or property damage which may result to you or others.
Due to continuing research in new energy-saving technology, all information in this manual is subject to change without notice.

This service manual is designed to be used in conjunction with the installation and operation manuals provided with each air conditioning system. This service manual was written to assist the professional service technician to quickly and accurately diagnose and repair malfunctions.

Installation procedures are not given in this manual. They are given in the Installation/Operation manual.

SAFETY IS IMPORTANT

We have provided many important safety messages in this manual and on your appliance. Always read and obey all safety messages.

This is a safety Alert symbol. This symbol alerts you to potential hazards that can kill or hurt you and others.

All safety messages will tell you what the potential hazard is, tell you how to reduce the chance of injury, and tell you what will happen if the instructions are not followed.

All safety messages will follow the safety alert symbol with the word “WARNING” or “CAUTION”. These words mean:

WARNING Indicates a hazard which, if not avoided, can result in severe personal injury or death and damage to product or other property.

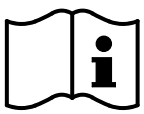
CAUTION Indicates a hazard which, if not avoided, can result in personal injury and damage to product or other property.

NOTICE Indicates property damage can occur if instructions are not followed.

This symbol indicates that this appliance uses a flammable refrigerant. If the refrigerant is leaked and is exposed to an external ignition source, there is a risk of fire.

This symbol indicates that the Operation Manual should be read carefully.

This symbol indicates that service personnel should be handling this equipment with reference to the installation manual.



This symbol indicates that information is available such as the Installation and Operation manual, or the Service Manual.

INTRODUCTION

Important Safety Information

⚠WARNING: The manufacturer's warranty does not cover any damage or defect to the air conditioner caused by the attachment or use of any components, accessories or devices (other than those authorized by the manufacturer) into, onto or in conjunction with the air conditioner. You should be aware that the use of unauthorized components, accessories or devices may adversely affect the operation of the air conditioner and may also endanger life and property. The manufacturer disclaims any responsibility for such loss or injury resulting from the use of such unauthorized components, accessories or devices.

⚠WARNING: This appliance is not intended for use by persons (Including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance.

⚠WARNING: The maximum altitude for this appliance is 2,000 meters(6,562 feet).

Do not use above 2,000 meters(6,562 feet).

⚠WARNING: Electrical Shock Hazard

Disconnect all power to the unit before starting maintenance. All electrical connections and wiring MUST be installed by a qualified electrician and conform to the National Code and all local codes which have jurisdiction. Failure to do so can result in property damage, severe electrical shock or death.

⚠WARNING: Read Installation Manual

Read this manual thoroughly prior to equipment installation or operation. It is the installer's responsibility to properly apply and install the equipment. Installation must be in conformance with the NFPA 70-2023 national electric code or current edition, International Mechanic code 2021 or current edition, and any other local or national codes.

⚠WARNING: Safety First

Do not remove, disable, or bypass this unit's safety devices. Doing so may cause fire, injuries, or death.

⚠WARNING: This Product uses R-32 Refrigerant

Refrigerant Safety Group A2L

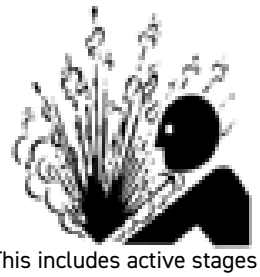
Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.

The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater.

Do not pierce or burn.

Be aware that refrigerants may not contain an odor.

⚠WARNING: Refrigeration System under High pressure



Do not puncture, heat, expose to flame or incinerate. Only certified refrigeration technicians should service this equipment. R32 systems operate at higher pressures than R22 equipment. Appropriate safe service and handling practices must be used.

⚠CAUTION: Do Not Operate Equipment During Active Stages Of Construction

To ensure proper operation, Friedrich requires that all equipment is not operated during active construction phases. This includes active stages of completing framing, drywalling, spackling, sanding, painting, flooring, and moulding in the equipment's designated conditioning space. The use of this equipment during construction could result in premature failure of the components and/or system and is in violation of our standard warranty guidelines. The operation of newly installed equipment during construction will accelerate the commencement and/or termination of the warranty period.

⚠WARNING: Keep all air circulation and ventilation openings free from obstruction.

⚠WARNING: The unit should not be in contact with any equipment that will transmit vibration to the unit. Any excessive vibration or pulsation to the unit could result in damage to the refrigerant tubing.

INTRODUCTION

Personal Injury Or Death Hazards

	⚠ WARNING	⚠ AVERTISSEMENT	⚠ ADVERTENCIA
SAFETY FIRST	Do not remove, disable or bypass this unit's safety devices. Doing so may cause fire, injuries, or death.	Ne pas supprime, désactiver ou contourner cette l´unité des dispositifs de sécurité, faire vous risqueriez de provoquer le feu, les blessures ou la mort.	No eliminar, desactivar o pasar por alto los dispositivos de seguridad de la unidad. Si lo hace podría producirse fuego, lesiones o muerte.

⚠ WARNING
ALWAYS USE INDUSTRY STANDARD PERSONAL PROTECTIVE EQUIPMENT (PPE)

ELECTRICAL HAZARDS:

- Unplug and/or disconnect all electrical power to the unit before performing inspections, maintenance, or service.
- Make sure to follow proper lockout/tag out procedures.
- Always work in the company of a qualified assistant if possible.
- Capacitors, even when disconnected from the electrical power source, retain an electrical charge potential capable of causing electric shock or electrocution.
- Handle, discharge, and test capacitors according to safe, established, standards, and approved procedures.
- Extreme care, proper judgment, and safety procedures must be exercised if it becomes necessary to test or troubleshoot equipment with the power on to the unit.
- Do not spray water on the air conditioning unit while the power is on.
- Electrical component malfunction caused by water could result in electric shock or other electrically unsafe conditions when the power is restored and the unit is turned on, even after the exterior is dry.
- Use air conditioner on a single dedicated circuit within the specified amperage rating.
- Follow all safety precautions and use proper and adequate protective safety aids such as: gloves, goggles, clothing, properly insulated tools, and testing equipment etc.
- Failure to follow proper safety procedures and/or these warnings can result in serious injury or death.

INTRODUCTION

Personal Injury Or Death Hazards

- **REFRIGERATION SYSTEM REPAIR HAZARDS:**
- Use approved standard refrigerant recovering procedures and equipment to relieve high pressure before opening system for repair. Reference EPA regulations (40 CFR Part 82, Subpart F) Section 608.
- Do not allow liquid refrigerant to contact skin. Direct contact with liquid refrigerant can result in minor to moderate injury.
- Be extremely careful when using an oxy-acetylene torch. Direct contact with the torch's flame or hot surfaces can cause serious burns.
- Make certain to protect personal and surrounding property with fire proof materials and have a fire extinguisher at hand while using a torch.
- Provide adequate ventilation to vent off toxic fumes, and work with a qualified assistant whenever possible.
- Always use a pressure regulator when using dry nitrogen to test the sealed refrigeration system for leaks, flushing etc.
- **MECHANICAL HAZARDS:**
- Extreme care, proper judgment and all safety procedures must be followed when testing, troubleshooting, handling, or working around unit with moving and/or rotating parts.
- Be careful when, handling and working around exposed edges and corners of the sleeve, chassis, and other unit components especially the sharp fins of the indoor and outdoor coils.
- Use proper and adequate protective aids such as: gloves, clothing, safety glasses etc.
- Failure to follow proper safety procedures and/or these warnings can result in serious injury or death.

• PROPERTY DAMAGE HAZARDS

- **FIRE DAMAGE HAZARDS:**
- Read the Installation/Operation Manual for the air conditioning unit prior to operating.
- Use air conditioner on a single dedicated circuit within the specified amperage rating.
- Be extremely careful when using acetylene torch and protect surrounding property.
- Failure to follow these instructions can result in fire and minor to serious property damage.
- **WATER DAMAGE HAZARDS:**
- Improper installation, maintenance or servicing of the air conditioner unit can result in water damage to personal items or property.
- Insure that the unit has a sufficient pitch to the outside to allow water to drain from the unit.
- Do not drill holes in the bottom of the drain pan or the underside of the unit.
- Failure to follow these instructions can result in damage to the unit and/or minor to serious property damage.

INTRODUCTION

Operation of Equipment in During Construction

- **OPERATION OF EQUIPMENT MUST BE AVOIDED DURING CONSTRUCTION PHASES WHICH WILL PRODUCE AIRBORNE DUST OR CONTAMINANTS NEAR OR AROUND AIR INTAKE OPENINGS:**
- Wood or metal framing;
- Drywalling or sheathing,
- Spackling or applying joint compound.
- Sanding or grinding.
- Moulding or trimwork.
- Concrete dust.
- Insulation .
- Spray foam.
- Stucco spray and mortar.
- Plastic sheathing.

NOTICE
Operating the equipment during any phase of active construction noted above can void the equipment's warranty, and also lead to poor performance and premature failure.

INTRODUCTION

This service manual is designed to be used in conjunction with the installation and operation manuals provided with each air conditioning system.
This service manual was written to assist the professional service technician to quickly and accurately diagnose and repair malfunctions. Due to continuing research in new energy-saving technology, all information in this manual is subject to change without notice.

Installation procedures are not given in this manual. They are given in the Installation and Operation Manual.

Equipment Identification

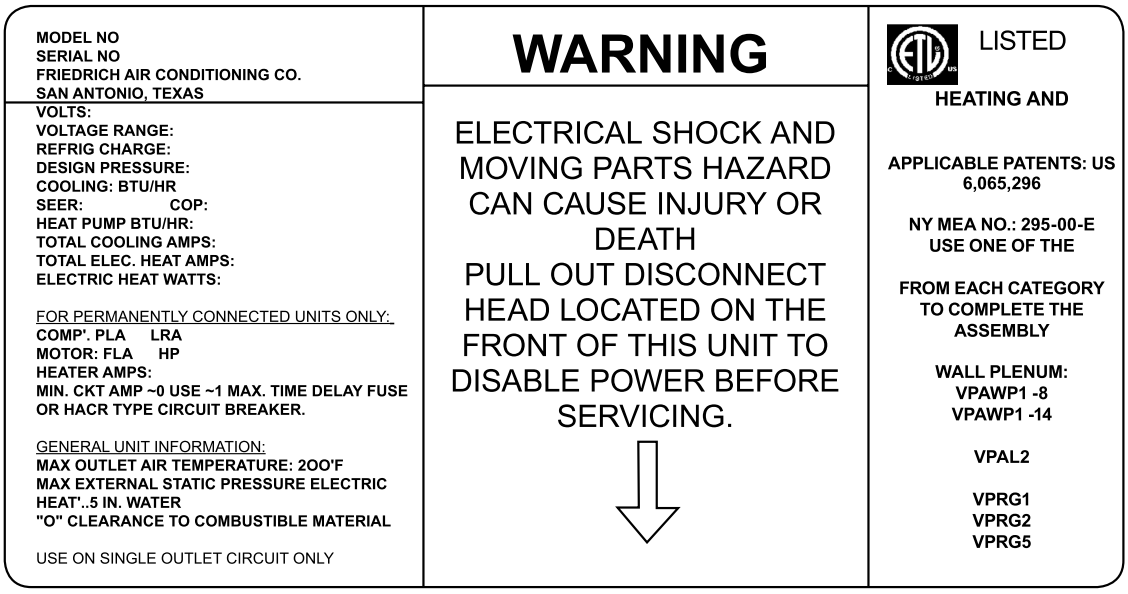


Figure 101 (Equipment Identification Example)

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Model Number Identification Guide

MODEL NUMBER	V	H	A	09	K	34	RC	Q

Marketing Revision

Series
V = Vertical

HA = Air-Source Heat Pump

Nominal Capacity
09 = 9,000 Btu/hr 18 = 18,000 Btu/hr
12 = 12,000 Btu/hr 24 = 24,000 Btu/hr

Voltage
K = 208/230V-1Ph-60Hz
R = 265V-1Ph-60Hz

RT = R410a Refrigerant
RC = R32 Refrigerant

Electric Heater Size
A Series
25 = 2.5 kW
34 = 3.4 kW
50 = 5.0 kW
75 = 7.5 kW*
10 = 10.0 kW**

*** ONLY AVAILABLE ON THE 18 & 24 K/R MODELS**
****ONLY AVAILABLE ON THE 24 K/R MODELS**

IMPORTANT: It will be necessary for you to accurately identify the unit you are servicing, so you can be certain of a proper diagnosis and repair.

Figure 102 (Model Number Identification)

Serial Number Identification Guide

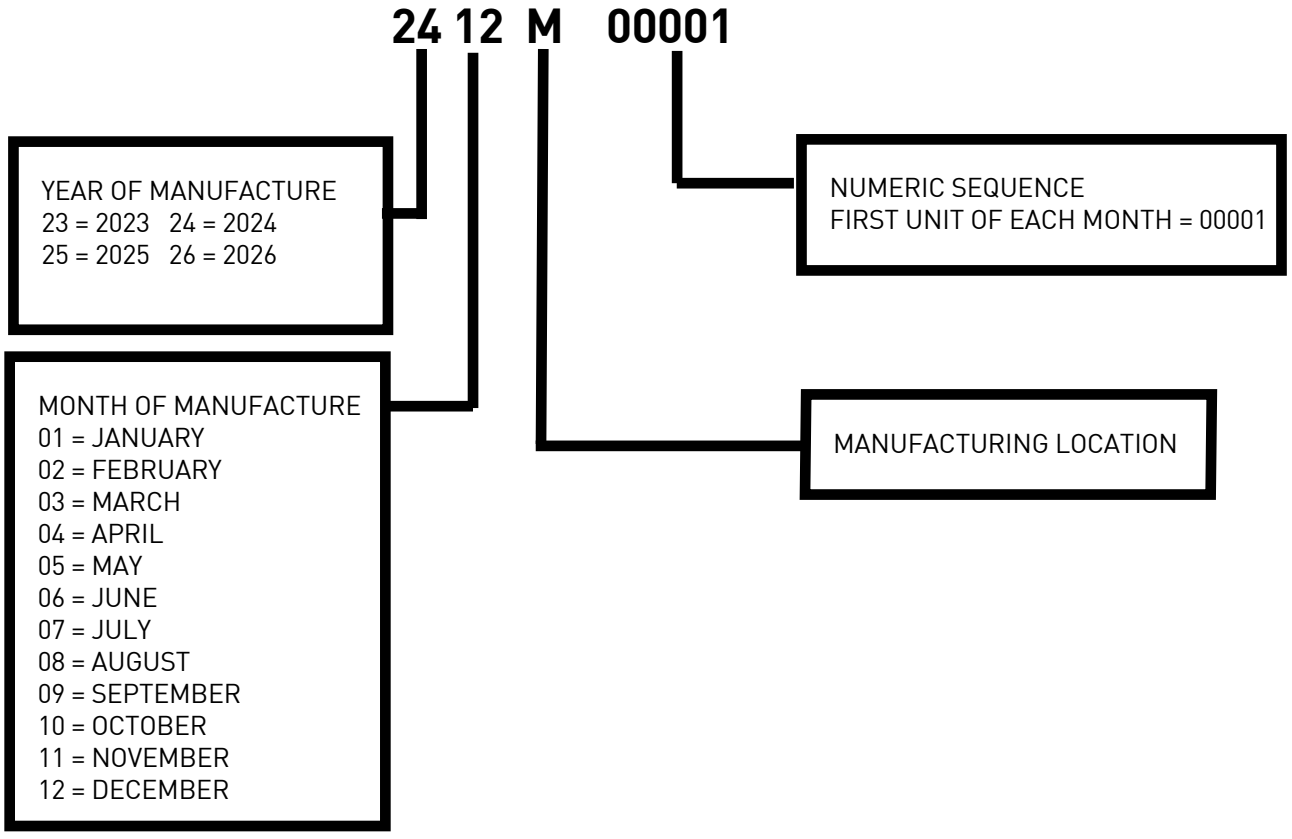


Figure 103 (Serial Number Identification)

SPECIFICATIONS

General Specifications

MODEL	VHA09K	VHA09R	VHA12K	VHA12R	VHA18K	VHA18R	VHA24K	VHA24R
COOLING DATA								
TOTAL COOLING CAP. (Btu/hr) @95°F	9,400	9,400	11,200	11,200	17,800	17,800	22,600	22,600
SENSIBLE COOLING CAP. (Btu/hr)	7,100	7,100	8,800	8,800	13,100	13,100	14,700	14,700
SEER2	12.3	12.3	12.3	12.3	12.1	12.1	12.1	11.9
EER2	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6
POWER (W)	887	887	1057	1057	1679	1679	2132	2132
VOLTAGE	208/230	265	208/230	265	208/230	265	208/230	265
HEATING DATA								
HEAT PUMP CAP. (Btu/hr) @ 47°F	8,600	8,600	10,400	10,400	16,200	16,200	19,500	19,500
HEAT PUMP CAP. (Btu/hr) @ 17°F	4,900	4,900	6,000	6,000	9,800	9,800	12,400	12,400
HSPF2	6.3	6.3	6.3	6.3	6.7	6.7	6.7	6.7
HEATER SIZE (kW)	2.5/3.4/5.0	2.5/3.4/5.0	2.5/3.4/5.0	2.5/3.4/5.0	2.5/3.4/5.0/7.5	2.5/3.4/5.0/7.5	2.5/3.4/5.0/7.5/10.0	2.5/3.4/5.0/7.5/10.0
PHYSICAL								
DIMENSIONS (W X D X H)	23"x23"x32"	23"x23"x32"	23"x23"x32"	23"x23"x32"	23"x23"x47"	23"x23"x47"	23"x23"x52"	23"x23"x52"
REFRIGERANT	R32							
VOLUME (OZ)	26	26	28.7	28.7	40	40	44	44
AIRFLOW (CFM)	360		420		560		580	
VENTILATION AIR								
CFM	UPTO 60							

NOTES:

Due to continuing research in new energy-saving technology, specifications are subject to change without notice.

SPECIFICATIONS

Electrical Specifications

Vert-I-Pak Family	Model Number	Total Refrigeration Amps	Total Electric Heat Amps	Electric Heat Watts	Electric Heat Amps	Compressor RLA LRA	Blower Motor FLA/HP	Condenser Motor FLA/HP	MCA	MOP/ MOCP
VHA09K (230v/208v)	25RCQ	5.6/5.3	11.5/10.4	2450/2000	10.7/9.6	4.1/3.8 20	0.8 1/8	0.7 1/4	14.4	15
	34RCQ	5.6/5.3	15.4/14.0	3350/2740	14.6/13.2				19.3	20
	50RCQ	5.6/5.3	22.5/20.5	5000/4090	21.7/19.7				28.2	30
VHA09R (265v)	25RCQ	6.1	10	2450	9.2	4.6 20			12.5	15
	34RCQ	6.1	13.4	3350	12.6				16.8	20
	50RCQ	6.1	19.7	5000	18.9				24.7	25
VHA12K (230v/208v)	25RCQ	6.4/6.0	11.5/10.4	2450/2000	10.7/9.6	4.1/3.8 20		0.9 1/4	14.4	15
	34RCQ	6.4/6.0	15.4/14.0	3350/2740	14.6/13.2				19.3	20
	50RCQ	6.4/6.0	22.5/20.5	5000/4090	21.7/19.7				28.2	30
VHA12R (265v)	25RCQ	5.8	10	2450	9.2	4.6 20		0.7 1/4	12.5	15
	34RCQ	5.8	13.4	3350	12.6				16.8	20
	50RCQ	5.8	19.7	5000	18.9				24.7	25
VHA18K (230v/208v)	25RCQ	9.9/9.5	11.5/10.4	2450/2000	10.7/9.6	7.8/7.4 40	0.8 1/5	1.3 1/4	15	15
	34RCQ	9.9/9.5	15.4/14.0	3350/2740	14.6/13.2				19.2	20
	50RCQ	9.9/9.5	22.5/20.5	5000/4090	21.7/19.7				28.5	30
	75RCQ	9.9/9.5	33.4/30.3	7500/6135	32.6/29.5				41.8	45
VHA18R (265v)	25RCQ	9.1	10	2450	9.2	7.2 40	0.6 1/5		13.9	15
	34RCQ	9.1	13.4	3350	12.6				16.9	20
	50RCQ	9.1	19.7	5000	18.9				25.6	30
	75RCQ	9.1	29.1	7500	28.3				36.4	40
VHA24K (230v/208v)	25RCQ	12.1/11.2	11.5/10.4	2450/2000	10.7/9.6	9.4/8.5 43	0.8 1/5	1.9 1/4	17.1	20
	34RCQ	12.1/11.2	15.4/14.0	3350/2740	14.6/13.2				20.3	25
	50RCQ	12.1/11.2	22.5/20.5	5000/4090	21.7/19.7				30	30
	75RCQ	12.1/11.2	33.4/30.3	7500/6135	32.6/29.5				41.8	45
	10RCQ	12.1/11.2	44.3/40.1	1000/8180	43.5/39.3				55.4	60
VHA24R (265v)	25RCQ	10.9	10	2450	9.2	8.5 43	0.6 1/5	1.8 1/4	15.5	20
	34RCQ	10.9	13.4	3350	12.6				18.5	20
	50RCQ	10.9	19.7	5000	18.9				27.3	30
	75RCQ	10.9	29.1	7500	28.3				36.2	40
	10RCQ	10.9	38.5	10000	37.7				47.9	50

NOTES: All units must be hard wired with a properly sized breaker. See unit nameplate for specific electrical requirements. Use HACR type breakers to avoid nuisance trips. All field wiring must be done in accordance with NEC and local codes. It is the installer's responsibility that the electrical codes are met. The electrical requirement may change without notice.

ELECTRICAL REQUIREMENTS SEE UNIT NAMEPLATE FOR SPECIFIC ELECTRICAL REQUIREMENTS.	
FUSE/CIRCUIT BREAKER	**USE ONLY TYPE AND SIZE FUSE OR HACR CIRCUIT BREAKER INDICATED ON UNIT'S RATING GUIDE. PROPER OVER CURRENT PROTECTION TO THE UNITS IS THE RESPONSIBILITY OF THE OWNER.**
GROUNDING	**UNIT MUST BE GROUNDED FROM BRANCH CIRCUIT TO UNIT, OR THROUGH SEPARATE GROUND WIRE PROVIDED ON PERMANENTLY CONNECTED UNITS. ENSURE THAT BRANCH CIRCUIT OR GENERAL PURPOSE OUTLET IS GROUNDED.**
WIRE SIZING	**ALL WIRING MUST COMPLY WITH LOCAL AND NATIONAL CODES. NOTE: USE COPPER CONDUCTORS ONLY. USE MINIMUM AMPACITY RATINGS TO DETERMINE BRANCH CIRCUIT WIRING SIZES.**

⚠ WARNING

Electrical Shock Hazard.

Turn OFF electric power before service or installation.

Unit must be properly grounded.

Unit must have correct fuse or circuit breaker protection. Unit's supply circuit must have the correct wire conductor size. All electrical connections and wiring must be installed by a qualified electrician and conform to the National Electrical Code and all local codes which have jurisdiction. Failure to do so can result in property damage, personal injury and/or death.

SPECIFICATIONS

Indoor CFM & External Static Pressure

Vert-I-Pak is designed to install through an exterior wall with a plenum (VPAWP1-8, VPAWP1-14) and an external louver. If the default plenum and louver combinations are not used, the selections and design must be evaluated by us to ensure the total pressure drop does not exceed the maximum allowable limits.

MODEL	VHA09		VHA12		VHA18		VHA24	
Fan Speed	Low	High	Low	High	Low	High	Low	High
ESP (")	SCFM							
0.0"	400	490	400	490	620	705	675	765
0.05"	370	475	370	475	580	675	635	735
0.10"	355	460	355	460	550	640	600	700
0.15"	335	450	335	450	510	610	560	670
0.20"	315	435	315	435	480	585	525	635
0.25"	300*	425	300*	425	450	570	490	615
0.30"	280	420*	280	420*	400*	560	440*	580
0.35"	--	--	--	--	365	500	400	540
0.40"	--	--	--	--	320	450*	350	490*

*Maximum Allowable Static. Units rated at 0.3" ESP.

Indoor airflow may be determined by measuring the external static pressure (ESP) of the duct system using an inclined manometer or magnahelic gauge and consulting the above chart to derive actual air flow. Under no circumstances should the Vert-I-Pak be operated at an higher external static pressure than indicated above. Operation of the Vert-I-Pak over the recommended ESP will result in inadequate airflow, leading to poor performance and/or premature component failure.

SPECIFICATIONS

Airflow Data (Condenser)

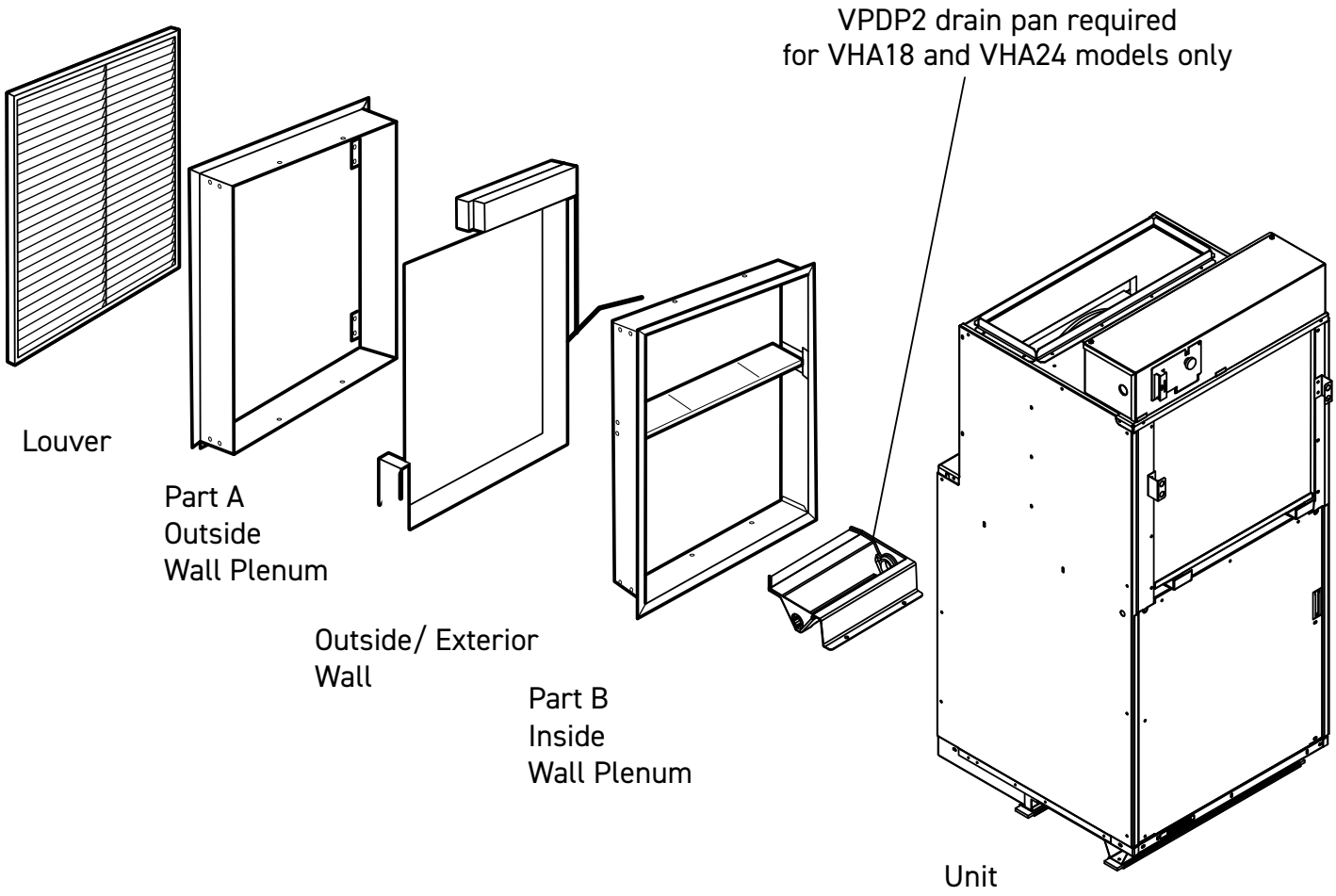
Condenser CFM & External Static Pressure

Vert-I-Pak is designed to install through an exterior wall with a plenum (VPAWP-8, VPAWP-14) and a Friedrich external louver .

Condenser External Static Pressure			
Model	Design		Maximum
	CFM	ESP ("WC)	ESP ("WC)
VHA09	650	0.03	0.12
VHA12	650	0.03	0.12
VHA18	950	0.03	0.12
VHA24	980	0.03	0.12

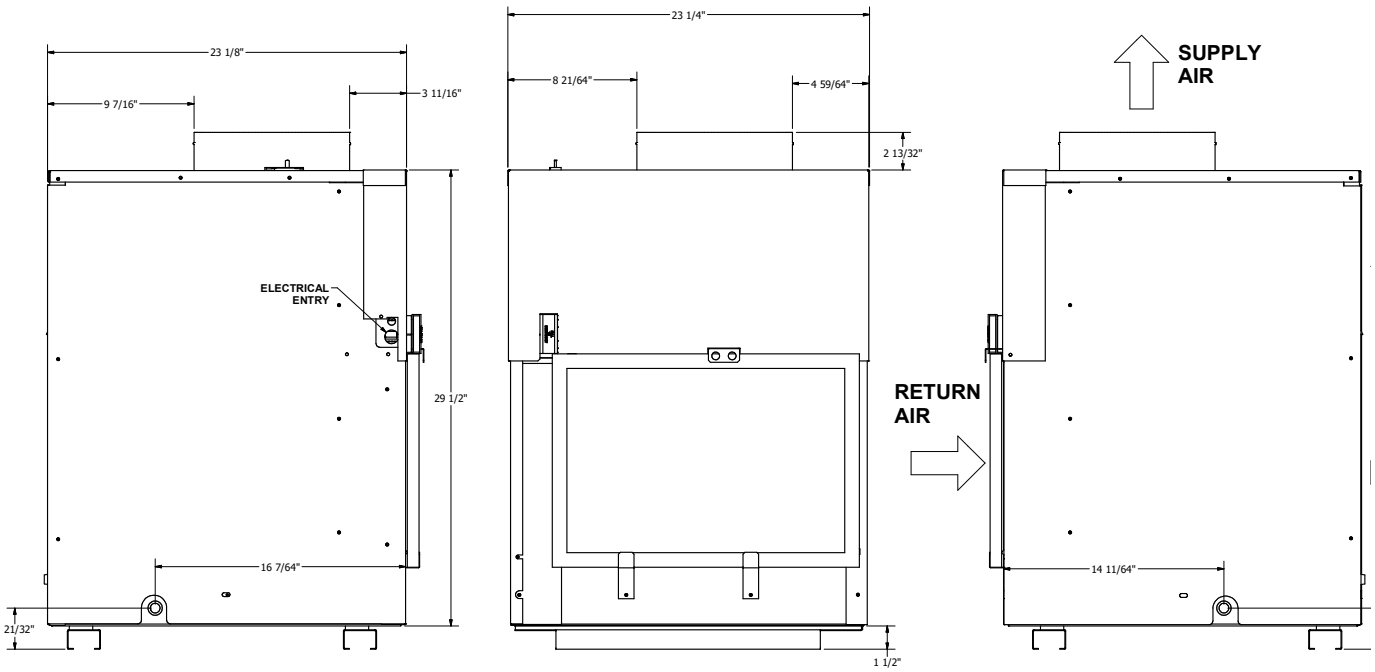
If the Friedrich designed plenum and louver combinations are not used, the selections and design must be evaluated by Friedrich to ensure the total pressure drop does not exceed the maximum allowable limits.

Typical Installation Overview



SPECIFICATIONS

Chassis Dimensions 9K, 12K



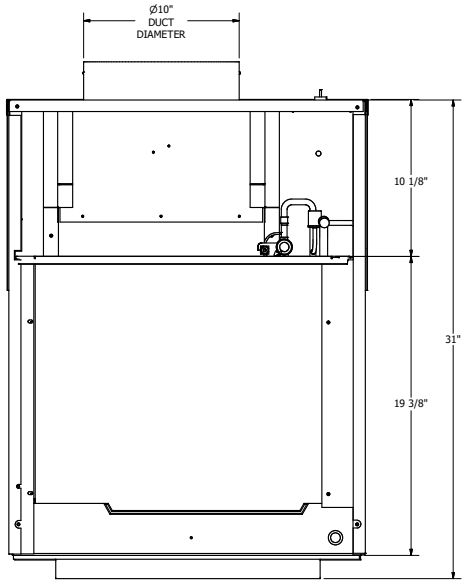


Figure 202 (9-12K Chassis Specs)

SPECIFICATIONS

Chassis Dimensions, 18k

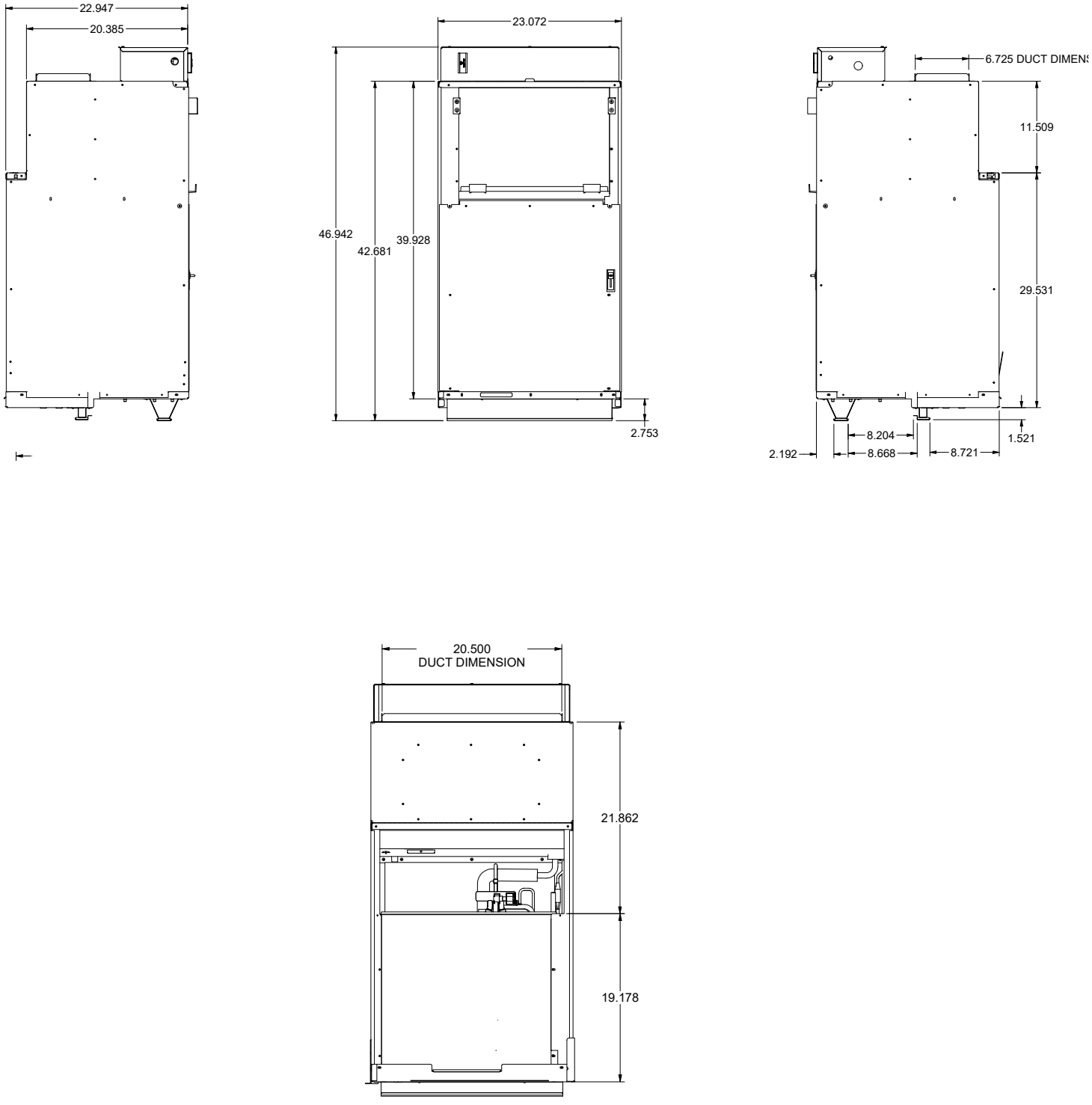


Figure 203 (18K Chassis Specs)

SPECIFICATIONS

Chassis Dimensions, 24k

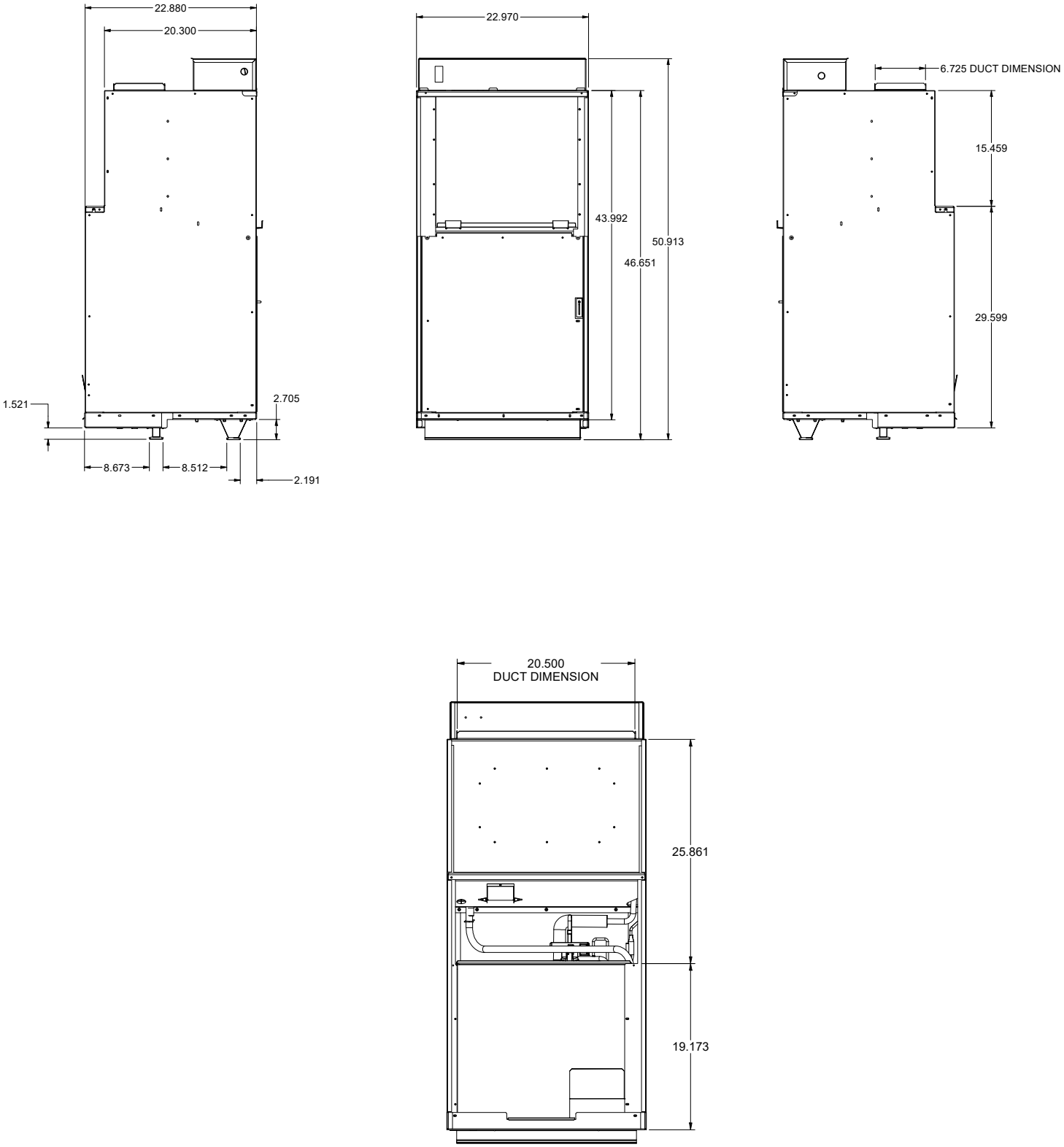


Figure 204 24K Chassis Specs)

SPECIFICATIONS

Required Minimum Clearances

Building Exterior Unit Opening Requirements

Vert-I-Pak units must be installed on an outside wall. Confined spaces and/or covered areas should be avoided. Units must be installed no closer than 12" apart when two units are side by side. If three or more units are to operate next to one another, maintain a minimum of 60" between units or pairs of units (Figure B). If more than two units are sharing a floor with adjacent, outset units, a minimum distance of 64" must be kept between units (Figure C). Also, a vertical clearance of 60" must be maintained (Figure A) between units. Units installed on the bottom floor must be mounted at least 6" off of the ground.If two units are facing each other, a minimum distance of 108" must be kept between units (Figure D).

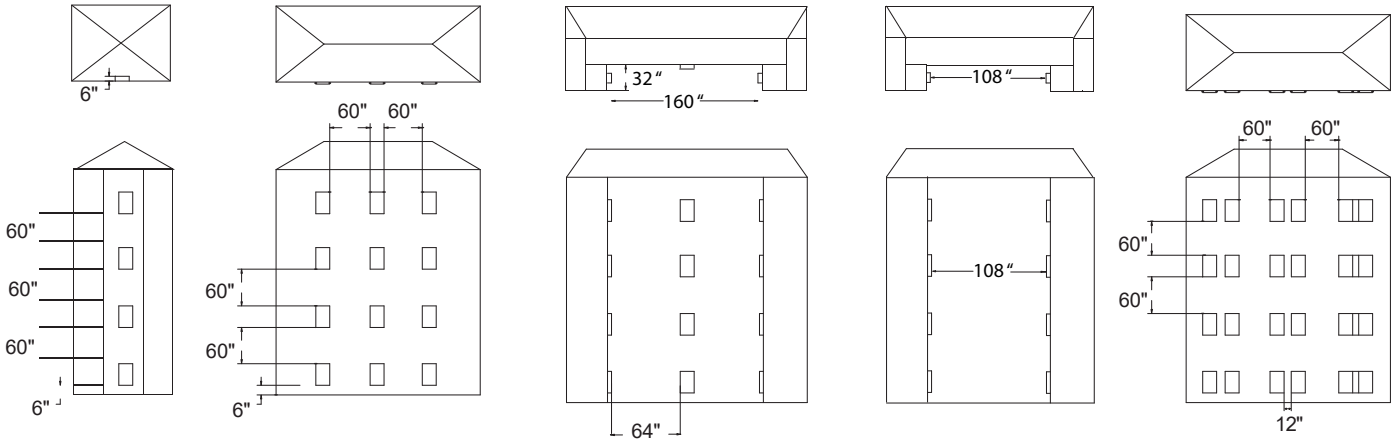


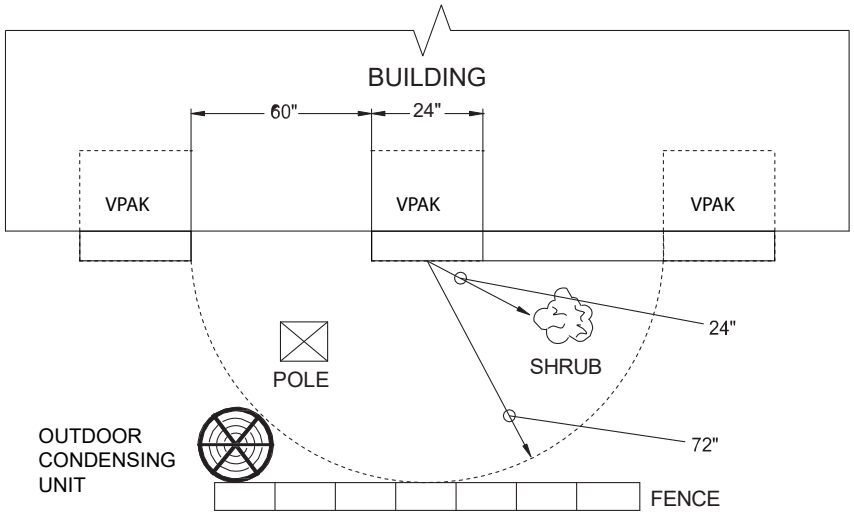
Figure A Figure B Figure C Figure D Figure E

Grill Clearance Requirements

Where obstructions are present use the following guidelines for proper spacing from the Vert-I-Pak exterior louvered grill. Friedrich recommends that ALL obstructions are a minimum of 72" from the exhaust.

For minor obstruction(s) such as lamp poles or small shrubbery, a clearance of 24" from the outdoor louver must be maintained.

For major obstructions such as a solid fence, wall, or other heat rejecting devices like a condensing unit, a minimum distance of 72" must be kept.



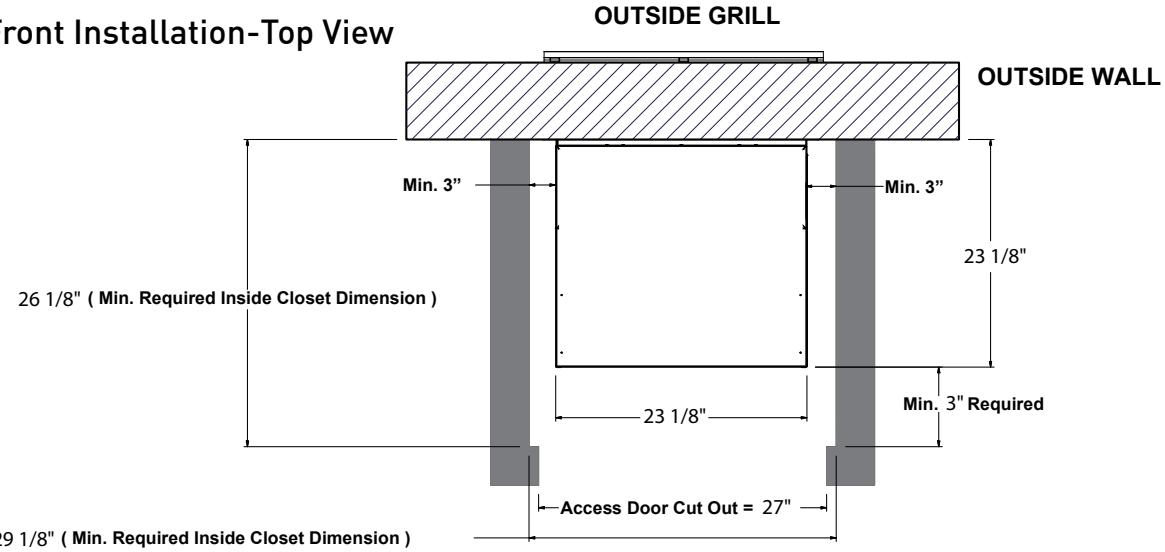
The the example pictured above is for reference only and does not represent all possible installations. Please contact Friedrich Air Conditioning for information regarding effects of other installation arrangements.

Figure 205

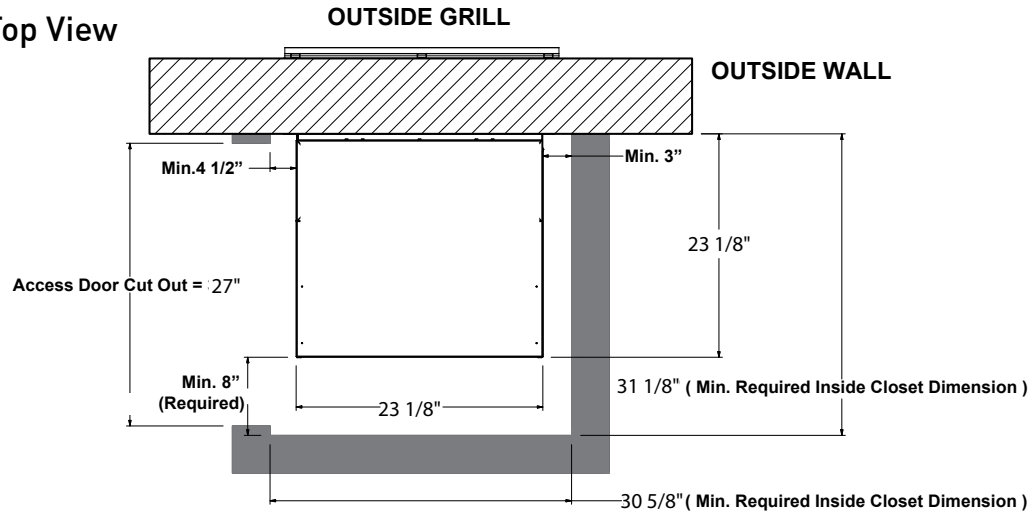
SPECIFICATIONS

Closet Orientations & Dimensions

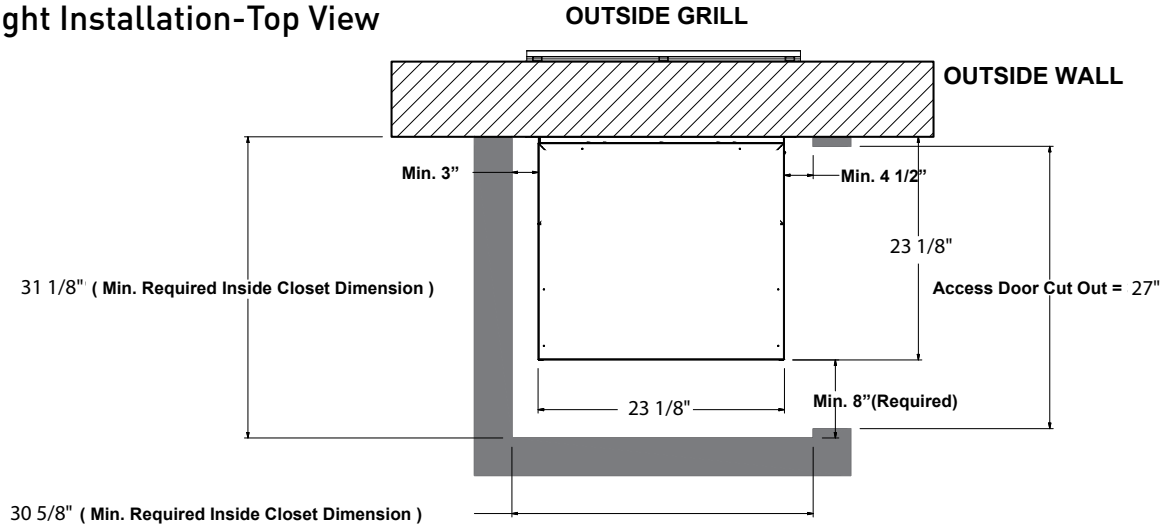
Front Installation-Top View



Left Installation-Top View

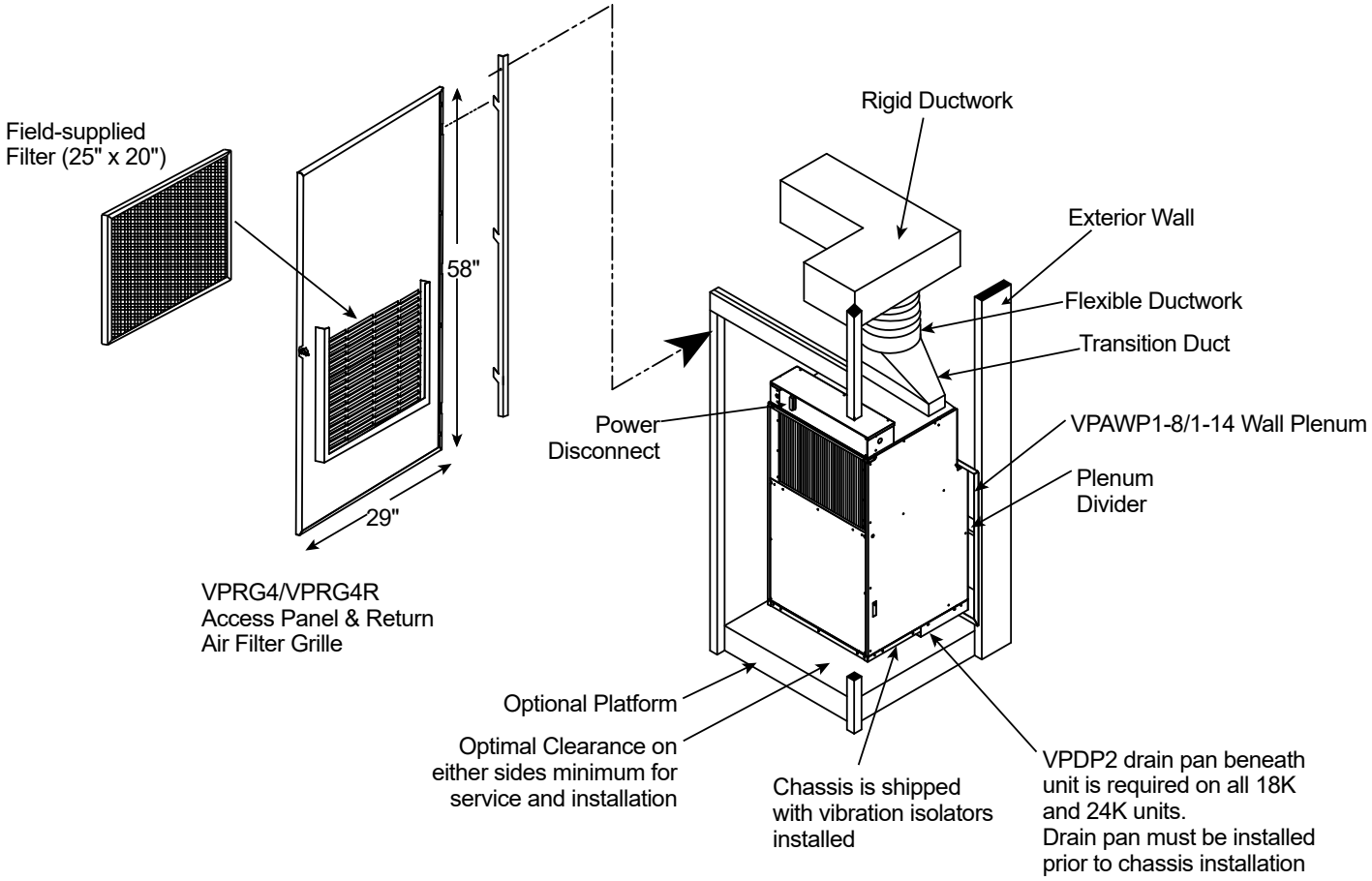


Right Installation-Top View



SPECIFICATIONS

Closet View

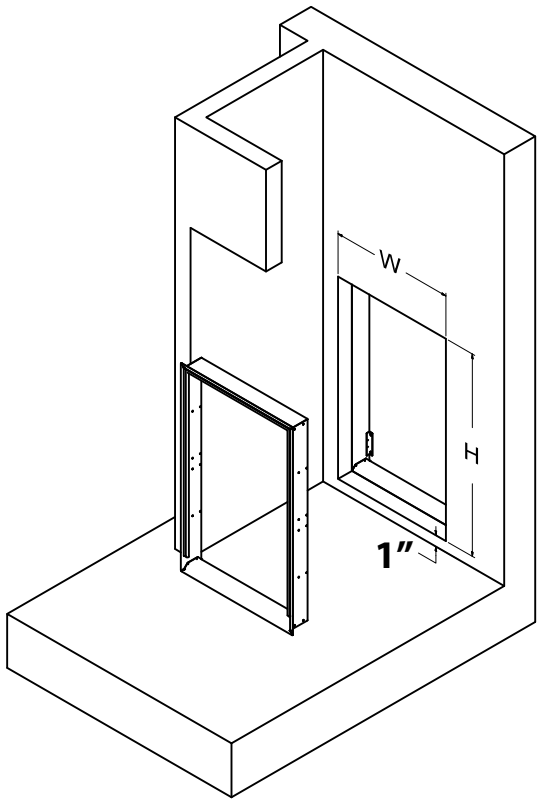


SPECIFICATIONS

Wall Opening Dimensions

Exterior Wall Plenum Cut-Out

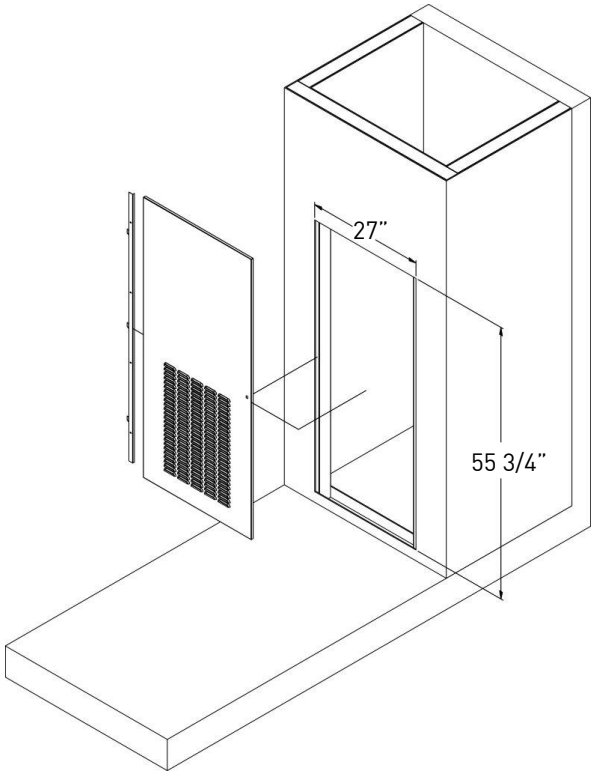
Dimensions (W x H):
24 5/8" x 30 7/8"



NOTE: The distance between the rough opening and the finished floor/platform must be **1".**

Return Air Access Door Wall Cut-Out

Dimensions (W x H):
27" x 55 3/4"



OPERATION

Sequence of Operation

Power-up

When power is applied to the unit (230 VAC), L1 and L2 provide power to energize all relays, contactors, and control boards receive power. 1 leg of the compressor is energized. Power is supplied to the transformer which provides 24 VAC to the thermostat and the defrost control board.

When power is applied to the unit (265 VAC), L1 and L2 provide power to the heater relays, the main transformer which steps down the voltage from 265 VAC to 230 VAC. 230 VAC energizes all other relays, contactors, and control boards. 1 leg of the compressor is energized. Power is supplied to the secondary transformer which provides 24 VAC to the thermostat and the defrost control board.

When power is first applied to the Defrost control board, the defrost timers are reset and the short cycle timer is cleared. All defrost mode calibration is cleared when power is applied to the control. If the power to the control is interrupted for less than 20 milliseconds, the control shall resume operation at the same point in the timing cycle.

The control shall not change modes of operation due to a power interruption of less than 20 milliseconds. Relays may temporarily drop out during the power interruption. Power interruptions greater than 100 milliseconds may reset the control as a power-up sequence. Power interruptions of any duration are not to cause lockout.

Fan only mode

Thermostat sends a G signal to energize the indoor fan motor relay (IMR) closing contacts 2 and 4 providing power to the low voltage tap on the indoor motor controller.

Emergency Heat

If thermostat provides W2 signal to the safety relay (SR) it will energize the safety relay which removes power to the compressor and provides power to pin 5 of the indoor fan motor relay (IMR), which provides power to the LI pin on ID motor controller for ID fan operation.

Simultaneously power is provided to energize the heat relay (HR) and the defrost heat relay (DHR) so that L1 and L2 of the heater legs are energized providing power to the electric heat strips. Basepan heat is also provided at this time.

Compressor Contactor Operation

Anti-Short Cycle Delay (ASCD)

The Anti-Short Cycle time Delay is 3-minutes. This delay is active at power up and when the compressor has been de-energized. The ASCD will not be reset during the 30-second compressor delay time after reversing valve change of state.

Compressor Operation

If the control receives a call for compressor operation "Y", in heating or cooling, the compressor contactor output "Y out" will be energized immediately, or immediately after the ASCD timer has expired, whichever occurs last. The control shall de-energize the contactor output immediately when the "Y" signal is removed.

Enable Temperature

If the condenser coil temperature is above 35°F, all defrost functions are disabled.

Ambient Sensor Failure Detection

If the ambient temperature sensor is detected as being open or shorted, the control will operate as shown in Table 5.2.4 Thermistor resistance values greater than 280K ohms (below -35°F) or resistance values less than 3.75K ohms (above 120°F) measured on the ambient sensor will trigger this failure condition.

Condenser Coil Sensor Failure Detection

If the coil temperature sensor is detected as being open or shorted, the control will operate as shown in Table 501.
Thermistor resistance values greater than 280K ohms (below -35°F) or resistance values less than 3.75K ohms (above 120°F) measured on the coil sensor will trigger this failure condition.

Ambient probe	Coil Probe	Ambient Temp	Coil Temp	Defrost Action	Defrost Termination
Bad	Good	**N/A**	**‹ 30˚F**	Begins after 60 minutes accumulated run time	Time/Temp: 14 minutes or termination temperature
Bad	Good	**N/A**	**> 30˚F**	No defrost	N/A
Good	Bad	**‹ 42˚F**	**N/A**	Begins after 60 minutes accumulated run time	Time/Temp: 14 minutes
Good	Bad	**> 42˚F**	**N/A**	No defrost	N/A

Table 501 (Sensor Conditions)

OPERATION

Sequence of Operation

Compressor Delay Time

At the beginning of the defrost cycle the compressor is shut off for 30 seconds and then the reversing valve is de-energized. At the end of the defrost cycle, the compressor will be shut off for 30 seconds before the reversing valve is energized. Following a 30 second delay, the compressor will be turned back on. I

Cooling

When powering unit for the first time there is a time delay of 3 minutes. The thermostat energizes the Y out terminal at the defrost control board. The defrost control board will send complete the circuit though the common (cc) to energize the contactor; L1 to T1 on the contactor providing power to the compressor and the outdoor condenser motor.
If the control has "Y" thermostat input present without a "B" input, the compressor output should be active (once the ASCD has expired), and the condenser fan relay contacts (located on the defrost control board) should remain closed.

Low Pressure Switch Operation (Cooling)

Normally Closed. Opens at 30 psig and closes at 50 psig.
If the Low Pressure switch opens during cooling operation, the compressor contactor will be de-energized and the ASCD will be reset. During the period with a low pressure switch open, the "Low Pressure Switch Open" fault condition will be displayed as described in Table 701.

High Pressure Switch Operation (Cooling)

Normally Closed. Open At 675 Psig And Close At 475 Psig.
If the High Pressure switch opens during cooling operation, the compressor contactor will be de-energized and the ASCD will be reset. During the period with a high pressure switch open, the "High Pressure Switch Open" fault condition will be displayed as described in section Table 701. If three High Pressure Switch faults happen within the same call for cooling, the control will lockout the compressor and display the "High Pressure Switch Lockout" fault condition will be displayed on the defrost control board as described in Table 701. If the "Y" thermostat demand is removed, the counter that keeps track of the three pressure switch trips will be reset.

Heating

Heating is same as cooling except thermostat sends B signal to defrost control board which energizes the reversing valve solenoid.

A safety relay is incorporated into the design of the system to prevent emergency heat and the compressor from running simultaneously. Thermostat should not send a B and W2 signal at the same time, however if that happens then W2 will break the signal to defrost control board through the safety relay.

If the control has recognized both "Y" and "B" thermostat inputs present, the compressor contactor should be active (once the ASCD has expired), and the condenser fan relay contacts should remain closed.

Low Pressure Switch Operation (Heating)

Normally Closed. Opens at 30 psig and closes at 50 psig.

If the Low Pressure switch opens during heating operation, the compressor contactor will be de-energized and the ASCD will be reset. During the period with a low pressure switch open, the "Low Pressure Switch Open" fault condition will be displayed as described in Table 701.

If three Low Pressure Switch faults happen within a 120 minute period and within the same call for heating, the control will lockout the compressor and display the "Low Pressure Switch Lockout" fault condition will be displayed as described in Table 701. If the "Y" thermostat demand is removed, the counter that keeps track of the three pressure switch trips and the 120 minute period will be reset. The Low pressure switch is ignored the first 90 seconds after the compressor is energized. The Low pressure switch is ignored if the "Y" thermostat demand is removed.

High Pressure Switch Operation (Heating)

Normally Closed. Open At 675 Psig And Close At 475 Psig.
If the High Pressure switch opens during heating operation, the compressor contactor will be de-energized and the ASCD will be reset. During the period with a High pressure switch open, the "High Pressure Switch Open" fault condition will be displayed as described in Table 701. If three High Pressure Switch faults happen within a 90 minute period and within the same call for heating, the control will lockout the compressor and display the "High Pressure Switch Lockout" fault condition will be displayed as described in Table 701. If the "Y" thermostat demand is removed, the counter that keeps track of the three pressure switch trips and the 90 minute period will be reset. The High pressure switch is ignored if the "Y" thermostat demand is removed.

Air Pressure Switch

An air pressure switch is installed which is designed to remove power to the electric heater and basepan heat if a low airflow condition occurs. If differential pressure between ambient pressure and blower inlet is higher (more positive) than -0.20 inH20 power will be removed to the electric heater by input from the Heat Relay, Safety Relay, and the Defrost Heat Relay. For example, if the duct outlet is blocked or the fan is not turning, the differential pressure will be between -0.20 and 0.00 inH20 and the electric heat relays will not receive an input signal.

OPERATION

Sequence of Operation

Defrost Mode Operation

When the unit goes into heat pump mode for the first time and the outdoor coil temp drops below 30 °F it will run a defrost to calibrate the control even though there is no ice build up.

Normally the unit will go into defrost when the outdoor coil temp sensor provides signal to the board reads below 30 °F and the defrost control board detects a frost condition based on the the calibration point and the ambient temp sensor. At this point the unit will set a timer for 38 minutes and then begin a defrost. The defrost control board sends 24 vac from pin d of the control board to energize the defrost heat relay and close contacts to one strip of electric heat. Basepan heat is also provided at this time. The defrost control board also removes L2 power to fan out, shutting off the outdoor condenser fan motor. Compressor will run during defrost mode.

After the outdoor coil reaches 70 °F or after 14 minutes the defrost cycle will be terminated. The outdoor coil temp defrost finish point can be changed by moving the jumper on the defrost control board to 50, 60, 70, or 80 °F. Factory default is 70 °F.

Defrost Calibration Mode

The control is considered un-calibrated when power is applied to the control, after cool mode operation. Calibration of the controller occurs after a defrost cycle to ensure that there is no ice on the coil. During calibration, the temperature of both the coil and ambient sensors are measured to establish a Dry Coil Delta T.
When the controller is in an un-calibrated state, the controller should initiate a sacrificial defrost after 34 minutes of accumulated compressor runtime with coil temperature below 35°F (Enable Temperature). The defrost will terminate if the coil sensor reaches the selected termination temperature or after a 14 minute defrost. If the above defrost was concluded due to termination temperature, or if terminated by time with a coil temperature of greater than the enable Temperature for more than two back-to-back 2-minute transient delay periods, a clear coil (non-iced condition) can be assumed. Otherwise, the control remains in an un-calibrated state.

A stabilized coil would be one that is determined stable after (4) minutes following the defrost cycle allowing the system pressures and temperatures to stabilize. If the coil temperature is not considered stable and the accumulated runtime is ≥ 14-minutes, the control will operate in time-temperature mode for 90 minutes. Upon the completion of the 90-minute operation the control will initiate a sacrificial defrost. At that point a Dry Coil Delta T at the particular outdoor ambient temperature can be determined. After initial calibration has been completed, the controller prevents a defrost occurrence for 34 minutes of accumulated runtime in order to avoid unnecessary defrost operation due to system transient conditions.

Demand Defrost Operation

The need for a defrost cycle while in Demand Defrost operation is determined by one of two factors: Time or Frost Detection. Should six hours of compressor run time elapse without a defrost cycle and the coil temperature is below the frost accumulation temperature, a defrost will be initiated. If this defrost is terminated on time rather than temperature, the controller shall establish a new Dry Coil Delta T. If the defrost is terminated on temperature the unit will continue with demand mode operations. The compressor run time will be reset when the defrost cycle is complete. The control shall be capable of detecting frost accumulation on the outdoor coil and initiate a defrost when the Dry Coil Delta T + the Coil Temperature Dependant Variable is sensed. As the ambient temperature changes, a slope of 1°F Defrost Delta T change for every 8°F ambient change will be used to adjust the detection of frost accumulation.

Defrost Mode Activation

To activate a defrost sequence, the "B" thermostat input must be active, and the coil temperature must be below 35°F. When these conditions are met, the defrost enable timer tracks the compressor output, and accumulates compressor run time in the heating mode. If the "B" thermostat input is inactive, the defrost enable timer is cleared. If the coil temperature is above 35°F, the defrost enable timer is not cleared, but does not accumulate compressor run time. If the coil temperature is above the selected defrost termination temperature, the defrost enable timer will be cleared. When the defrost enable timer reaches 34 minutes, the defrost mode is enabled. If the control is in the time/temperature defrost operation mode, defrost operation will be initiated immediately. If the control is in demand mode, defrost operation will be initiated as described in defrost demand operation.

Defrost Mode Operation

When operating in the defrost mode, the control will have the compressor contactor, and auxiliary heat outputs activated. The condenser fan relay contacts will be open, de-energizing the fan motor. The accumulated defrost time is monitored while in the defrost mode and compressor is energized. The Low Pressure Switch is ignored during Defrost. When a defrost cycle has been initiated, if the Y thermostat input is removed, the current defrost cycle will be suspended, but the accumulated defrost time is frozen, and the control will resume defrost operation at the start of the next heating cycle (Y active, B active and coil temperature is below 35°F) with a minimum of the ASCD between compressor activations.

The accumulated defrost time resumes when the compressor output is re-energized. The defrost relay will de-energize when the Y thermostat input is removed and energize when the Defrost is resumed.

OPERATION

Sequence of Operation

Defrost Mode Termination

Once a defrost mode has been initiated, it shall be terminated immediately and reset the internal timing if the coil sensor temperature exceeds the selected termination temperature. If the temperature select shunt is not installed, the default termination temperature shall be 50°F. The Low Pressure Switch is ignored for 90 seconds following termination of a Defrost. Once a defrost mode has been initiated, an internal timer shall count the time that the defrost mode is engaged and compressor is energized. After 14 minutes of operation in the defrost mode, the defrost sequence shall terminate immediately and reset internal timing regardless of the state of the coil sensor temperature. If a defrost cycle is terminated by time and the coil temperature did not remain above 70°F for 14 minutes, the controller will return to an un-calibrated state.

Forced Defrost

When the "TEST" terminals are shorted with the "Y" and "B" inputs active, the ASCD timer will be canceled and control will enter the defrost mode. If the short on the "TEST" terminals is removed and then reapplied, the defrost mode will be exited and the control will return to heating operation. These modes can continue to be cycled through by removing and reapplying the short to the "TEST" terminals. The Compressor Delay Time (30 Seconds) will remain active when switching between defrost mode and heat mode with the test feature.

The Enable Temperature is ignored when the "TEST" terminals are shorted, and a forced defrost can be entered with the coil temperature above the Enable Temperature (35°F). The forced defrost will terminate when either the coil temperature exceeds the selected Termination Temperature, 14 minutes of defrost has accumulated, or the test terminals are shorted a second time.

Blower Control

All Vert-I-Paks, by default, will be configured to low speed blower operation. The speed setting can be changed to high speed by updating the speed tap settings on the fan control relay.

NOTE: The fan speed setting cannot be changed at the thermostat. Regardless of wiring GH and/or GL, the unit will continue to operate at the speed setting at the fan control relay. TO change fan speed from low to high change the speed relay tap from red to blue wire.

NOTE: Thermostats that have high and low terminals must be jumped at the thermostat for proper operation.

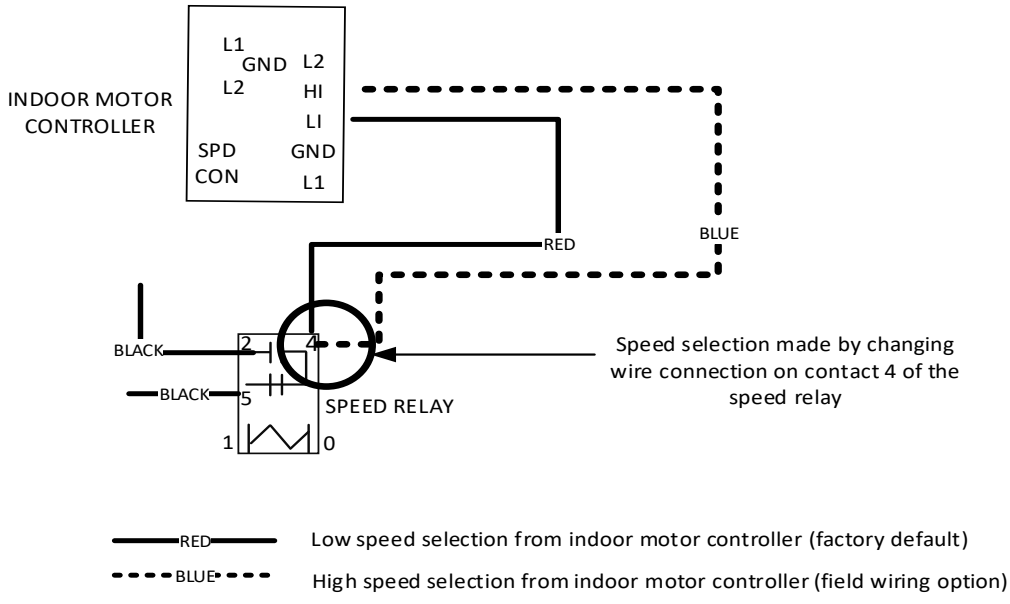


Figure 503 (Blower Speed Control)

OPERATION

Defrost Control Board

Inputs

C - 24 VAC Common

R - 24 VAC Output (Power Supply) supplied via the transformer to the thermostat.

Y - 24 VAC thermostat input for compressor demand - Thermostat Call for Compressor ("Y"). This signal is monitored by the control logic, and is recognized as active when "R" is connected to "Y". Inputs of less than 11 VAC will not be detected as active.

B - 24 VAC thermostat input for reversing valve demand. Thermostat Call for Reversing Valve ("B"). This signal is monitored by the control logic, and is recognized as active when "R" is connected to "B" at the thermostat. The input signal is connected through the normally closed relay contacts of K1 on the defrost control board to the "RV" quick connect terminal.

P3 – Connections for outdoor ambient temperature sensor. Ambient Temperature Sensor ("AMB") The ambient temperature sensor is a thermistor input. In addition to measuring the temperature value of the thermistor, the control shall detect an open thermistor condition, and a shorted thermistor condition.

P4 - Connections for the Condenser temperature sensor: Coil Temperature Sensor ("COIL"). The coil temperature sensor is a thermistor input. In addition to measuring the temperature value of the thermistor, the control shall detect an open thermistor condition, and a shorted thermistor condition.

P1 - 5 position, P1 provides selection of the defrost terminate temperature based on the position of selection shunt. Selections include 50°F, 60°F, 70°F, and 80°F. If the temperature shunt is not installed, the default termination temperature shall be 50°F. The control shall be provided from the factory with the temperature shunt installed in the 70°F position.

HPC -High pressure switch input. The high-pressure switch input is a 24 VAC input. The input is supplied from the "Y" thermostat input, is in series with the compressor contactor output, and is monitored by the control logic. The hp switch Opens at 675 psig and closes at 475 psig.

LPC - The low-pressure switch input is a 24 VAC input. The input is supplied from the "Y" thermostat input, is in series with the compressor contactor output, and is monitored by the control logic. The lp switch opens at 30 psig and closes at 50 psig.

Outputs

Y out - The Y out "Y" terminal is sourced 24 VAC from the "Y" input terminal of the thermostat

CC out - Switched compressor contactor 24 VAC common CC" terminal. CC out is removed during compressor lockout, if hi or low pressure switches open, or 3 minute time delay

Reversing Valve ("RV") B out

(RV) Switched 24 VAC to reversing valve.

(C) 24 VAC common to reversing valve.

The control provides a pilot duty 24 VAC output for the reversing valve. This output provides a normally closed relay connection between the "B" and "RV" terminals. This connection is opened during a defrost cycle.

D - 24 VAC auxiliary heat output (sourced from Y input) The control provides a pilot duty 24 VAC output during defrost operation which activates the defrost relay. For defrost operation of the auxiliary heat, the "D" output is connected to the 24 VAC through the high pressure switch which is sourced by the "Y" thermostat input.

FAN - 240 VAC line voltage source for PSC condenser fan. The control provides a 240 VAC line voltage output for the condenser fan. The condenser fan output is a normally closed relay contact output. During the defrost operation, the normally closed contacts of the K2 relay on the defrost control board will be opened.

Diagnostic Indicator LED ("LED1" & "LED2")

Two red LED's are provided to display diagnostic codes for the control.

OPERATION

Remote Thermostat Connection

Remote Wall Thermostat Location

The thermostat should not be mounted where it may be affected by drafts, discharge air from registers (hot or cold), or heat radiated from the sun appliances, windows etc.. The thermostat should be located about 3-5 Ft. above the floor in an area of average temperature, with good air circulation. Thermostats should be level for aesthetics.

Note: An improperly operating or poorly located remote wall thermostat can be the source of perceived equipment problems. A careful check of the thermostat's location and wiring must be made to ensure that it is not the source of problems.

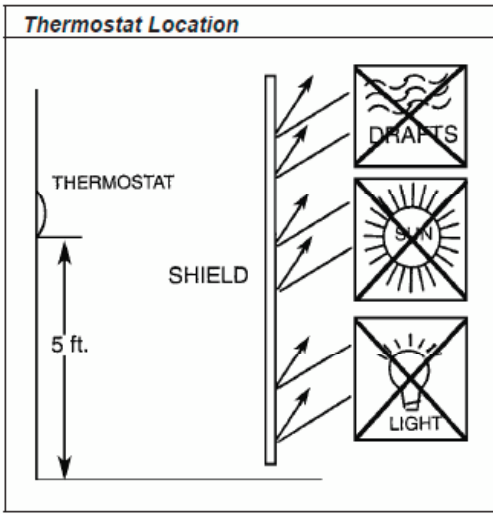


Figure 504 (Thermostat Locations)

Remote Thermostat

This unit is configured to be controlled by using a single stage cool - dual stage heat pump remote wall mounted thermostat. The thermostat may be auto or manual changeover as long as the control configuration matches that of the Vert-I-Pak unit.

To connect the wall mounted thermostat:

1. Pull the disconnect switch.
2. Unscrew and remove the control box panel.
3. Select which side to run your thermostat wire.
4. Run the wires through the side hole in the box to reach the connection terminal wiring.
5. Make the connections, appropriately matching the wires as shown in the wiring diagram.
6. Reattach the control box cover.

Terminal Code	Wire Connection Function
C	Common Ground Terminal
G	Call for Fan*
B	Energized for Heat (Reversing Valve)
Y	Call for Compressor
W2	Second Stage Heat
R	24 VAC to Wall Thermostat

Figure 505(Thermostat Connections)

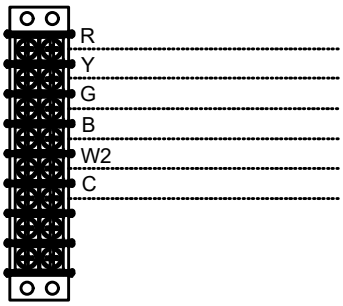


Figure 506 Low Voltage Connections)

Note: It is the installer's responsibility to ensure that all control wiring connections are made in accordance with the installation instructions. Improper connection of the thermostat control wiring and/or tampering with the unit's internal wiring can void the equipment warranty and may result in property damage, personal injury, or death. Questions concerning proper connections to the unit should be directed to the factory

OPERATION

General Knowledge Sequence Of Refrigeration

A good understanding of the basic operation of the refrigeration system is essential for the service technician. Without this understanding, accurate troubleshooting of refrigeration system problems will be more difficult and time consuming, if not (in some cases) entirely impossible. The refrigeration system uses four basic principles in its operation which are as follows:

1. "Heat always flows from a warmer body to a cooler body."

2. "Heat must be added to or removed from a substance before a change in state can occur"

3. "Flow is always from a higher pressure area to a lower pressure area."

4. "The temperature at which a liquid or gas changes state is dependent upon the pressure."

The refrigeration cycle begins at the compressor when a demand is received from the thermostat. Starting the compressor creates a low pressure in the suction line which draws refrigerant gas (vapor) into the compressor. The compressor then "compresses" this refrigerant vapor, creating a super-heated state.

The refrigerant leaves the compressor through the discharge line as a hot high pressure gas (vapor). The refrigerant enters the condenser coil where it gives up some of its heat. The condenser fan moving air across the coil's finned surface facilitates the transfer of heat from the refrigerant to the relatively cooler outdoor air.

When a sufficient quantity of heat has been removed from the refrigerant gas (vapor), the refrigerant will "condense" (i.e. change to a liquid). Once the refrigerant has been condensed (changed) to a liquid it is sub-cooled by the air that continues to flow across the condenser coil.

The design determines at exactly what point (in the condenser) the change of state (i.e. gas to a liquid) takes place. In all cases, however, the refrigerant must be totally condensed (changed) to a liquid before leaving the condenser coil.

The refrigerant leaves the condenser coil through the liquid line as a high pressure high temperature liquid.
The liquid refrigerant next enters the metering device. The metering device on this unit is a Thermal Expansion Valve (TXV). The purpose of the metering device is to "meter" (i.e. control or measure) the quantity of refrigerant entering the evaporator coil and maintain superheat.

The TXV has a sensing bulb installed on the suction line. The bulb is filled with a liquid cross charge. Maintains superheat by sensing the suction line temp.. and modulating the flow of refrigerant to the evaporator coil.

As it enters the evaporator coil, the larger area and lower pressure allows the refrigerant to expand and lower its temperature (heat intensity). This expansion is often referred to as "boiling" or atomizing. Since the unit's blower is moving indoor air across the finned surface of the evaporator coil, the expanding refrigerant absorbs some of that heat. This results in a lowering of the indoor air temperature, or cooling.

The expansion and absorbing of heat cause the liquid refrigerant to evaporate (i.e. change to a gas). Once the refrigerant has been evaporated (changed to a gas), it is superheated by the air that continues to flow across the evaporator coil.

The particular system design determines at exactly what point (in the evaporator) the change of state (i.e. liquid to a gas) takes place. In all cases, however, the refrigerant must be totally evaporated (changed) to a gas before leaving the evaporator coil.

The low pressure (suction) created by the compressor causes the refrigerant to leave the evaporator through the suction line as a superheated vapor. The refrigerant then returns to the compressor, where the cycle is repeated.

REMOVE AND INSTALL THE CHASSIS

⚠ WARNING

ELECTRIC SHOCK HAZARD

Turn off electric power before service or installation.

All electrical connections and wiring MUST be installed by a qualified electrician and conform to the National Electrical Code and all local codes which have jurisdiction.

Failure to do so can result in personal injury or death.

⚠ WARNING

CUT/SEVER HAZARD

Be careful with the sharp edges and corners. Wear protective clothing and gloves, etc.

Failure to do so could result in serious injury.

Servicing / Chassis Quick Changeouts

The chassis is designed for quick disconnect and change out. For minor electrical service, the control box cover lifts straight up after the screws & disconnect head are removed. For major electrical, refrigeration and fan service the chassis may be removed from utility closet.

To Remove the Chassis from the Closet:

1. Switch off the power coming into the unit from the main breaker panel or the closet mounted disconnect.
2. Switch the wall Thermostat off.
3. Pull the Power Disconnect located in the front of the chassis.
4. Disconnect the L1 and L2 electrical connections and remove conduit from chassis.
5. Disconnect low voltage thermostat connections.
5. Disconnect the duct work.
6. Disconnect condensate drain
7. Slide the chassis out of the wall plenum.

Caution:
Do not tear Gasket during removal.

8. Remove the chassis out of the utility closet.

Reinstallation

1. Installation is the reverse of the removal above.
2. Verify that the unit is level after installation.

Adjust as required.

EXTERNAL STATIC PRESSURE

External Static Pressure can best be described as the pressure difference (drop) between the Positive Pressure (discharge) and the Negative Pressure (intake) sides of the blower. External Static Pressure is developed by the blower as a result of resistance to airflow (Friction) in the air distribution system EXTERNAL to the VERT-I-PAK cabinet.
Resistance applied externally to the VERT-I-PAK (i.e. duct work, filters, etc.) on either the supply or return side of the system causes an INCREASE in External Static Pressure accompanied by a REDUCTION in airflow.
External Static Pressure is affected by two factors.

1. Resistance
2. Blower Speed (Changing to a higher or lower blower speed will raise or lower the External Static Pressure accordingly).

These affects must be understood and taken into consideration when checking External Static Pressure/Airflow to insure that the system is operating within design conditions.
Operating a system with insufficient or excessive airflow can cause a variety of different operating problems. Among these are problems such as, reduced capacity, freezing evaporator coils, premature compressor' heating component failures, and/ or other air local distribution issues..
System airflow should always be verified upon completion of a new installation, or before a change-out, compressor replacement, or in the case of heat strip failure to insure that the failure was not caused by improper airflow.

Checking External Static Pressure

The airflow through the unit can be determined by measuring the external static pressure of the system, and consulting the blower performance data for the specific VERT-I-PAK.

1. Set up to measure external static pressure at the supply and return air.
2. Ensure the coil and filter are clean, and that all the registers are open.
3. Determine the external static pressure with the blower operating.
   Use a digital manometer to measure. Measurement should be taken roughly 3-6" from the Vert-I-Pak collar and the center of the indoor coil with the filter installed.
4. Refer to the Air Flow Data for your VERT-I-PAK system to find the actual airflow for factory-selected fan speeds.
5. If the actual airflow is either too high or too low, the blower speed will need to be changed to appropriate setting or the ductwork will need to be reassessed and corrections made as required.
6. Select a speed, which most closely provides the required airflow for the system.
7. Recheck the external static pressure with the new speed. External static pressure (and actual airflow) will have changed to a higher or lower value depending upon speed selected. Recheck the actual airflow (at this "new" static pressure) to confirm speed selection.
8. Repeat steps 7 and 8 (if necessary) until proper airflow has been obtained.

EXAMPLE: Airflow requirements are calculated as follows: (Having a wet coil creates additional resistance to airflow. This additional resistance must be taken into consideration to obtain accurate airflow information.

Determining the Indoor CFM						
MODEL	VHA 09/12		VHA 18		VHA 24	
FAN SPEED	LOW	HIGH	LOW	HIGH	LOW	HIGH
ESP (")	CFM					
0.0"	470	520	730	800	755	805
0.05"	460	510	670	735	700	750
*0.10"	430	490	630	675	660	700
0.15"	410	470	595	640	615	665
0.20"	360	440	550	600	575	625
0.25"	310	400	505	550	525	580
0.30"	260	350	455	500	485	540
0.35"	--	--	400	445	450	500
0.40"	--	--	345	400	415	465

Table 601 (Determining the Indoor CFM)

* values indicate rated performance point

External Static Pressure

Correct CFM (if needed): Correction Multipliers	
230V	1.00
208V	0.97
265V	
Heating	1.00
Cooling	0.95
Table 602 (Correction Multiplier)	

Explanation of Tables

Table 601 is the nominal dry coil VERT-I-PAK CFMs. Table 602 is the correction factors beyond nominal conditions.
1 ½ TON SYSTEM (18,000 Btu)
Operating on high speed @ 230 volts with dry coil.
measured external static pressure .10
Air Flow = 450 CFM
In the same SYSTEM used in the previous example but having a WET coil you must use a correction factor of .95 (i.e. 450 x .95=428 CFM) to allow for the resistance (internal) of the condensate on the coil.
It is important to use the proper procedure to check external Static Pressure and determine actual airflow. Since in the case of the VERT-I-PAK, the condensate will cause a reduction in measured External Static Pressure for the given airflow.
It is also important to remember that when dealing with VERT-I-PAK units that the measured External Static Pressure increases as the resistance is added externally to the cabinet. Example: duct work, filters, grilles.

Indoor Airflow Data

The Vert-I-Pak A series units must be installed with a free return air configuration. Table 601 lists the indoor airflow at corresponding static pressures. All units are rated at low speed.

Ductwork Preparation

If flex duct is used, be sure all the slack is pulled out of the flex duct. Flex duct ESP can increase considerably when not fully extended. DO NOT EXCEED a total of .30 ESP, as this is the MAXIMUM design limit for the VERT-I-PAK A-Series unit.
IMPORTANT: FLEX DUCT CAN COLLAPSE AND CAUSE AIRFLOW RESTRICTIONS. DO NOT USE FLEX DUCT FOR: 90 DEGREE BENDS, OR UNSUPPORTED RUNS OF 5 FT. OR MORE.

External Static Pressure

Fresh Air Door

The Fresh Air Door is an "intake" system. The fresh air door opened via a slide on the front of the chassis located just above the indoor coil. Move the slide left to open and right to close the fresh air door. The system is capable of up to 60 CFM of fresh air @ ~.3" H2O internal static pressure.

Checking Approximate Airflow

If a digital manometer is not available to check the External Static Pressure, or the blower performance data is unavailable for your unit, approximate airflow can be calculated by measuring the temperature rise, then using tile following criteria.

$$\text{CFM} = \frac{\text{Kilowatts} \times 3413}{\text{Temp Rise } \times 1.08}$$

Electric Heat Strips

The approximate CFM actually being delivered can be calculated by using the following formula:
DO NOT simply use the Kilowatt Rating of the heater (i.e. 2.5, 3.4, 5.0) as this will result in a less-than-correct airflow calculation. Kilowatts may be calculated by multiplying the measured voltage to the unit (heater) times the measured current draw of all heaters (ONLY) in operation to obtain watts. Kilowatts are than obtained by dividing by 1000.
EXAMPLE: Measured voltage to unit (heaters) is 230 volts. Measured Current Draw of strip heaters is 11.0 amps.
230 x 11.0 = 2530
2530/1000 = 2.53 Kilowatts
2.53 x 3413 = 8635
Supply Air = 95°F
Return Air = 75°F
Temperature Rise = 20°F
20 x 1.08 = 21.6

$$\frac{8635}{21.6} = 400\ CFM$$

TROUBLESHOOTING

Control Diagnostic Modes

Control Diagnostic Modes

Diagnostic Description	LED 1	LED 2	Solution
Control Fault (No Power)	Off	Off	Confirm incoming voltage, if present replace the board.
Normal Operation	Flash	Flash	Normal operation.
Anti-Short Cycle Delay		Alternating Flash	Wait for shot cycle delay to expire. Approximately 3-minutes.
Coil Sensor Failure	On	On	1. An open or shorted sensor is detected. 2 .Confirm connection points. 3. Ohm out sensor to confirm if open (OL) or shorted (0.0 Ohms). If ok replace the board. Refer to Appendix 1 (Thermistor resistor values).
Ambient Sensor Failure	Off	On	1. An open or shorted sensor is detected. 2. Confirm connection points. 3 .Ohm out sensor to confirm if open (OL or shorted (0.0 Ohms). If ok replace the board. Refer to Appendix 1 (Thermistor resistor values).
Low Pressure Switch Open	On	Flash	1. Possible faulty pressure switch. 2. Confirm connection points. 3 .Suction line pressure is too low. Confirm system pressures and operation, address as needed. 4 .In cooling possible indoor blower not running or insufficient airflow. Check filters and for blockage. 5. Check for low refrigerant. 6. Check for clogged evaporator.
Low Pressure Switch Lockout	Off	Flash	1. Possible faulty pressure switch. 2. Confirm connection points. 3 .Suction line pressure is too low. Confirm system pressures and operation, address as needed. 4 .In cooling possible indoor blower not running.
High Pressure Switch Open	Flash	On	1. Possible faulty pressure switch. 2 .Confirm connection points. 3 .Discharge pressure too high. Confirm system pressures and operation, address as needed. 4 .In cooling possible outdoor condensing fan motor not running. 5. Check for refrigerant restriction. 6. Wall sleeve baffles not in place or adjusted properly. 7. Insufficient condenser airflow. 8. Check for plugged condenser coil. 9. Wall sleeve baffles not in place or adjusted properly.
High Pressure Switch Lockout	Flash	Off	1. Possible faulty pressure switch. 2 .Confirm connection points. 3 .Discharge pressure too high. Confirm system pressures and operation, address as needed. 4 .In cooling possible outdoor condensing fan motor not running. 5. Lockout will reset after the Y call is removed. 6. Check for refrigerant restriction. 7. Insufficient condenser airflow. 8. Check for plugged condenser coil.

Table 701

COMPONENT IDENTIFICATION

Electrical Control Box 9K & 12k

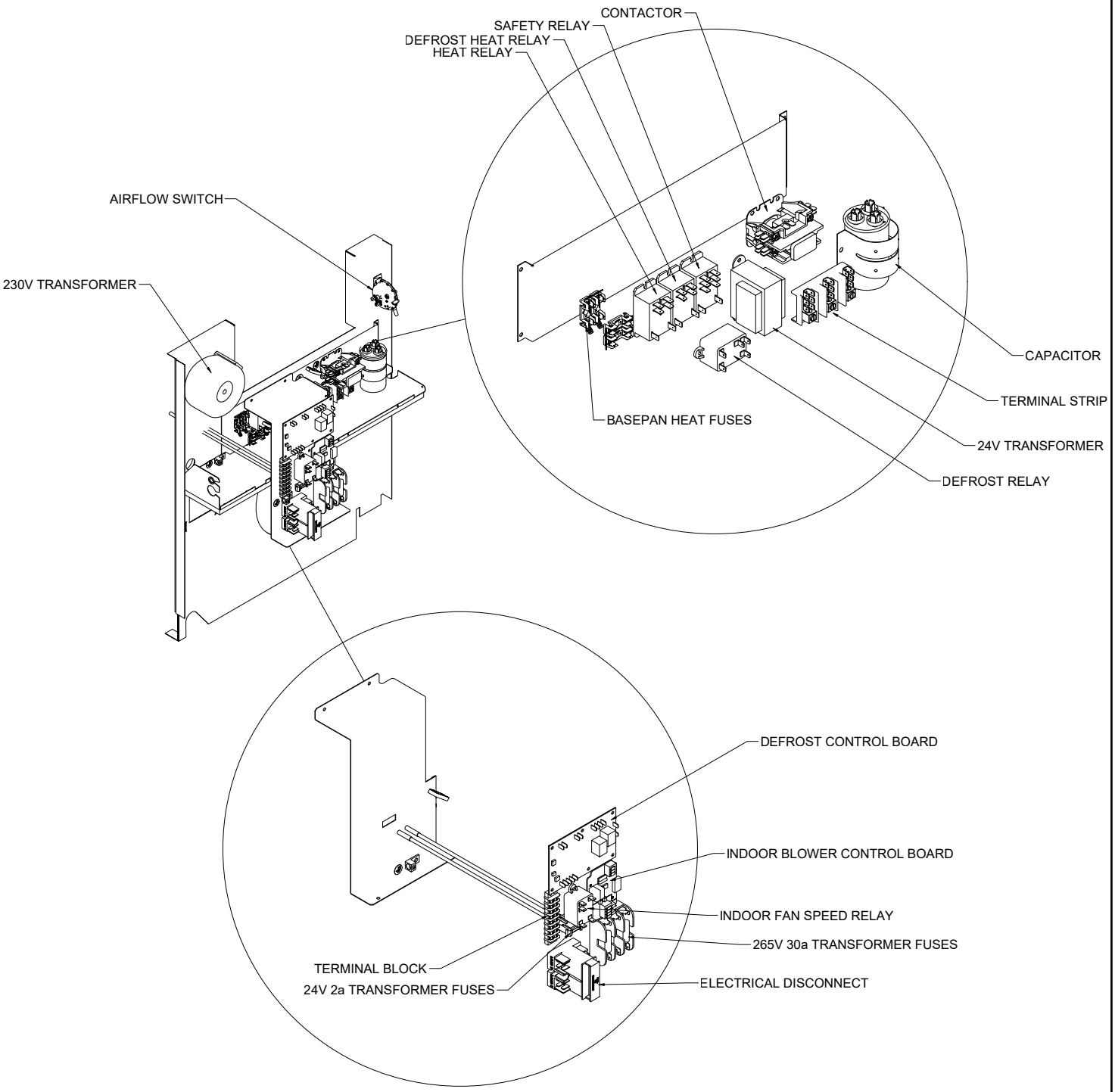
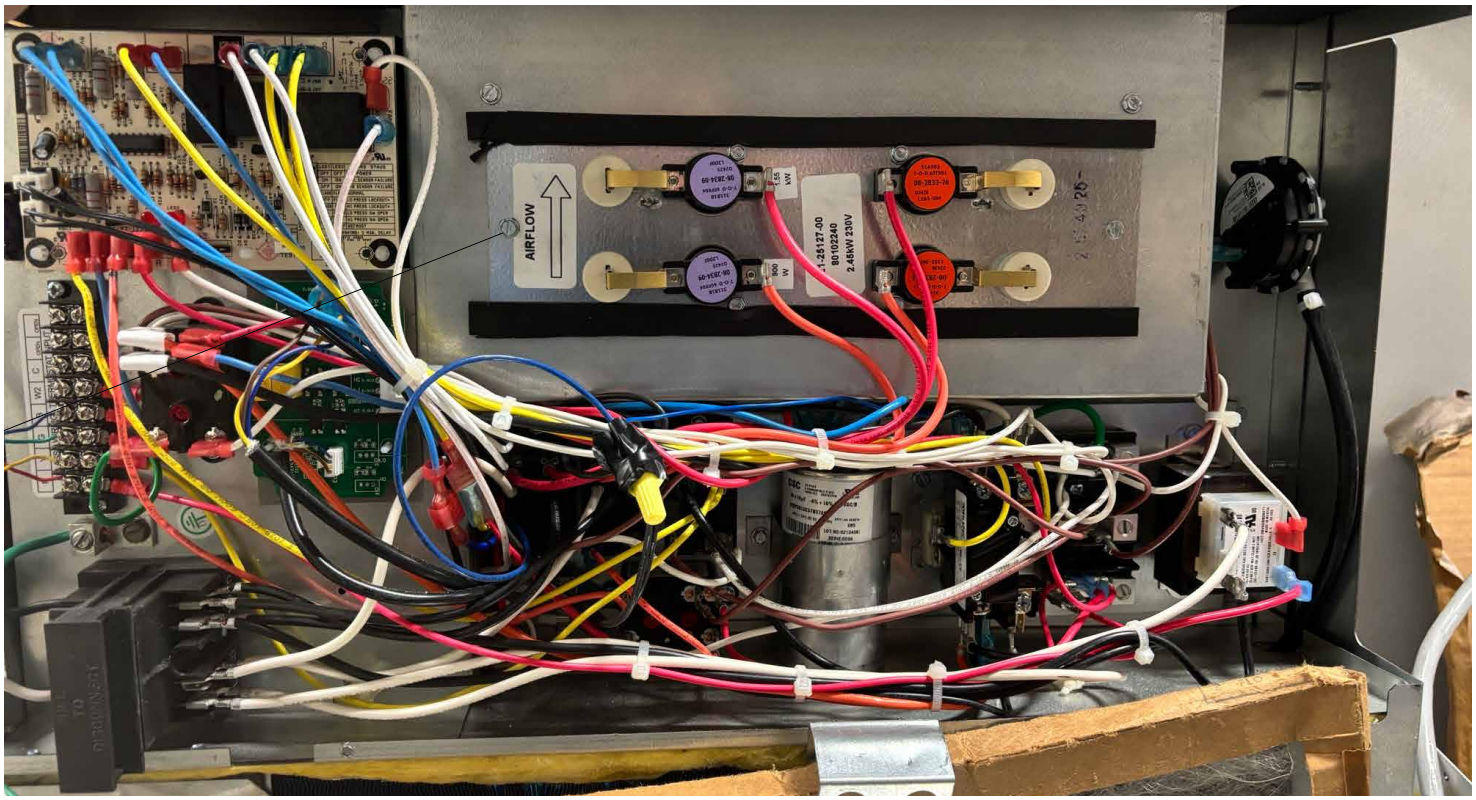


Figure 601 (9k &12k Volt Electrical Box)

COMPONENT IDENTIFICATION

Electrical Control Box 9K & 12k



COMPONENT IDENTIFICATION

Electrical Control Box 18K & 24k

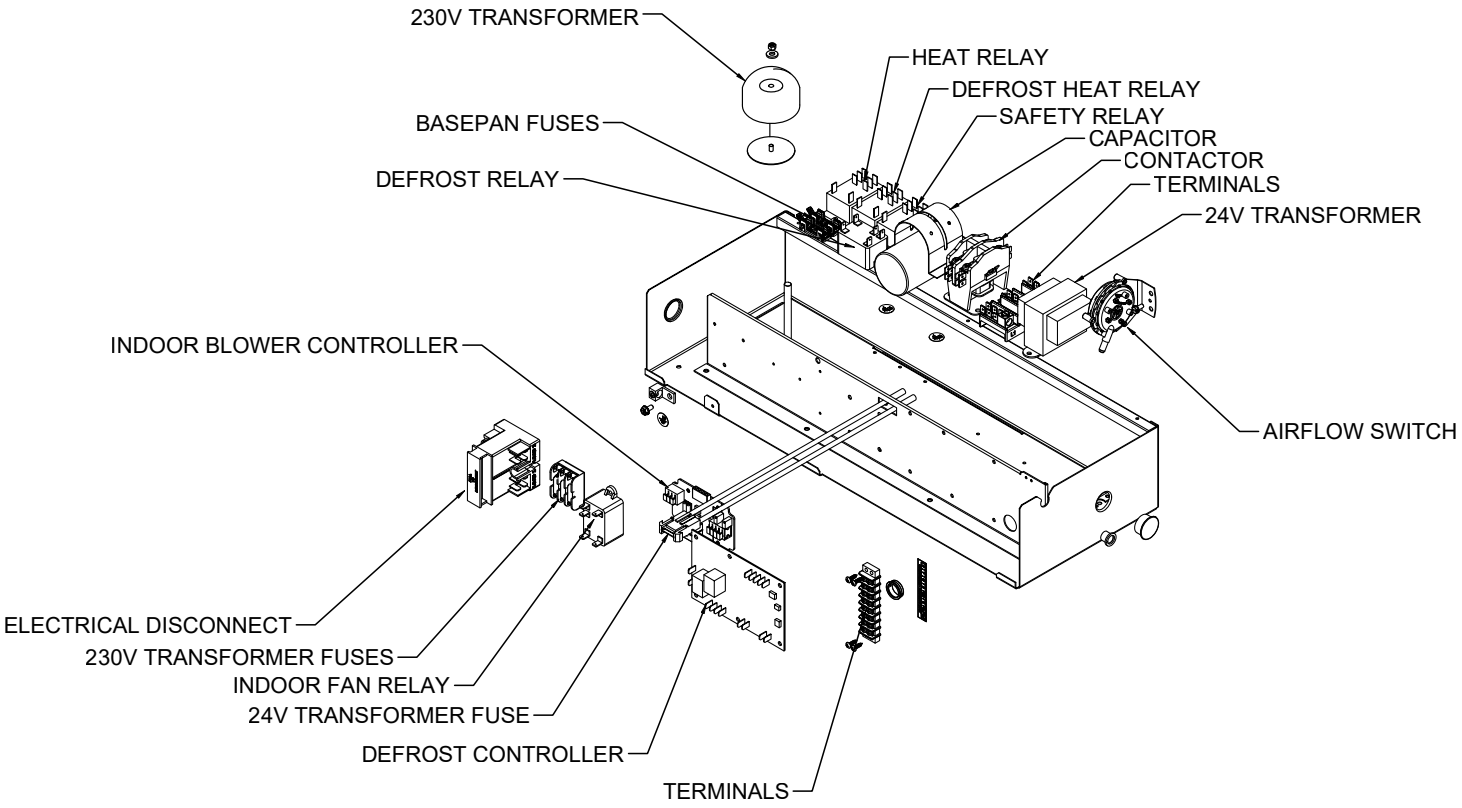


Figure 603 (18 & 24k Electrical Box)

COMPONENT IDENTIFICATION

Defrost Control Board

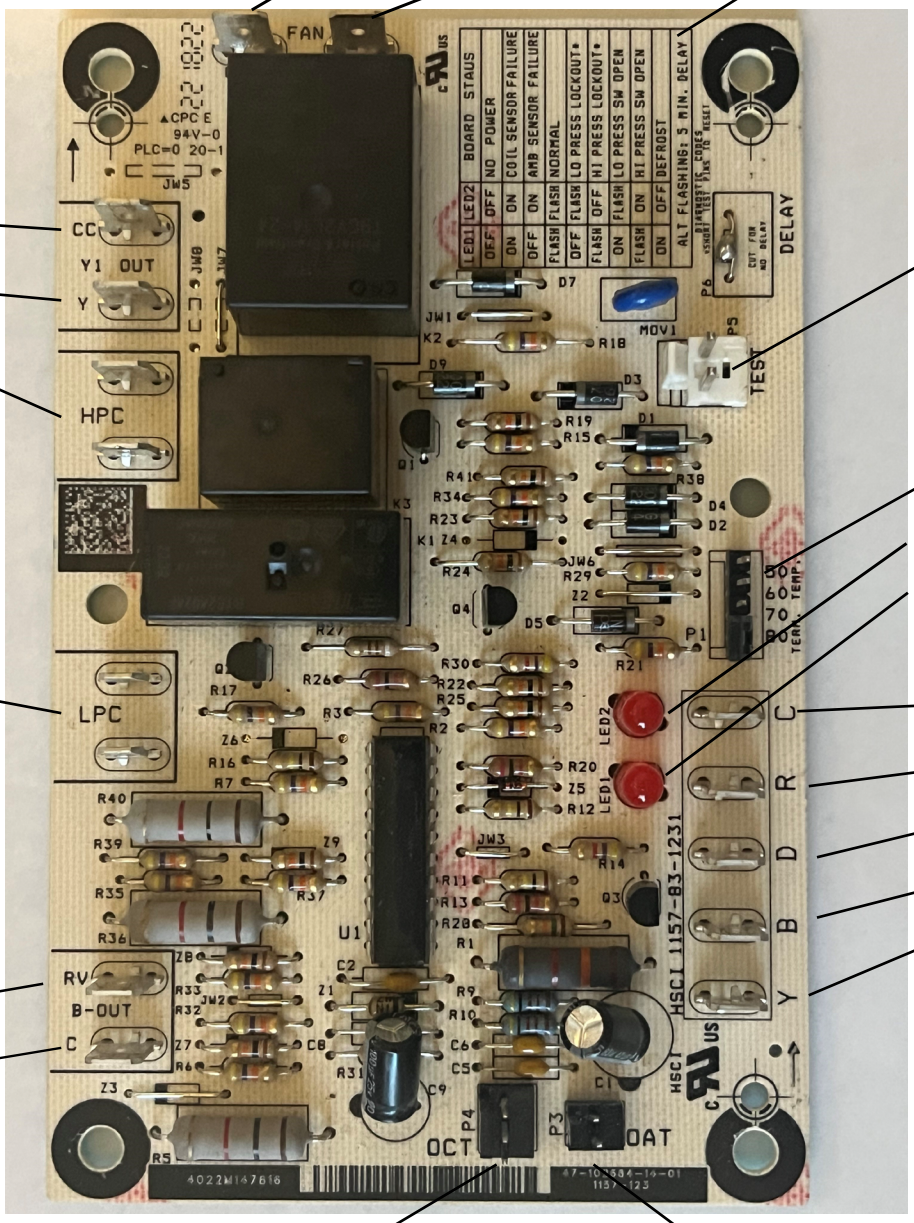


Figure 604 (Defrost Control Board Identification)

COMPONENT TESTING

Reversing Valve

A reversing valve is a component of a heat pump that changes the direction of refrigerant flow, allowing the system to function in both heating and cooling modes.

It consists of a pressure-operated, main valve and a pilot valve actuated by a solenoid plunger. The solenoid is energized by 24 vac during the heating cycle only.

The single tube on one side of the main valve body is the high-pressure inlet to the valve from the compressor. The center tube on the opposite side is connected to the low pressure (suction) side of the system. The other two are connected to the indoor and outdoor coils. Small capillary tubes connect each end of the main valve cylinder to the "A" and "B" ports of the pilot valve. A third capillary is a common return line from these ports to the suction tube on the main valve body. Four-way reversing valves also have a capillary tube from the compressor discharge tube to the pilot valve.

The plunger assembly in the main valve can only be shifted by the pressure differential between the high and low sides of the system. The pilot section of the valve opens and closes ports for the small capillary tubes to the main valve to cause it to shift.

⚠ WARNING

ELECTRIC SHOCK HAZARD

Disconnect power to the unit before servicing. Failure to follow this warning could result in serious injury or death.

⚠ WARNING

HIGH PRESSURE HAZARD

Sealed Refrigeration System contains refrigerant and oil under high pressure.

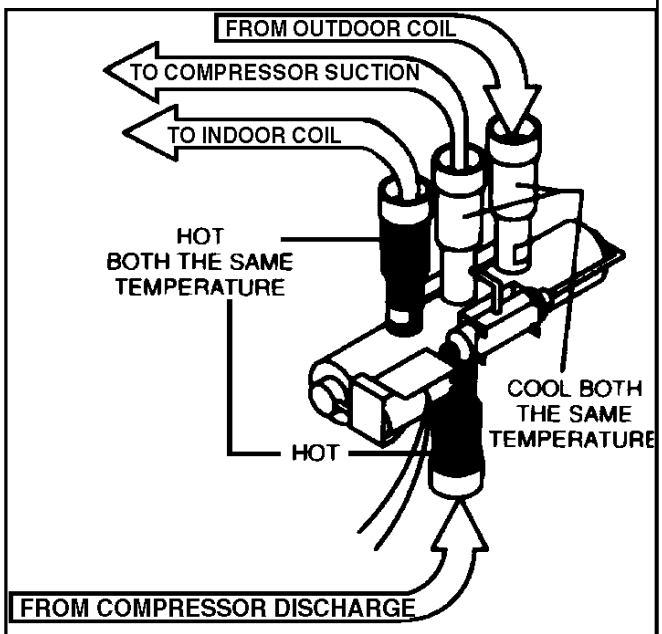
Proper safety procedures must be followed, and proper protective clothing must be worn when working with refrigerants.

Failure to follow these procedures could result in serious injury or death.

Checking the Reversing Valve

NOTE: System operating pressures must be near normal before valve can shift. NOTE: You must have normal operating pressures before the reversing valve can shift.

Run the unit in the heating mode then disconnect one of the 24 vac wires at the reversing valve and the valve should shift to cooling mode. If valve does not shift - replace the valve(verify the unit is properly charged before replacing valve.) For a stuck valve diagnosis run in the cooling mode and check the temp difference between the suction line from the evaporator and the common suction line at the compressor, if there is more than a 3 °F difference then change the valve.



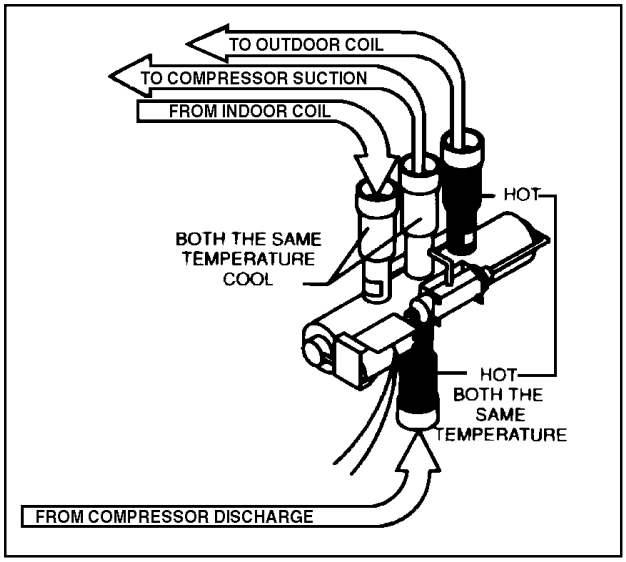
Reversing Valve in Heating Mode

Checking The Reversing Valve Solenoid

The solenoid coil is an electromagnetic type coil mounted on the reversing valve and is energized during the operation of the compressor in the heating cycle.

1. Turn off high voltage electrical power to unit.
2. Unplug line voltage lead from reversing valve coil.
3. Check for electrical resistance through the coil. If the coil is open replace the coil.
4. Check from each lead of coil to the copper liquid line as it leaves the unit or the ground lug. There should be no continuity between either of the coil leads and ground; if there is, coil is grounded and must be replaced.
5. If coil tests okay, reconnect the electrical leads.
6. Make sure coil has been assembled correctly.

NOTE: Do not start unit with solenoid coil removed from valve, or do not remove coil after unit is in operation. This will cause the coil to burn out.



COMPONENT TESTING

Compressor Checks

⚠ WARNING

ELECTRIC SHOCK HAZARD

Turn off electric power before service or installation.

All electrical connections and wiring MUST be installed by a qualified electrician and conform to the National Electrical Code and all local codes which have jurisdiction.

Failure to do so can result in personal injury or death.

⚠ WARNING

BURN HAZARD

Proper safety procedures must be followed, and proper protective clothing must be worn when working with a torch.

Failure to follow these procedures could result in moderate or serious injury.

Locked Rotor Voltage (L.R.V.) Test
Locked rotor voltage (L.R.V.) is the actual voltage available at the compressor under a stalled condition.

Single Phase Connections
Disconnect power from unit. Using a voltmeter, attach one lead of the meter to the run "R" terminal on the compressor and the other lead to the common "C" terminal of the compressor. Restore power to unit.

Determine L.R.V.
Start the compressor with the volt meter attached; then stop the unit. Attempt to restart the compressor within a couple of seconds and immediately read the voltage on the meter. The compressor under these conditions will not start and will usually kick out on overload within a few seconds since the pressures in the system will not have had time to equalize. Voltage should be at or above minimum voltage of 197 VAC, as specified on the rating plate. If less than minimum, check for cause of inadequate power supply; i.e., incorrect wire size, loose electrical connections, etc.

Amperage (R.L.A) Test
The running amperage of the compressor is the most important of these readings. A running amperage higher than that indicated in the performance data indicates that a problem exists mechanically or electrically.

Single Phase Running and L.R.A. Test
NOTE: Consult the specification and performance section for running amperage. The L.R.A. can also be found on the rating plate.
Select the proper amperage scale and clamp the meter probe around the wire to the "C" terminal of the compressor.
Turn on the unit and read the running amperage on the meter. If the compressor does not start, the reading will indicate the locked rotor amperage (L.R.A.).

Overloads
The compressor is equipped with either an external or internal overload which senses both motor amperage and winding temperature. High motor temperature or amperage heats the overload causing it to open, breaking the common circuit within the compressor. Heat generated within the compressor shell, usually due to recycling of the motor, is slow to dissipate. It may take anywhere from a few minutes to several hours for the overload to reset.

Checking the Overloads

Internal Overloads
The overload is embedded in the motor windings to sense the winding temperature and/or current draw. The overload is connected in series with the common motor terminal.
Should the internal temperature and/or current draw become excessive, the contacts in the overload will open, turning off the compressor. The overload will automatically reset, but may require several hours before the heat is dissipated.

Checking the Internal Overload
WARNING: Make sure Compressor is cool to the touch prior to OHMs testing.
1. With no power to unit, remove the leads from the compressor terminals.
2. Using an ohmmeter, test continuity between terminals

C-S and C-R. If no continuity, the compressor overload is open and the compressor must be replaced.

COMPONENT TESTING

Compressor Checks

⚠ WARNING

ELECTRIC SHOCK HAZARD
Turn off electric power before service or installation. Extreme care must be used, if it becomes necessary to work on equipment with power applied.

Failure to do so could result in serious injury or death.

⚠ WARNING

HIGH PRESSURE HAZARD
Sealed Refrigeration System contains refrigerant and oil under high pressure.

Proper safety procedures must be followed, and proper protective clothing must be worn when working with refrigerants.

Failure to follow these procedures could result in serious injury or death.

Single Phase Resistance Test
Remove the leads from the compressor terminals and set the ohmmeter on the lowest scale (R x 1).
Touch the leads of the ohmmeter from terminals common to start ("C" to "S"). Next, touch the leads of the ohmmeter from terminals common to run ("C" to "R").
Add values "C" to "S" and "C" to "R" together and check resistance from start to run terminals ("S" to "R"). Resistance "S" to "R" should equal the total of "C" to "S" and "C" to "R."
In a single phase PSC compressor motor, the highest value will be from the start to the run connections ("S" to "R"). The next highest resistance is from the start to the common connections ("S" to "C"). The lowest resistance is from the run to common. ("C" to "R") Before replacing a compressor, check to be sure it is defective.

GROUND TEST
Ensure the that compressor wires are disconnected. Use an ohmmeter set on its highest scale. Touch one lead to the copper tubing (clean point of contact as a good connection is a must) and the other probe in turn to each compressor terminal. If a reading is obtained the compressor is grounded and must be replaced.
Check the complete electrical system to the compressor and compressor internal electrical system, check to be certain that compressor is not out on internal overload.
Complete evaluation of the system must be made whenever you suspect the compressor is defective. If the compressor has been operating for sometime, a careful examination must be made to determine why the compressor failed.
Many compressor failures are caused by the following conditions:

1. Improper air flow over the evaporator.
2. Overcharged refrigerant system causing liquid to be returned to the compressor.
3. Restricted refrigerant system.
4. Lack of lubrication.
5. Liquid refrigerant returning to compressor causing oil to be washed out of bearings.
6. Non-condensables such as air and moisture in the system. Moisture is extremely destructive to a refrigerant system.
7. Run Capacitor.

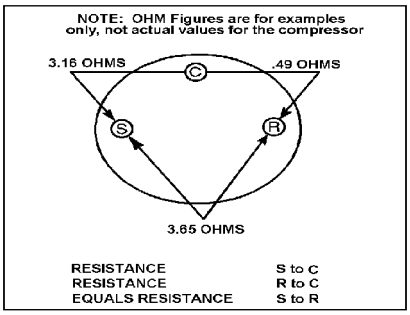


Figure 608 (Resistance Chart)

CHECKING COMPRESSOR EFFICIENCY
The reason for compressor inefficiency is normally due to broken or damaged suction and/or discharge valves, reducing the ability of the compressor to pump refrigerant gas.

NOTE: Before installing valves and gauges, check the compressor discharge temperature and compressor current, Low compressor amperage combined with low discharge temperature is an indication that the compressor might be faulty,

This condition can be checked as follows:

1. Install a piercing valve on the suction and discharge or liquid process tube.
2. Attach gauges to the high and low sides of the system.-
3. Start the system and run a "cooling or heating performance test." If test shows:
   - A. Below normal high side pressure
   - B. Above normal low side pressure
   - C. Low temperature difference across coil

The compressor valves are faulty - replace the compressor.

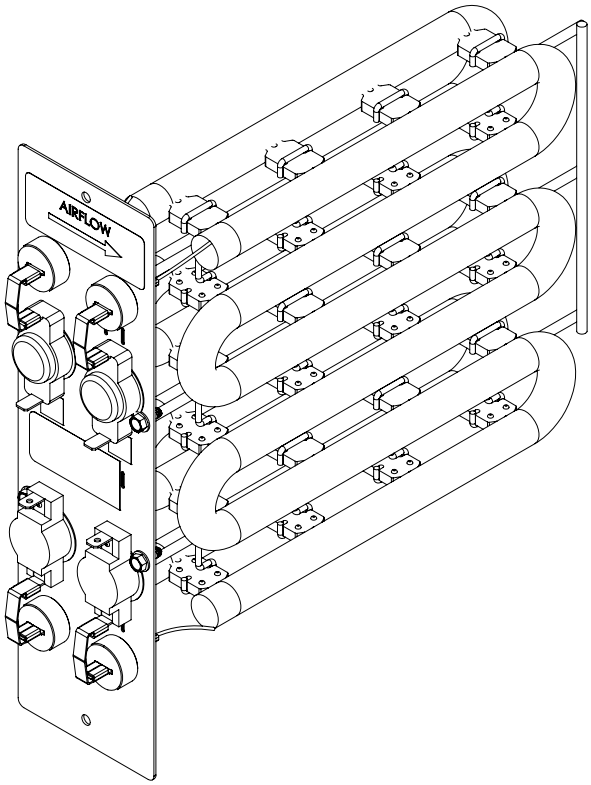
COMPONENTS TESTING

Heating Element and Limit Switches

⚠ WARNING

ELECTRIC SHOCK HAZARD
Turn off electric power before service or installation. Extreme care must be used, if it becomes necessary to work on equipment with power applied.

Failure to do so could result in serious injury or death.



All models are equipped with a dual heating element. Each element has a primary limit switch (bimetal thermostat). Should the blower motor fail, filter become clogged or air-flow be restricted etc., the high limit switch will open and interrupt the power to the heater before reaching an un-safe temperature condition.
The limit switches are in series with the element and will interrupt the power at a designed temperature. (Open at 165˚ and close at 135˚F. Each element is also equipped with a one time switch that will open at 200˚F. If this switch opens the heating element module will need to be replaced.

To Check the Heater elements:
1. Open the control box and disconnect the leads from the heater control relays.
2. Ohm out the the elements through the applicable wires.
Refer to the specifications chart below and the applicable Wiring Diagram..
3. If you determine the heat element to be out of tolerance (Open, shorted, or out of specifications) access the heater element by remove the left side access panel of the unit (See Heater removal) , remove the wires from the heater element and recheck. If findings are confirmed replace the heater element.

Model	Part Number	Coil 1 (Defrost Coil) Specifications	Coil 2 Specifications	Primary Limit Switch (Auto)	Secondary Limit Switch (1 Time)
230v 2.5 kW	8010240	.9 kW 230V 51.70 Ω ±5%	1550W 230V 30.02 Ω ±5%	OPEN 165 F° CLOSE 135 F°	OPEN 200 F°
230v 3.4 kW	8010241	1.55 kW 230V 30.02 Ω ±5%	1600W 230V 25.85 Ω ±5%		
230v 5 kW	80102042	3.4 kW 230V 13.68 Ω ±5%	1600W 230V 29.08 Ω ±5%		
230v 7.5 kW	80102043	5 kW 230V 9.31 Ω ±5%	2500W 230V 18.61 Ω ±5%		
230v 10 kW	8010244	5 kW 230V 9.31 Ω ±5%	5000W 230V 9.31 Ω ±5%		
265v 2.5 kW	8010245	.9 kW 265V 68.63 Ω ±5%	1550W 265V 39.85 Ω ±5%		
265v 3.4 kW	8010246	1.55 kW 265V 39.85 Ω ±5%	1800W 265V 34.31 Ω ±5%		
265v 5 kW	8010247	3.4 kW 265V 18.17 Ω ±5%	1600W 265V 38.60 Ω ±5%		
265v 7.5 kW	8010248	5 kW 265V 12.35 Ω ±5%	2500W 265V 24.71 Ω ±5%		
265v 10 kW	8010249	5 kW 265V 12.35 Ω ±5%	5000W 265V 12.35 Ω ±5%		

Table 609 (Electrical Heater Coil Specifications)

COMPONENTS TESTING

Heater Assembly Removal 9 and 12k

1. Remove electrical box cover.
2. Disconnect Wiring.
4. Remove 2 screws.
5. Carefully unhook heater assembly from rear hook and slide out of the unit.

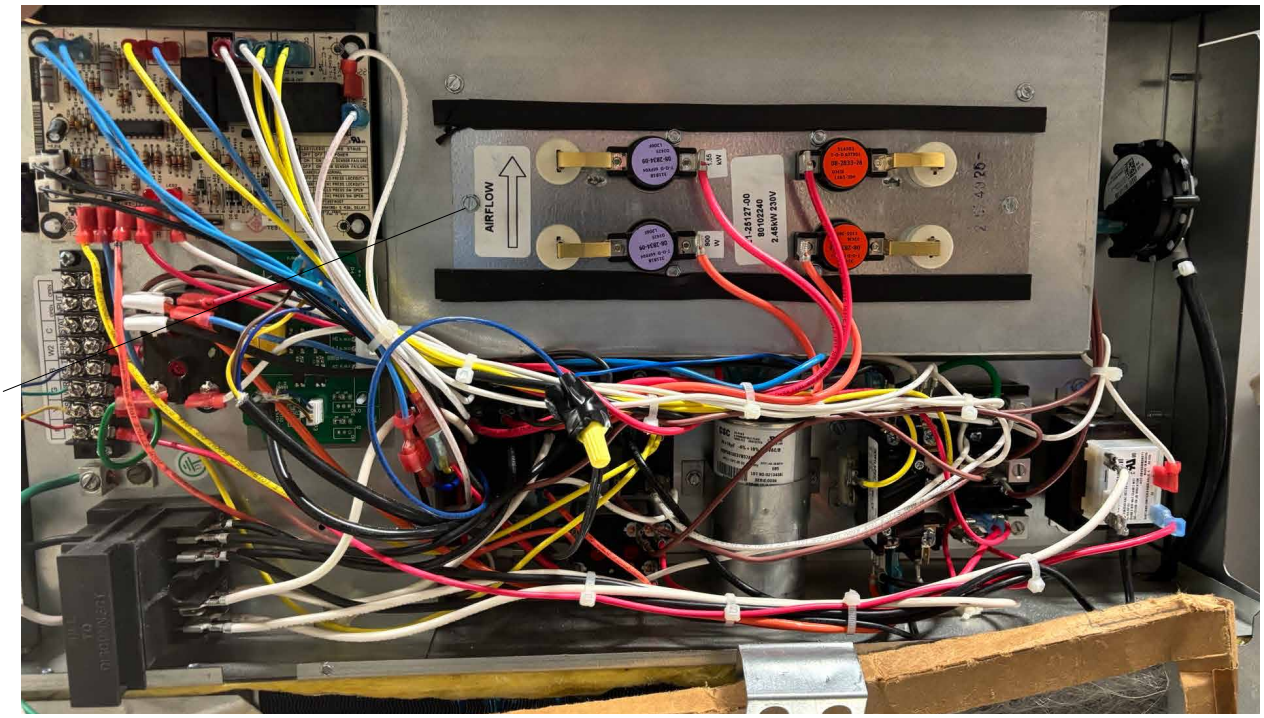


Figure 610

Figure 611

COMPONENTS TESTING

Heater Assembly Removal 18k and 24k

1. Remove right side access panel.
2. Disconnect Wiring.
3. Remove 2 screws.
4. Carefully unhook heater assembly from rear hook and slide out of the unit.

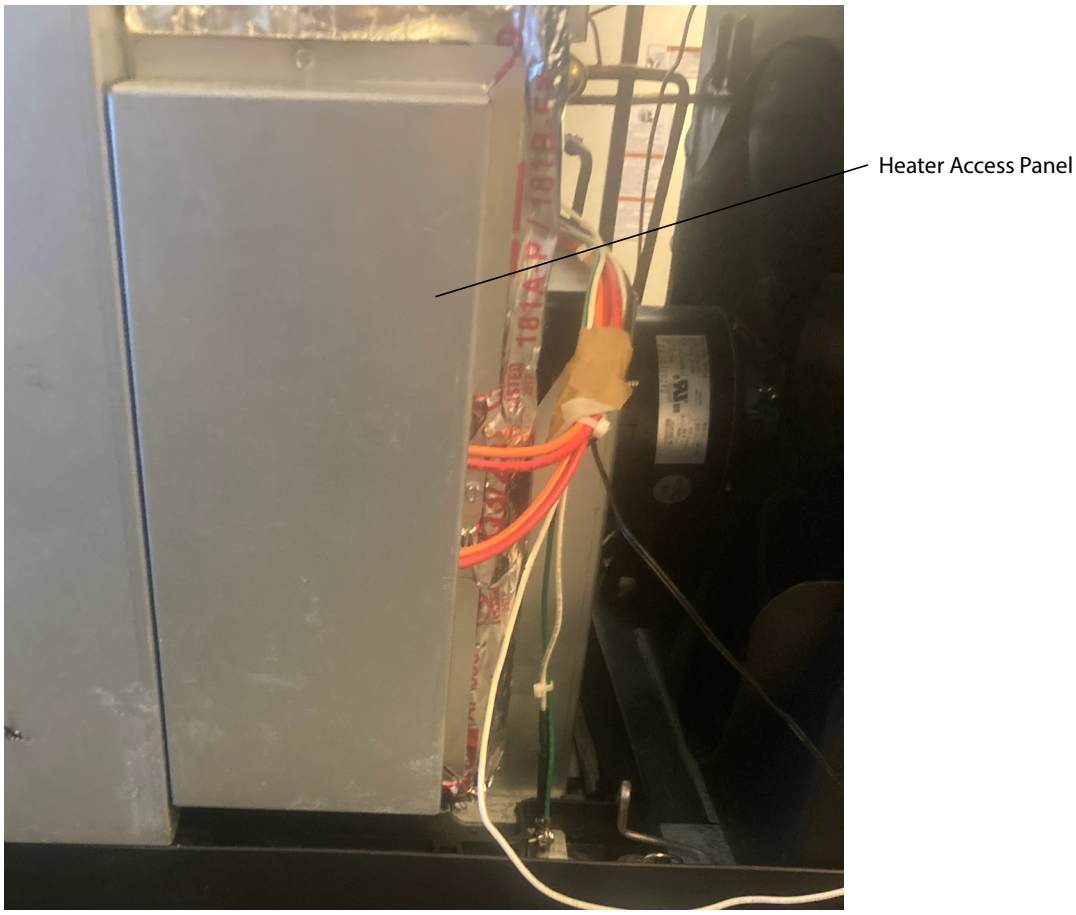


Figure 612

Figure 613

COMPONENTS TESTING

Drain Pan Valve

⚠ WARNING

ELECTRIC SHOCK HAZARD
Turn off electric power before service or installation. Extreme care must be used, if it becomes necessary to work on equipment with power applied.

Failure to do so could result in serious injury or death.

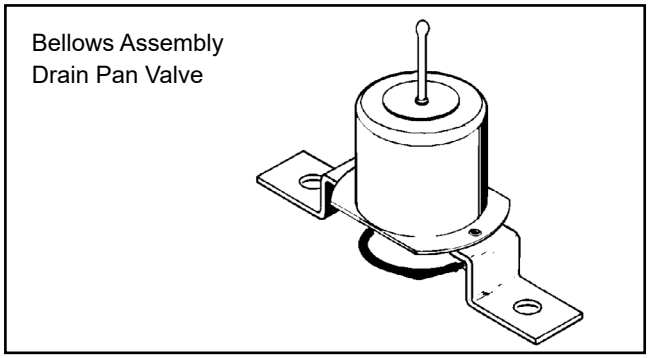


Figure 614 Drain Pan Valve

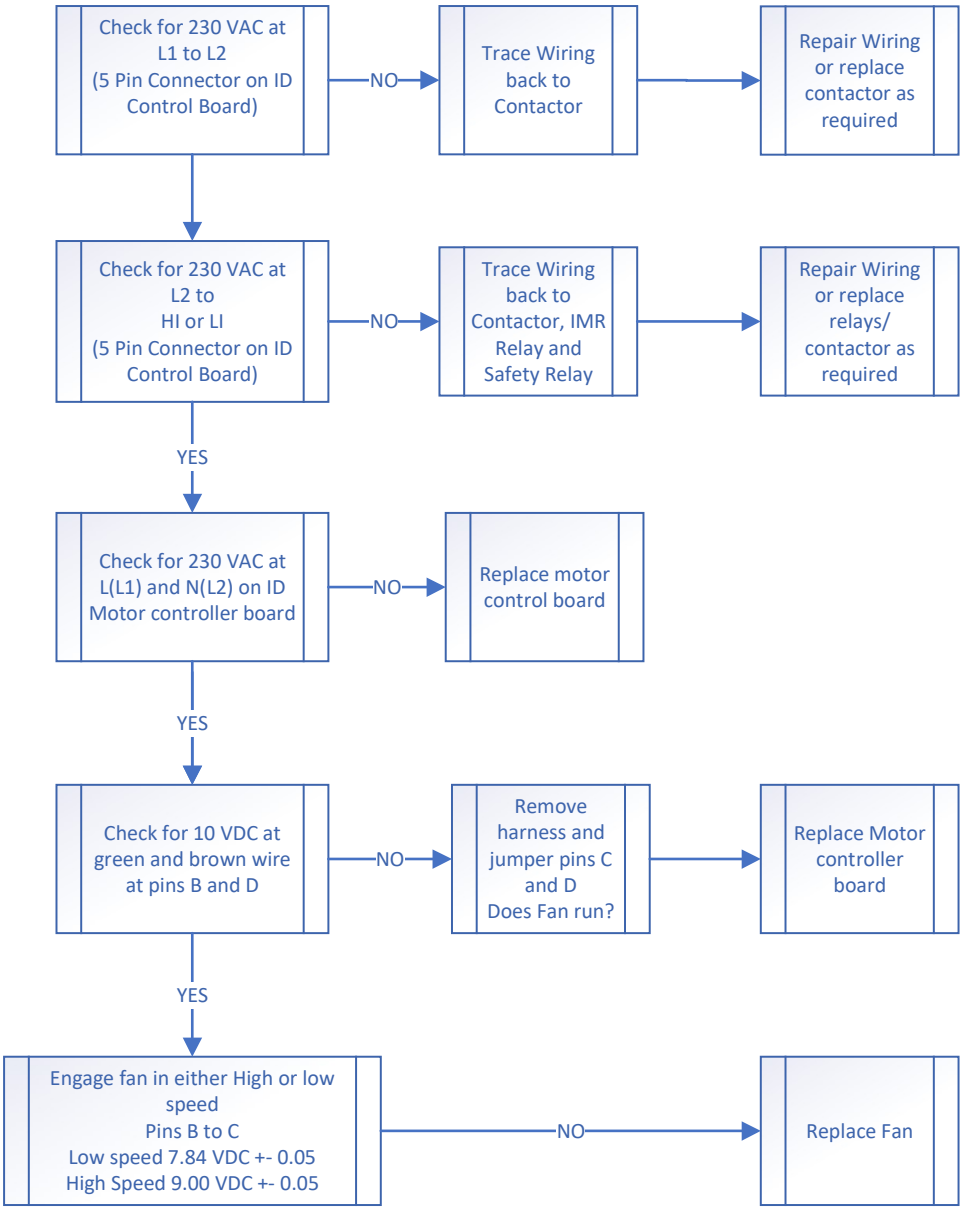
During the cooling mode of operation, condensate which collects in the drain pan is picked up by the con-denser fan blade and sprayed onto the condenser coil. This assists in cooling the refrigerant plus evaporating the water.
During the heating mode of operation, it is necessary that water be removed to prevent it from freezing during cold outside temperatures. This could cause the condenser fan blade to freeze in the accumulated water and prevent it from turning.
To provide a means of draining this water, a bellows type drain valve is installed over a drain opening in the base pan.
This valve is temperature sensitive and will open when the outside temperature reaches 40°F. The valve will close gradually as the temperature rises above 40°F to fully close at 60°F.

To test the drain pan valve;

1) Place a pack of ice on the capillary
2) Ensure that the valve opens as it cools down.
3) remove the pack of ice.
4) Ensure that the valve closes fully as the valve warms back up.

COMPONENT TESTING

Check Evaporator Blower Motor and Control Board



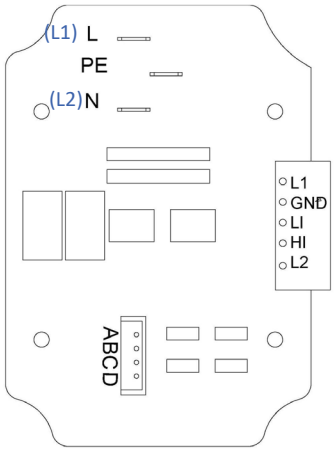
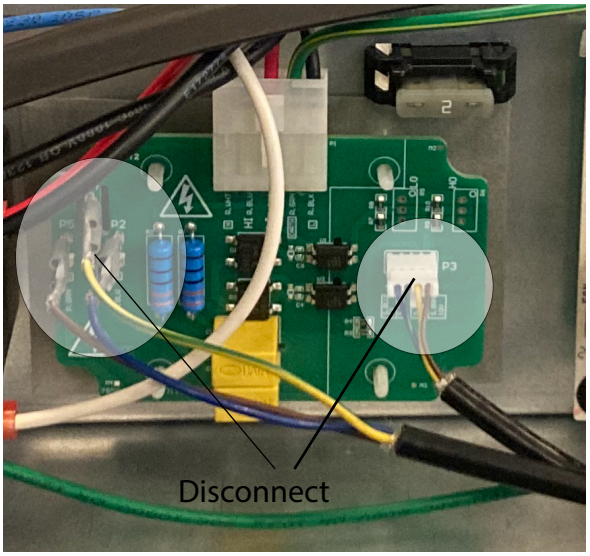


FIGURE 615 (INDOOR BLOWER MOTOR TESTING)

COMPONENT TESTING

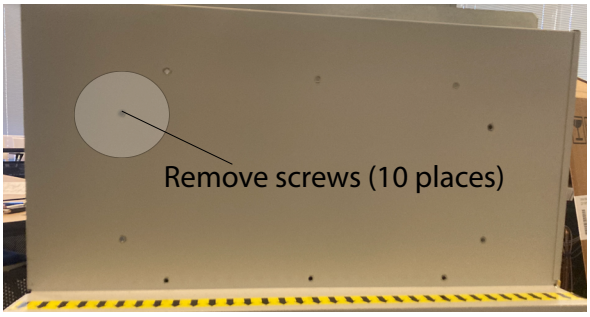
Replace Evaporator Blower Motor (18 & 24k)

1. Unit needs to be removed from sleeve or closet to facilitate fan replacement. Refer to Chassis Removal
2. Remove electrical box cover.
3. Disconnect the terminals and the P3 cable connector on the indoor fan motor controller.



3. Remove right side access panel.

4. Remove 10 fan mounting screws.

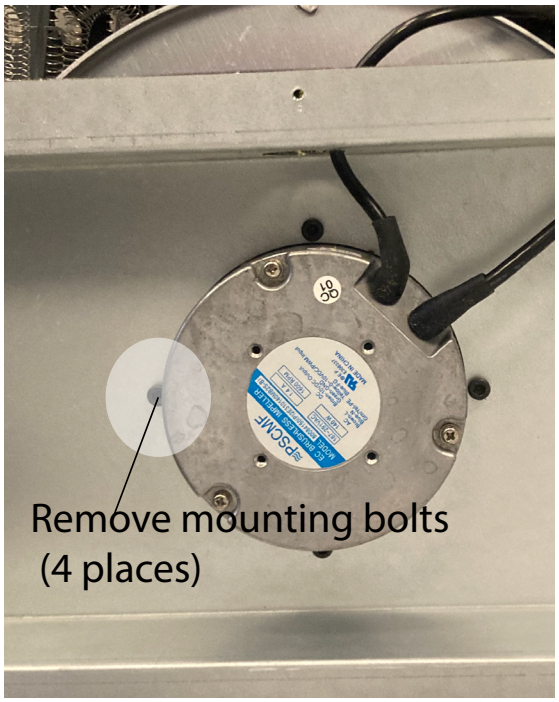


5. Remove four screws on top.

6. Remove 3 screws on right side.

7. Move inner fan support wall back and slide fan out of the right side of the unit.

8. Remove 4 allen screws to separate motor from mount.



COMPONENT TESTING

Outdoor Fan Check

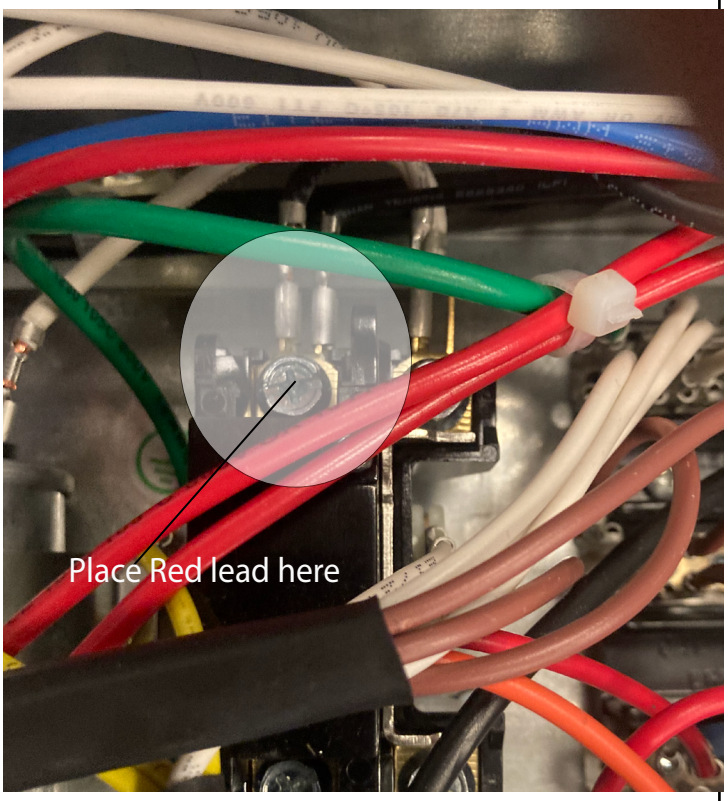
1. Remove Electrical box cover.

2. Ensure that unit is running with a demand for outdoor fan.

3. Check for 230/ 265 VAC by placing multimeter probes on Contactor Terminal and fan Out terminal of the defrost control board.

4. If 230/265 VAC is present- remove power from unit and check for loose terminals.

5. Replace motor.



COMPONENT TESTING

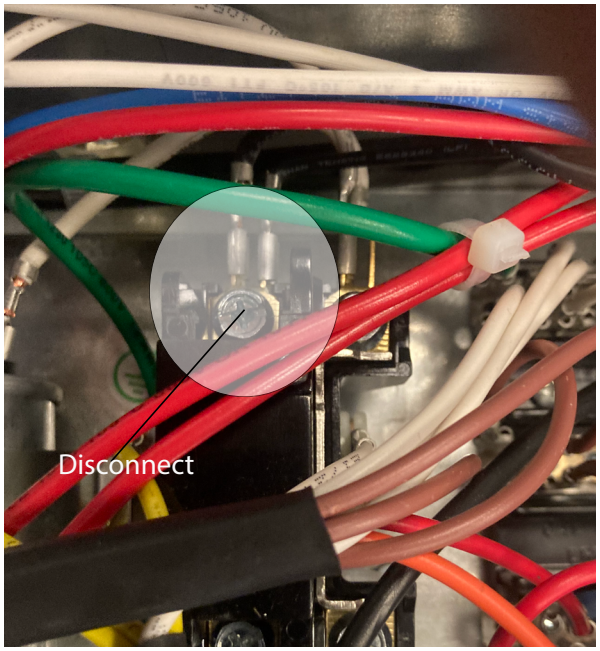
Outdoor Fan Replacement 9 & 12k

1. Remove chassis from closet. Refer to chassis removal.

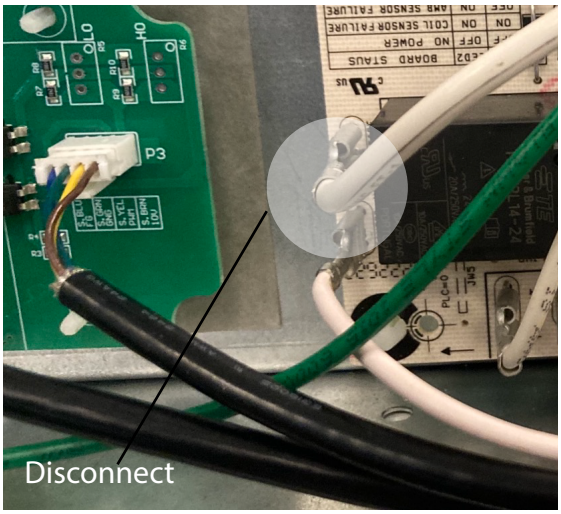
2. Remove electrical box cover.

3. Remove left and right side access panels.

NOTE: For blade replacement only, disconnection of fan motor wires is not required



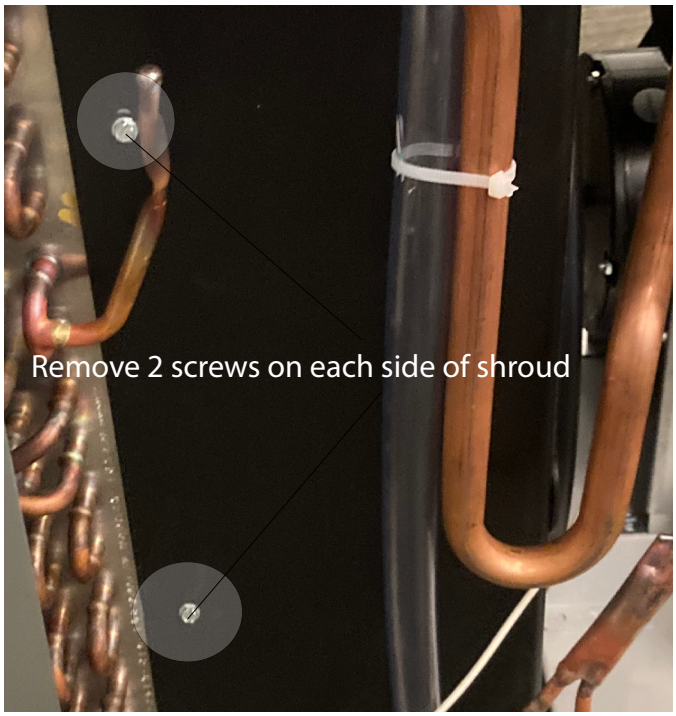
4. Disconnect black red (9k), or blue (12k) wire from T1 of the contactor.



5. Disconnect white wire from fan out terminal of the defrost board .

6. Pull some slack out of white wire in the bundle to facilitate fan removal.

7. Remove 2 screws on each side of shroud.



8. Remove 1 screw from bottom of shroud.

9. Remove 2 screws on rear panel.
10. Remove four fan mounting screws and ground wire.

COMPONENT TESTING

Outdoor Fan Replacement 18 & 24k

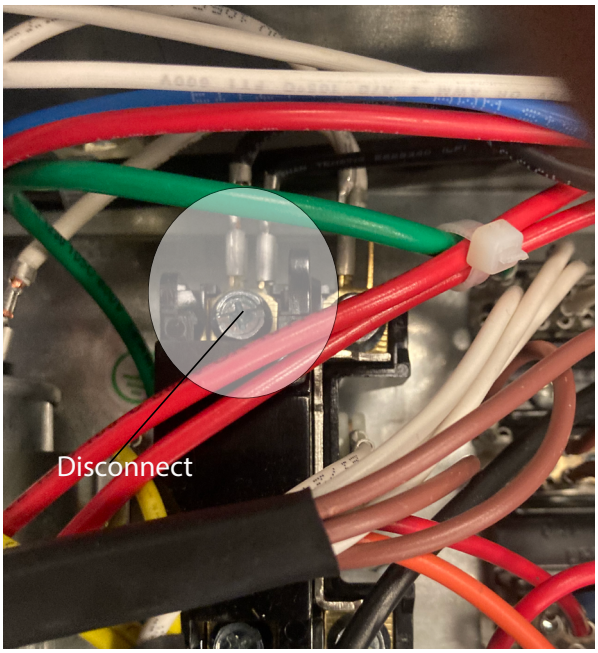
1. Remove chassis from closet. Refer to chassis removal.

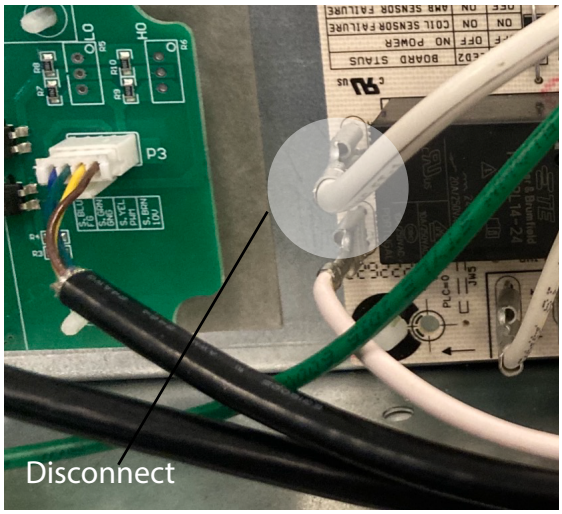
2. Remove left and right side lower access panels.

NOTE: For blade replacement only, disconnection of fan motor wires is not required

3. Disconnect black wire from T1 of the contactor.

4. Disconnect white wire from fan out terminal of the defrost board .

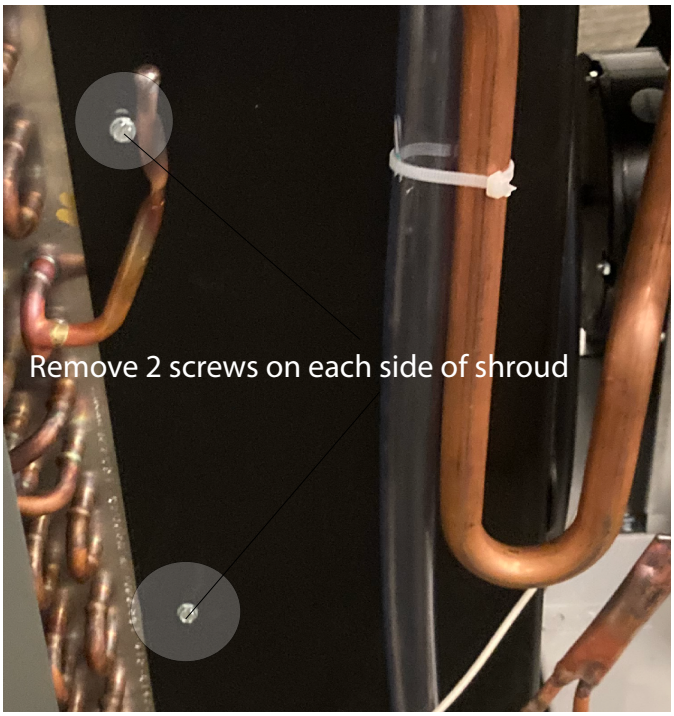




5. Remove sensor from coil.

6. Pull some slack out of white wire in the bundle to facilitate fan removal..

7. Remove 2 screws on each side of shroud.

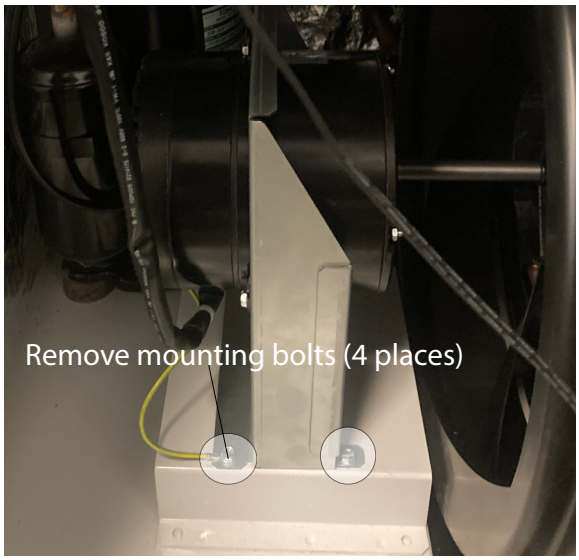


COMPONENT TESTING

Outdoor Fan Replacement 18&24k

8. Remove 2 screws on rear panel.

9. Remove four fan mounting screws and ground wire.



10. Loosen set screw to remove fan blade.

11. Remove 3 screws from fan motor bracket.

COMPONENT TESTING

Basepan Heater

To check the basepan heater operation;

1. Access the electrical box
2. With Power removed from the unit ohm out the 1 amp in line fuses located behind the electrical box.
    a. If fuse is open - check the heater element wiring by ohming out the wiring to each side and to ground.
    b. If no shorts are found - replace fuse and check operation.
    c. If heater is shorted out - replace basepan heater - contact customer support for assistance.

    NOTE: The defrost control board sends 24 vac from pin d of the control board to energize the defrost heat relay and close contacts to one strip of electric heat. Basepan heat is also provided at this time.
3. Restore Power to the unit.
4. Force the unit into defrost mode:
    NOTE: When operating in the defrost mode, the control will have the compressor contactor, and auxiliary heat outputs activated. The condenser fan relay contacts will be open, de-energizing the fan motor. The accumulated defrost time is monitored while in the defrost mode and compressor is energized. The Low Pressure Switch is ignored during Defrost. When a defrost cycle has been initiated, if the Y thermostat input is removed, the current defrost cycle will be suspended, but the accumulated defrost time is frozen, and the control will resume defrost operation at the start of the next heating cycle (Y active, B active and coil temperature is below 35°F) with a minimum of the ASCD between compressor activations.

    The accumulated defrost time resumes when the compressor output is re-energized. The defrost relay will de-energize when the Y thermostat input is removed and energize when the Defrost is resumed.

5. Check for 24 vac at the Defrost heat relay. If 24 vac is not available, use wiring diagram to chase back signal through the defrost relay and back to pin C on the defrost control board. Replace parts as required.
6. Check for 230 vac on both sides of the relay to ensure it has properly energized.
7. Check that airflow switch is not activated or faulty.

R-32 SEALED SYSTEM REPAIR

General Information

⚠WARNING: Electrical Shock Hazard

Disconnect all power to the unit before starting maintenance. All electrical connections and wiring MUST be installed by a qualified electrician and conform to all codes which have jurisdiction. Failure to do so can result in property damage, severe electrical shock or death.

⚠WARNING: This Product uses R-32 Refrigerant

Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.

When not installed, the appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater.

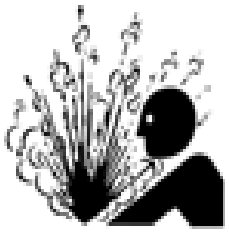
Do not pierce or burn.

Be aware that refrigerants may not contain an odor.

Refrigerant Safety Group A2L

⚠WARNING: Refrigeration System under High pressure

Do not puncture, heat, expose to flame or incinerate. Only certified refrigeration technicians should service this equipment. R-32 systems operate at higher pressures than R22 equipment. Appropriate safe service and handling practices must be used.



⚠ **Warning:** Prior to beginning work on systems containing FLAMMABLE REFRIGERANTS, safety checks are necessary to ensure that the risk of ignition is minimized.

NOTICE: Individuals working on these units must be EPA 608 Certified along with A2L Refrigerant Training.

⚠ **Warning:** Refrigerant R-32 cannot be used as a retrofit for R-410A refrigerant. The mixing of refrigerant across classes is prohibited. R-32 is not a drop in replacement for R-410A.

General Work Area: All maintenance staff and others working in the installation area shall be instructed on the nature of work being carried out. Work in confined spaces as defined by the Occupational Safety And Health Administration shall be avoided.

⚠ **Warning:** Job site should be examined for safety hazards such as flammable vapors, ignition sources, ventilation and confined spaces. Create a safe perimeter with barriers and signs designating a flammable area.

⚠ **Warning:** Work shall be undertaken under a controlled procedure so as to minimise the risk of a flammable gas or vapor being present while the work is being performed.

Check for presence of refrigerant:

- The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres.
- Ensure that the leak detection equipment being used is suitable for use with all applicable refrigerants, i.e. non-sparking, adequately sealed or intrinsically safe.
- Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.
- The following leak detection methods are deemed acceptable for all refrigerant systems:

  1. Electronic leak detectors may be used to detect refrigerant leaks but, in the case of FLAMMABLE REFRIGERANTS, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. 2. Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

  If a leak is suspected, all flame sources shall be removed/extinguished.

  If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system per EPA guidelines.

Presence of fire extinguisher: If any hot work is to be conducted on the refrigerating equipment or any associated parts, a class ABC Rated fire extinguishing equipment shall be available to hand. Have a class ABC Rated fire extinguisher adjacent to the charging area.

R-32 SEALED SYSTEM REPAIR

General Information

⚠ Warning:

No ignition sources: No person carrying out work in relation to a REFRIGERATING SYSTEM which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks.

Ventilated Area: Ensure that the area is in the open or that it is adequately ventilated before accessing the refrigerant in the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant away from the work area or external to building envelope.

During Repairs To Sealed Components: All power must be removed from the equipment being worked on prior to any removal of sealed covers, etc. If it is absolutely necessary to have an electrical supply to equipment during servicing, then a constant leak detector shall be located at the most critical point to warn of a potentially hazardous situation.

Checks And Repairs To Electrical Devices:

- Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected remove power supply to unit. **DO NOT OPERATE.**
- Initial safety checks shall include:
  - ·That capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking;
  - ·That no live electrical components and wiring are exposed while charging, recovering or purging the system;
  - ·Verify unit is properly grounded.
- Particular attention shall be paid to the following to ensure that by working on electrical components, the casing is not altered in such a way that the level of protection is affected. This shall include damage to cables, excessive number of connections, terminals not made to original specification, damage to seals, incorrect fitting of glands, etc.
- Ensure that the apparatus is mounted securely.
- Ensure that seals or sealing materials have not degraded to the point that they no longer serve the purpose of preventing the ingress of flammable atmospheres. Replacement parts shall be in accordance with the manufacturer's specifications.

The following is a list of important considerations when working with R-32 equipment:

- R-32 pressure is similar to R-410A and approximately 60% higher than R-22 pressure.
- R-32 cylinders must not be allowed to exceed 125°F, they may leak or rupture.
- R-32 must never be pressurized with a mixture of compressed air, it may become MORE flammable.
- Servicing equipment and components must be specifically designed for use with R-32 and dedicated to prevent contamination.
- Manifold sets must be equipped with gauges capable of reading 750 psig (high side) and 200 psig (low side), with a 500-psig low-side retard.
- Gauge hoses must have a minimum 750-psig service pressure rating.
- Recovery cylinders must have a minimum service pressure rating of 400 psig, (DOT 4BA400 and DOT BW400 approved cylinders).
- POE (Polyol-Ester) lubricants must be used with R-32 equipment.
- To prevent moisture absorption and lubricant contamination, do not leave the refrigeration system open to the atmosphere for extended periods of time.
- If unit refrigerant is low, recover the refrigerant, evacuate, and recharge unit to nameplate amount.
- If there is any amount of refrigerant in the system charge from the low side.
- Always charge by liquid inverted.

Verify with tool manufacturers that all tools used during this repair are non-sparking and can be used with A2L Refrigerants.
No halide torches for leak testing.
Refrigerant monitors or detectors must be used to detect refrigerant in the work area.

- R-32 A2L Refrigerant Recovery System.
- Vacuum Pump rated for A2L refrigerant (capable of 300 microns or less vacuum.)
- Nitrogen bottle with purging and pressurizing capabilities up to 550 psi.
- Oxy/ Acetylene torch or similar equipment utilized for brazing.
- Non-Sparking (Not Halide)Electronic Leak Detector rated for detecting A2L refrigerant.
- Digital refrigerant scale
- Refrigeration Gauges rated for A2L Refrigerants with temp scales for R-32 refrigerant.
- Gauge Manifold (Right handed threads).
- A2L compatible Vacuum Gauge capable of 300 microns or less.

R-32 SEALED SYSTEM REPAIR

Required Equipment

- Nitrogen regulator for purging and testing, rated to 800 psi. (Capable of low psi flow)
- Pipe tubing cutter.
- Refrigerant recovery cylinder. (Flammable A2L label)
- Ventilation fan.
- Class ABC fire extinguisher.
- Process Tube adapter kit
- Recovery access tool.
- Purge hose fittings
- Pinch off and opening tools

ABC Fire Extinguisher

Recovery Machine

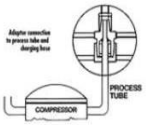
Vaccum Pump

Nitrogen

Guage Manifold

Nitrogen Regulator

Vaccum Guage



Recovery access tool

Process tube adapter kit

Purge hose fittings

Pinch off and opening tools

R-32 SEALED SYSTEM REPAIR

Refrigerant Removal, Recovery, and Evacuation

NOTE: When accessing the refrigerant in the system to make repairs or for any other purpose, conventional procedures shall be used. However, for FLAMMABLE REFRIGERANTS (R-32 is classified in the A2L group for mildly flammable refrigerants) it is important that best practice is followed since flammability is a consideration. Follow all EPA 608 regulations and procedures along with AHRI 15 Best Practices for A2L refrigerants.

⚠ **Warning:** Ensure sufficient ventilation at the repair place.

⚠ **Warning:** Ensure there are no open flame sources or hot surfaces that exceed 1200˚F in the work area.

⚠ **Warning:** Discharge capacitors in a way that won't cause any spark. The standard procedure to short circuit the capacitor terminals usually creates sparks.

NOTICE: Ensure that the following precautions are taken prior to opening the sealed system.

- Verify Recovery machine is rated for A2L refrigerants.
- Mark the Job site inspection area as flammable work zone using appropriate signs.
- Utilize a Refrigerant leak detector or refrigerant monitor to sense the area for the presence of refrigerants.
- Disconnect all power supply to unit.
- Properly ground all equipment and hoses along with tank to prevent a static build up .
- Ensure adequate ventilation is provided for the job site.
- Do not mix A2L refrigerant Gages and hoses with other refrigerants.
- Keep exposure of refrigerant to Air to as minimum as possible (creates a dangerous condition).
- Under no circumstances is the mixing of refrigerants in the recovery cylinders allowed and should be strictly avoided at all times. Do not introduce oxygen into any recovery cylinders.

1. Install a piercing valve to recover refrigerant from the sealed system. (Piercing valve must be removed from the system before recharging.)
2. Recover refrigerant to EPA sec. 608 standards. If a low charge is suspected weigh recovered refrigerant and compare to unit nameplate.

NOTE: DO NOT RECOVER TO A VACUUM PRIOR TO FLUSHING WITH NITROGEN. STOP RECOVERY AT 0-5 PSI.

3. Flush refrigerant out of system with a dry nitrogen purge, make sure you energize and de-energize all reversing valves and solenoid valves to release any trapped refrigerant.(3-5 minutes).

4. Perform an evacuation to 29.9 in. hg. and break vacuum with Dry Nitrogen.
5. Re-purge the unit for 3-5 mins or until the nitrogen flows out both process tubes.
6. Re-evacuate unit to 29.9 in. hg. and break vacuum with Dry Nitrogen.
8. Open the refrigerant circuit by cutting out components.
9. Cut off the crimp on the process tubes and install a 5/16 copper access fitting to the process tube.

Transportation

Be aware that local, state, and national codes exist that regulate the transportation of flammable gases. Be sure to become informed of the regulations and always stay compliant.

R-32 SEALED SYSTEM REPAIR

Component Replacement/Brazing

Warning: Ensure sufficient ventilation at the repair place.

Warning: Presence of fire extinguisher. If any hot work is to be conducted on the refrigerating equipment or any associated parts, have a ABC class fire extinguisher available to hand.

Warning: No person carrying out work in relation to a REFRIGERATING SYSTEM which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks.

Warning: Ensure there are no open flame sources or hot surfaces that exceed 1200˚F in the work area.

NOTE: When brazing is required, the following procedures shall be carried out in the right order:

1. Remove and recover refrigerant, and evacuate the system. Refer to the refrigerant removal, recovery, and evacuation section of this manual.

Warning: Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

2. Perform a check of the work area for the presence of flammable refrigerant prior to brazing or performing any hot work. Use a non-Sparking (Not Halide) A2L certified Electronic Leak Detector rated for detecting R-32 refrigerant.
3. Re-pipe all repairs and install all components to sealed system.
4. Purge nitrogen through the unit. at approximately 2-3 psi through the duration of the brazing process. (Nitrogen must be purging through the unit while any brazing is being performed.)
5. Pressure test unit to 550 psi minimum and hold pressure for 30 minutes minimum. Inspect for any leaks with a leak detection fluid and repair as required. Repeat as required until system passes leak test.
6. Triple evacuate the unit to achieve a 500 micron level.
7. Pressurize nitrogen to 550 psi and leak test all connections with a leak detection fluid. Repair any leaks found.
8. Reassemble sealed enclosures accurately. If seals are worn, replace them.
9. Charge the system with the amount of refrigerant specified on the model nameplate. Refer to the refrigerant charging section of this manual for charging procedures.

R-32 SEALED SYSTEM REPAIRS

Refrigerant Charging

⚠WARNING: Electrical Shock Hazard

Disconnect all power to the unit before starting maintenance. All electrical connections and wiring MUST be installed by a qualified electrician and conform to all codes which have jurisdiction. Failure to do so can result in property damage, severe electrical shock or death.

⚠WARNING: This Product uses R-32 Refrigerant

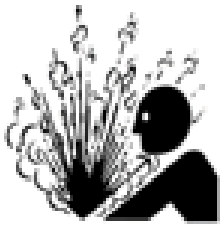
Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.

When not installed, the appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater.

Do not pierce or burn.

Be aware that refrigerants may not contain an odor.

⚠WARNING: Refrigeration System under High pressure



Do not puncture, heat, expose to flame or incinerate. Only certified refrigeration technicians should service this equipment. R32 systems operate at higher pressures than R22 equipment. Appropriate safe service and handling practices must be used.

⚠WARNING: Freeze Hazard

Proper safety procedures must be followed, and all PPE must be utilized when working with liquid refrigerant. Failure to comply could result in minor to moderate injury.

NOTE: Always weigh in refrigerant based on the model nameplate.

⚠Warning:

- Ensure that contamination of different refrigerants does not occur when using charging equipment.
- Hoses or lines shall be as short as possible to minimise the amount of refrigerant contained in them.
- Charge unit with refrigerant cylinder in the inverted position to obtain liquid refrigerant.
- Charge the unit according to the amount on the name plate matching the unit.
- Extreme care shall be taken not to overfill the REFRIGERATING SYSTEM.
- Prior to recharging a system, it shall be pressure-tested with the dry nitrogen.

NOTE: Because the refrigerant system is a sealed system, service process tubes will have to be installed. First install a line tap and recover refrigerant from system. Refer to the Refrigerant removal section of this manual for procedures.

The acceptable method for charging the sealed system is the Weighed in Charge Method. The weighed in charge method is applicable to all units. It is the preferred method to use, as it is the most accurate.

The weighed in method should always be used whenever a charge is removed from a unit such as for a leak repair, compressor replacement, or when there is no refrigerant charge left in the unit. To charge by this method, requires the following steps:

⚠**Warning:** Ensure sufficient ventilation at the repair place.

⚠**Warning:** Ensure there are no open flame sources or hot surfaces that exceed 1200˚F in the work area.

1. Recover Refrigerant in accordance with EPA regulations. (Refer to Refrigerant Removal, Recovery, and Evacuation Section).

NOTE: If a low charge is suspected weigh recovered refrigerant and compare to unit nameplate.
NOTE: Access valves must be removed after charging is complete to return this unit to a sealed system.

2. Weigh in the refrigerant charge with the proper quantity of R-32 refrigerant per model nameplate.
3. Crimp the process tube and solder the end shut.
4. Start unit, and verify performance.

NOTE: EPA Section 608 regulations require that if a system is charged with flammable refrigerant it must have red markings on the access ports (Process tube).

R-32 SEALED SYSTEM REPAIRS

Compressor Replacement

⚠ WARNING

ELECTRIC SHOCK HAZARD
Turn off electric power before service or installation. Extreme care must be used, if it becomes necessary to work on equipment with power applied.

Failure to do so could result in serious injury or death.

⚠ WARNING

HIGH PRESSURE HAZARD
Sealed Refrigeration System contains refrigerant and oil under high pressure.

Proper safety procedures must be followed, and PPE must be utilized
when working with refrigerants.

Failure to follow these procedures could result in serious injury or death.

⚠ WARNING

EXPLOSION HAZARD
The use of nitrogen requires a pressure regulator. Follow all safety procedures and wear protective safety clothing etc.

Failure to follow proper safety procedures could result in serious injury or death.

⚠ CAUTION

FREEZE HAZARD
Proper safety procedures must be followed, and proper protective clothing must be worn when working with liquid refrigerant.

Failure to follow these procedures could result in minor to moderate injury.

⚠ WARNING

NEVER, under any circumstances, liquid charge a rotary-compressor through the LOW side. Doing so would cause permanent damage to the new compressor. Use a charging adapter.

1. Be certain to perform all necessary electrical and refrigeration tests to be sure the compressor is actually defective before replacing.

2. Recover all refrigerant from the system though the process tubes. Refer to Refrigerant Removal, Recovery, and Evacuation Section of this manual).

PROPER HANDLING OF RECOVERED REFRIGERANT ACCORDING TO EPA REGULATIONS IS REQUIRED.

3. After all refrigerant has been recovered, cut and remove compressor. Be certain to have both suction and discharge process tubes open to atmosphere.

4. Carefully pour a small amount of oil from the suction stub of the defective compressor into a clean container.

5. Using an acid test kit (one shot or conventional kit), test the oil for acid content according to the instructions with the kit.

6. If any evidence of a burnout is found, no matter how slight, refer to Compressor Replacement -Special Procedure in Case of Compressor Burnout.

7. Install the replacement compressor.

CAUTION: Seal all openings on the defective compressor immediately. Compressor manufacturers will void warranties on units received not properly sealed. Do not distort the manufacturers tube connections.

8. Braze all connections. Refer to the Component Replacement/ Brazing section of this manual.

9. Charge system with proper amount of refrigerant per the model nameplate. Refer to the Refrigerant charging section of this manual.

R-32 SEALED SYSTEM REPAIRS

Compressor Replacement -Special Procedure in Case of Compressor Burnout

⚠ WARNING

HIGH PRESSURE HAZARD

Sealed Refrigeration System contains refrigerant and oil under high pressure.

Proper safety procedures must be followed, and PPE must be utilized when working with refrigerants.

Failure to follow these procedures could result in serious injury or death.

⚠ WARNING

ELECTRIC SHOCK HAZARD

Turn off electric power before service or installation. Extreme care must be used, if it becomes necessary to work on equipment with power applied.

Failure to do so could result in serious injury or death.

⚠ WARNING

EXPLOSION HAZARD

The use of nitrogen requires a pressure regulator. Follow all safety procedures and wear protective safety clothing etc.

Failure to follow proper safety procedures could result in serious injury or death.

⚠ WARNING

NEVER, under any circumstances, liquid charge a rotary-compressor through the LOW side. Doing so would cause permanent damage to the new compressor. Use a charging adapter.

1. Recover all refrigerant and oil from the system. Refer to Refrigerant Removal, Recovery, and Evacuation Section of this manual.

2. Cut and remove compressor and capillary tube from the system.

CAUTION: Seal all openings on the defective compressor immediately. Compressor manufacturers will void warranties on units received not properly sealed. Do not distort the manufacturers tube connections.

3. Flush evaporator condenser and all connecting tubing with dry nitrogen or equivalent. Use A2L approved flushing agent to remove all contamination from system. Inspect suction and discharge line for carbon deposits. Remove and clean if necessary. Ensure all acid is neutralized.

4. Reassemble the system, including a new capillary tube assembly and strainers.

5. Install a dual port suction line drier on the common suction line and remove when the pressure differential across the drier ports reaches 3 psi. or greater.

6. Braze all connections. Refer to the Brazing section of this manual.

7. Charge system with proper amount of refrigerant per the model nameplate. Refer to the refrigerant charging section of this manual.

R-32 SEALED SYSTEM REPAIR

Replace The Reversing Valve

⚠ WARNING

HIGH PRESSURE HAZARD

Sealed Refrigeration System contains refrigerant and oil under high pressure.

Proper safety procedures must be followed, and PPE must be utilized when working with refrigerants.

Failure to follow these procedures could result in serious injury or death.

⚠ WARNING

EXPLOSION HAZARD

The use of nitrogen requires a pressure regulator. Follow all safety procedures and wear protective safety clothing etc.

Failure to follow proper safety procedures could result in serious injury or death.

NOTICE

FIRE HAZARD

The use of a torch requires extreme care and proper judgment. Follow all safety recommended precautions and protect surrounding areas with fire proof materials. Have a fire extinguisher readily available. Failure to follow this notice could result in moderate to serious property damage.

1. Recover all refrigerant from the system though the process tubes. Refer to Refrigerant Removal, Recovery, and Evacuation Section of this manual).

PROPER HANDLING OF RECOVERED REFRIGERANT ACCORDING TO EPA REGULATIONS IS REQUIRED.

2. Remove solenoid coil from reversing valve. If coil is to be reused, protect from heat while changing valve.

NOTE: When brazing a reversing valve into the system, it is of extreme importance that the temperature of the valve does not exceed 250°F at any time.

Wrap the reversing valve with a large rag saturated with water. "Re-wet" the rag and thoroughly cool the valve after each brazing operation of the four joints involved.

The wet rag around the reversing valve will eliminate conduction of heat to the valve body when brazing the line connection.

3. Cut all lines from reversing valve. Refer to the Brazing section of this manual.

4. Clean all excess braze from all tubing so that they will slip into fittings on new valve.

5. Remove solenoid coil from new valve.

6. Protect new valve body from heat while brazing with plastic heat sink (Thermo Trap) or wrap valve body with wet rag.

7. Fit all lines into new valve and braze lines into new valve.

8. Braze all connections. Refer to the Brazing section of this manual.

9. Pressurize with nitrogen to 550 psi and leak test all connections with a leak detection fluid. Repair any leaks found.

10. Once the sealed system is leak free, install solenoid coil on new valve.

11. Charge system with proper amount of refrigerant per the model nameplate. Refer to the refrigerant charging section of this manual.

R-32 REFRIGERANT SYSTEM REPAIR

TXV Replacement

⚠ WARNING

HIGH PRESSURE HAZARD

Sealed Refrigeration System contains refrigerant and oil under high pressure.

Proper safety procedures must be followed, and proper protective clothing must be worn when working with refrigerants.

Failure to follow these procedures could result in serious injury or death.

NOTICE

FIRE HAZARD

Not following the above WARNING could result in fire or electically unsafe conditions which could cause moderate or serious property damage.
Read, understand and follow the above warning.

⚠ WARNING

EXPLOSION HAZARD

The use of nitrogen requires a pressure regulator. Follow all safety procedures and wear protective safety clothing etc.

Failure to follow proper safety procedures could result in serious injury or death.

Please follow the steps below when replacing TXV:

1. Disassemble the front panel.

2. Remove the thermal bulb down by undoing the insulation around it.

3. Recover all refrigerant from the system though the process tubes. Refer to Refrigerant Removal, Recovery, and Evacuation Section of this manual).

PROPER HANDLING OF RECOVERED REFRIGERANT ACCORDING TO EPA REGULATIONS IS REQUIRED.

4. Cut all lines from TXV. Refer to the Brazing section of this manual.

5. Braze all connections. Refer to the Brazing section of this manual.

Wrap the new TXV with a piece of wet cloth to prevent damage caused by heat from being too hot and connect the nitrogen flow to the liquid pipe to prevent it from being oxidized. Weld the TXV to the liquid pipe, (solder must be 5% or more silver content) and pay attention to the direction of the TXV, then weld the pressure pipe to the gas pipe.

6. When the repair has cooled ,pressure test with 550 psi nitrogen, repair any leaks and Evacuate to hold at 300 microns and recharge to name plate quantity.

7. Secure the thermal bulb to the suction pipe with insulation strips.

8. Charge system with proper amount of refrigerant per the model nameplate. Refer to the refrigerant charging section of this manual.

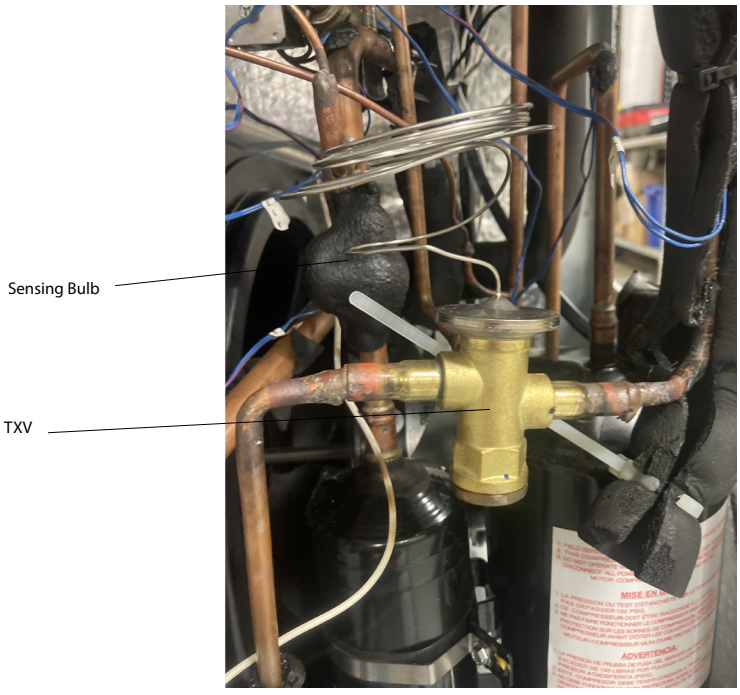
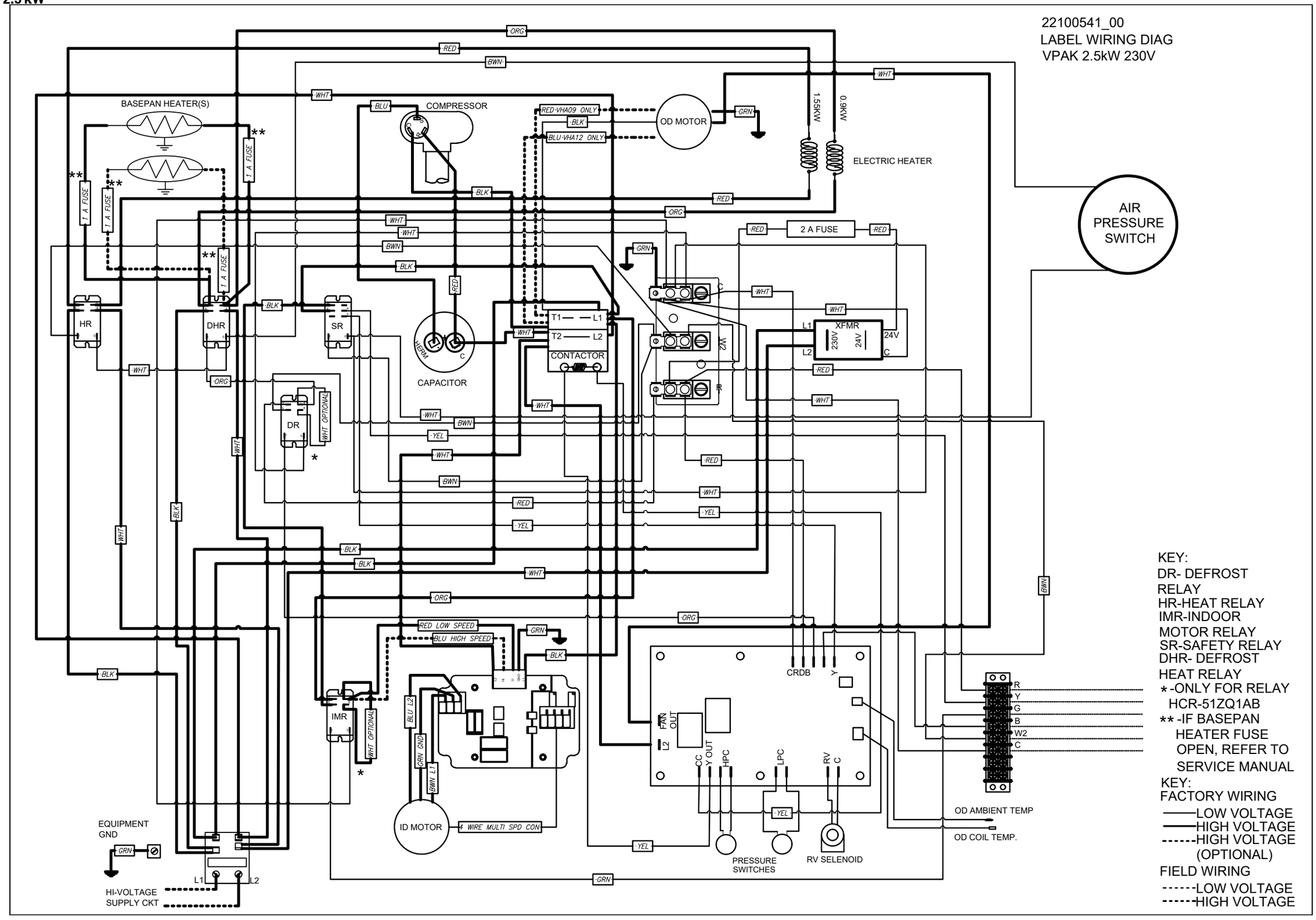


Figure 701 (TXV Valve Replacement)

WIRING DIAGRAMS

208/230V 2.5 kW

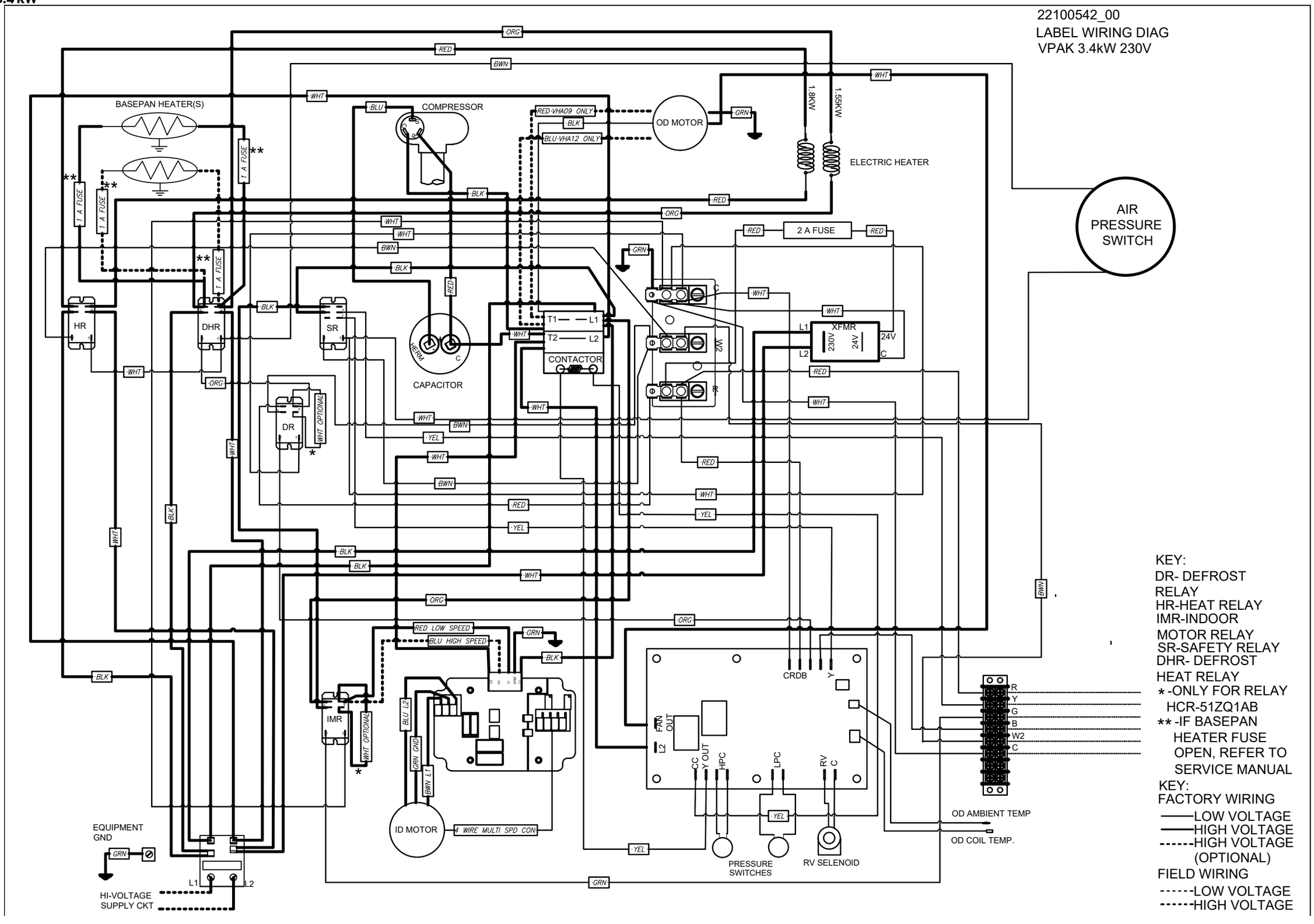
Figure 801



WIRING DIAGRAMS

208/230V 3.4 kW

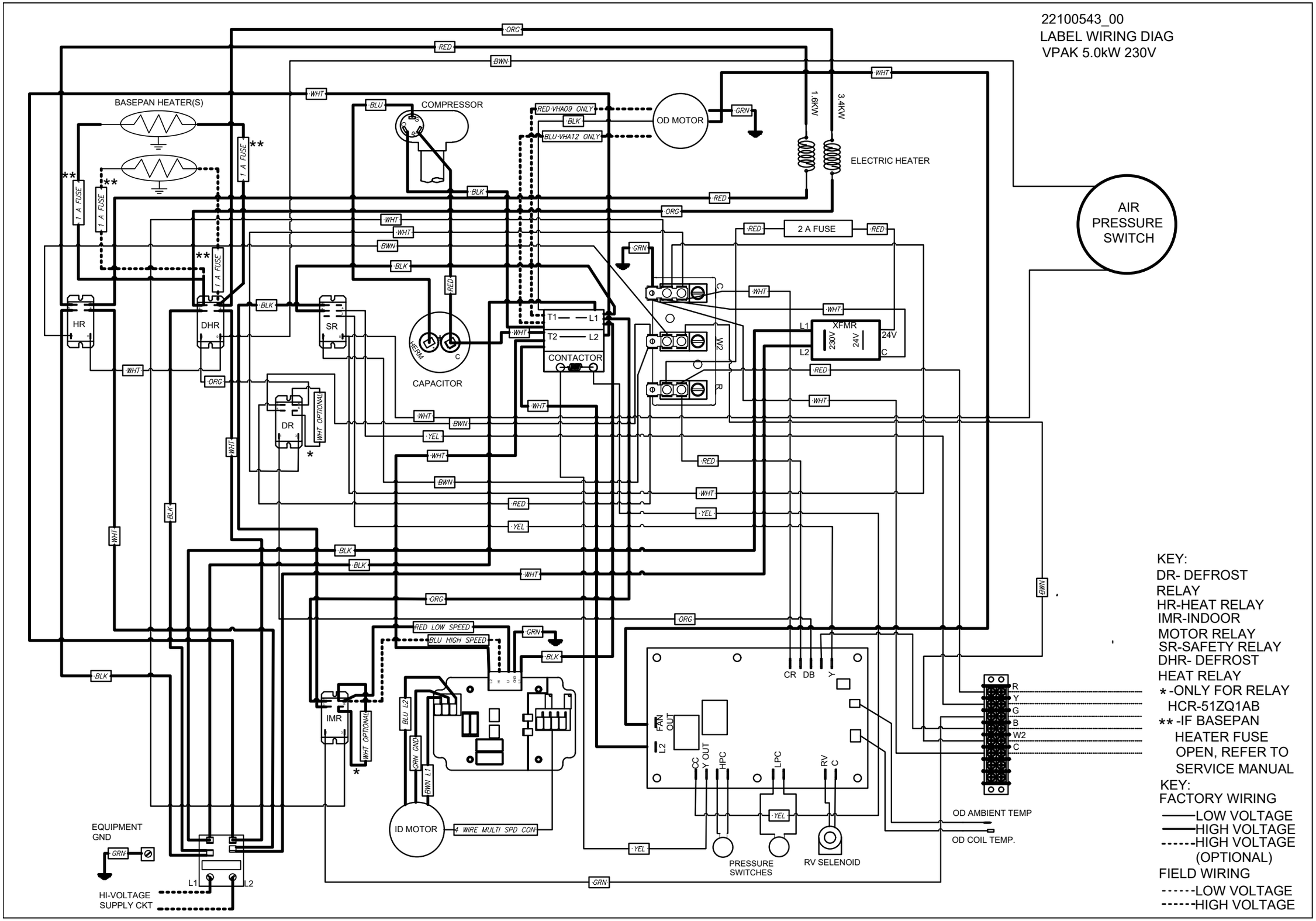
Figure 802



WIRING DIAGRAMS

208/230V 5.0 kW

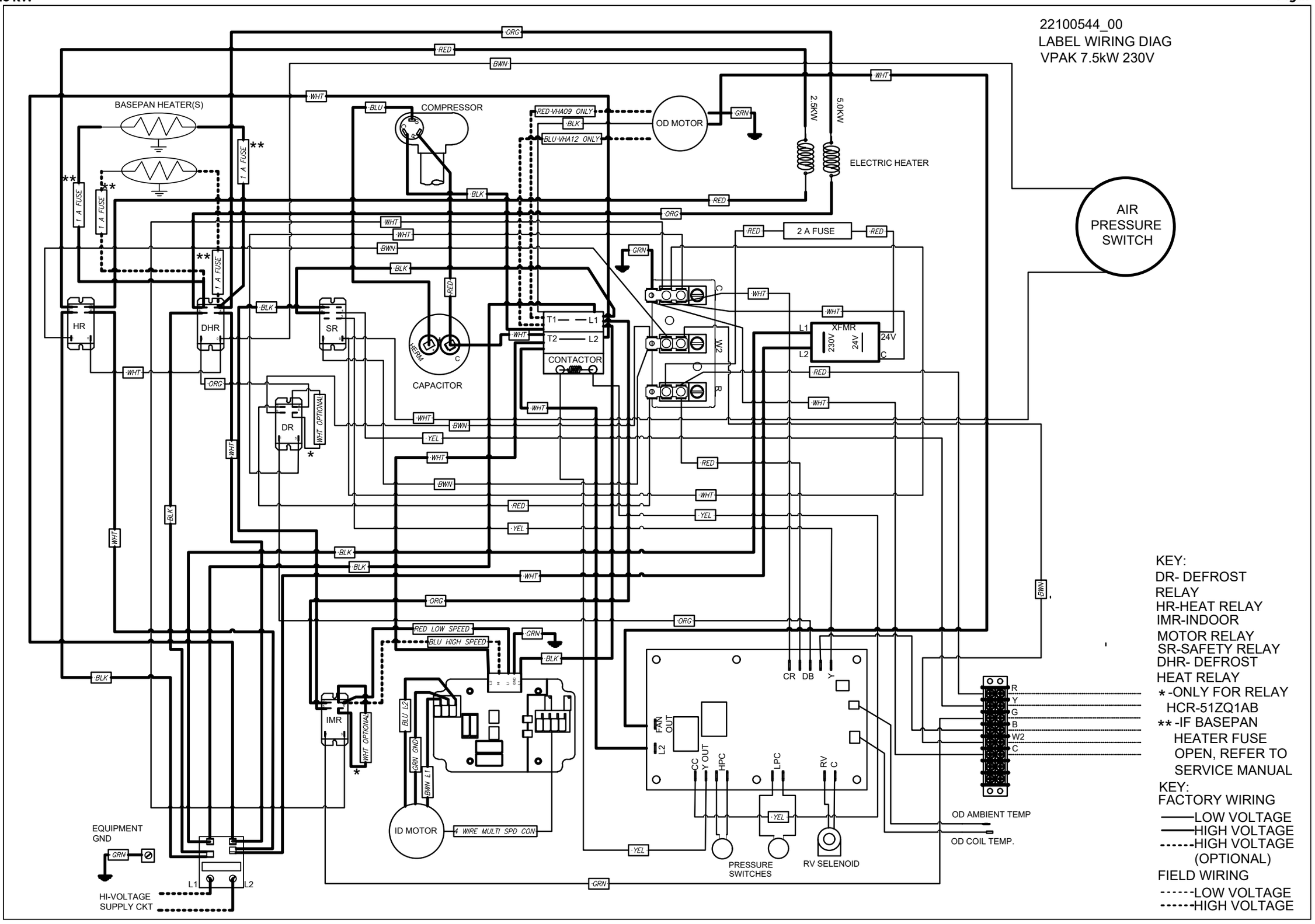
Figure 803



WIRING DIAGRAMS

208/230V 7.5 kW

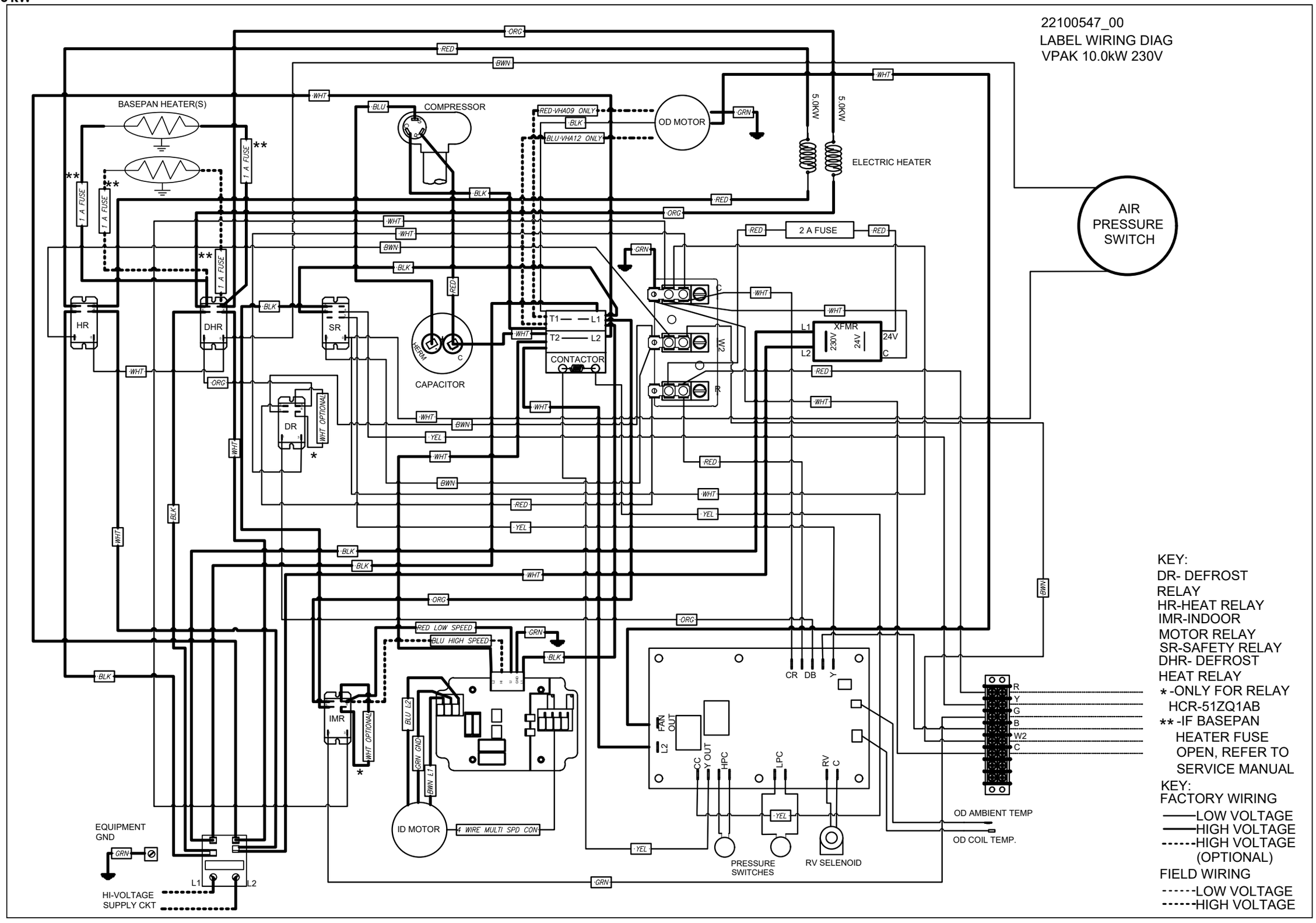
Figure 804



WIRING DIAGRAMS

208/230V 10 kW

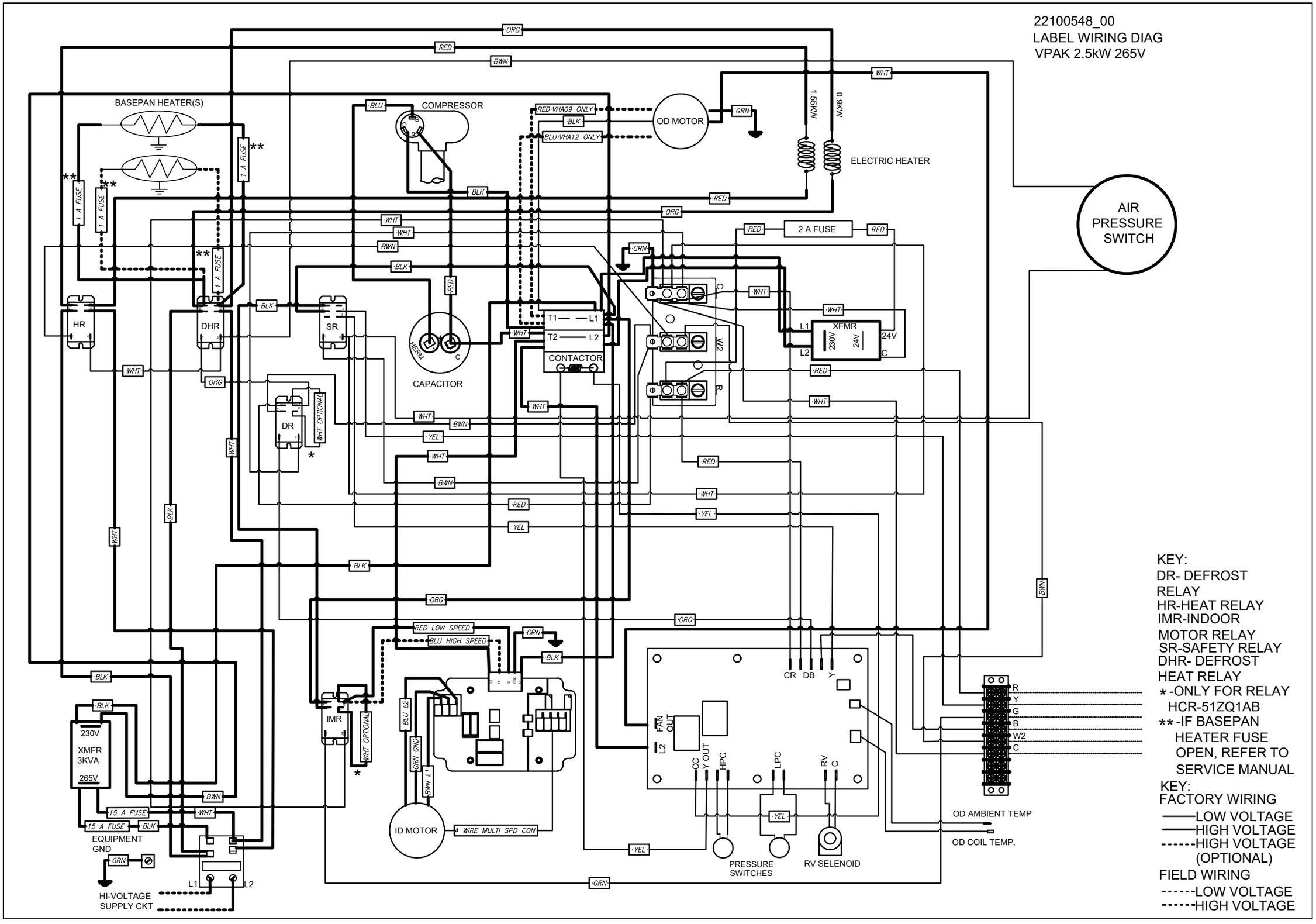
Figure 805



WIRING DIAGRAMS

265V 2.5 kW

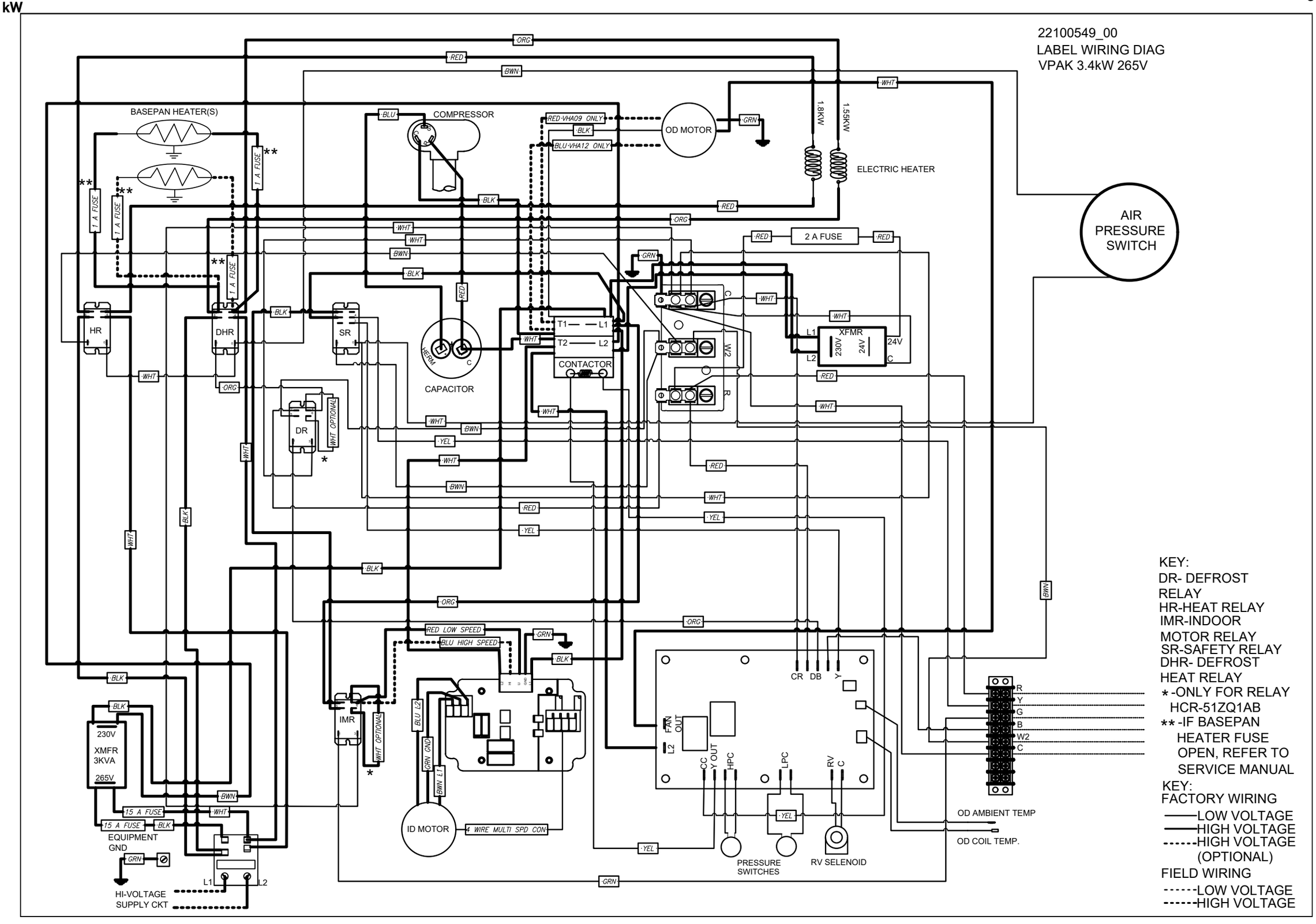
Figure 806



WIRING DIAGRAMS

265V 3.4 kW

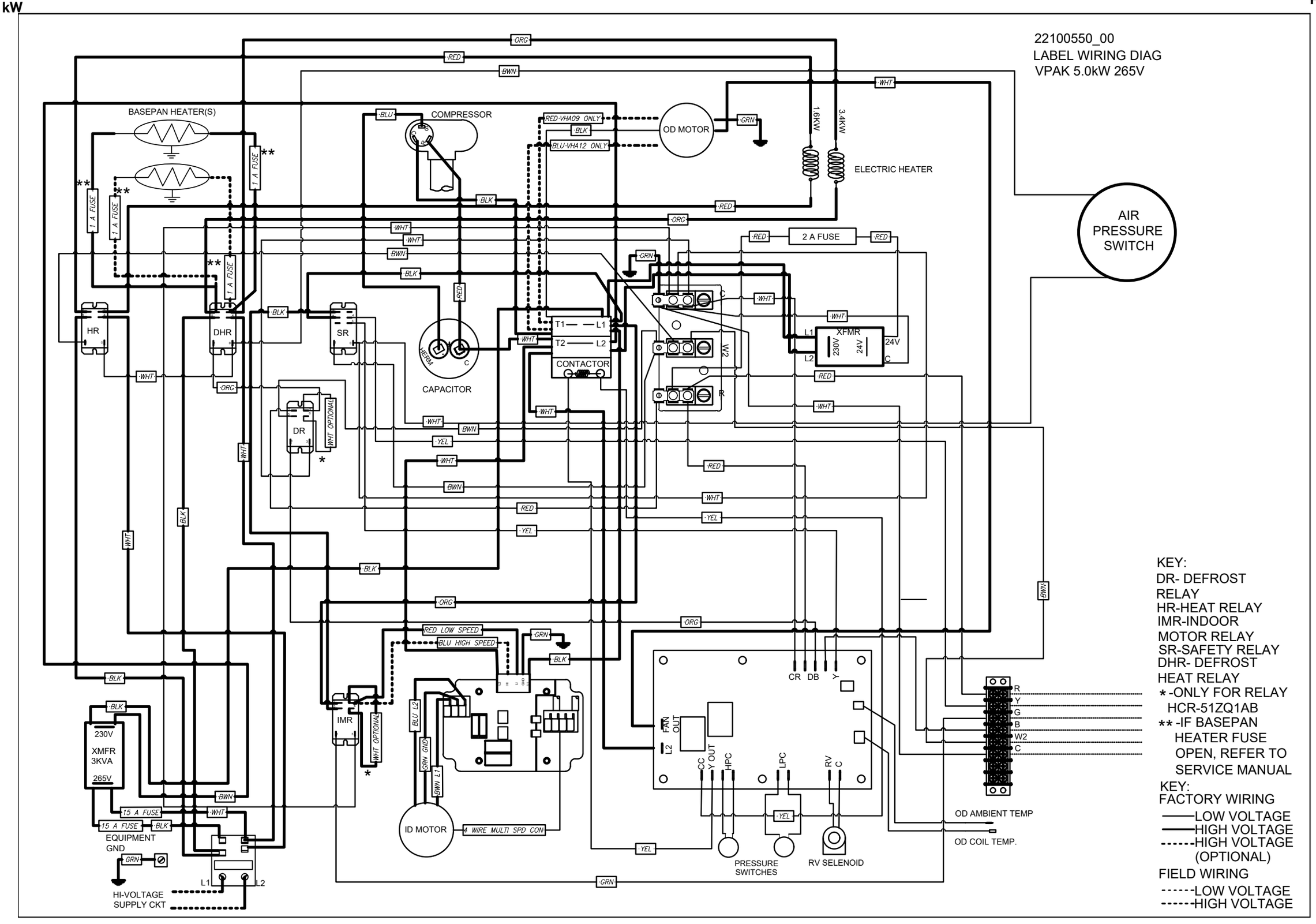
Figure 807



WIRING DIAGRAMS

265V 5 kW

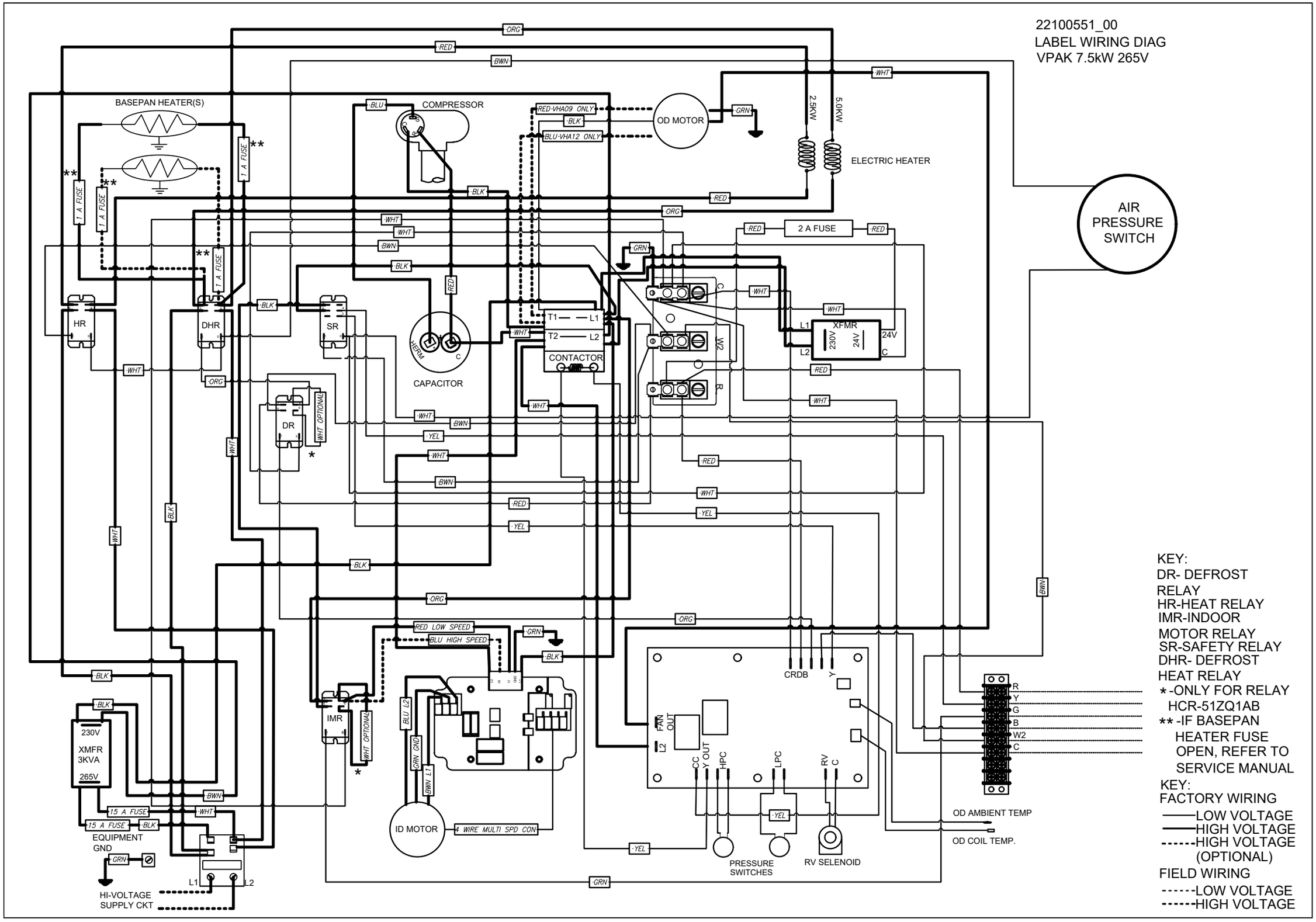
Figure 808



WIRING DIAGRAMS

265V 7.5 kW

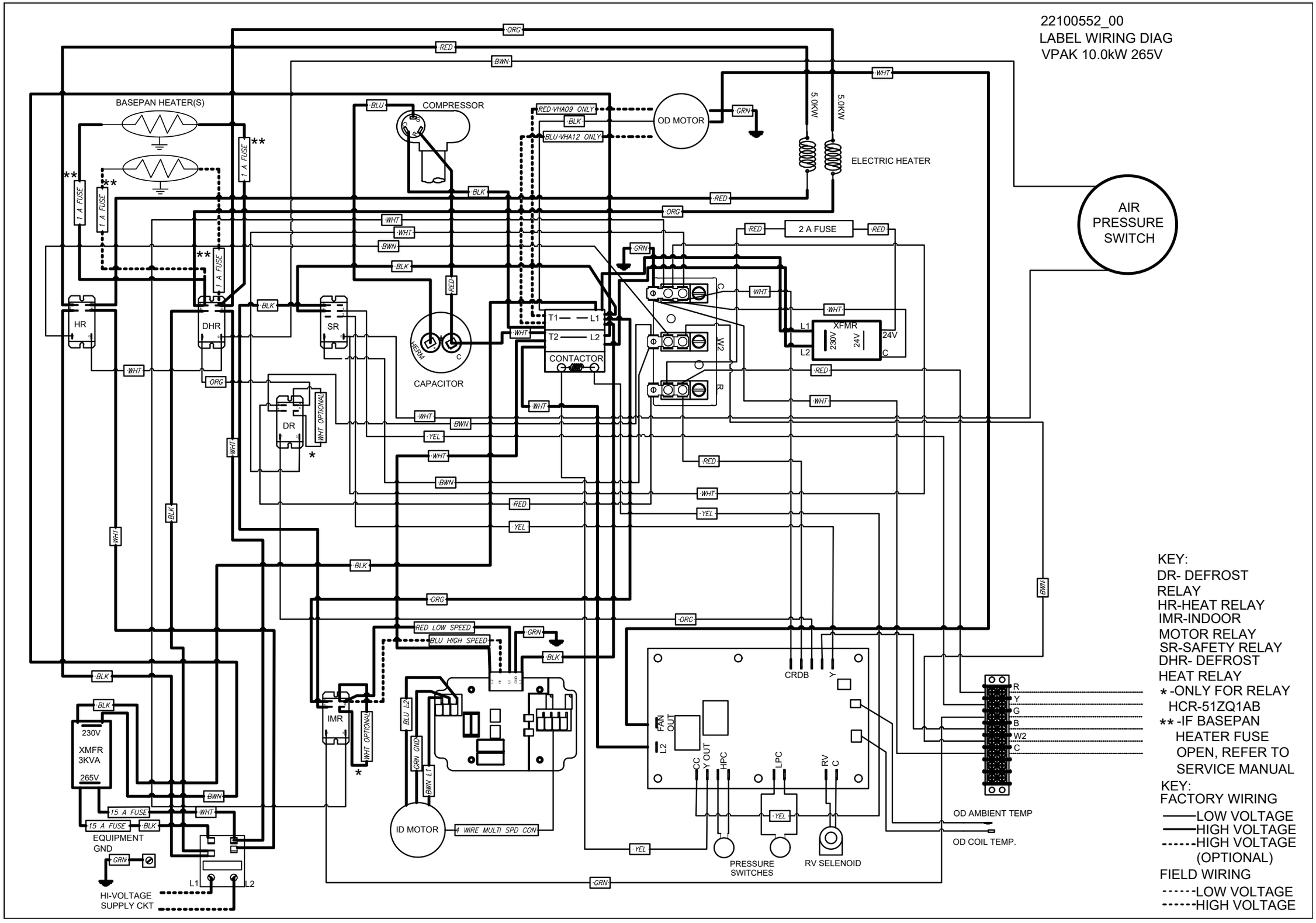
Figure 809



WIRING DIAGRAMS

265V 7.5 kW

Figure 810



APPENDIX

Appendix 1 Thermistor Resistance Values (This Table Applies to All Thermistors)

TEMP	RESISTENCE (K Ohms)			RESISTANCE TOLERANCE %	
F	MIN	CENTR	MAX	MIN	MAX
-25	210.889	225.548	240.224	6.50	6.51
-20	178.952	190.889	202.825	6.25	6.25
-15	151.591	161.325	171.059	6.03	6.03
-10	128.434	136.363	144.292	5.81	5.81
-5	108.886	115.340	121.794	5.60	5.60
0	92.411	97.662	102.912	5.38	5.38
5	78.541	82.812	87.083	5.16	5.16
10	66.866	70.339	73.812	4.94	4.94
15	57.039	59.864	62.688	4.72	4.72
20	48.763	51.060	53.357	4.50	4.50
25	41.786	43.654	45.523	4.28	4.28
30	35.896	37.415	38.934	4.06	4.06
31	34.832	36.290	37.747	4.02	4.02
32	33.803	35.202	36.601	3.97	3.97
33	32.808	34.150	35.492	3.93	3.93
34	31.846	33.133	34.421	3.89	3.89
35	30.916	32.151	33.386	3.84	3.84
36	30.016	31.200	32.385	3.80	3.80
37	29.144	30.281	31.418	3.75	3.75
38	28.319	29.425	30.534	3.76	3.77
39	27.486	28.532	29.579	3.67	3.67
40	26.697	27.701	28.704	3.62	3.62
45	23.116	23.931	24.745	3.40	3.40
50	20.071	20.731	21.391	3.18	3.18
55	17.474	18.008	18.542	2.96	2.96
60	15.253	15.684	16.115	2.75	2.75
65	13.351	13.697	14.043	2.53	2.53
66	13.004	13.335	13.666	2.48	2.48
67	12.668	12.984	13.301	2.44	2.44
68	12.341	12.644	12.947	2.39	2.39
69	12.024	12.313	12.603	2.35	2.35
70	11.716	11.993	12.269	2.31	2.31
71	11.418	11.682	11.946	2.26	2.26
72	11.128	11.380	11.633	2.22	2.22
73	10.846	11.088	11.329	2.18	2.18
74	10.574	10.804	11.034	2.13	2.13
75	10.308	10.528	10.748	2.09	2.09
76	10.051	10.260	10.469	2.04	2.04
77	9.800	10.000	10.200	2.00	2.00
78	9.550	9.748	9.945	2.03	2.03
79	9.306	9.503	9.699	2.07	2.07
80	9.070	9.265	9.459	2.10	2.10
81	8.841	9.033	9.226	2.13	2.13
82	8.618	8.809	9.000	2.17	2.17
83	8.402	8.591	8.780	2.20	2.20
84	8.192	8.379	8.566	2.23	2.23
85	7.987	8.172	8.358	2.27	2.27
86	7.789	7.972	8.155	2.30	2.30
87	7.596	7.778	7.959	2.33	2.33
88	7.409	7.589	7.768	2.37	2.37
89	7.227	7.405	7.583	2.40	2.40
90	7.050	7.226	7.402	2.43	2.43
91	6.878	7.052	7.226	2.47	2.47
92	6.711	6.883	7.055	2.50	2.50
93	6.548	6.718	6.889	2.53	2.53
94	6.390	6.558	6.727	2.57	2.57
95	6.237	6.403	6.569	2.60	2.60
96	6.087	6.252	6.417	2.63	2.63
97	5.942	6.105	6.268	2.67	2.67
98	5.800	5.961	6.122	2.70	2.70
99	5.663	5.822	5.981	2.73	2.73
100	5.529	5.686	5.844	2.77	2.77
105	4.912	5.060	5.208	2.93	2.93
110	4.371	4.511	4.651	3.10	3.10
115	3.898	4.030	4.161	3.27	3.27
120	3.482	3.606	3.730	3.43	3.43

APPENDIX

Required Accessories

REQUIRED ACCESSORIES

ARCHITECTURAL LOUVER

VPAL2 and VPAL2-42

Extruded aluminum grille (30° or 42° blade angle) that attaches to the outdoor section of the wall plenum.

VPSC2 and VPSC2-42

VPAL2 and VPAL2-42 in custom colors.

DIMENSIONS: 25 9/16" W x 31 1/16" H

VPAL2

VPDP2

WALL PLENUM

VPAWP1-8, VPAWP1-14

Two-part sleeve that telescopes in and out. Sits inside the exterior wall penetration.

VPAWP1-8 telescopes from 5 1/2"–8"
VPAWP1-14 telescopes from 8"–14"

DIMENSIONS: 24 1/8" W x 30 3/8" H
CUTOUT DIMENSIONS: 24 5/8" W x 30 7/8" H

VPAWP1-8/14

DRAIN PAN

VPDP2
Required for all 18K and 24K models. Can be installed prior to chassis for easy installation/removal.

OPTIONAL ACCESSORIES

RETURN AIR GRILLE/ACCESS PANEL

VPRG4 / VPRG4R

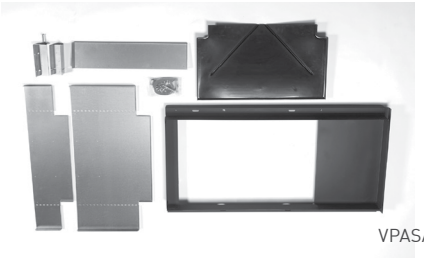
Hinged panel allows access to unit and return air filter.
A field-supplied filter (25" x 20") should be mounted on the inside grille. Panel can be mounted with return air openings high or low on the door for optimum sound attenuation.

DIMENSIONS: 29" W x 58" H
CUTOUT DIMENSIONS: 27" W x 55 3/4" H

VPRG4/R

FIRST COMPANY SLEEVE ADAPTER

VPASA1
Single piece, welded adapter allows retrofit into existing First Company SPXR-series single package vertical unit wall sleeve and louver. Easy connection to small chassis Vert-I-Pak only.



VPASA1

SINGLE STAGE THERMOSTATS

RT7P
Wired, single stage, wall-mounted programmable thermostat.

RT7
Wired, single stage, wall-mounted digital thermostat and backlight.

WRT2
Wireless, single stage, wall-mounted digital thermostat and backlight.

RT7

RT7

WRT2

ENERGY MANAGEMENT THERMOSTATS

EMRT2 & EMWRT2
Wired/Wireless thermostat with occupancy sensor.

EMOCT	EMRAF	EMROS
Online connection kit.	Remote access fee.	Remote Occupancy Sensor

EMRTS	EMRDS	EMCWP	EMRWOS
Remote Temperature Sensor	Door Switch	Wall-Plate	Wireless Occ. Sensor

EMRT2, EMWRT2

APPENDIX

Interactive Parts Viewer

All Friedrich Service Parts can be found on our online interactive parts viewer.

Please click on the link below:

Interactive Parts Viewer

For Further Assistance contact Friedrich customer service at **(1-800-541-6645)**.

Limited Warranty

Current warranty information can be obtained by referring to https://www.friedrich.com/professional/support/product-resources

APPENDIX

Friedrich Authorized Parts Depots

NEUCO Inc.
515 W Crossroads Parkway
Bolingbrook, IL 60440
312.809.1418
borr@neuco.com

United Products Distributors Inc.
4030A Benson Ave
Halethorpe, MD 21227
888-907-9675
c.businsky@updinc.com

Shivani Refigeration & Air Conditioning Inc.
2259 Westchester Ave.
Bronx, NY 10462
sales@shivanionline.com

The Gabbert Company
6868 Ardmore
Houston, Texas 77054

713-747-4110
800-458-4110

Johnstone Supply of Woodside
27-01 Brooklyn Queens Expway
Woodside, New York 11377

718-545-5464
800-431-1143

Reeve Air Conditioning, Inc.
2501 South Park Road
Hallandale, Florida 33009

954-962-0252
800-962-3383

Total Home Supply
26 Chapin Rd Ste 1109
Pine Brook, NJ 07058
877-847-0050
support@totalhomesupply.com
https://www.totalhomesupply.com/brands/Friedrich.html

TECHNICAL SUPPORT CONTACT INFORMATION

FRIEDRICH

Friedrich Air Conditioning Co.
10001 Reunion Place, Suite 500 • San Antonio, Texas 78216
1-800-541-6645
www.friedrich.com