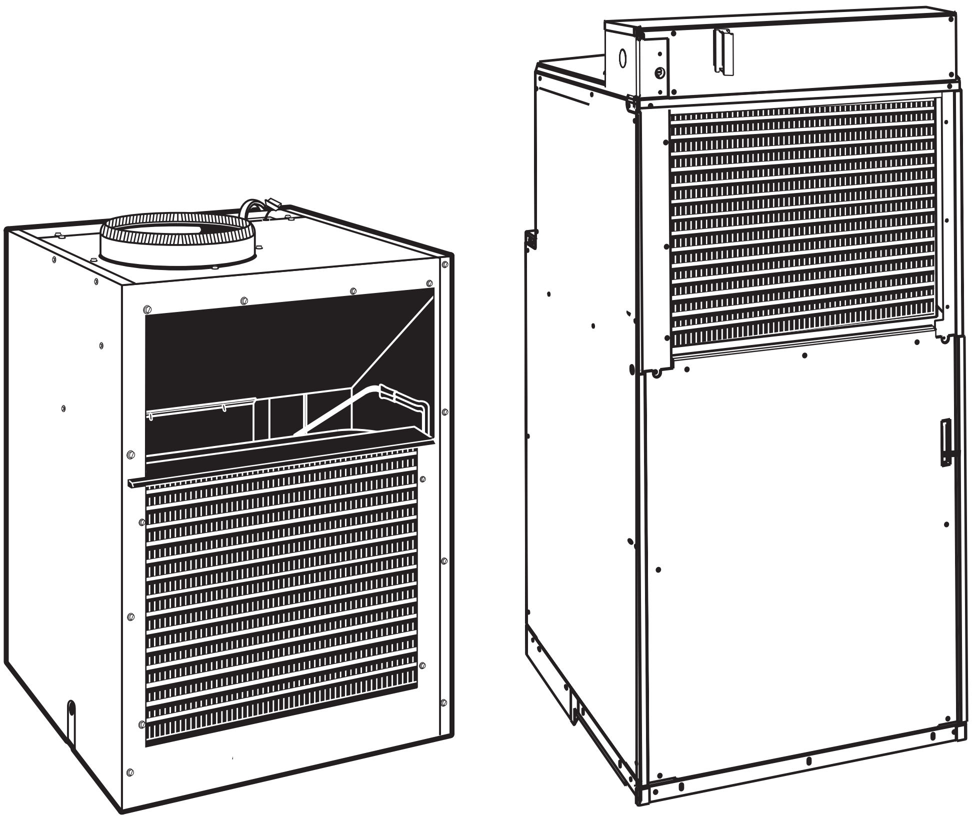
FRIEDRICH®

VERT-I-PAK

Service Manual



Standard Chassis Models

9K	**VHA - 09K25RTP, 09K34RTP, 09K50RTP** **VHA - 09R25RTP, 09R34RTP, 09R50RTP**
12K	**VHA - 12K25RTP, 12K34RTP, 12K50RTP** **VHA - 12R25RTP, 12R34RTP, 12R50RTP**
18K	**VHA - 18K25RTP, 18K34RTP, 18K50RTP, 18K75RTP** **VHA - 18R25RTP, 18R34RTP, 18R50RTP, 18K75RTP**
24K	**VHA - 24K25RTP, 24K34RTP, 24K50RTP, 24K75RTP, 24K10RTP** **VHA - 24R25RTP, 24R34RTP, 24R50RTP, 24R75RTP, 24R10RTP**

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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.

Due to continuing research in new energy-saving technology, all information in this manual is subject to change without notice.

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.

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.

Your safety and the safety of others is very 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 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.

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.

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

⚠ WARNING

Refrigeration system under high pressure

Do not puncture, heat, expose to flame or incinerate.

Only certified refrigeration technicians should service this equipment.

R410A systems operate at higher pressures than R22 equipment. Appropriate safe service and handling practices must be used.

Only use gauge sets designed for use with R410A.
Do not use standard R22 gauge sets.

INTRODUCTION

Personal Injury Or Death Hazards

SAFETY FIRST	⚠ WARNING	⚠ AVERTISSEMENT	⚠ ADVERTENCIA
	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 CONTAMINTES 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.

Installation procedures are not given in this manual. They are given in the Installation and Operation Manual which can be aquired on the website (www.friedrich.com).

Equipment Identification

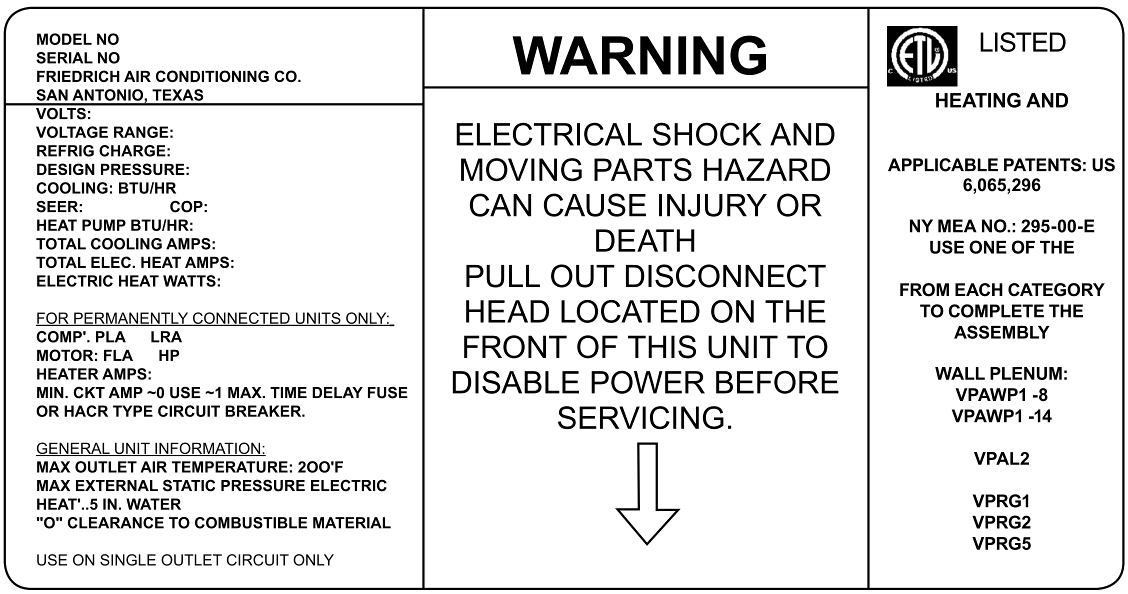


Figure 101 (Equipment Identification Example)

Model and Serial Number Location

Model and Serial Number information is found on the Manufacturer's DATA TAG, located on the front or top.

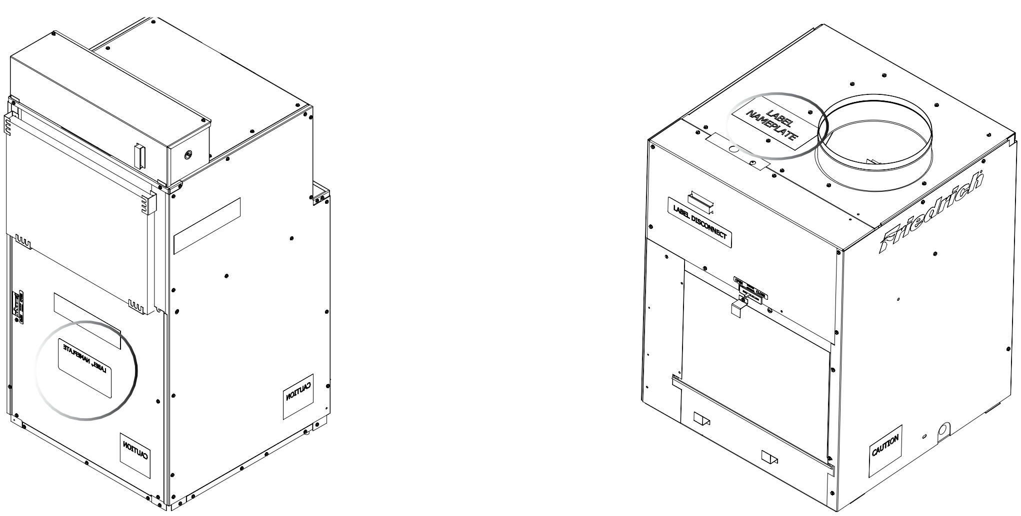
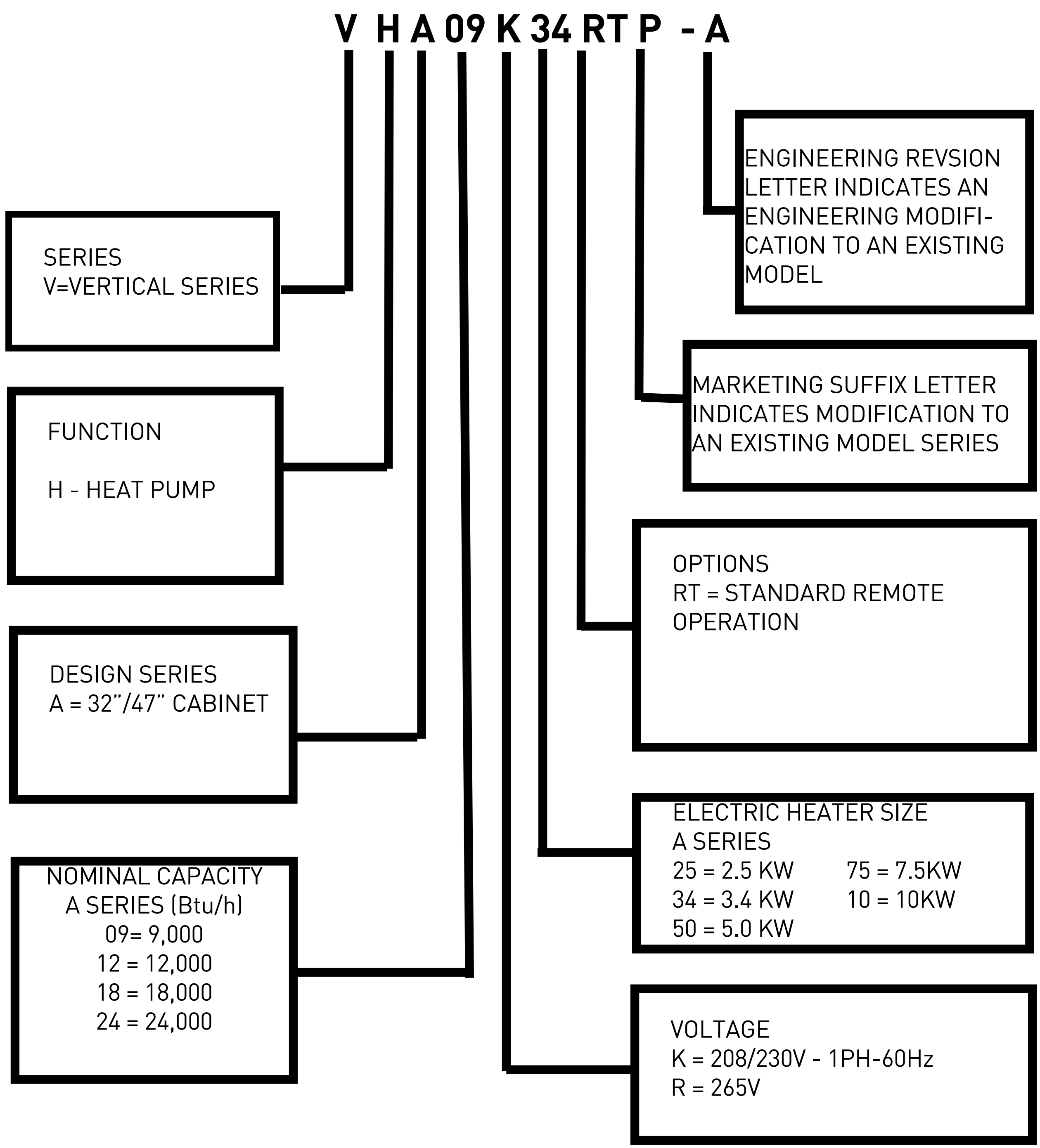


Figure 102 (Model and Serial Number Location)

INTRODUCTION

Model Number Reference Guide



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 103

INTRODUCTION

Serial Number Reference Guide

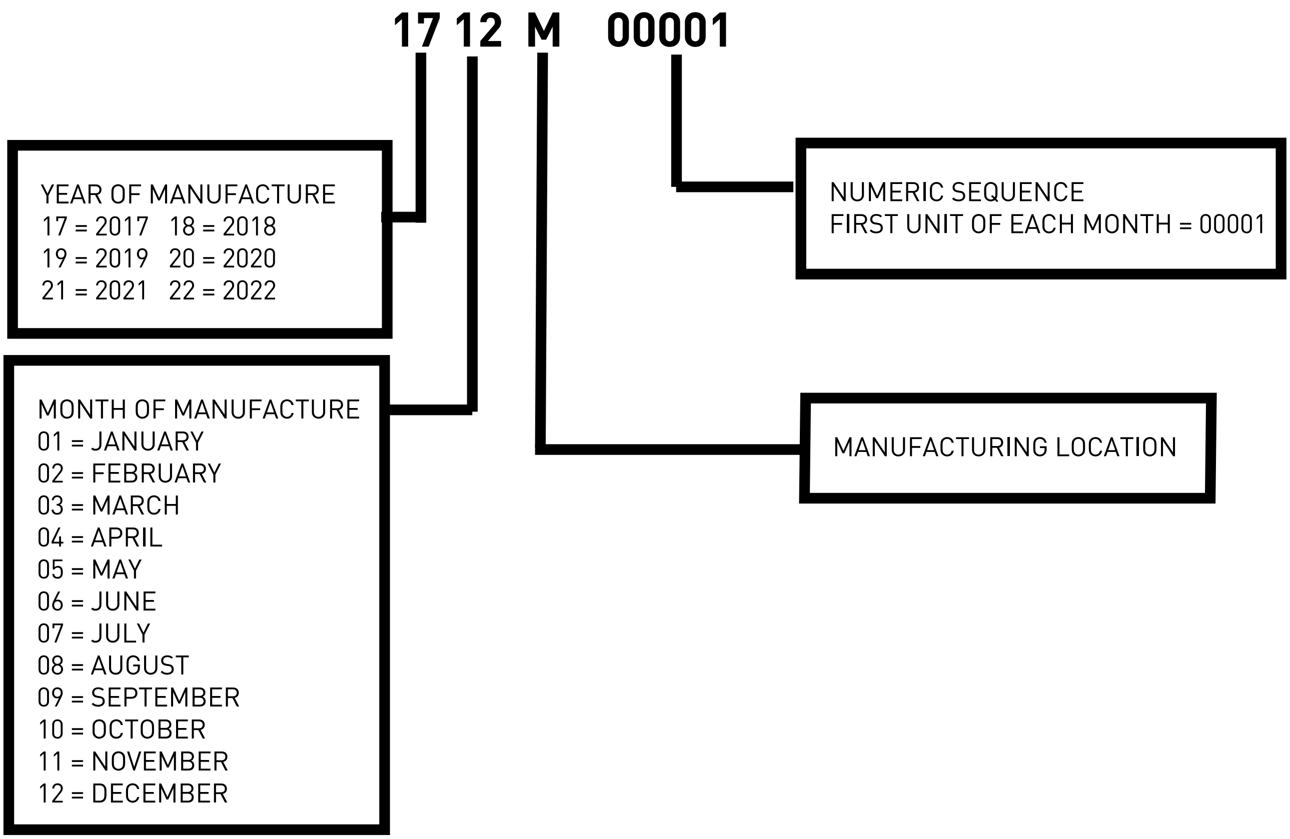


Figure 104

SPECIFICATIONS

General Specifications -A Models

MODEL	VHA09K		VHA09R		VHA12K		VHA12R		VHA18K		VHA18R		VHA24K		VHA24R	
COOLING DATA																
TOTAL COOLING CAP.	9300		9300		11500		11500		18400		18400		22500		22500	
SENSIBLE COOL CAP.	7440		7440		9085		9085		13430		13430		15750		15750	
POWER (W)	845		845		1045		1045		1670		1670		2045		2045	
EER	11.0		11.0		11.0		11.0		11.0		11.0		11.0		11.0	
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	
HEAT PUMP DATA																
REVERSE HEATING BTU	8300		8300		10600		10600		16700		16700		19500		19500	
COP @ 47F	3.3		3.3		3.3		3.3		3.3		3.3		3.3		3.3	
HEATING POWER (W)	730		730		940		940		1480		1480		1732		1732	
HEATING CURRENT (A)	3.6		3.1		4.5		3.7		7.0		6.1		9.2		9.2	
ELECTRICAL DATA																
VOLTAGE (1 PHASE, 60 HZ)	208-230		265		208-230		265		208-230		265		208-230		265	
VOLT RANGE	197-253		239-292		197-253		239-292		197-253		239-292		197-253		239-292	
COOLING CURRENT (A)	4.1		3.5		4.9		4.0		7.9		7.0		10.5		10.5	
AMPS L.R	21.0		21.0		23.0		23.0		37.0		37.0		44.0		44.0	
INDOOR MOTOR (HP)	1/4		1/4		1/4		1/4		1/4		1/4		1/5		1/5	
INDOOR MOTOR (A)	1.2		1.2		1.2		1.2		0.42		0.42		1.4		1.4	
OUTDOOR MOTOR (HP)	—		—		—		—		1/4		1/4		1/4		1/4	
OUTDOOR MOTOR (A)	—		—		—		—		1.6		1.6		1.7		1.7	
PHYSICAL																
DIMENSIONS (W X D X H)	23" X23" X32"		23"X 23"X32"		23"X 23"X32"		23"X 23"X32"		23"X 23"X47"		23"X 23"X47"		23"X 23"X52"		23"X 23"X52"	
NET WEIGHT (LBS)	142		144		147		149		190		192		225		227	
R410A CHARGE (OZ)	37.0		37.0		42.1		42.1		57		57		62		62	
AIRFLOW DATA																
INDOOR CFM	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
.10" ESP	430	490	430	490	430	490	430	490	630	675	630	675	660	700	660	700
.15" ESP	410	470	410	470	410	470	410	470	595	640	595	640	615	665	615	665
.20" ESP	360	440	360	440	360	440	360	440	550	600	550	600	575	625	575	625
.25" ESP	310	400	310	400	310	400	310	400	505	550	505	550	525	580	525	580
.30" ESP	260	350	260	350	260	350	260	350	455	500	455	500	485	540	485	540
.35" ESP	-	-	-	-	-	-	-	-	400	445	400	445	450	500	450	500
.40" ESP	-	-	-	-	-	-	-	-	345	400	345	400	415	465	415	465
VENT CFM																
UP TO " " CFM	60		60		60		60		60		60		60		60	

Figure 201a (General Specs - A Models)

SPECIFICATIONS

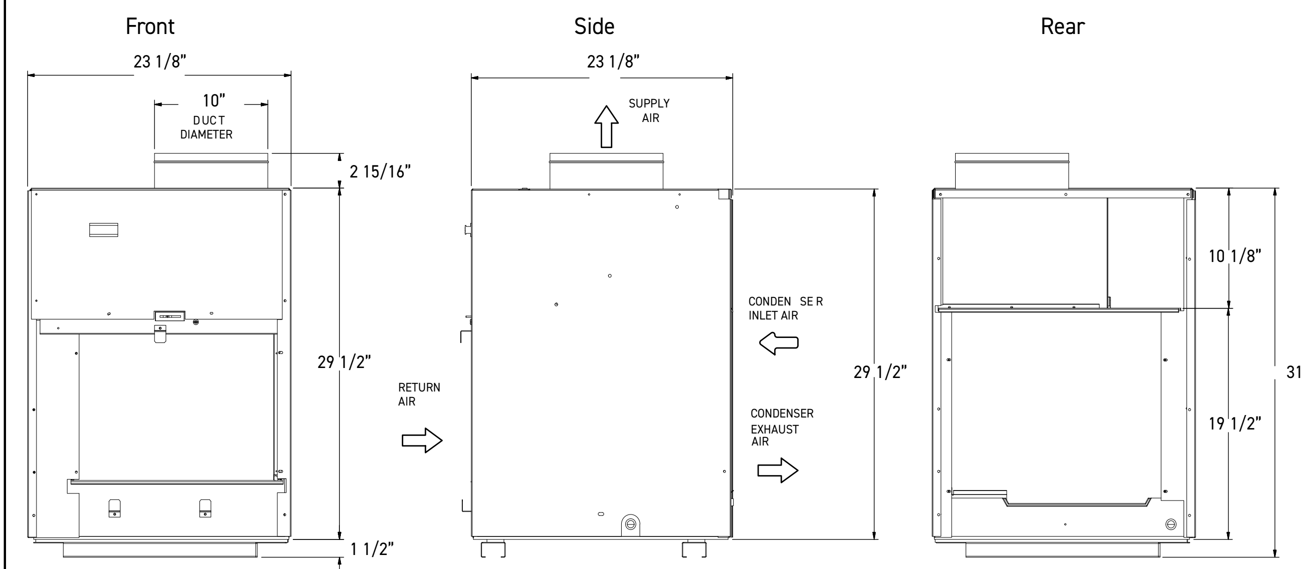
General Specifications -B Models

MODEL	VHA09K		VHA09R		VHA12K		VHA12R		VHA18K		VHA18R	
COOLING DATA												
TOTAL COOLING CAP.	9300		9300		11500		11500		18400		18400	
SENSIBLE COOL CAP.	7440		7440		9085		9085		13430		13430	
POWER (W)	845		845		1045		1045		1670		1670	
EER	11.0		11.0		11.0		11.0		11.0		11.0	
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	
HEAT PUMP DATA												
REVERSE HEATING BTU	8300		8300		10600		10600		16700		16700	
COP @ 47F	3.3		3.3		3.3		3.3		3.3		3.3	
HEATING POWER (W)	730		730		940		940		1480		1480	
HEATING CURRENT (A)	3.6		3.1		4.5		3.7		7.0		6.1	
ELECTRICAL DATA												
VOLTAGE (1 PHASE, 60 HZ)	208-230		265		208-230		265		208-230		265	
VOLT RANGE	197-253		239-292		197-253		239-292		197-253		239-292	
COOLING CUR-RENT (A)	4.1		3.5		4.9		4.0		7.9		7.0	
AMPS L.R	21.0		21.0		23.0		23.0		37.0		37.0	
INDOOR MOTOR (HP)	1/4		1/4		1/4		1/4		1/4		1/4	
INDOOR MOTOR (A)	1.2		1.2		1.2		1.2		0.42		0.42	
OUTDOOR MOTOR (HP)	—		—		—		—		1/4		1/4	
OUTDOOR MOTOR (A)	—		—		—		—		1.6		1.6	
PHYSICAL												
NET WEIGHT (LBS)	142		144		147		149		190		192	
R410A CHARGE (OZ)	38.0		38.0		42.1		42.1		58.5		58.5	
AIRFLOW DATA												
INDOOR CFM	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
.10" ESP	430	490	430	490	430	490	430	490	630	675	630	675
.15" ESP	410	470	410	470	410	470	410	470	595	640	595	640
.20" ESP	360	440	360	440	360	440	360	440	550	600	550	600
.25" ESP	310	400	310	400	310	400	310	400	505	550	505	550
.30" ESP	260	350	260	350	260	350	260	350	455	500	455	500
.35" ESP	-	-	-	-	-	-	-	-	400	445	400	445
.40" ESP	-	-	-	-	-	-	-	-	345	400	345	400
VENT CFM												
UP TO " " CFM	60		60		60		60		60		60	

Figure 201b (General Specs - B Models)

SPECIFICATIONS

Chassis Specifications 9K, 12K



UNIT TOP VIEW DIMENSIONS

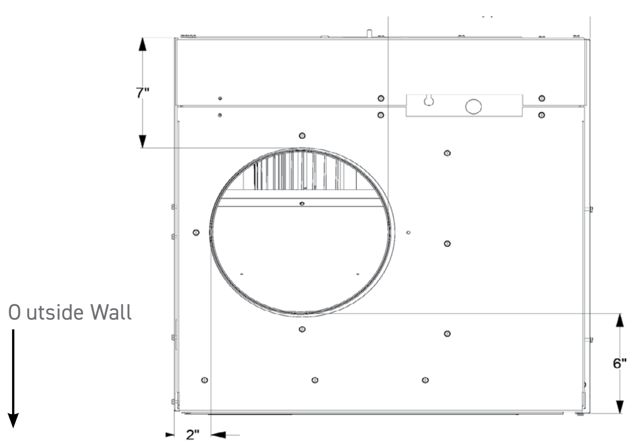
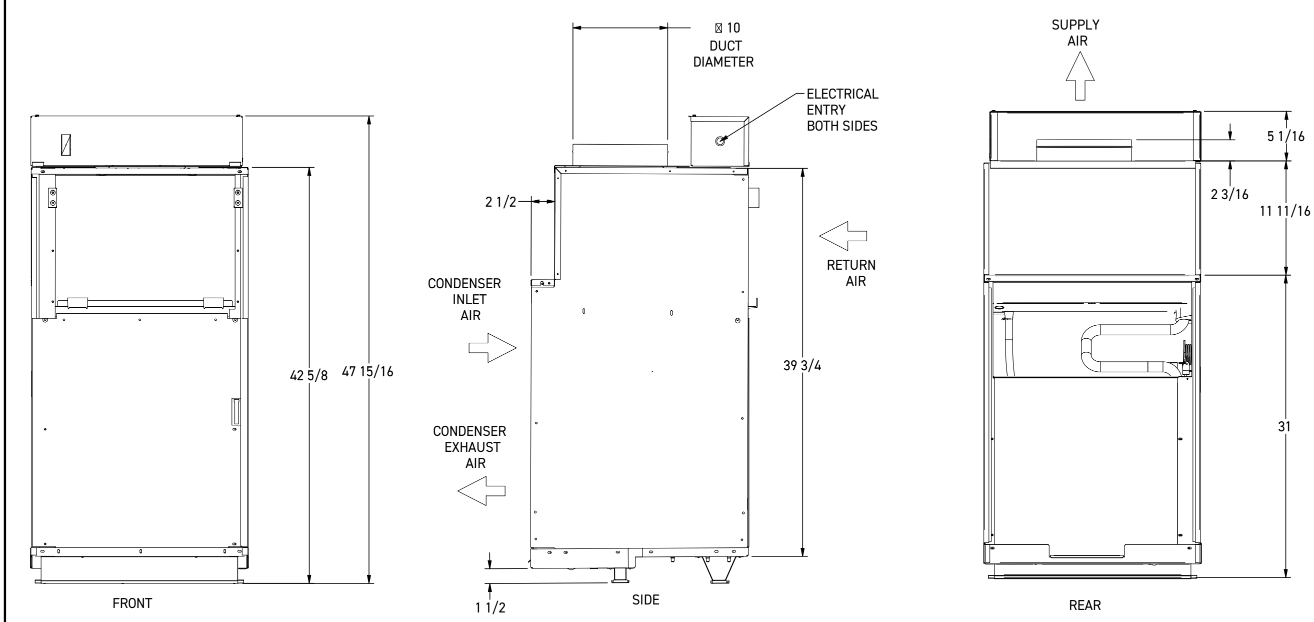


Figure 202 (9-12K Chassis Specs)

SPECIFICATIONS

18K Dimensions



UNIT TOP VIEW DIMENSIONS

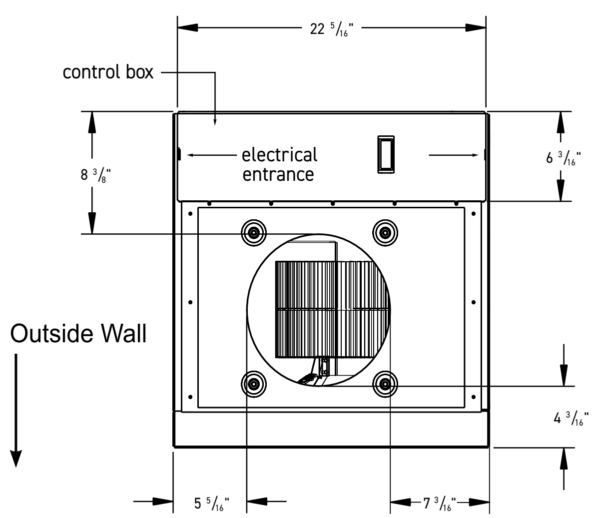
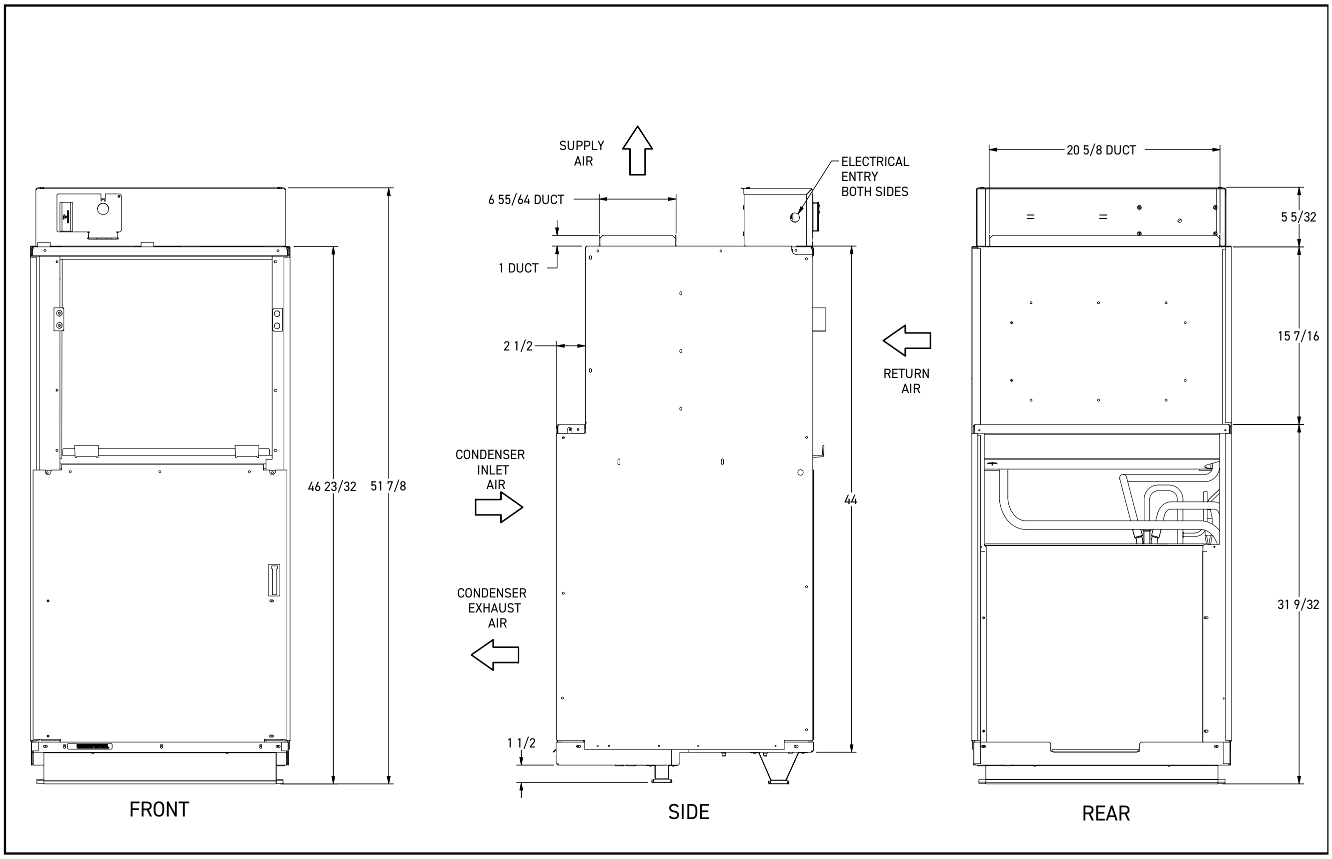


Figure 203 (18K Chassis Specs)

SPECIFICATIONS

24K Dimensions



UNIT TOP VIEW DIMENSIONS

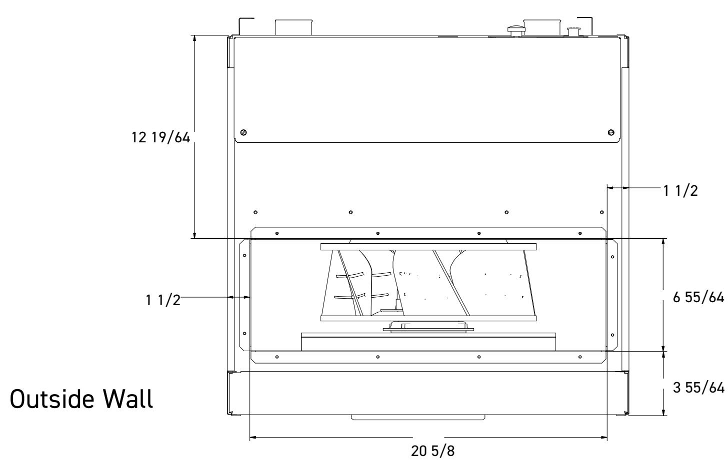


Figure 204 24K Chassis Specs)

SPECIFICATIONS

Electrical Data (208/ 230v 9K btu and 12K BTU)

MODEL	9K			12K		
HEATER WATTS	2050-2500	2780-3400	4090-5000	2050-2500	2780-3400	4090-5000
VOLTAGE	208-230					
ELECTRIC HEATING BTU	7000-8500	9500-11600	13900-17000	7000-8500	9500-11600	13900-17000
ELEC. HEATING CUR-RENT (AMPS)	11.1-12.0	14.6-16.0	20.9-22.9	11.1-12.0	14.6-16.0	20.9-22.9
MINIMUM CIRCUIT AMPACITY	15	20.0	29.2	15	20.0	29.2
BRANCH CIRCUIT FUSE (AMPS)	15	20	30	15	20	30
LRA - COMPRESSOR (AMPS)	21.0	21.0	21.0	23.0	23.0	23.0
BASIC HEATER SIZE	2.5 KW	3.4 KW	5.0 KW	2.5 KW	3.4 KW	5.0 KW
POWER CONNECTION	HARD WIRED					
RECOMMENDED BRANCH CIRCUIT WIRE SIZES* AWG-AMERI-CAN WIRE GAUGE	14	12	10	12	12	10

Figure 205a (9&12K 208/230V Electrical Data) -A Models

MODEL	9K			12K		
HEATER WATTS	2050-2500	2780-3400	4090-5000	2050-2500	2780-3400	4090-5000
VOLTAGE	208-230					
ELECTRIC HEATING BTU	7000-8500	9500-11600	13900-17000	7000-8500	9500-11600	13900-17000
ELEC. HEATING CUR-RENT (AMPS)	11.5-12.5	15.0-16.4	21.3-23.3	11.5-12.5	15.0-16.4	21.3-23.3
MINIMUM CIRCUIT AMPACITY	16	20.9	29.6	16	20.9	29.6
BRANCH CIRCUIT FUSE (AMPS)	20	25	30	20	25	30
LRA - COMPRESSOR (AMPS)	21.0	21.0	21.0	23.0	23.0	23.0
BASIC HEATER SIZE	2.5 KW	3.4 KW	5.0 KW	2.5 KW	3.4 KW	5.0 KW
POWER CONNECTION	HARD WIRED					
RECOMMENDED BRANCH CIRCUIT WIRE SIZES* AWG-AMERI-CAN WIRE GAUGE	12	12	10	12	12	10

Figure 205a (9&12K 208/230V Electrical Data) -B Models

SPECIFICATIONS

Electrical Data (265v 9K and 12K BTU)

MODEL	9R			12R		
HEATER WATTS	2500	3400	5000	2500	3400	5000
VOLTAGE	265					
ELECTRIC HEATING BTU	8500	11600	17000	8500	11600	7000
ELEC. HEATING CURRENT (AMPS)	10.5	13.9	19.9	10.5	13.9	19.9
MINIMUM CIRCUIT AMPACITY	13.8	18.0	25.7	13.8	18.0	25.7
BRANCH CIRCUIT FUSE (AMPS)	15	20	30	15	20	30
LRA - COMPRESSOR (AMPS)	21.0	21.0	21.0	23.0	23.0	23.0
BASIC HEATER SIZE	2.5 KW	3.4 KW	5.0 KW	2.5 KW	3.4 KW	5.0 KW
POWER CONNECTION	HARD WIRED					
RECOMMENDED BRANCH CIRCUIT WIRE SIZES* AWG-AMERICAN WIRE GAUGE	14	12	10	12	12	10

Figure 206a (9K BTU&12K BTU 265 Electrical Data) -A Models

MODEL	9R			12R		
HEATER WATTS	2500	3400	5000	2500	3400	5000
VOLTAGE	265					
ELECTRIC HEATING BTU	8500	11600	17000	8500	11600	17000
ELEC. HEATING CURRENT (AMPS)	11.0	14.4	20.5	11.0	14.4	20.5
MINIMUM CIRCUIT AMPACITY	14.2	18.5	26.0	14.2	18.5	26.0
BRANCH CIRCUIT FUSE (AMPS)	15	20	30	15	20	30
LRA - COMPRESSOR (AMPS)	21.0	21.0	21.0	23.0	23.0	23.0
BASIC HEATER SIZE	2.5KW	3.4KW	5.0KW	2.5KW	3.4KW	5.0KW
POWER CONNECTION	HARD WIRED					
RECOMMENDED BRANCH CIRCUIT WIRE SIZES* AWG-AMERICAN WIRE GAUGE	14	12	10	12	12	10

Figure 206b (9K BTU&12KBTU 265 Electrical Data) -B Models

SPECIFICATIONS

Electrical Data (208/ 230v 18K BTU and 24K BTU)

MODEL	18K			24K				
HEATER WATTS	2050-2500	2780-3400	4090-5000	2050-2500	2780-3400	4090-5000	6135-7500	8180-10000
VOLTAGE	208-230							
ELECTIC HEATING BTU	7000-8500	9500-11600	13900-17000	7000-8500	9500-11600	13900-17000	20900-25600	27900-34100
ELEC. HEATING CURRENT (AMPS)	11.1-12.0	14.6-16.0	20.9-22.9	11.3-12.3	14.8-16.2	21.1-23.1	30.9-34.0	40.7-44.9
MINIMUM CIRCUIT AMPACITY	15.0	20.0	29.2	15.4	20.3	29.0	42.6	56.1
BRANCH CIRCUIT FUSE (AMPS)	15	20	30	20	25	30	45	60
LRA - COMPRESSOR (AMPS)	37.0	37.0	37.0	44.0	44.0	44.0	44.0	44.0
BASIC HEATER SIZE	2.5KW	3.4KW	5.0KW	2.5KW	3.4KW	5.0KW	7.5KW	10.0KW
POWER CONNECTION	HARD WIRED							
RECOMMENDED BRANCH CIRCUIT WIRE SIZES* AWG-AMERICAN WIRE GAUGE	14	12	10	12	10	10	6	4

Figure 207a (18K BTU &24K BTU 208/230V Electrical Data)-A Models

MODEL	18K			
HEATER WATTS	2050-2500	2780-3400	4090-5000	6135-7500
VOLTAGE	208-230			
ELECTIC HEATING BTU	7000-8500	9500-11600	13900-17000	20900-25600
ELEC. HEATING CURRENT (AMPS)	11.5-12.5	15.0-16.4	21.3-23.3	31.1-34.2
MINIMUM CIRCUIT AMPACITY	15.6	20.5	29.2	42.8
BRANCH CIRCUIT FUSE (AMPS)	20	25	30	45
LRA - COMPRESSOR (AMPS)	37.0	37.0	37.0	37.0
BASIC HEATER SIZE	2.5KW	3.4KW	5.0KW	7.5KW
POWER CONNECTION	HARD WIRED			
RECOMMENDED BRANCH CIRCUIT WIRE SIZES* AWG-AMERICAN WIRE GAUGE	12	12	10	6

Figure 207b (18K BTU 208/230V Electrical Data)-B Models

SPECIFICATIONS

Electrical Data (265v 18K BTU and 24K BTU)

MODEL	18R			24R				
HEATER WATTS	2500	3400	5000	2500	3400	5000	7500	10000
VOLTAGE	265							
ELECTIC HEATING BTU	8500	11600	17000	8500	11600	17000	25600	34100
ELEC. HEATING CURRENT (AMPS)	10.5	13.9	19.9	10.8	14.2	20.3	29.7	39.1
MINIMUM CIRCUIT AMPACITY	13.8	18.0	25.7	13.6	17.8	25.4	37.2	49.0
BRANCH CIRCUIT FUSE (AMPS)	15	20	30	20	20	30	40	50
LRA - COMPRESSOR (AMPS)	37.0	37.0	37.0	44.0	44.0	44.0	44.0	44.0
BASIC HEATER SIZE	2.5KW	3.4KW	5.0KW	2.5KW	3.4KW	5.0KW	7.5KW	10.0KW
POWER CONNECTION	HARD WIRED							
RECOMMENDED BRANCH CIRCUIT WIRE SIZES* AWG-AMERICAN WIRE GAUGE	14	12	10	12	12	10	6	4

Figure 208a (18K BTU &24K BTU 265V Electrical Data)-A Models

MODEL	18R			
HEATER WATTS	2500	3400	5000	7500
VOLTAGE	265			
ELECTIC HEATING BTU	8500	11600	17000	25600
ELEC. HEATING CURRENT (AMPS)	11.0	14.4	20.5	29.9
MINIMUM CIRCUIT AMPACITY	13.8	18.1	25.6	37.4
BRANCH CIRCUIT FUSE (AMPS)	15	20	30	40
LRA - COMPRESSOR (AMPS)	37.0	37.0	37.0	37.0
BASIC HEATER SIZE	2.5KW	3.4KW	5.0KW	7.5KW
POWER CONNECTION	HARD WIRED			
RECOMMENDED BRANCH CIRCUIT WIRE SIZES* AWG-AMERICAN WIRE GAUGE	14	12	10	6

Figure 208b (18K BTU &24K BTU 265V Electrical Data)-B Models

SPECIFICATIONS

Electrical Requirements

ELECTRICAL REQUIREMENTS	
WIRE SIZE	Use ONLY wiring size recommended by Local and/ or National electric codes for single outlet branch circuit.
FUSE/CIRCUIT BREAK-ER	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 RESPON-SIBILITY 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 PUR- POSE OUTLET IS GROUNDED.
WIRE SIZING	USE RECOMMENDED WIRE SIZE GIVEN IN TABLES AND INSTALL A SINGLE BRANCH CIRCUIT. ALL WIRING MUST COMPLY WITH LOCAL AND NATIONAL CODES. NOTE: USE COPPER CONDUCTORS ONLY.

Electrical Ratings Table

NOTE: Use copper conductors ONLY. Wire sizes are per NEC.
AWG - American Wire Gauge
* Single circuit from main box.
** Based on 100' or less of copper, single insulated conductor at 60° C

WARNING

Electrical Shock Hazard.

Turn OFF electric power before service or instal-lation.

Unit must be properly grounded.

Unit must have correct fuse or circuit breaker pro-tection. 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.

NOTE: ALL 230/208 CHASSIS 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 TO ENSURE THAT THE ELECTRICAL CODES ARE MET.

SPECIFICATIONS

Sound Data

Sound Power and STC					
MODEL		INDOOR (DBA)		OUTDOOR (DBA)	
	STC	HIGH COOL	LOW COOL	HIGH COOL	LOW COOL
VHA09	23	63.6	61.4	75.4	72.9
VHA12	23	63.0	60.8	75.3	72.7
VHA18	24	67.2	65.7	74.9	74.8
VHA24	25	67.8	66.4	78.5	72.7

Figure 209 (Sound Data)

SPECIFICATIONS

Supply Air Flow and Data

	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

Figure 210 (Indoor CFM & External Static Pressure)

Indoor air flow 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 large chassis Vert-I-Pak equipment be operated at an external static pressure in excess of 0.4" W.C. Operation of the Vert-I-Pak under these conditions will result in inadequate air flow, leading to poor performance and/or premature component failure.

Control

For LOW speed only operation, connect the fan output terminal from the thermostat to the GL terminal of the electronic control.
For HIGH speed only operation, connect the fan output terminal from the thermostat to the GH terminal of the electronic control.
For thermostats with two-speed capability, connect the LOW speed output to the GL terminal and the HIGH speed output to the GH terminal.

Condenser CFM & External Static Pressure

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

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

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

Figure 211 (Condenser CFM & External Static Pressure)

SPECIFICATIONS

Required Minimum Clearances

Building Exterior Unit Opening Requirements

VPAK 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" above "FINISHED GRADE ELEVATION". No exceptions.

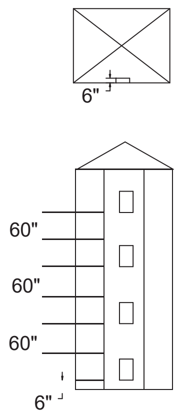


Figure A

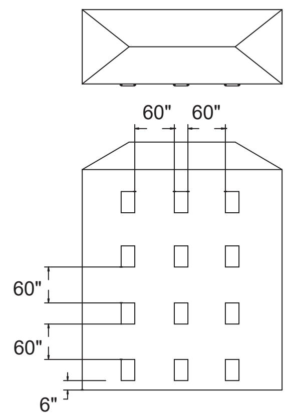


Figure B

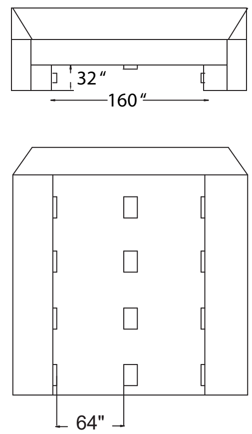


Figure C

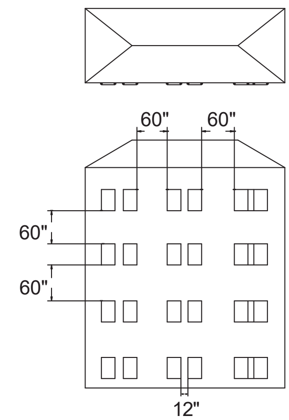


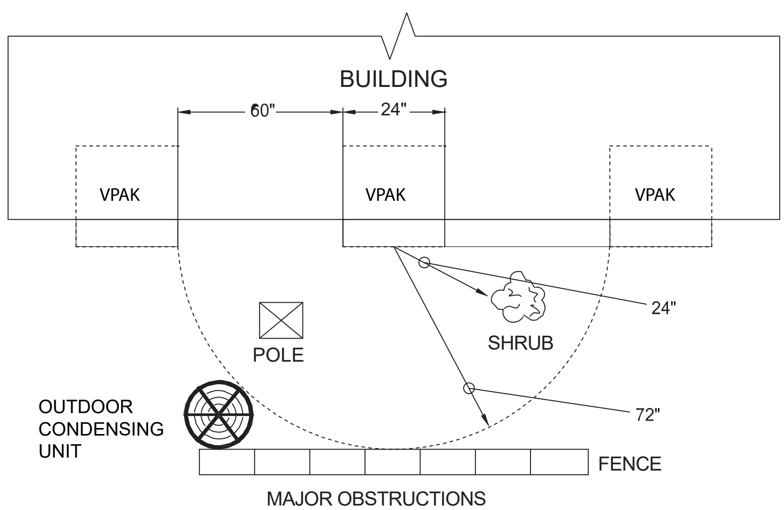
Figure D

Grill Clearance Requirements

Where obstructions are present use the following guidelines for proper spacing from the VPAK 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, railing, 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 212

OPERATION

Electronic Control Board Features

The Vert-I-Pak has state of the art features to improve guest comfort and conserve energy.
Below is a list of standard features on every VPAK and their benefitt to the owner.

Quite Start/ Stop Fan Delay	The fan start and stop delays prevent abrupt changes in room acoustics due to the compressor energizing or stopping immediately. Upon call for cooling or heating the unit fan will run for five seconds prior to en-ergizing the compressor. Also, the fan off delay allows for "free cooling" by utilizing the already cool indoor coil to its maximum capacity by running for 30 seconds after the compressor.
Remote Thermostat Opera-tion	VPAK units can be configured to be set up with a wired thermostat, wireless thermostat, or an ernegy management thermostat.
Internal Diagnostic Program	The VPAK features a self diagnostic program that can alert maintenance to compo-nent failures or operating problems. The internal diagnostic program saves properties valuable time when diagnosing running problems.
Service Error Code Storage	The self diagnosis program will also store error codes in memory if certain conditions occur and correct themselves such as extreme high or low operating conditions or activation of the room freeze protection feature. Storing error codes can help properties determine if the unit faced obscure conditions or if an error occurred and corrected itself.
Random Compressor Restart	Multiple compressors starting at once can often cause electrical overloads and premature unit failure. The random restart delay eliminates multiple units from starting at once following a power outage or initial power up. The compressor delay will range from 180 to 240 seconds.
Heat Pump Units Digital Defrost Thermostat	The VPAK uses a digital thermister to accurately monitor the outdoor coil conditions to allow the heat pump to run whenever conditions are correct. Running the VPAK in heat pump mode save energy and reduces operating costs. The digital thermostat allows maximization of heat pump run time.
Instant Heat Heat Pump Mode	Heat pump models will automatically run the electric heater during compressor lock-out to quickly provide heat when initially energized, then return to heat pump mode. This ensures that the room is heated quickly without the usual delay associated with heat pump units.
Room Air Sampling Feature	The room air sampling feature maintains a balanced temperature throughout the room by circulating the air for 90 seconds once every 9 minutes that the unit is not running when it is set to cooling or heating mode. By circulating the air, the unit can detect hot or cold areas in the room and operate the unit to cool or warm the room as necessary. This function is only available when the fan mode is set to 'AUTO' during COOL or HEAT Mode.
Desk Control Ready	All electronic VPAK units have low voltage terminals ready to connect a desk control energy management system. Controlling the unit's on/off operation from a remote location like the front desk can reduce energy usage and requires no additional accessories at the VPAK.
Indoor Coil Frost Sensor	The frost sensor protects the compressor from damage in the event that airflow is reduced or low outdoor temperatures cause the indoor coil to freeze. When the indoor coil reaches 30°F the compressor is diabled and the fan continues to operate based on demand. Once the coil tempera-ture returns to 45°F the compressor returns to operation.
Auxiliary Fan Ready	The VPAK features a 24V AC terminal for connection to a relay that may be used to operate an auxiliary fan to transfer air to adjoining rooms. Auxiliary fans can provide air conditioning to odd shaped rooms.

Operation

Electronic Sequence of Operation

Compressor and Reversing Valve Control

Active Mode	Compressor	Reversing Valve
Cooling	On	De-Energized
Heat - Pump	On	Energized
Heat - Electric	Off	
Fan Only	Off	

Reversing Valve
The reversing valve stays in the last state until a call for heat or cooling.
The reversing valve only changes when required to provide coooling or heat pump. Leave the reversing valve in it's last state until it's required to change.

Unit Cooling Mode

Once the ambient temperature rises past the cool demand set point of the t-stat (see figure below), and the compressor is not locked out, the cooling cycle begins. As shown in the figure below, the fan is started 5 seconds prior to the compressor. Once the ambient temperature has been lowered to the cool set point, the cooling cycle starts to terminate by shutting off the compressor. After a 30 seconds delay, the fan is shut off.

Heating Mode Control Operation

There are two heating methods: Heat Pump and Electric Resistance Heat.
There are 2 Types of units that provide heating:
Cool / Heat Pump with Electric Heat and Cool with Electric heat.

Heat Mode in Cool with Electric Heat Units
When the t-stat is in the Heat Mode, if the indoor ambient temperature is below the heat set point, the fan turns on 5 seconds prior then the electric heat will turn on. When the t-stat is satisfied, the electric heat will turn off. The fan turns off 15 seconds later.

Heat Pump With Electric Heat Operation
This heating has two heating methods. If the ambient indoor temperature is below the heat set point and the compressor is not locked out, the compressor turns on. If the ambient temperature rises above the t-stat's heat set point, the compressor turns off.

If the Compressor is Locked Out on the 3 Minute Time Delay and Electric Heat is Available

1. The control turns on the electric heat until the compressor is not locked out.
2. After lockout, the control turns off the electric heat, waits 5 seconds, then turns on the compressor.(The wired remote wall t-stat's time delay may override this feature).

Condition 1
If the outdoor coil temperature sensor drops to 30 degrees F for less than 2 consecutive minutes, the unit will switch to electric heat if available. Thereafter, the unit will switch back to Heat Pump heat until the outdoor coil temperature sensor rises to 45 degrees F or greater.

OPERATION

Compressor Lock Out Time

The lockout feature ensures that the compressor is de-energized for a period of time. The timer varies randomly from 180 to 240 seconds.
The compressor lockout is initiated every time the compressor is "off" due to:

(1) Satisfying the T-stat temperature set point
(2) Changing mode to fan only or heat
(3) Turning the unit off
(4) Power is restored after failure
(5) Line power is restored from a brown out condition

Cooling Fan Delay

This is only for t-stat Fan Auto Mode only.
When unit cycles cooling ON – starts the fan 5 seconds EARLY. When unit cycles cooling OFF – DELAYS the fan off for 30 seconds

Heating Fan Delay

This is only for Fan Auto Mode (Fan cycles with cool/heat operation) and not for continuous fan mode. When unit cycles Heating ON – starts the fan 5 seconds EARLY. When unit cycles Heating OFF – DELAYS the fan off for 15 seconds.
Continuous fan operation enables fan to run continuously.

Fan Speed Change Delay

Relay activation is delayed by a minimum number of seconds. The default for this value is 2 seconds and is used to eliminate relay chatter.

Room Air Sampling Feature

The room air sampling feature maintains a balanced temperature throughout the room by circulating the air for 90 seconds once every 9 minutes that the unit is not running when it is set to cooling or heating mode. By circulating the air, the unit can detect hot or cold areas in the room and operate the unit to cool or warm the room as neces-sary. This function is only available when the fan mode is set to 'AUTO' during COOL or HEAT Mode.

Low Voltage Interface Connections

All Vert-I-Pak units have a low voltage interface connector through which a Remote Wall Thermostat, Desk Control and Auxiliary Fan's Relay can be connected. The interface connector is located on the electronic control board.

Interface Connector Definitions	
FP	Factory use only. (Ensure there is no jumper at FP an F2)
F2	Used with F1 to provide 24 VAC to external fan relay. (Ensure there is no jumper at FP an F2
F1	Used with F2 to provide 24 VAC to external fan relay.
D2	Used with D1 for desk control on or off operation.
D1	Used with D2 for desk control on or off operation.
C	Common Ground TerminaL
GH	Call for high fan
GL	Call for low fan
B	Call for heat pump reversing valve
Y	Call for compressor
W	Call for heating
R	24V Power from Electronic Control to Wall

Figure 301 (Inteface Connections)

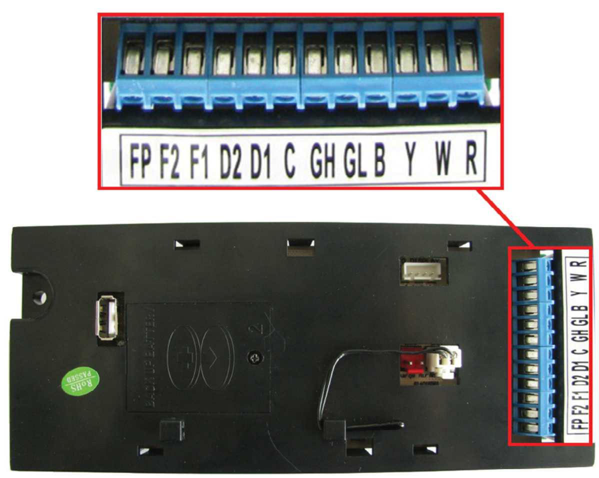


Figure 302 (Inteface Connections)

OPERATION

Remote Wall Thermostat

All Vert-I-Pak units are factory configured to be controlled by using a single stage heat/cool remote wired wall mounted thermostat.

Thermostat Selection
SINGLE STAGE THERMOSTATS
RT7P
Wired, single stage, wall-mounted programmable thermostat with two fan speeds and backlight. Controls VERT-I-PAK.
RT7
Wired, single stage, wall-mounted digital thermostat with two fan speeds and backlight. Controls VERT-I-PAK.
WRT2
Wireless, single stage, wall-mounted programmable thermostat with two fan speeds and backlight. Controls VERT-I-PAK.
ENERGY MANAGEMENT THERMOSTATS
EMRT2/EMWRT2
Wired/Wirelss thermostat with occupancy sensor
Thermostat terminals requirements:
C, R, G, Y, W, B.
For two fan speeds, thermostat must have 2 fan speed selection.

During Heat Mode:
The B terminal must be continuously energized. The W terminal must have 24 VAC output to call for heat. The control board decides on whether to turn on the Heat Pump Heat (compressor) or Electric Heat. The Y terminal should not have 24 VAC output during heat mode.

Connecting a Remote Wall Thermostat

CONNECT THERMOSTAT USING FIGURES 301, 302, and 303. Refer to thermosts Manuals for installation. Current thermostat manuals may be obtained online at www.friedrich.com.

⚠ WARNING

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

⚠ CAUTION

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.

Failure to follow these instructions can result in personal injury and damage to product or other property.

1) Ensure jumper Is not Installed At FP And F2
2) Disconnect power to the unit.
3) Unscrew and remove the electrical control box's cover.
4) Locate the Interface Connector (24 VAC terminal strip (See figure 1 at left).
5) Make the wire connections according to the con figuration needed for
your unit Use #18 gauge wire size.
6) Once each wire is matched and connected, the unit is now ready to be controlled by the thermostat.
7) Reattach the electrical control box's cover.

OPERATION

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 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.

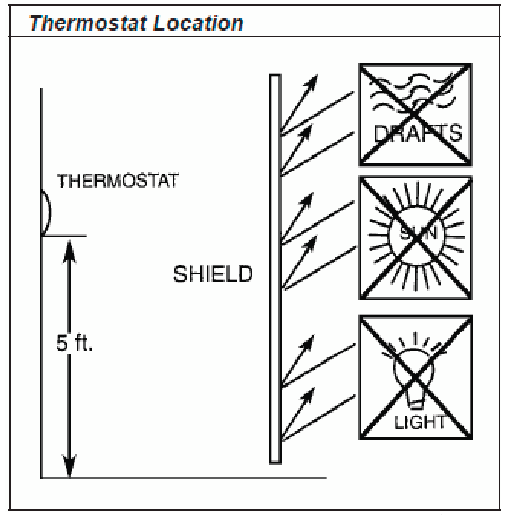


Figure 303 (Thermostat Locations)

Desk Control

The unit's electronic control has built-in provisions for connection to an external switch to control power to the unit. The switch can be a central desk control system or even a normally open door switch.

For desk control operation, connect one side of the switch to the D1 terminal and the other to the D2 terminal (See page 12). Whenever the switch closes, the unit operation will stop.

Maximum wire Length for Desk Control Switch	
Wire Size	Maximum Length
#24	400 ft.
#22	600 ft.
#20	900 ft.
#18	1500 ft.
#16	2000 ft.

Auxiliary Fan Control

The electronic control also has the ability to control a 24 VAC relay to activate an auxiliary, or transfer fan. The outputs are listed as F1 and F2 on the interface connector (See page 12).
To connect the relay, simply wire one side of the relay to F1 and the other side to F2. Anytime that the fan runs, the terminals will send a 24 VAC signal to the relay. The relay must be 24 VAC, 50mA or less.

Note: The Desk Control, Auxiliary Fan relay and wires must be field supplied.

OPERATION

Unit Heat Control Operation - Heat Pump With Electric Heat

Automatic Emergency Heat

If the sealed system fails with a bad reversing valve or anything that causes the indoor coil to get colder than the indoor ambient temperature:

1) If the indoor coil thermistor senses a 5 degree temperature drop as compared to the ambient temperature thermistor and this lasts up to 5 minutes, the control board will switch the unit to electric heat and continue heating with it.

2) At this point, error code 15 is generated; heat pump failure. Indoor coil temperature lower than indoor ambient temperature for 5 or more degrees for 5 consecutive minutes.

Note: It is Ok to continue to use the unit with the electric heater until the heat pump is repaired.

Heat Control Operation - Electric Heat Only

When in the Heat mode, with and without Fan Mode Auto (Fan cycling):

If the indoor ambient temperature is below the Heat Demand Threshold (Heat Set Point minus 1.5 °F), turn on electric heat. If Ambient is 0.3 °F above the Heat Set Point turn off the electric heat.

System Mode Auto

This mode provides automatic change over between cool and heat. The auto mode runs based on the room ambient temperature vs. the Demand Thresholds. It is only available in Heat-Cool Unit.

Notes:

There is a buffer zone between the cool and heat set points where no heating or cooling is allowed to occur. It is critical that the Cool Demand Threshold be greater than the Heat Demand Threshold by a minimum of 3° while in the Auto System Mode. For example, if a user enters a value for the Auto Cooling Set Point that violates the minimum delta 3° rule, the Auto Heating Set Point will adjust accordingly.

Automatic Change Over Delay (Cool with Heat Units)

The change over delay ensures that any system heating or cooling over shoot does not trigger an opposite demand cycle. The change over delay = 15 min. This timer blocks the opposite demand cycle from running until the timer expires. As an example, if the last demand was a cool cycle, and another cool cycle is requested, the timer will not block the request. However, if the last demand cycle was a cool cycle, and heat cycle is requested, the timer will block the request until the change over delay is expired.

Compressor Lock Out Time

The lockout feature ensures that the compressor is de-energized for a period of time. The timer varies randomly from 180 to 240 seconds

The compressor lockout is initiated every time the compressor is “off” due to:

(1) Satisfying the temperature set point
(2) Changing mode to fan only or heat
(3) Turning the unit off
(4) Control is first plugged in or power is restored after failure
(5) Line power is restored from a brown out condition

Cooling Fan Delay

Fan cycle/Auto mode only

When unit cycles cooling ON – starts the fan 5 seconds EARLY. When unit cycles cooling OFF – DELAYS the fan off for 30 seconds.

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, raising its pressure and its (heat intensity) temperature.

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 cooled even further 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 warm high pressure liquid. It next will pass through the refrigerant drier (if equipped). It is the function of the drier to trap any moisture present in the system, contaminants, and large particulate matter.

The liquid refrigerant next enters the metering device. The metering device is called a capillary tube. The purpose of the metering device is to “meter” (i.e. control or measure) the quantity of refrigerant entering the evaporator coil.
In the case of the capillary tube this is accomplished (by design) through size (and length) of device, and the pressure difference present across the device. Since the evaporator coil is under a lower pressure (due to the suction created by the compressor) than the liquid line, the liquid refrigerant leaves the metering device entering 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 heated even further by the air that continues to flow across the evaporator coil.

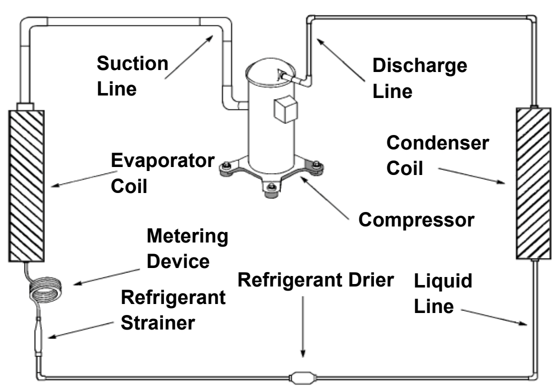


Figure 304 (Sequence of Operation)

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 cool low pressure vapor. The refrigerant then returns to the compressor, where the cycle is repeated.

Routine Maintenance

Coils & Chassis

NOTE: Do not use a caustic (alakaline) or acidic cleaning agent on coils or base pan. Use a biodegradable cleaning agent and degreaser. The use of harsh cleaning materials may lead to deterioration of the aluminum fins or the coil end plates.

The indoor coil and outdoor coils and base pan should be inspected periodically (annually or semi-annually) and cleaned of all debris (lint, dirt, leaves, paper, etc.) as necessary. Under extreme conditions, more frequent cleaning may be required. Clean the coils with and base pan with a coil comb or soft brush and compressed air or vacuum. A low pressure washer device may also be used; however, you must be careful not to bend the aluminum fin pack. Use a sweeping up and down motion in the direction of the vertical aluminum fin pack when pressure cleaning coils.

NOTE: It is extremely important to insure that none of the electrical and/ or electronic parts of the unit get wet when cleaning. Be sure to cover all electrical components to protect them from water or spray.

NOTE: When installed on or near sea coast environments, it recommended that all coils be cleaned at minimum biannually.

Decorative Front

Use a damp (not wet) cloth when cleaning the control area to prevent water from entering the unit, and possibly damaging the electronic control.

The decorative front and the cabinet can be cleaned with warm water and a mild liquid detergent. Do NOT use solvents or hydrocarbon based cleaners such as acetone, naphtha, gasoline, benzene, etc.

The indoor coil can be vacuumed with a dusting attachment if it appears to be dirty. DO NOT BEND FINS. The outdoor coil can be gently sprayed with a garden hose.

The air filter should be inspected weekly and cleaned if needed by vacuuming with a dust attachment or by cleaning in the sink using warm water and a mild dishwashing detergent. Dry the filter thoroughly before reinstalling. Use caution, the coil surface can be sharp.

Fan Motor & Compressor

The fan motor & compressor are permanently lubricated and require no additional lubrication.

Wall Sleeve

Inspect the inside of the wall sleeve and drain system periodically (annually or semi-annually) and clean as required. Under extreme conditions, more frequent cleaning may be necessary. Clean both of these areas with an] bio-growth cleaner. Rinse both items thoroughly with water and ensure that the drain outlets are operating correctly. Check the sealant around the sleeve and reseal areas as needed.

Inspect for bio-growth periodically. If present, ensure the sealing gasket around the unit is in good condition and not allowing outside air (or light) through the gasket.

Blower Wheel / Housing / Condensor Fan / Shroud

Inspect the indoor blower and its housing, evaporator blade, condenser fan blade and condenser shroud periodically (yearly or bi-yearly) and clean of all debris (lint, dirt, bio-growth etc.). Clean the blower housing area and blower wheel with a bio-growth cleaner. Use a biodegradable cleaning agent and degreaser on condenser fan and condenser shroud. Use warm or cold water when rinsing these items. Allow all items to dry thoroughly before reinstalling them.

Electrical / Electronic

Periodically (at least yearly or bi-yearly) inspect all control components: electronic, electrical and mechanical, as well as the power supply. Use proper testing instruments (voltmeter, ohmmeter, ammeter, wattmeter, etc.) to perform electrical tests. Use an air conditioning or refrigeration thermometer to check room, outdoor and coil operating temperatures.

Air Filter

To ensure proper unit operation, the air filter should be cleaned at least monthly, and more frequently if conditions warrant. The unit must be turned off before the filter is cleaned.

REMOVE AND INSTALL THE CHASSIS

Remove The Chassis

⚠ WARNING

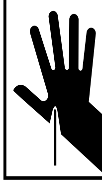
ELECTRIC SHOCK HAZARD

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:

A. Disconnect the power coming into the unit from the main breaker panel or the closet mounted disconnect.
B. Switch the wall Thermostat off.
C. Pull the Power Disconnect located in the front of the chassis.
D. Disconnect the electrical connection.
E. Disconnect the duct work.
F. Disconnect condensate drain on 9-18,000 BTU models (2018 18,000 BTU models excluded).
G. Slide the chassis out of the wall plenum.
H. Lift the chassis out of the utility closet.

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. The supply measurement should be taken roughly 3-6" from the Vert-I-Pak collar and the return measurement taken from center of the indoor coil with the filter installed.

NOTE: Ensure that the closet door is closed. Failure to close closet door will result in erroneous readings.

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.

External Static Pressure

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

* values indicate rated performance point

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

Explanation of charts

Chart A is the nominal dry coil VERT-I-PAK CFMs. Chart B 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 airfl ow. Since in the case of the VERT-I-PAK, the condensate will cause a reduction in measured External Static Pressure for the given airfl ow.
It is also important to remember that when dealing with VERT-l-PAK units that the measured External Static Pressure increases as the resistance is added externally to the cabinet. Example: duct work, fi lters, grilles.

Indoor Airflow Data

The Vert-I-Pak A series units must be installed with a free return air configuration. The table below lists the indoor airflow at corresponding static pressures. All units are rarted at low speed.
The Vert-I-Pak units are designed for either single speed or two fan speed operation. For single speed operation refer to the airflow table below and select the most appropriate CFM based on the ESP level. Connect the fan output from the thermostat to the unit on either the GL terminal for low speed or to the GH terminal for high speed operation.
For thermostats with two-speed fan outputs connect the low speed output to the unit GL terminal and the high speed output to the GH terminal.

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" H20 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 call 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 airfl ow 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

Error Codes and Alarm Status

Unit Control Panel
The display shown below has four digits. The left two digits indicate the error code # (1 to 24), The On/Off icons above these two digits indicate the currents state of the error code. The right two digits show the history count (up to 99) of the associated ERROR CODE. THE DISPLAY CONTAINS A MAINTENANCE ICON (WRENCH) THAT WILL ILLUMINATE TO INDICATE WHEN THE UNIT NEEDS SERVICE.
THIS WRENCH INDICATES AN ERROR CODE # IS ON (ACTIVE). TO FIND OUT WHICH ONE, CHECK ALL ERROR CODES.

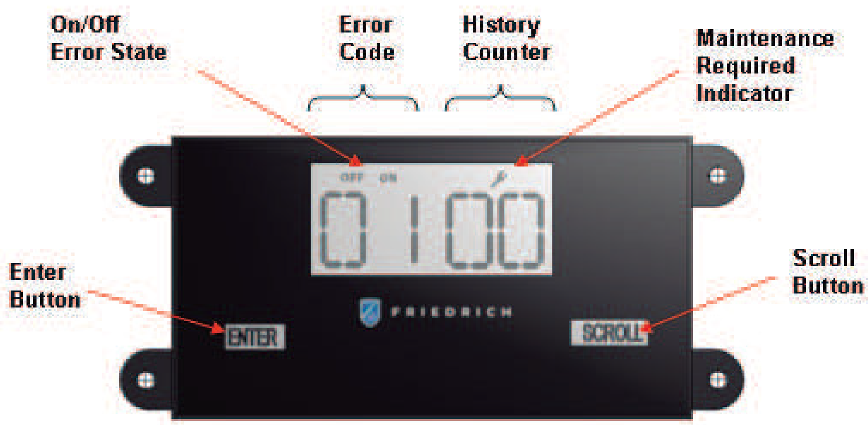


FIGURE 715 (SERVICE MODULE CONNECTOR)

CHECK ERROR CODES
1. Press the Enter key to activate the display.
2. Each press of the scroll key display the next error code.

Clear History Counters
1. Press & hold the Enter key and the Scroll Key for 6 seconds.

TROUBLESHOOTING

Error Codes and Alarm Status

DIAG CODE	PROBLEM	CONTROL BOARD'S ACTION
1	Front Panel Button Stuck For More Than 20 Seconds	Continue to monitor for "OPEN" (Unstuck) switch. Do not process switch input.
2	Input Voltage Out of Specification (187 - 253)	Unit stops, open all relays until voltage is back within specs then resume operation.
3	Indoor Temperature Sensor is Open or Shorted	Unit defaults to 75°F in COOLING or 68°F in HEATING and will continue to operate if setting is below 75°F in cool mode or if above 68°F in heat mode.
4	Indoor Coil Temperature Sensor is Open or Shorted	The unit's control board defaults to 40°F. It will override the sensor and the unit will continue to operate.
5	Outdoor Coil Temperature Sensor is Open or Shorted	The unit defaults to 20°F, overriding the sensor. The unit will continue to operate. Using Elec Heat if available for HEATING. If not available, it will use HEAT PUMP if the outdoor temperature allows.
6	Outdoor Coil > (grater than) 175 F	The unit will shut down for 5 minutes. resume operation for 3 minutes. If test fails 3 times, the unit operation is locked out. See troubleshooting figure 715. To reset, turn power off and on.
7	Indoor Coil < (less than) 30 F for 2 consecutive minutes	The compressor will turn off and the High Fan speed will run. When coil temp reachs 45°F the unit will resume operation after lockout time.
8	Unit Cycles > (greater than) 9 Times per hour	The unit will continue to operate and be monitored.
9	Unit Cycles < (less than) 3 Times per Hour	The unit will continue to operate and be monitored.
11	WallStat Problem or Connection Issue	The unit will not operate.
13	VPAK 18K, 24K Unit Only High Pressure Limit Switch is Open	If unit is cooling or heat pump is on, shut down compressor. Run high fan until switch closes, then resume operation. The third occurance in 1 hour locks unit out. Applicable to 24K unit only. To reset, turn power off and on.
15	Heat Pump Error	If indoor coil temperature is less than ambient temperature for 3 minutes, the unit will use electric heat to satisfy the heating demand. Causes could be bad reversing valve, heat load too high.
16	Temperature beyond operating limits	Occurs if the indoor ambient temperature range falls below 0°F or greater than 130°F. The error code will remain on until the temperature reaches the operating range and then the unit will return to normal operation.
17	Equipment Doesn't Meet Minimum Configuration	The compressor must be enabled and have at least 2 fan speeds.
22	(Not an error code) Outdoor Coil Temperature < 30 F for 2 consecutive minutes	Unit will use electric heat to satisfy heating demands until the temperature equals or exceeds 45°F. Applicable for Heat Pump models only.

FIGURE 715 (ERROR CODES AND ALARM STATUS)

TROUBLESHOOTING

Electrical Troubleshooting Chart - Cooling

9K Btu, 12K Btu, & 18K Btu

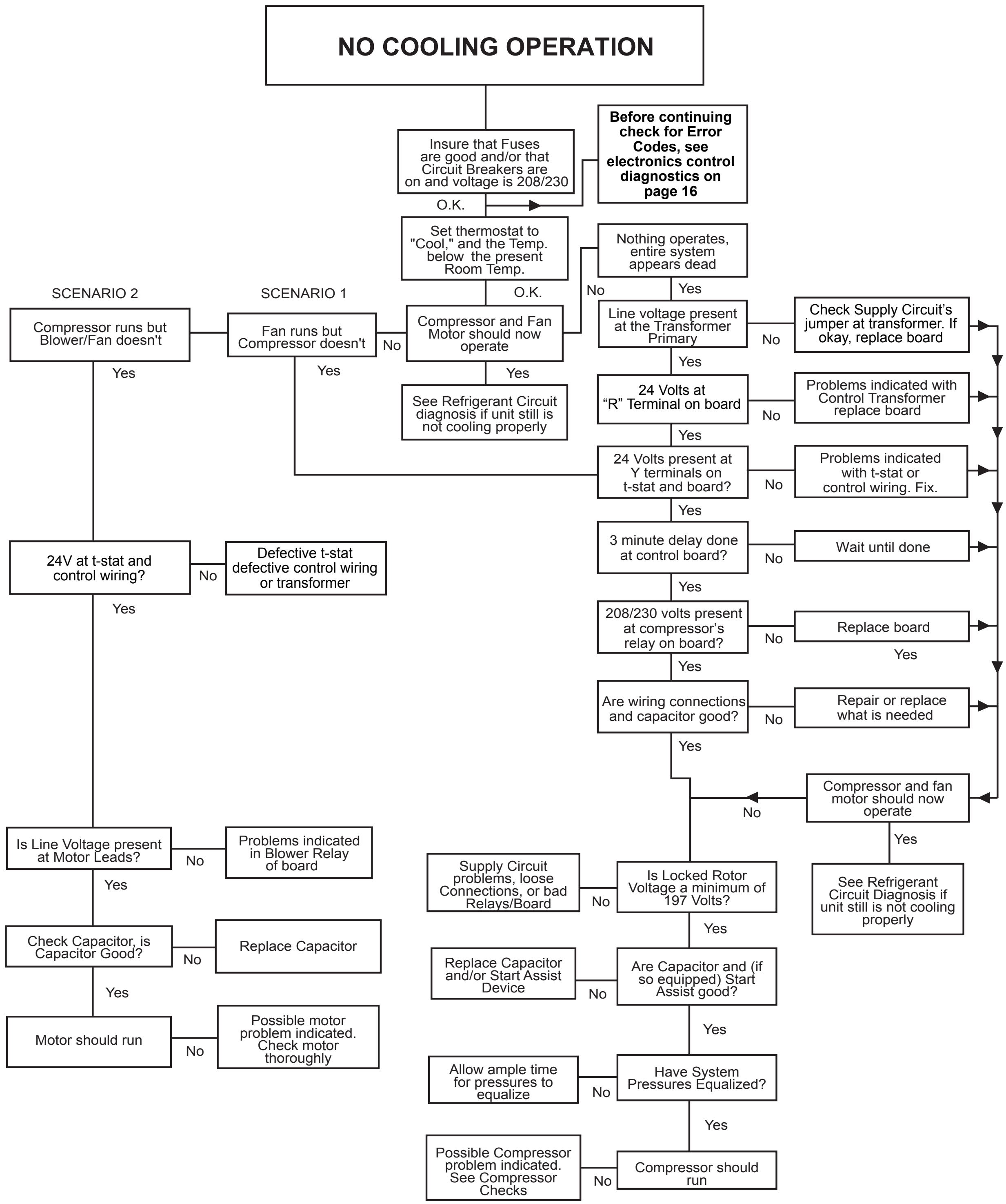


FIGURE 716 (TROUBLESHOOTING)

Electrical Troubleshooting Chart - Cooling

24K Btu

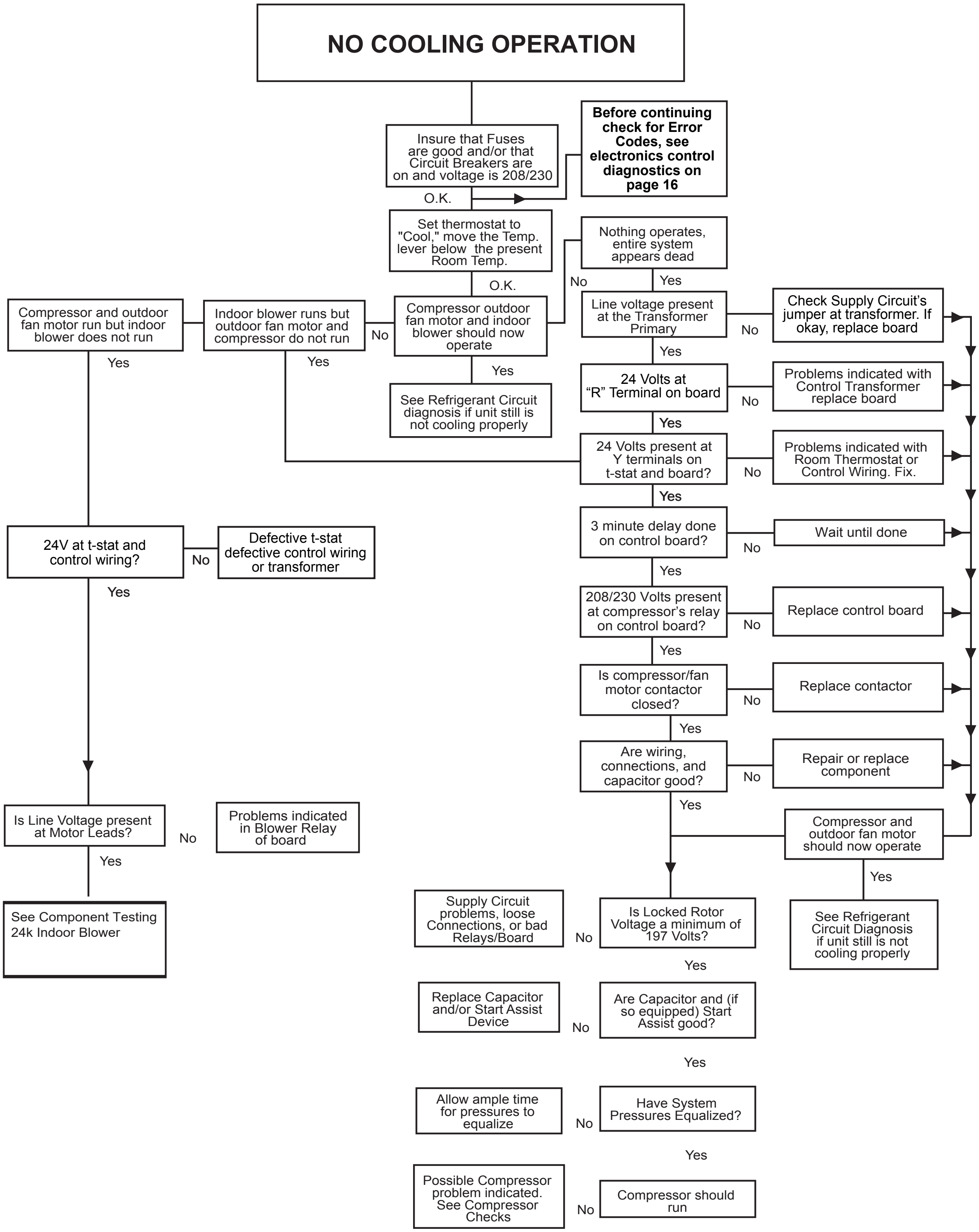


FIGURE 717 (TROUBLESHOOTING)

Electrical Troubleshooting Chart - Heat Pump

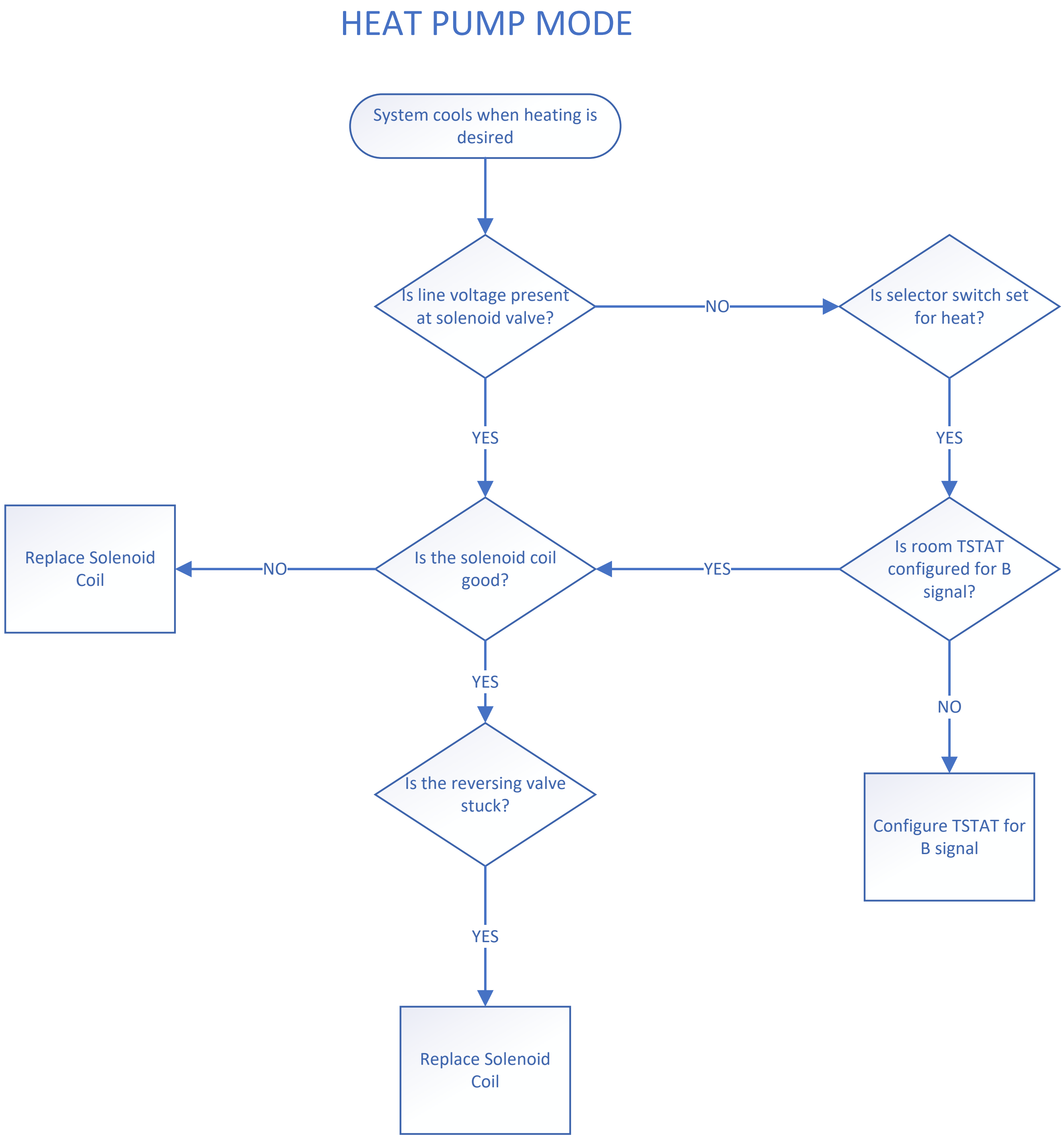
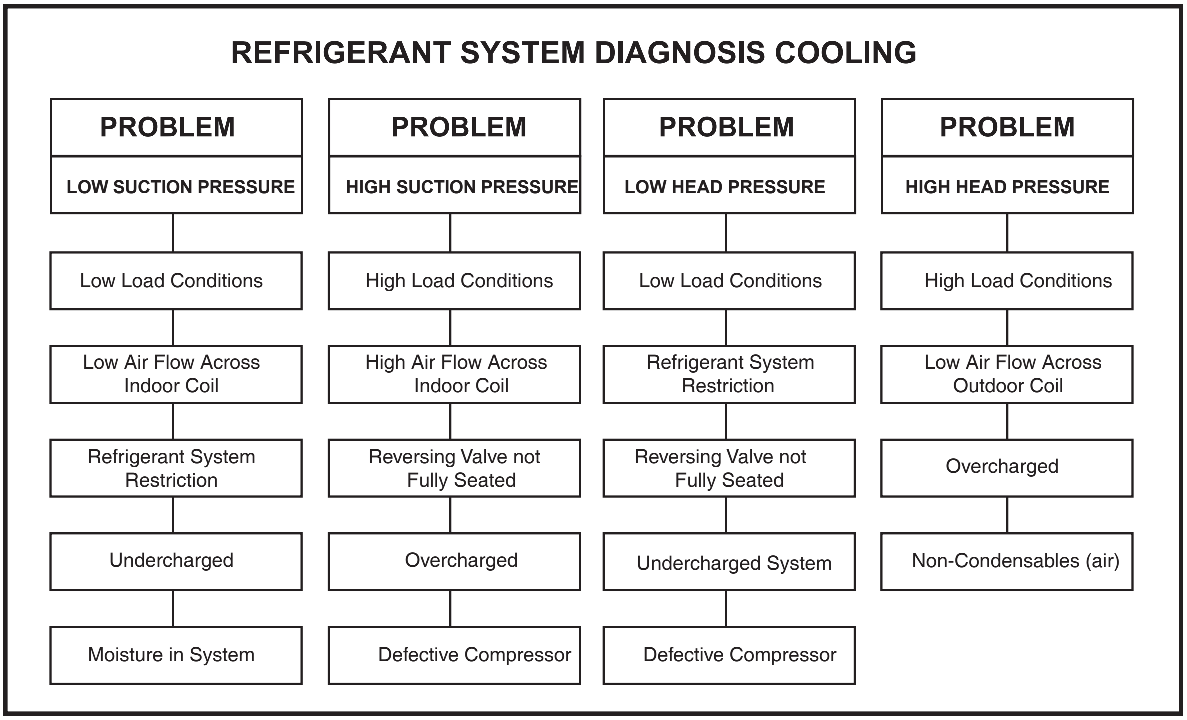


FIGURE 718 (TROUBLESHOOTING)

TROUBLESHOOTING

Troubleshooting Chart - Cooling



TROUBLESHOOTING CHART - HEATING (HEAT PUMP)

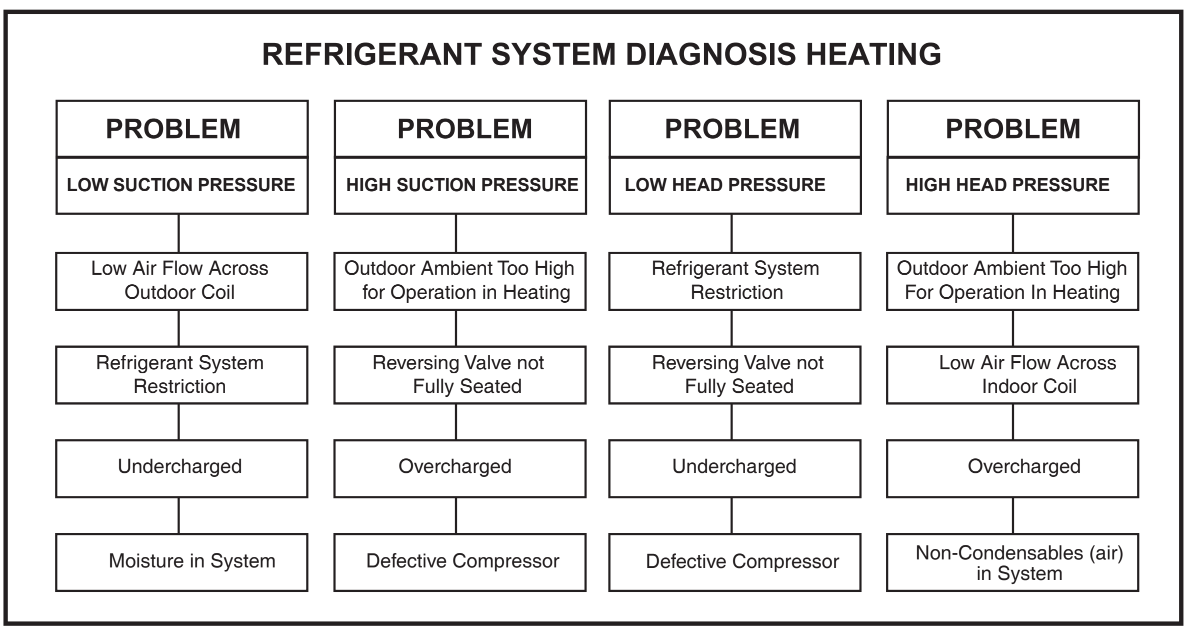


FIGURE 719 (TROUBLESHOOTING)

COMPONENT TESTING

Capillary Tube and Check Valve Assy (Heat Pump Units)

⚠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.

⚠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.

CHECK VALVE OPERATION

Check Valves

2 check valves are installed on Heat pump units. They are pressure operated and used to direct the flow of refrigerant to the proper capillary tube during either the heating or cooling cycle.

COOLING MODE

In the cooling mode of operation, high pressure liquid enters the check valve forcing the slide to close the opposite port (liquid line) to the indoor coil. Refer to figure 701a. This directs the refrigerant through the cooling capillary tube to the indoor coil.

HEATING MODE

In the heating mode of operation, high pressure refrigerant enters the check valve from the opposite direction, closing the port (liquid line) to the outdoor coil. The flow path of the refrigerant is then through the heating capillary to the outdoor coil.
Failure of the slide in the check valve to seat properly in either mode of operation will cause flooding of the cooling coil. This is due to the refrigerant bypassing the heating or cooling capillary tube and entering the liquid line.

Test the Capillary Tube and Check Valve Assy

Allow unit to run for ten minutes before checking temps in order for unit to stabilize. Units tested at low ambient temps may frost momentarily, but will retun to normal once unit pressure stabilizes. If frost does not stop after 10 minutes then a possible restricition or low refrigerant charge may be present.

1. Check the capillary tube temperature by hand where the refrigerant enters the capillary tube. A partial restriction of the capillary tube will be indicated by frost or freezing in that area.
2. If check valve fails closed or the capillary tube is fully restricted, then pressure will increase and pressure switch will open if installed. If no pressure switch is installed, the unit will shut down due to the compressor overload opening.High discharge temperature will be present at the compressor.
3. If check valve fails open the unit will continue to run, but there will be little to no cooling or heating.

In normal operation, the tube will be cooler on the side where the coolant is entering the cap tube then where it exits. If the check valve is stuck open, there will be little difference in temperature.

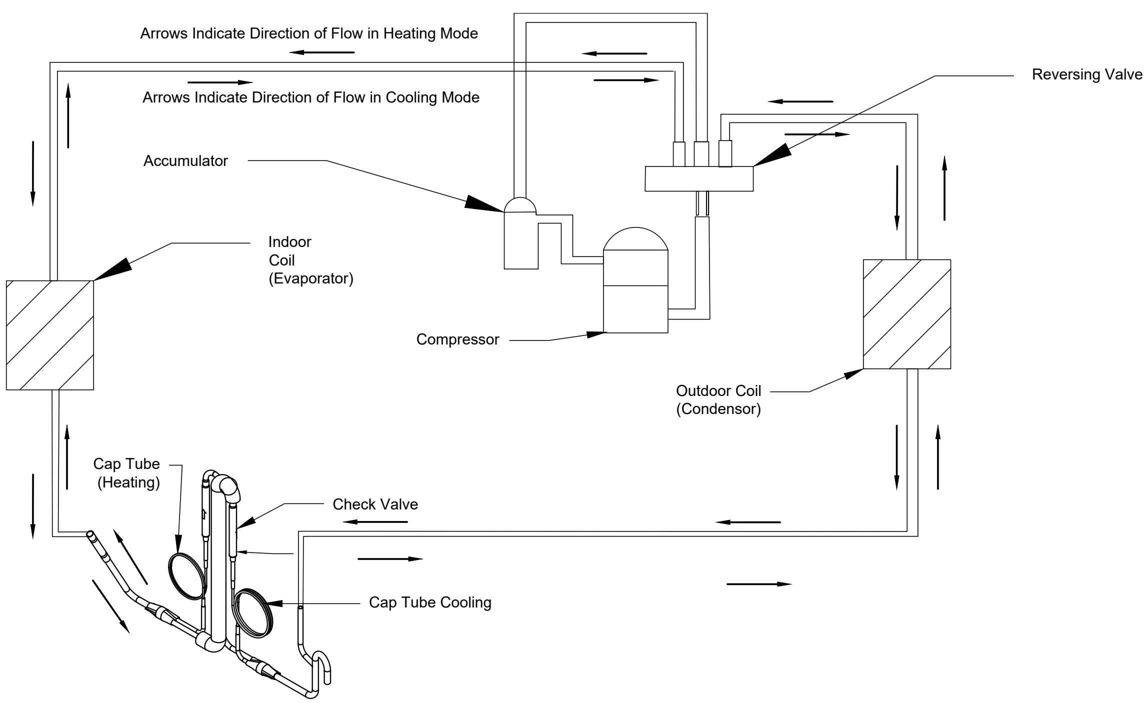


Figure 701a (Heat Pump Refigerant Flow)

COMPONENT TESTING

Capillary Tube Assy (Cool Only Units)

Test the Capillary Tube and Check Valve Assy

1. Check the capillary tube temperature by hand where the refrigerant enters the capillary tube. A partial restriction of the capillary tube will be indicated by frost or freezing in that area.
2. If the capillary tube is fully restricted, then pressure will increase and pressure switch will open if installed. If no pressure switch is installed, the unit will shut down due to the compressor overload opening. High discharge temperature will be present at the compressor.

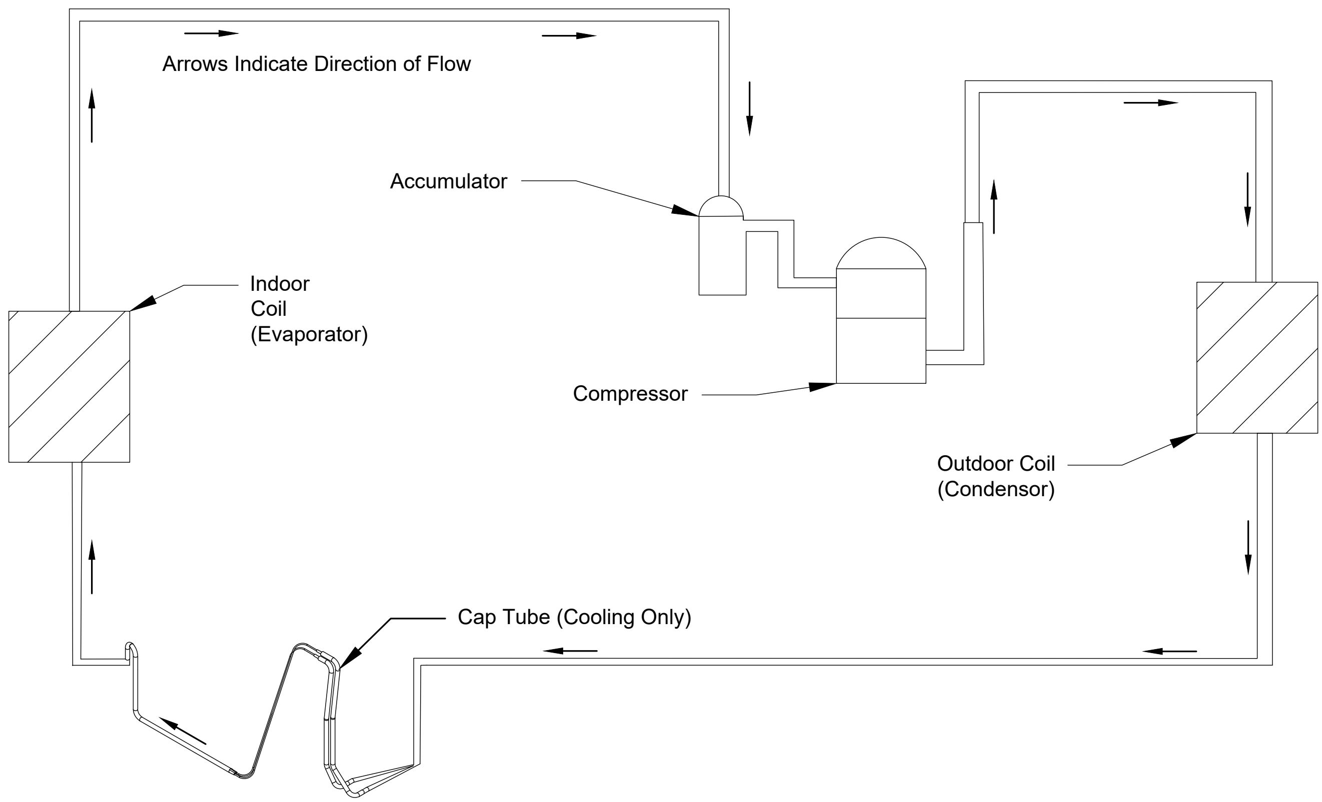


Figure 701b (Cooling Only Refigerant Flow)

COMPONENT TESTING

Reversing Valve Description And Operation

The Reversing Valve controls the direction of refrigerant flow to the indoor and outdoor coils. It consists of a pressure-operated, main valve and a pilot valve actuated by a solenoid plunger. The solenoid is energized during the heating cycle only. The reversing valves used in the RAC system is a 2-position, 4-way valve.

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 piston 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.

NOTE: System operating pressures must be near normal before valve can shift.

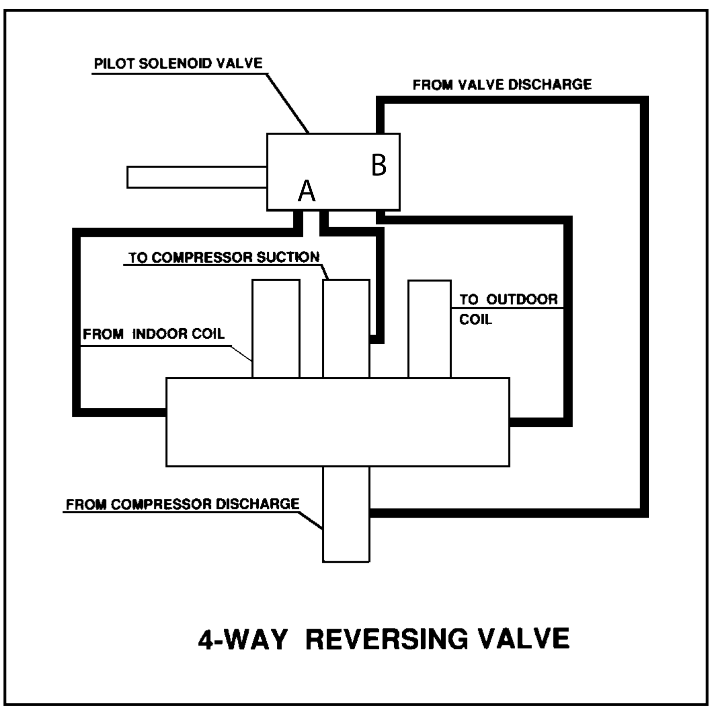
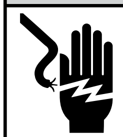


Figure 702 (Reversing Valve)

COMPONENT TESTING

Testing The Reversing Valve Solenoid Coil

⚠ WARNING



ELECTRIC SHOCK HAZARD

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

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 continuity through the coil. If you do not have continuity 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.

Touch Test in Heating/Cooling Cycle

⚠ WARNING

BURN HAZARD

Certain unit components operate at temperatures hot enough to cause burns.

Proper safety procedures must be followed, and proper protective clothing must be worn.

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

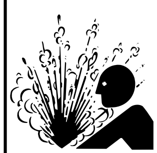
The only definite indications that the slide is in the mid-position is if all three tubes on the suction side of the valve are hot after a few minutes of running time.

NOTE: If both tubes shown as hot or cool are not the same corresponding temperature, refer to figure 703, then the reversing valve is not shifting properly.

COMPONENT TESTING

Checking The Reversing Valve

⚠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.

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

Check the operation of the valve by starting the system and switching the operation from "Cooling" to "Heating" and then back to "Cooling". Rapidly cycle. Do not hammer on valve.

Occasionally, the reversing valve may stick in the heating or cooling position or in the mid-position.
When sluggish or stuck in the mid-position, part of the discharge gas from the compressor is directed back to the suction side, resulting in excessively high suction pressure.

Should the valve fail to shift from cooling to heating, block the air flow through the outdoor coil and allow the discharge pressure to build in the system. Then switch the system from heating to cooling.

If the valve is stuck in the heating position, block the air flow through the indoor coil and allow discharge pressure to build in the system. Then switch the system from heating to cooling.

Should the valve fail to shift in either position after increasing the discharge pressure, replace the valve.

Dented or damaged valve body or capillary tubes can prevent the main slide in the valve body from shifting.
If you determing this is the problem, replace the reversing valve.

After all of the previous inspections and checks have been made and determined correct, then perform the "Touch Test" on the reversing valve.

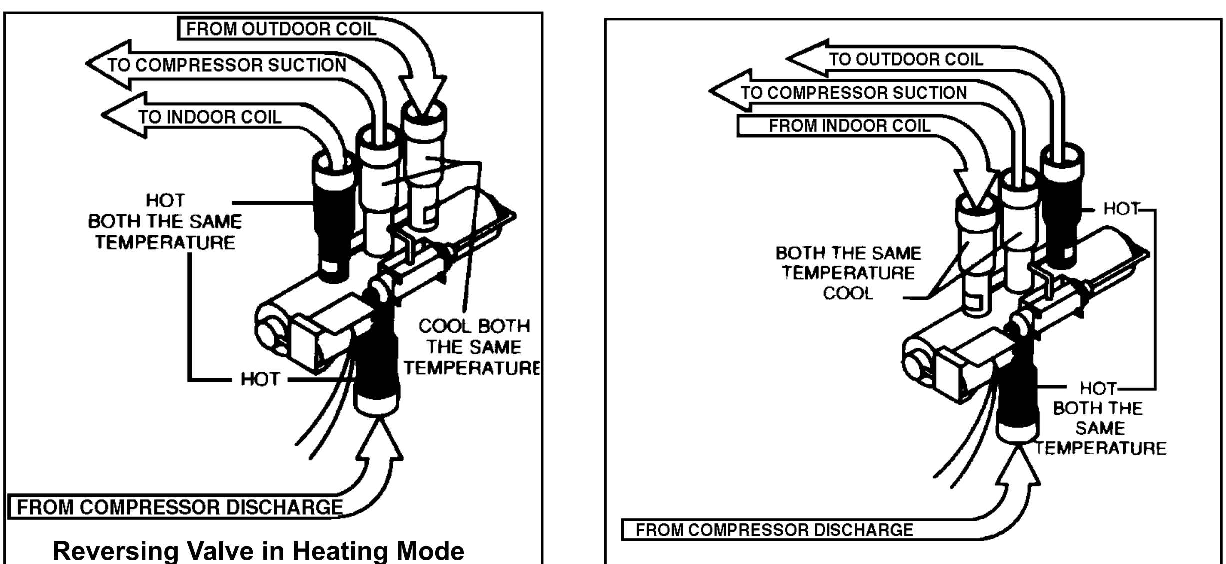


Figure 703 (Checking The Reversing Valve)

COMPONENT TESTING

Touch Test Chart : To Service Reversing Valves

NORMAL FUNCTION OF VALVE								
VALVE OPERATING CONDITION	DISCHARGE TUBE from Compressor	SUCTION TUBE	Tube to Indoor COIL	Tube to OUTSIDE COIL	LEFT Pilot	RIGHT Pilot	NOTES: * TEMPERATURE OF VALVE BODY ** WARMER THAN VALVE BODY	
	1	2	3	4	5	6	POSSIBLE CAUSES	CORRECTIONS
Normal Cooling	Hot	Cool	Cool as (2)	Hot as (1)	*TVB	TVB		
Normal Heating	Hot	Cool	Hot as (1)	Cool as (2)	*TVB	TVB		
MALFUNCTION OF VALVE								
Valve will not shift from cool to heat.	Check Electrical circuit and coil						No voltage to coil.	Repair electrical circuit.
							Defective coil.	Replace coil.
	Check refrigeration charge						Low charge.	Repair leak, recharge system.
							Pressure differential too high.	Recheck system.
	Hot	Cool	Cool, as (2)	Hot, as (1)	*TVB	Hot	Pilot valve okay. Dirt in one bleeder hole.	Deenergize solenoid, raise head pressure, reenergize solenoid to break dirt loose. If unsuccessful, remove valve, wash out. Check on air before installing. If no movement, replace valve, add strainer to discharge tube, mount valve horizontally.
							Piston cup leak	Stop unit. After pressures equalize, restart with solenoid energized. If valve shifts, reattempt with compressor running. If still no shift, replace valve.
Valve will not shift from cool to heat.	Hot	Cool	Cool, as (2)	Hot, as (1)	*TVB	*TVB	Clogged pilot tubes.	Raise head pressure, operate solenoid to free. If still no shift, replace valve.
	Hot	Cool	Cool, as (2)	Hot, as (1)	Hot	Hot	Both ports of pilot open. (Back seat port did not close).	Raise head pressure, operate solenoid to free partially clogged port. If still no shift, replace valve.
	Warm	Cool	Cool, as (2)	Hot, as (1)	*TVB	Warm	Defective Compressor.	Replace compressor
Starts to shift but does not complete reversal.	Hot	Warm	Warm	Hot	*TVB	Hot	Not enough pressure differential at start of stroke or not enough flow to maintain pressure differential.	Check unit for correct operating pressures and charge. Raise head pressure. If no shift, use valve with smaller port.
							Body damage.	Replace valve
	Hot	Warm	Warm	Hot	Hot	Hot	Both ports of pilot open.	Raise head pressure, operate solenoid. If no shift, use valve with smaller ports.
	Hot	Hot	Hot	Hot	*TVB	Hot	Body damage.	Replace valve
							Valve hung up at mid-stroke. Pumping volume of compressor not suffi cient to maintain reversal.	Raise head pressure, operate solenoid. If no shift, use valve with smaller ports.
	Hot	Hot	Hot	Hot	Hot	Hot	Both ports of pilot open.	Raise head pressure, operate solenoid. If no shift, replace valve.
Apparent leap in heat-ing.	Hot	Cool	Hot, as (1)	Cool, as (2)	*TVB	*TVB	Piston needle on end of slide leaking.	Operate valve several times, then recheck. If excessive leak, replace valve.
	Hot	Cool	Hot, as (1)	Cool, as (2)	**WVB	**WVB	Pilot needle and piston needle leaking.	Operate valve several times, then recheck. If excessive leak, replace valve.
Will not shift from heat to cool.	Hot	Cool	Hot, as (1)	Cool, as (2)	*TVB	*TVB	Pressure differential too high.	Stop unit. Will reverse during equalization period. Recheck system
							Clogged pilot tube.	Raise head pressure, operate solenoid to free dirt. If still no shift, replace valve.
	Hot	Cool	Hot, as (1)	Cool, as (2)	Hot	*TVB	Dirt in bleeder hole.	Raise head pressure, operate solenoid. Remove valve and wash out. Check on air before reinstalling, if no movement, replace valve. Add strainer to discharge tube. Mount valve horizontally.
	Hot	Cool	Hot, as (1)	Cool, as (2)	Hot	*TVB	Piston cup leak.	Stop unit. After pressures equalize, restart with solenoid deenergized. If valve shifts, reattempt with compressor running. If it still will not reverse while running, replace the valve.
	Hot	Cool	Hot, as (1)	Cool, as (2)	Hot	Hot	Defective pilot.	Replace valve.
	Warm	Cool	Warm, as (1)	Cool, as (2)	Warm	*TVB	Defective compressor.	Replace compressor

Figure 704 (Touch Test Chart)

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 com-pressor. 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

External Overloads VPAK 9, 12, and 18K BTUs

With power off, remove the leads from compressor terminals. If the compressor is hot, allow the overload to cool before starting check. Using an ohmmeter, test continuity across the terminals of the external overload. If you do not have continuity; this indicates that the overload is open and must be replaced.

Internal Overloads VPAK 24k BTUs

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

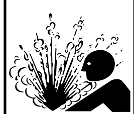
⚠WARNING

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

Use an ohmmeter set on its highest scale. Touch one lead to the compressor body (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.Noncondensables such as air and moisture in the system. Moisture is extremely destructive to a refrigerant system.
7.Capacitor.

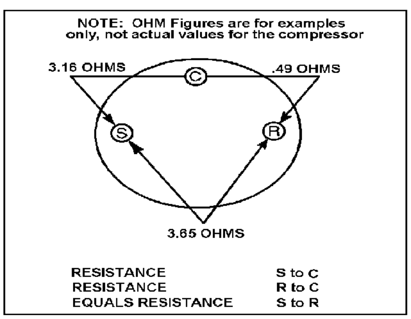


Figure 705 (Resistance Chart)

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 perfor mance 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

Fan Motor

A single phase permanent split capacitor motor is used to drive the evaporator blower and condenser fan. A self-resetting overload is located inside the motor to protect against high temperature and high amperage conditions.

⚠ 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.

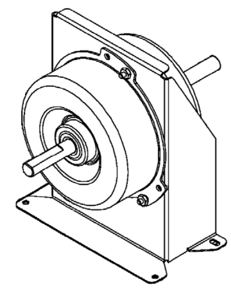


Figure 706 (Blower/ Fan Motor)

Blower / Fan Motor Test

1. Visually inspect the motor's wiring, housing etc., and determine that the capacitor is serviceable.
2. Make sure the motor has cooled down.
3. Disconnect the fan motor wires from the control board.
4. Test for continuity between the windings also, test to ground.
5. If any winding is open or grounded replace the motor.

Capacitors

⚠ 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.

Dual Rated Run Capacitor Hook-up

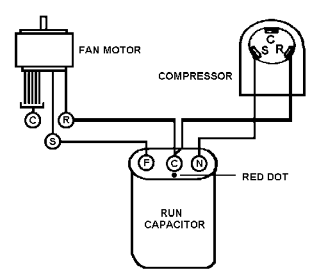


Figure 707 Dual Rated Capacitor Hook-Up

Many motor capacitors are internally fused. Shorting the terminals will blow the fuse, ruining the capacitor. A 20,000 ohm 2 watt resistor can be used to discharge capacitors safely. Remove wires from capacitor and place resistor across terminals. When checking a dual capacitor with a capacitor analyzer or ohmmeter, both sides must be tested.

Capacitor Check

The meter will show whether the capacitor is "open" or "shorted." It will tell whether the capacitor is within its micro farads rating and it will show whether the capacitor is operating at the proper power-factor percentage. The instrument will automatically discharge the capacitor when the test switch is released.

Capacitor Connections

The starting winding of a motor can be damaged by a shorted and grounded running capacitor. This damage usually can be avoided by proper connection of the running capacitor terminals.

From the supply line on a typical 230 volt circuit, a 115 volt potential exists from the "R" terminal to ground through a possible short in the capacitor. However, from the "S" or start terminal, a much higher potential, possibly as high as 400 volts, exists because of the counter EMF generated in the start winding. Therefore, the possibility of capacitor failure is much greater when the common terminal is connected to the "S" or start terminal. The common terminal should always be connected to the supply line, or "R" terminal, never to the "S" terminal.

When connected properly, a shorted or grounded running capacitor will result in a direct short to ground from the "R" terminal and will blow the line fuse. The motor protector will protect the main winding from excessive temperature.

COMPONENTS TESTING

Heating Element and Limit Switch

⚠ 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.

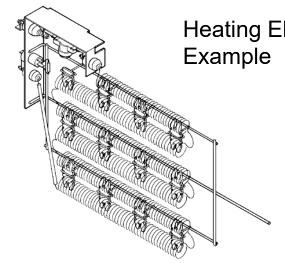


Figure 708 (Heating Element)

All heat pumps and electric heat models are equipped with a heating element and a limit switch (bimetal thermostat). The limit switches are in series with the element and will interrupt the power at a designed temperature.
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.

Heater Elements And Limit Switches' Specifications

VPAK 9K, 12K and 18K BTUs Models:
2.5 KW, 230 V, Resistance 18.61 Ohms + - 5%.
Has 1 Limit Switch, Opens at 120° F, Closes at 90° F,
It has a One Time Open Temp. of 145° F.

3.4 KW, 230 V, Resistance 13.68 Ohms + - 5%.
Has 1 Limit Switch, Opens at 120° F, Closes at 90° F,
It has a One Time Open Temp. of 145° F.

5 KW, 230 V, Resistance 9.31 Ohms + - 5%.
Has 1 Limit Switch, Opens at 130° F, Closes at 100° F, It has a One Time Open Temp. of 155° F.
VPAK 24K BTUs Models:

2.5 KW, 265 V, Resistance 24.86 Ohms + - 5%.
Has 2 Limit Switches, Primary Opens at 120° F,
Closes at 90° F, Secondary's Open Temp. is 145° F.

3.4 KW, 265 V, Resistance 13.68 Ohms + - 5%.
Has 2 Limit Switches, Primary Opens at 120° F,
Closes at 90° F, Secondary's Open Temp. is 145° F.

5 KW, 265 V, Resistance 9.31 Ohms + - 5%.
Has 2 Limit Switches, Primary Opens at 130° F,
Closes at 100° F, Secondary's Open Temp. is 155° F.
7.5 KW, 265 V (composed of 2, 3.7 KW Elements) Each Has a Resistance of 16.47 Ohms + - 5%.
Each Has 2 Limit Switches, Primary Opens at 155° F, Closes at 125° F With a 1 time Open Temp. of 200° F. Secondary Limit's Open Temp. is 200° F.

COMPONENTS TESTING

Heating Element and Limit Switch

VPAk 24K models
2.5 KW, 230 V, Resistance 18.61 Ohms + - 5%.
Has 1 Limit Switch, Opens at 155° F, Closes at 125° F,
It has a One Time Open Temp. of 200° F.

3.4 KW, 230 V, Resistance 13.68 Ohms + - 5%.
Has 1 Limit Switch, Opens at 155° F, Closes at 125° F,
It has a One Time Open Temp. of 200° F.

5 KW, 230 V, Resistance 9.31 Ohms + - 5%.
Has 1 Limit Switch, Opens at 155° F, Closes at 125° F, It has a One Time Open Temp. of 200° F.
VPAK 24K BTUs Models:
7.5 KW, 230 V (composed of 2, 3.7 KW Elements) Each Has a Resistance of 12.41 Ohms + - 5%.
Each Has 2 Limit Switches, Primary Opens at 165° F, Closes at 135° F With a 1 time Open Temp. of 210° F. Secondary Limit's Open Temp. is 200° F.

10 KW, 230 V (composed of 2, 5 KW Elements)
Each Has a Resistance of 9.31 Ohms + - 5%.
Each Has 2 Limit Switches, Primary Opens at 165° F, Closes at 135° F With a 1 time Open Temp. of 210° F. Secondary Limit's Open Temp. is 200° F.

2.5 KW, 265 V, Resistance 24.71 Ohms + - 5%.
Has 2 Limit Switches, Primary Opens at 155° F,
Closes at 125° F, Secondary's Open Temp. is 200° F.

3.4 KW, 265 V, Resistance 18.17 Ohms + - 5%.
Has 2 Limit Switches, Primary Opens at 155° F,
Closes at125° F, Secondary's Open Temp. is 200° F.

5 KW, 265 V, Resistance 12.35 Ohms + - 5%.
Has 2 Limit Switches, Primary Opens at 165° F,
Closes at 135° F, Secondary's Open Temp. is 200° F.

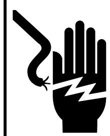
7.5 KW, 265 V (composed of 2, 3.7 KW Elements) Each Has a Resistance of 16.47 Ohms + - 5%.
Each Has 2 Limit Switches, Primary Opens at 155° F, Closes at 125° F With a 1 time Open Temp. of 200° F. Secondary Limit's Open Temp. is 200° F.

10 KW, 265 V (composed of 2, 5 KW Elements)
Each Has a Resistance of 12.35 Ohms + - 5%.
Each Has 2 Limit Switches, Primary Opens at 155° F, Closes at 125° F With a 1 time Open Temp. of 200° F. Secondary Limit's Open Temp. is 200° F.

NOTE: Always replace with an exact replacement.
Testing The Heating Element
Testing of the elements can be made with an ohmmeter across the terminals after the connecting wires have been removed.

COMPONENTS TESTING

⚠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.

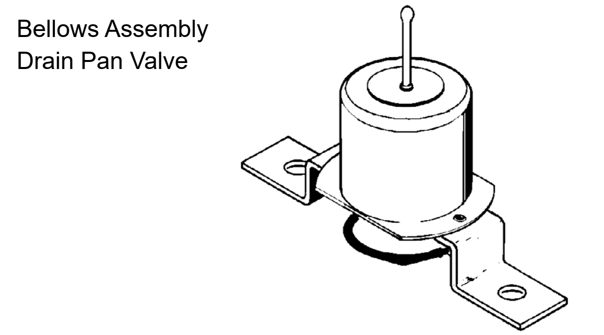


Figure 709 Drain Pan Valve

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.

COMPONENTS TESTING

Testing the Diagnostic Service Module

Testing the Electronic Control Board

⚠ 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.

If the Diagnostic Service Module does not turn on:
1. Make sure there is 208/230 VAC to the unit and that it is turned on.
2. Disconnect the diagnostic service module's wire harness on the control board.
3. Using a voltmeter, check the first two pins to the left of the female connector (see picture below).
   There should be up to 5VDC.
4. If there is no voltage, replace the electronic control board.
5. If there is voltage, check the wire harness and connections at the electronic control board and the diagnostic service module.
6. IF THE CONNECTIONS AND THE WIRE HARNESS ARE GOOD, REPLACE THE DIAGNOSTIC SERVICE MODULE.

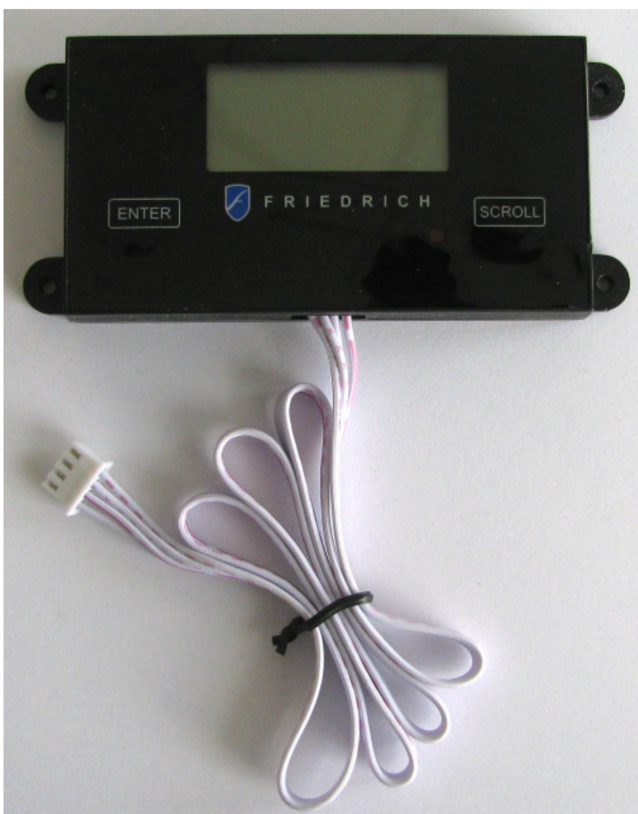


FIGURE 711 (DIAGNOSTIC SERVICE MODULE)

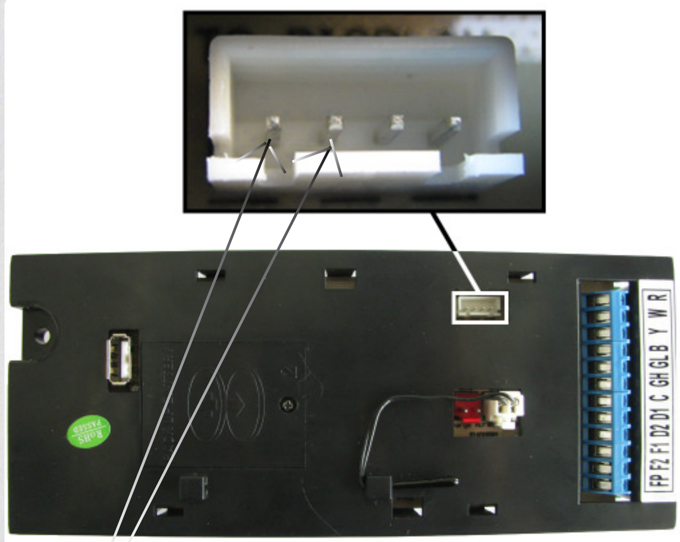


FIGURE 712 (SERVICE MODULE CONNECTOR)

TEST HERE UP TO 5VDC.
IF NO VOLTAGE, REPLACE BOARD.
IF THERE IS 5VDC, CHECK CONNECTIONS AND CABLE.
IF OK, REPLACE SERVICE MODULE.

COMPONENT TESTING

Electronic Control Board Components Identification And Testing

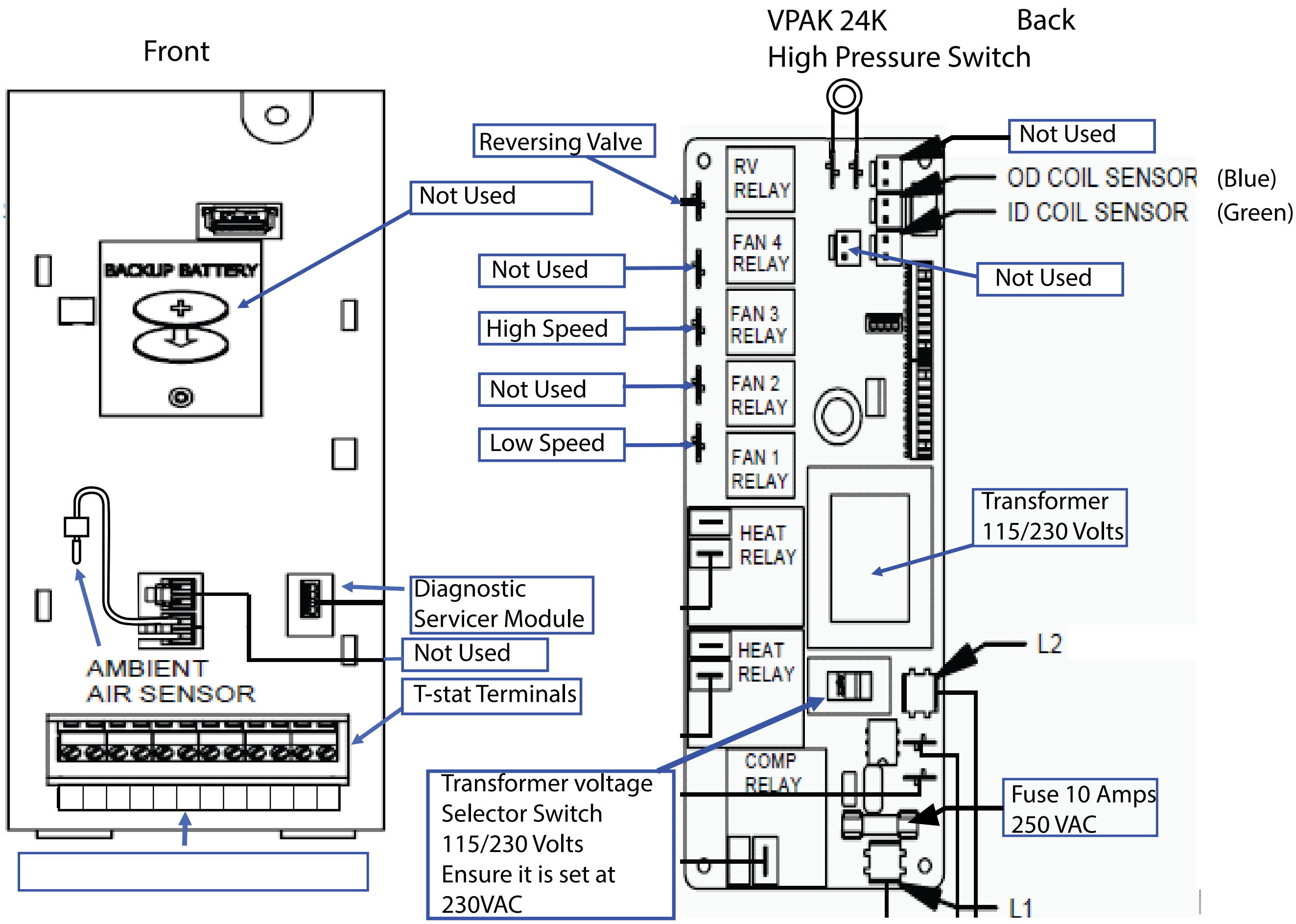


FIGURE 713 (ECB ID AND TESTING)

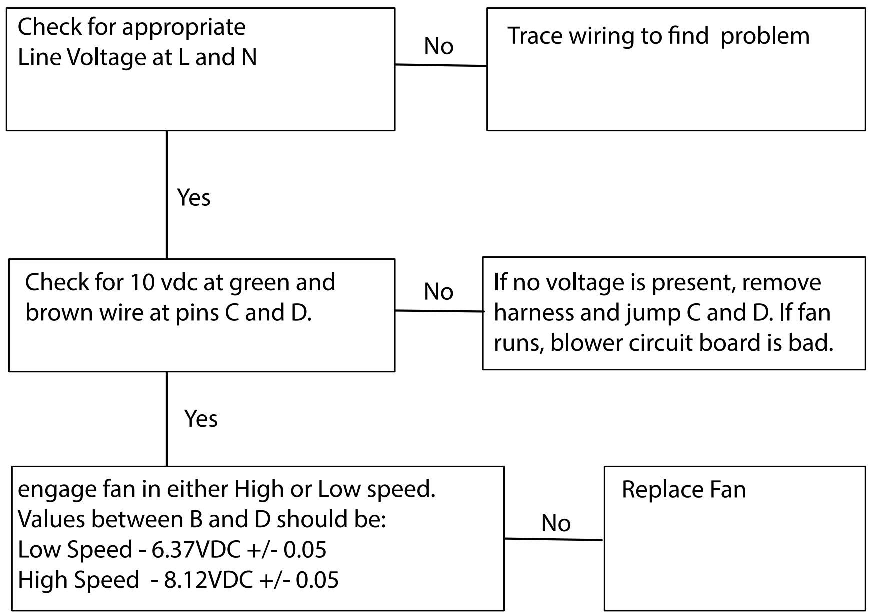
1. Test for power at L1 and L2 for 208/230 VAC. (Ensure the transformer voltage selector switch is set for 230 VAC)
2. TEST THE 10 AMP/250 VAC FUSE FOR CONTINUITY.

FOR THE FOLLOWING TESTS, ENSURE THE UNIT IS IN THE APPROPRIATE SETTINGS FOR THE TEST BEING PERFORMED. ENSURE THERE ARE NO ERROR CODES ACTIVE.

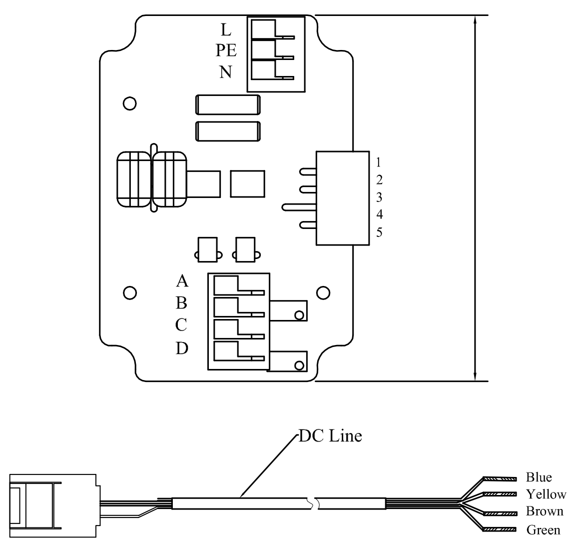
3. Testing the compressor relay and heat relays:
Test for power in and power out. If there is power in and no power out, replace the electronic control board.(208/230 to L2)
4. Testing the fan and reversing valve relays:
Test for power at the reversing valve and fan relays 1 or 3. (208/230 to L2)
5. Testing the transformer:
Test the low voltage terminal strip at:
R and C for 24 VAC
F2 and F1 for 24 VAC
D2 and D1 for 24 VAC
Test the service module connector for 5 VDC (see prior page)
Test the connectors for the thermistors for up to 5 VDC
If there is no voltage at any of the above, replace electronic control board.
6. Testing the thermistors:
Disconnect the thermistor and test for resistance value (see figure 710).
7. Testing the high pressure switch (VPAK 18K, 24K only).
Test for 24 VAC at board, if there is no voltage, replace the electronic control.
Test the pressure switch for continuity, if none, replace it (switch is normally closed).

COMPONENT TESTING

24k Indoor Blower Motor



Indoor Blower Circuit Board



A	Blue	FG
B	Yellow	VSP/PWM
C	Brown	10VDC
D	Green	GND

1	White	L1
2	Blue	High Speed
3	Red	Low Speed
4	Green	GND
5	Black	L2

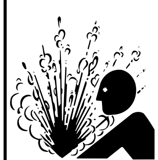
FIGURE 714 (INDOOR BLOWER MOTOR TESTING)

R-410A SEALED SYSTEM REPAIR

⚠ WARNING

Use approved standard refrigerant recovering procedures and equipment to relieve high pressure before opening system for repair.
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.

⚠ WARNING



Refrigeration system under high pressure

Do not puncture, heat, expose to flame or incinerate.

Only certified refrigeration technicians should service this equipment.

R410A systems operate at higher pressures than R22 equipment. Appropriate safe service and handling practices must be used.

Only use gauge sets designed for use with R410A. Do not use standard R22 gauge sets.

⚠ WARNING

EPA 608 Warning:
It is a violation of the environmental Protection Agency, Clause 608A, to service refrigeration systems without proper certification

The following is a list of important considerations when working with R-410A equipment

1. R-410A pressure is approximately 60% higher than R-22 pressure.
2. R-410A cylinders must not be allowed to exceed 125 F, they may leak or rupture.
3. R-410A must never be pressurized with a mixture of air, it may become flammable.
4. Servicing equipment and components must be specifically designed for use with R-410A and dedicated to prevent contamination.

5. 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.
6. Gauge hoses must have a minimum 750-psig service pressure rating
7. Recovery cylinders must have a minimum service pressure rating of 400 psig, (DOT 4BA400 and DOT BW400 approved cylinders).
8. POE (Polyol-Ester) lubricants must be used with R-410A equipment.
9. To prevent moisture absorption and lubricant contamination, do not leave the refrigeration system open to the atmosphere longer than 1 hour.
10. Weigh-in the refrigerant charge into the high side of the system.
11. Introduce liquid refrigerant charge into the high side of the system.
12. For low side pressure charging of R-410A, use a charging adaptor.
13. Use industry standard R-410A filter dryers.

EQUIPMENT REQUIRED:

1. Eletrical Multimeter
2. E.P.A. Approved Refrigerant Recovery System
3. Vacuum Pump (capable of 200 microns or less vacuum.)
4. Acetylene torch.
5. Electronic Halogen Leak Detector capable of detecting HFC (Hydrofluorocarbon) refrigerants.
6. R410A Refrigerant Manifold
7. 1/4" Braze-type Access Ports
8. Pinch Tool
9. Digital Refrigerant Scale
10. Vacuum Gauge - (0 - 1000 microns)
11. Facilities for flowing nitrogen through refrigeration tubing during all brazing processes.

EQUIPMENT MUST BE CAPABLE OF:

1. Recovering refrigerant to EPA required levels.
2. Evacuation from both the high side and low side of the system simultaneously.
3. Introducing refrigerant charge into high side of the system.
4. Accurately weighing the refrigerant charge introduced into the system.

R-410A SEALED SYSTEM REPAIRS

Refrigerant Charging

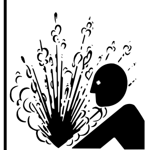
⚠ WARNING

RISK OF ELECTRIC SHOCK

Unplug and/or disconnect all electrical power to the unit before performing inspections, maintenances or service.

Failure to do so could result in electric shock, 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.

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

NOTE: Because the refrigerant system is a sealed system, service process tubes will have to be installed. First install a line tap and remove refrigerant from system. Make necessary sealed system repairs and vacuum system. Crimp process tube line and solder end shut. Do not leave a service valve in the sealed system.

Proper refrigerant charge is essential to proper unit operation. Operating a unit with an improper refrigerant charge will result in reduced performance (capacity) and/or efficiency. Accordingly, the use of proper charging methods during servicing will insure that the unit is functioning as designed and that its compressor will not be damaged.

NOTE:Factory sealed units will not be overcharged

Too much refrigerant (overcharge) in the system is just as bad (if not worse) than not enough refrigerant (undercharge). they both can be the source of certain compressor failures if they remain uncorrected for any period of time. Quite often, other problems (such as low air flow across evaporator, etc.) are misdiagnosed as refrigerant charge problems. The refrigerant circuit diagnosis chart will assist you in properly diagnosing the systems.

An overcharged unit will return liquid refrigerant (slugging) back to the suction side of the compressor eventually causing a mechanical failure within the compressor. This mechanical failure can manifest itself as valve failure, bearing failure, and/or other mechanical failure. The specific type of failure will be influenced by the amount of liquid being returned, and the length of time the slugging continues.

Not enough refrigerant (undercharge) on the other hand, will cause the temperature of the suction gas to increase to the point where it does not provide sufficient cooling for the compressor motor. When this occurs, the motor winding temperature will increase causing the motor to overheat and possibly cycle open the compressor overload protector. Continued overheating of the motor windings and/or cycling of the overload will eventually lead to compressor motor or overload failure.

R-410A SEALED SYSTEM REPAIRS

⚠WARNING

RISK OF ELECTRIC SHOCK

Unplug and/or disconnect all electrical power to the unit before performing inspections, maintenances or service.

Failure to do so could result in electric shock, 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.

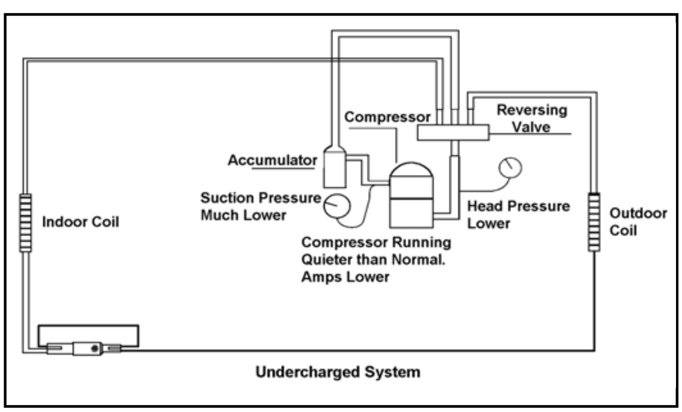


Figure 601 (Undercharged System)

Undercharged Refrigerant Systems

NOTE: Ensure fan is on high speed during testing.

An undercharged system will result in poor performance (low pressures, etc.) in both the heating and cooling cycle.

Whenever you service a unit with an undercharge of refrigerant, always suspect a leak. The leak must be repaired before charging the unit.

To check for an undercharged system, turn the unit on, allow the compressor to run long enough to establish working pressures in the system (15 to 20 minutes).

During the cooling cycle you can listen carefully at the exit of the metering device into the evaporator; an intermittent hissing and gurgling sound indicates a low refrigerant charge. Intermittent frosting and thawing of the evaporator is another indication of a low charge, however, frosting and thawing can also be caused by insufficient air over the evaporator or partial restriction in the refrigeration system besides the metering device..

Checks for an undercharged system can be made at the compressor. If the compressor seems quieter than normal, it is an indication of a low refrigerant charge.

If the compressor reads low amperage and has a high discharge line temperature at the compressor, it is an indication of low system refrigerant.

A check of the amperage drawn by the compressor motor should show a lower reading. (Check the Unit Specification.) After the unit has run 10 to 15 minutes, check the gauge pressures. Gauges connected to system with an undercharge will have low head pressures and substantially low suction pressures.

R-410A SEALED SYSTEM REPAIRS

WARNING

RISK OF ELECTRIC SHOCK

Unplug and/or disconnect all electrical power to the unit before performing inspections, maintenances or service.

Failure to do so could result in electric shock, 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.

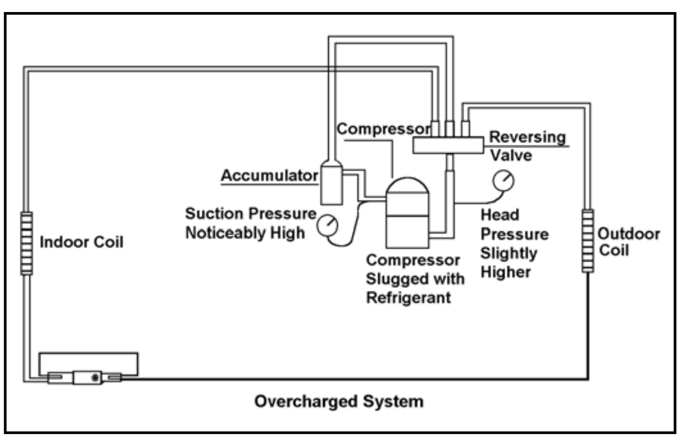


Figure 602 (Overcharged System)

Overcharged Refrigerant Systems

NOTE: Ensure fan is on high speed during testing.
NOTE: A unit sealed from the factory will not be overcharged.

Whenever an overcharged system is indicated, always make sure that the problem is not caused by air flow problems. Improper air flow over the evaporator coil may indicate some of the same symptoms as an over charged system.

NOTE: Factory sealed units will not be overcharged

An overcharge can cause the compressor to fail, since it would be "slugged" with liquid refrigerant.
The charge for any system is critical. When the compressor is noisy, suspect an overcharge, when you are sure that the air quantity over the evaporator coil is correct. Icing of the evaporator will not be encountered because the refrigerant will boil later if at all. Gauges connected to system will usually have higher head pressure (depending upon amount of over charge). Suction pressure should be slightly higher.

Compressor amps will be near normal or higher. Noncondensables can also cause these symptoms. To confirm, reclaim some of the charge, if conditions improve, system may be overcharged. If conditions don't improve, Noncondensables are indicated.

R-410A SEALED SYSTEM REPAIRS

Restricted Refrigerant System

NOTE: Ensure fan is on high speed during testing.

Troubleshooting a restricted refrigerant system can be difficult. The following procedures are the more common problems and solutions to these problems. There are two types of refrigerant restrictions: Partial restrictions and complete restrictions.

A partial restriction allows some of the refrigerant to circulate through the system.

With a complete restriction there is no circulation of refrigerant in the system.
Restricted refrigerant systems display the same symptoms as a "low-charge condition."

A quick check for either condition begins at the evaporator. With a partial restriction, there may be gurgling sounds at the metering device entrance to the evaporator. The evaporator in a partial restriction could be partially frosted or have an ice ball close to the entrance of the metering device. Frost may continue on the suction line back to the compressor.

Often a partial restriction of any type can be found by feel, as there is a temperature difference from one side of the restriction to the other. There will ususally be a diiference felt at the capillary tube. This does not indicate a restricted condition.

With a complete restriction, there will be no sound at the metering device entrance. An amperage check of the compressor with a partial restriction may show normal current when compared to the unit specification. With a complete restriction the current drawn may be considerably less than normal, as the compressor is running in a deep vacuum (no load.) Much of the area of the condenser will be relatively cool since most or all of the liquid refrigerant will be stored there.

Make all checks posible before tapping into the system and installing gauges.

When the unit is shut off, or the compressor disengages, the gauges may equalize very slowly.

The following conditions are based primarily on a system in the cooling mode.

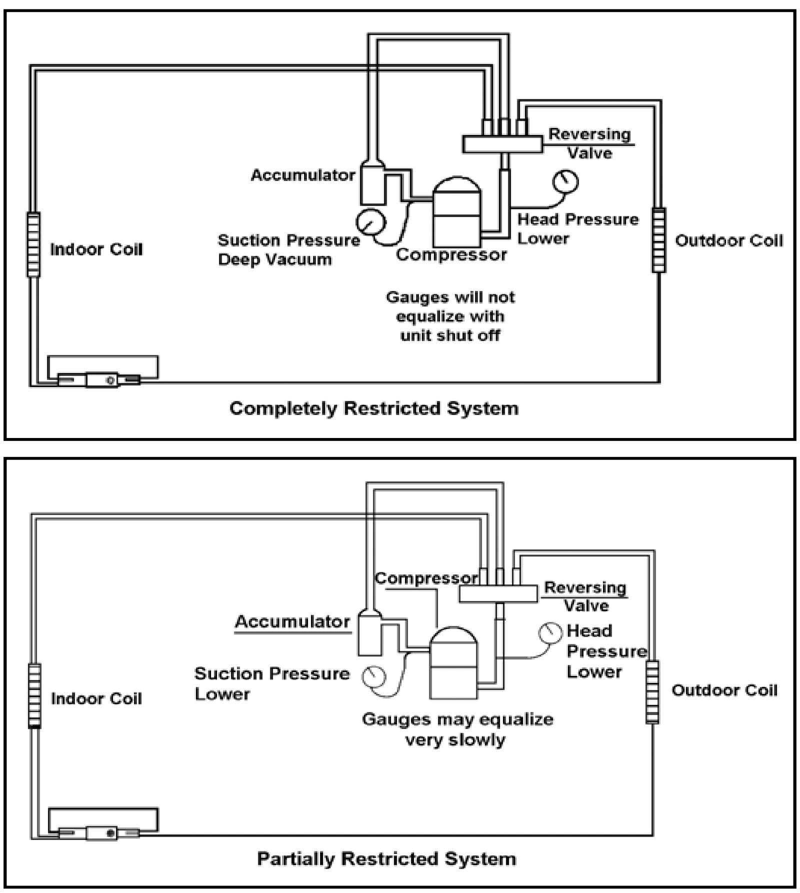
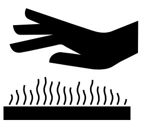


Figure 603 (Restricted System)

R-410A SEALED SYSTEM REPAIRS

Sealed System Method of Charging/ Repairs

⚠ WARNING

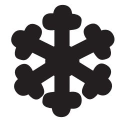


BURN HAZARD

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.

⚠ 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.

The refrigerant cycle is critically charged. The only acceptable method for charging the sealed system is the Weighed in Charge Method.

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:

1. Install a piercing valve to remove refrigerant from the sealed system. (Piercing valve must be removed from the system before recharging.)
2. Recover Refrigerant in accordance with EPA regulations.
3. Install a process tube to sealed system.
4. Make necessary repairs to system.
5. Evacuate the system to 1500 microns
6. Repressurize to 50 PSI with nitrogen
7. Evacuate the system to 1000 microns
8. Repressurize to 50 PSI with nitrogen
9. Evacuate the system to below 500 microns
10. Weigh in the refrigerant charge with the property quantity of R-410A refrigerant per model nameplate.
11. Start unit, and verify performance.
12. Crimp the process tube and solder the end shut.

R-410A 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 proper protective clothing must be worn 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. **PROPER HANDLING OF RECOVERED REFRIGERANT ACCORDING TO EPA REGULATIONS IS REQUIRED**. Do not use gauge manifold for this purpose if there has been a burnout. You will contaminate your manifold and hoses. Use a Schrader valve adapter and copper tubing for burnout failures.
3.After all refrigerant has been recovered, disconnect suction and discharge lines from the compressor 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, the system will need to be cleaned up following proper procedures.
7.Install the replacement compressor.

CAUTION: While the unit is being evacuated, seal all openings on the defective compressor. Compressor manufacturers will void warranties on units received not properly sealed. Do not distort the manufacturers tube connections.

8. Pressurize with trace amounts of R-410A and nitrogen to 550 psi and leak test all connections with a leak detector.Repair any leaks found.
8a. If leak detector is unavailable remove all refrigerant from system and pressurize with nitrogen to 550 psi. Check that system holds pressure.
Repeat Step 8 to ensure no more leaks are present
9. Evacuate the system with a good vacuum pump capable of a final vacuum of 300 microns or less. The system should be evacuated through both liquid line and suction line gauge ports.
    9a.Evacuate the system to 1500 microns.
    9b. Repressurize to 50 PSI with nitrogen.
    9c. Evacuate the system to 1000 microns.
    9d. Repressurize to 50 PSI with nitrogen.
    9e. Evacuate the system to below 500 microns.

10. Weigh in the refrigerant charge with the proper quantity of R-410A refrigerant using digital scale per model nameplate.
11.Start unit, and verify performance.
12. Crimp the process tube and solder the end shut.

R-410A 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 proper protective clothing must be worn 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.
2. Remove compressor, capillary tube and filter drier from the system.

3. Flush evaporator condenser and all connecting tubing with dry nitrogen or equivalent. Use 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 new drier strainer and capillary tube.

5. Pressurize with trace amounts of R-410A and nitrogen to 550 psi and leak test all connections with a leak detector. Repair any leaks found.

5a. If leak detector is unavailable remove all refrigerant from system and pressurize with nitrogen to 550 psi. Check that system holds pressure.

Repeat Step 5 to insure no more leaks are present.

NOTE: While the unit is being evacuated, seal all openings on the defective compressor. Compressor manufacturers will void warranties on units received not properly sealed. Do not distort the manufacturers tube connections.

9. Evacuate the system with a good vacuum pump capable of a final vacuum of 300 microns or less. The system should be evacuated through both liquid line and suction line gauge ports.
   - 9a.Evacuate the system to 1500 microns.
   - 9b. Repressurize to 50 PSI with nitrogen.
   - 9c. Evacuate the system to 1000 microns.
   - 9d. Repressurize to 50 PSI with nitrogen.
   - 9e. Evacuate the system to below 500 microns.

7. Recharge the system with the correct amount of refrigerant. The proper refrigerant charge will be found on the unit rating plate. The use of an accurate measuring device, such as a charging cylinder, electronic scales or similar device is necessary.

R-410A SEALED SYSTEM REPAIRS

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 proper protective clothing must be worn when working with refrigerants.

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

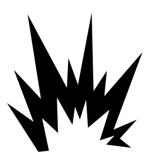
NOTICE

FIRE HAZARD

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. Install Process Tubes. Recover refrigerant from sealed system. PROPER HANDLING OF RECOVERED REFRIGERANT ACCORDING TO EPA REGULATIONS IS REQUIRED.
2. Remove solenoid coil from reversing valve. If coil is to be reused, remove solenoid and protect from heat while changing valve.
3. Unbraze all lines from reversing valve.
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.

⚠ 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.

8. Pressurize sealed system with trace amounts of R-410A and nitrogen up to 550 psi. Perform Triple evacuation and leak processes, using a suitable leak detector according to HVAC industry standards.
9. Once the sealed system is leak free, install solenoid coil on new valve and charge the sealed system by weighing in the proper amount and type of refrigerant as shown on rating plate. Crimp the process tubes and solder the ends shut. Do not leave Schrader or piercing valves in the sealed system.

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.

WIRING DIAGRAMS

9-12K 208/230V

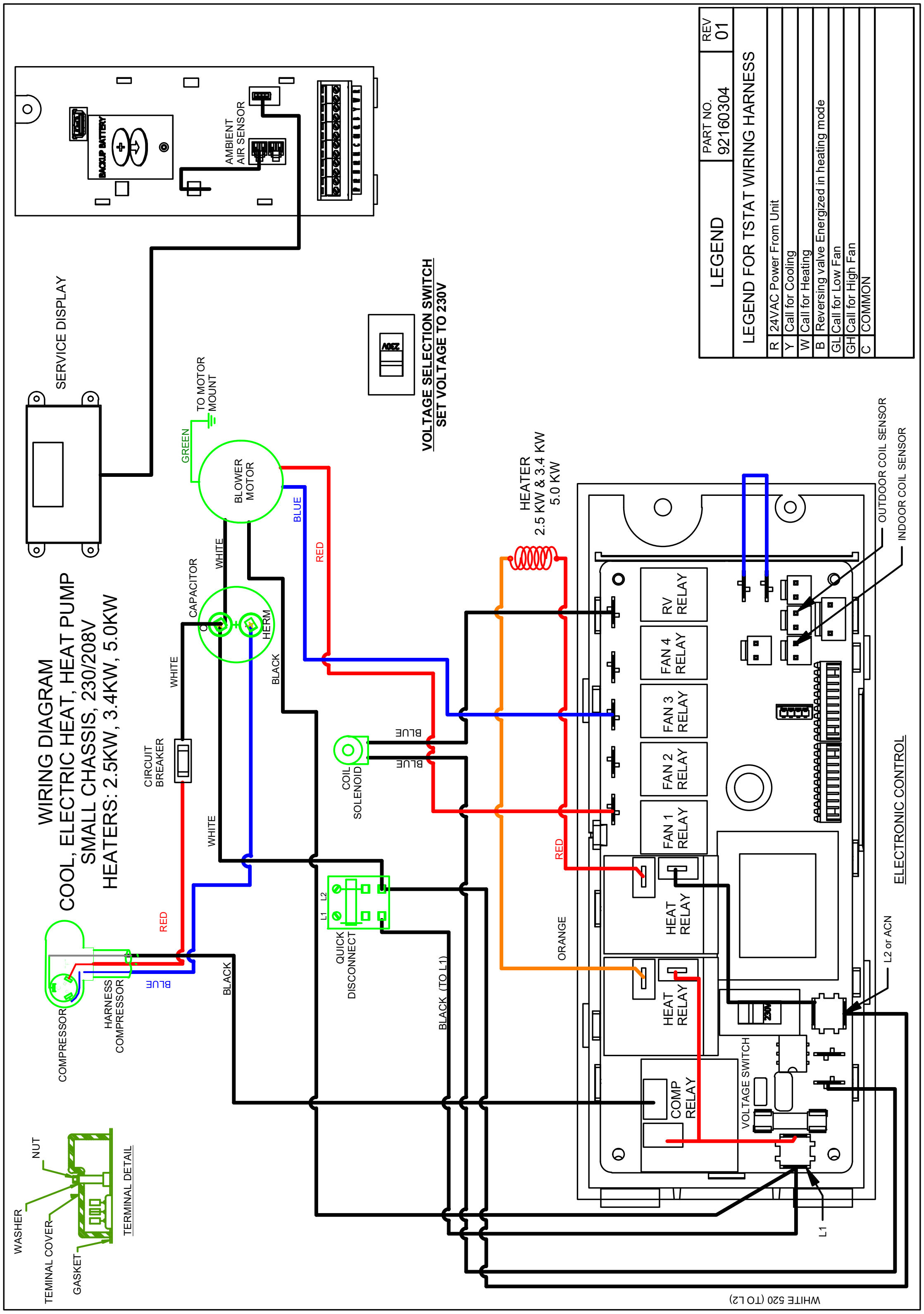


Figure 801

WIRING DIAGRAMS

9-12K 265V

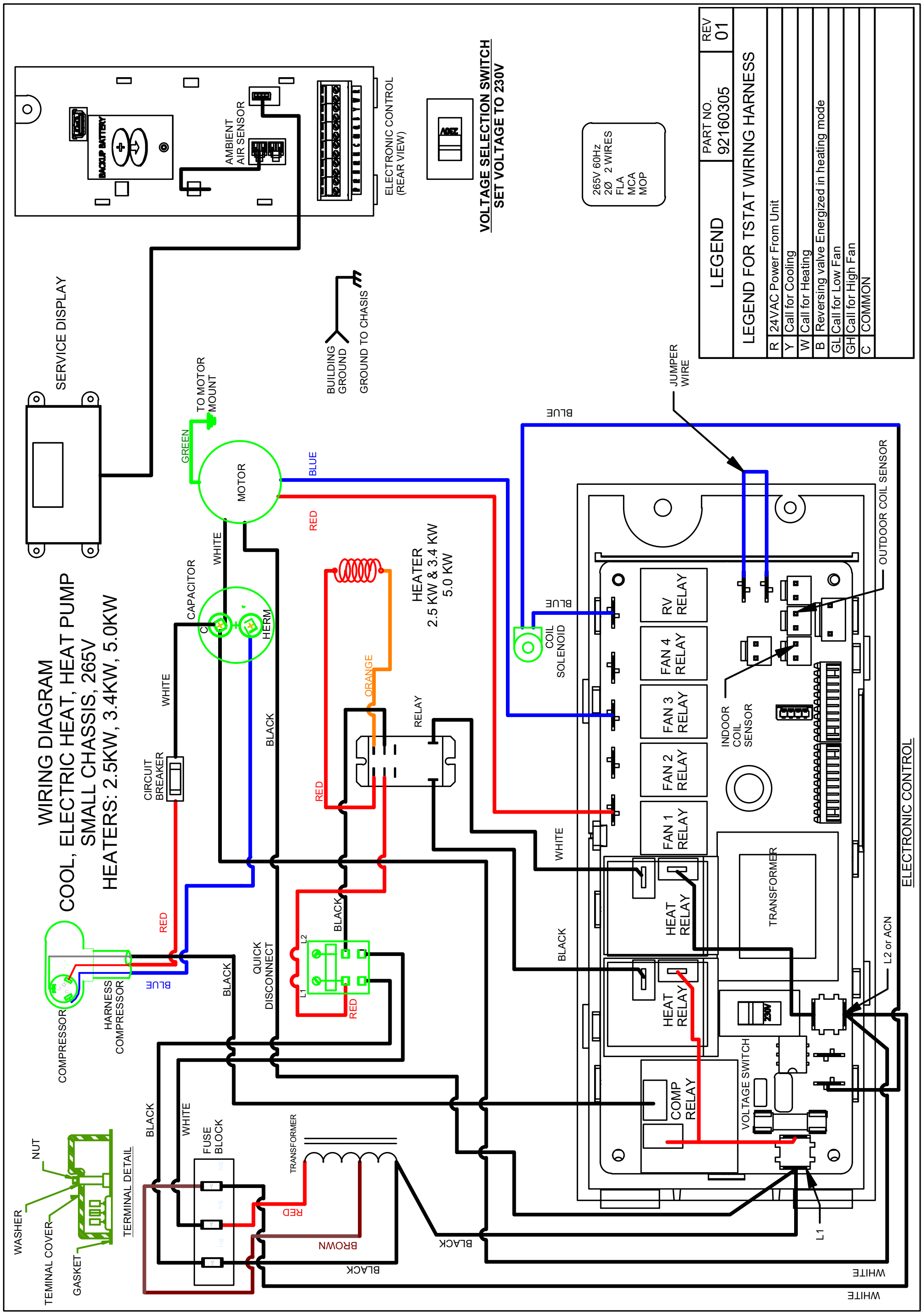


Figure 802

WIRING DIAGRAMS

18K 208/230V (2.5KW, 3.5KW, 5KW)

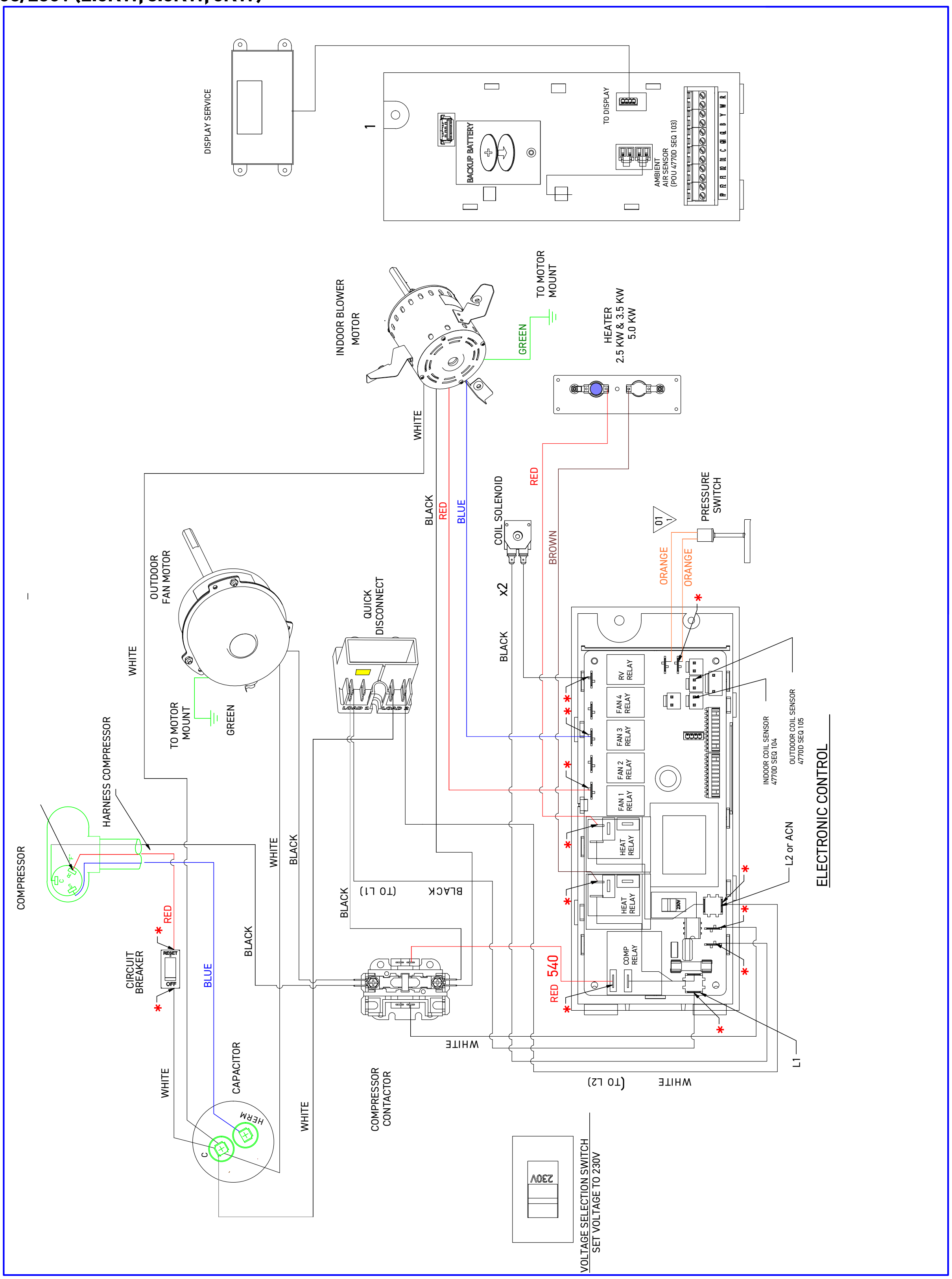


Figure 803

WIRING DIAGRAMS

18K 265V (2.5KW, 3.5KW, 5.0KW)

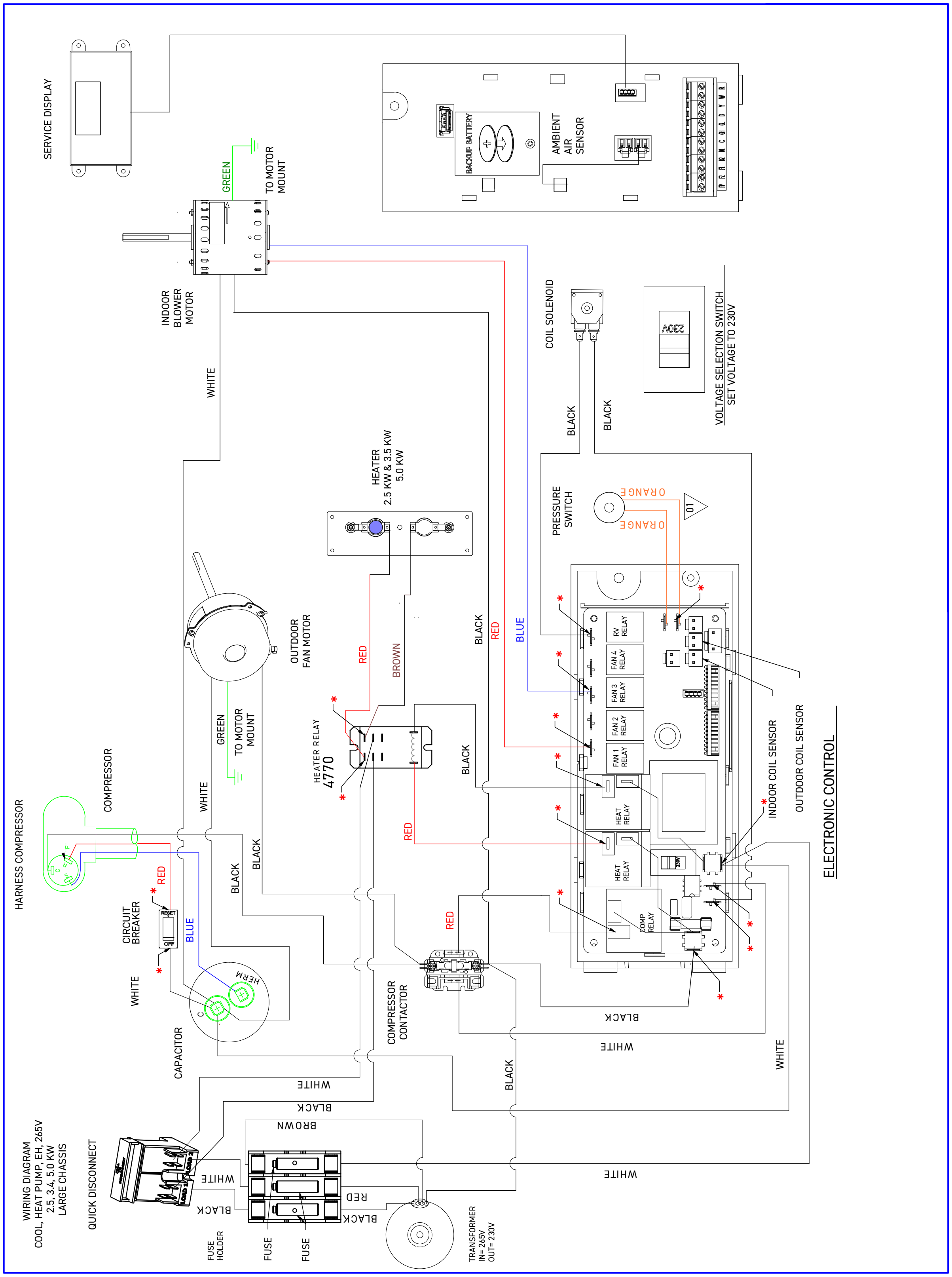


Figure 804

WIRING DIAGRAMS

18K 208/230V (7.5KW)

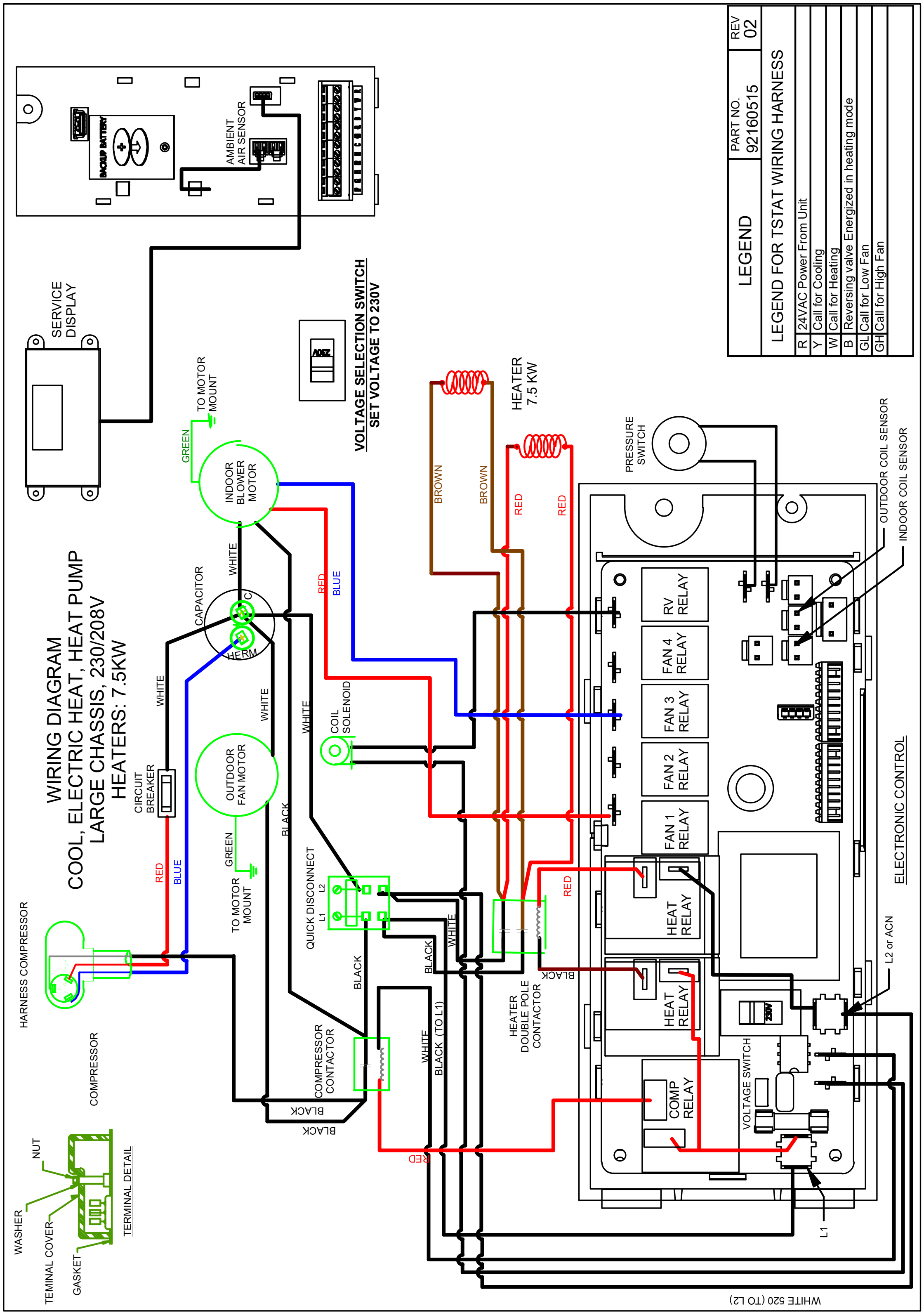


Figure 805

WIRING DIAGRAMS

18K 265V (7.5KW)

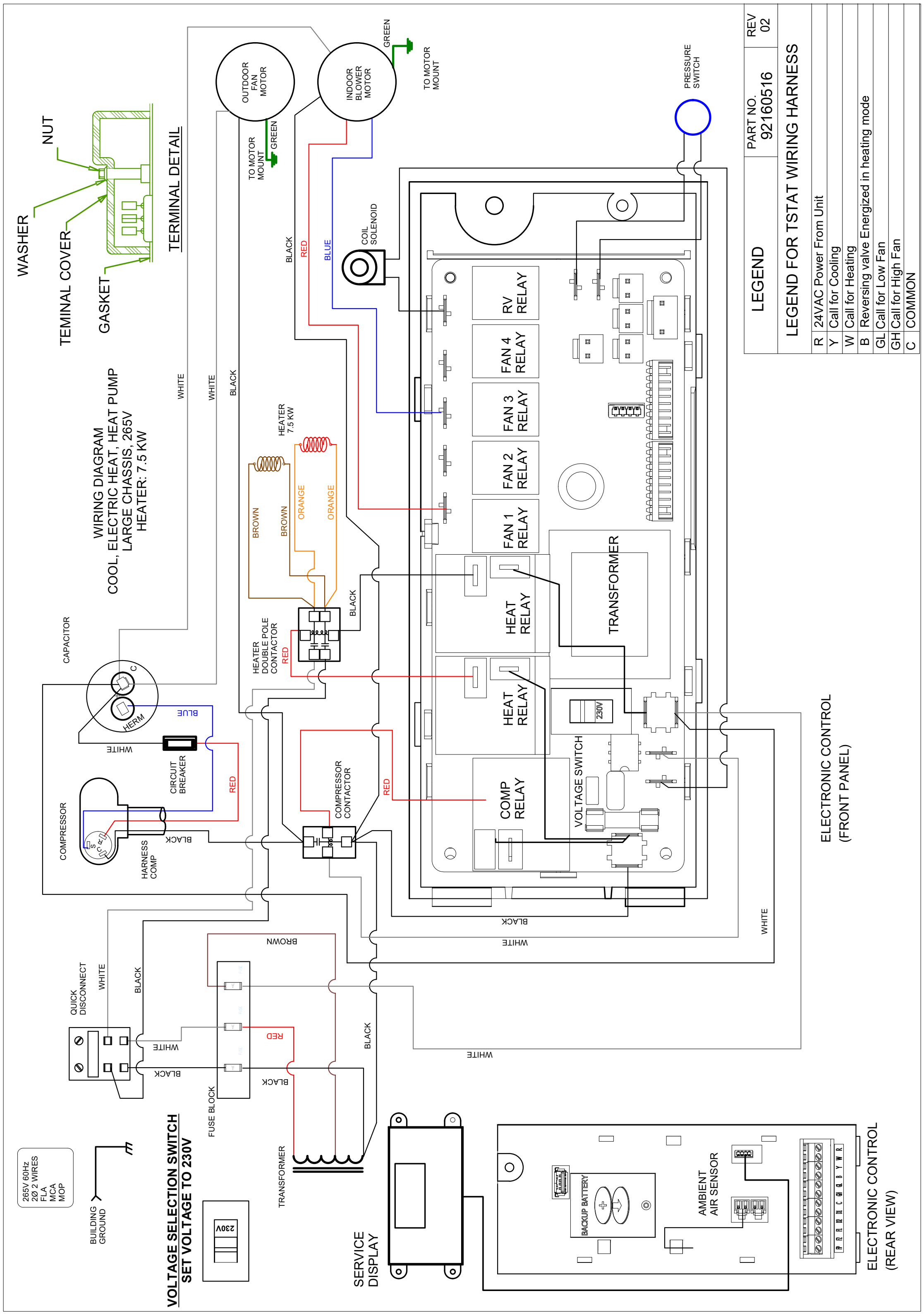


Figure 806

WIRING DIAGRAMS

24K 208/230V (2.5KW, 3.5KW, 5KW)

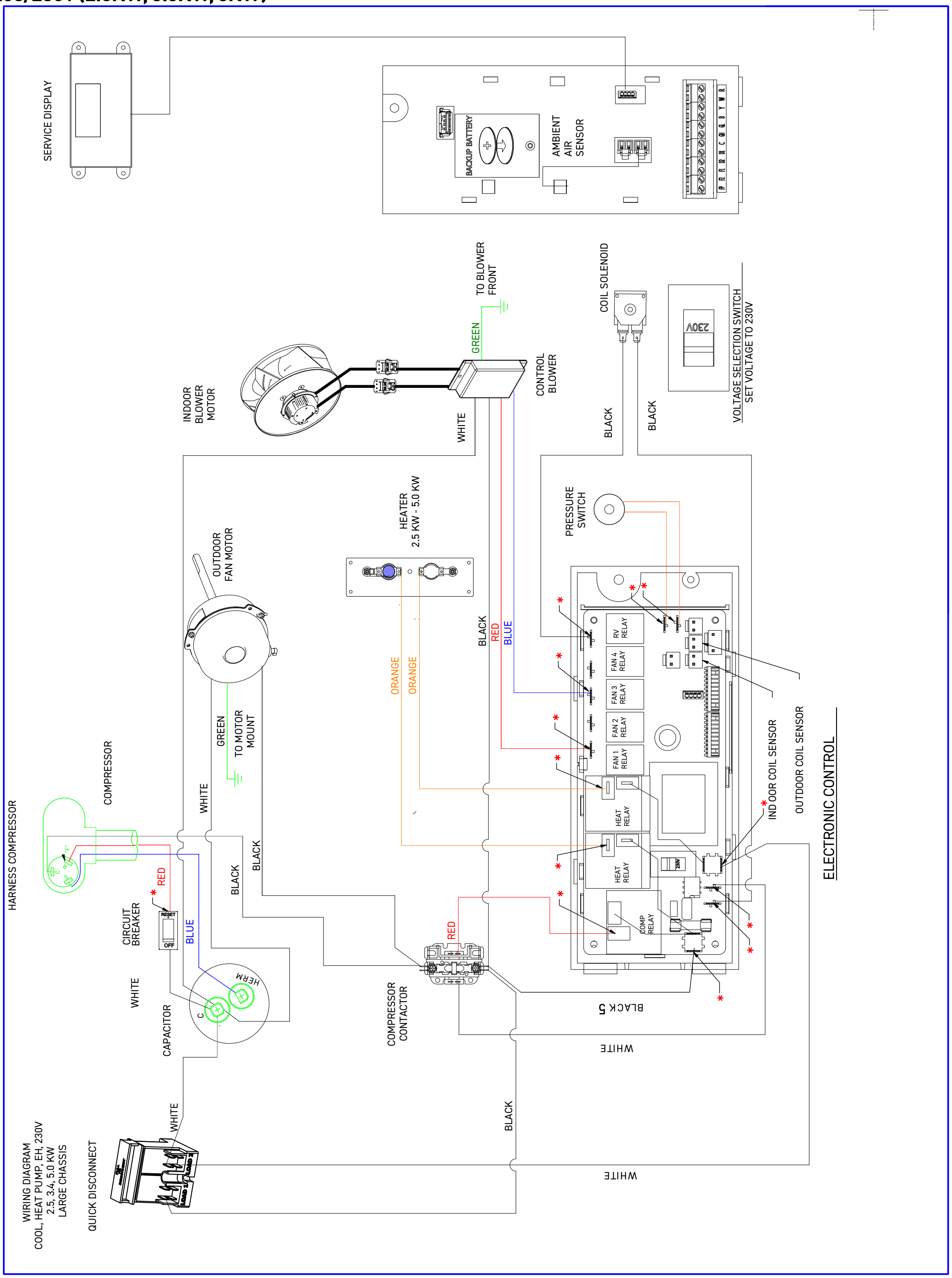


Figure 807

WIRING DIAGRAMS

24K 208/230V (7.5KW AND 10KW)

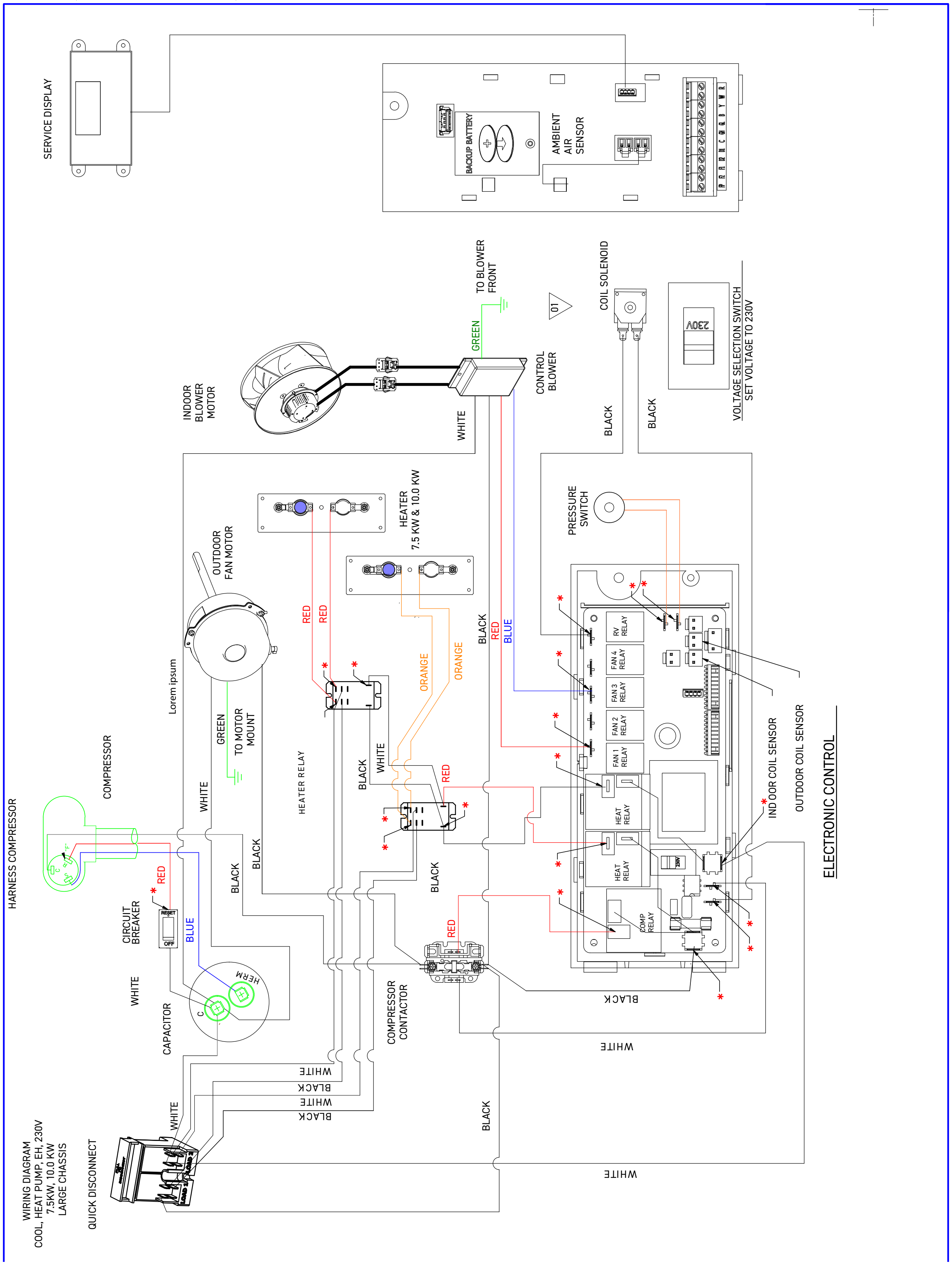


Figure 808

WIRING DIAGRAMS

24K 265V (2.5KW, 3.5KW, 5KW)

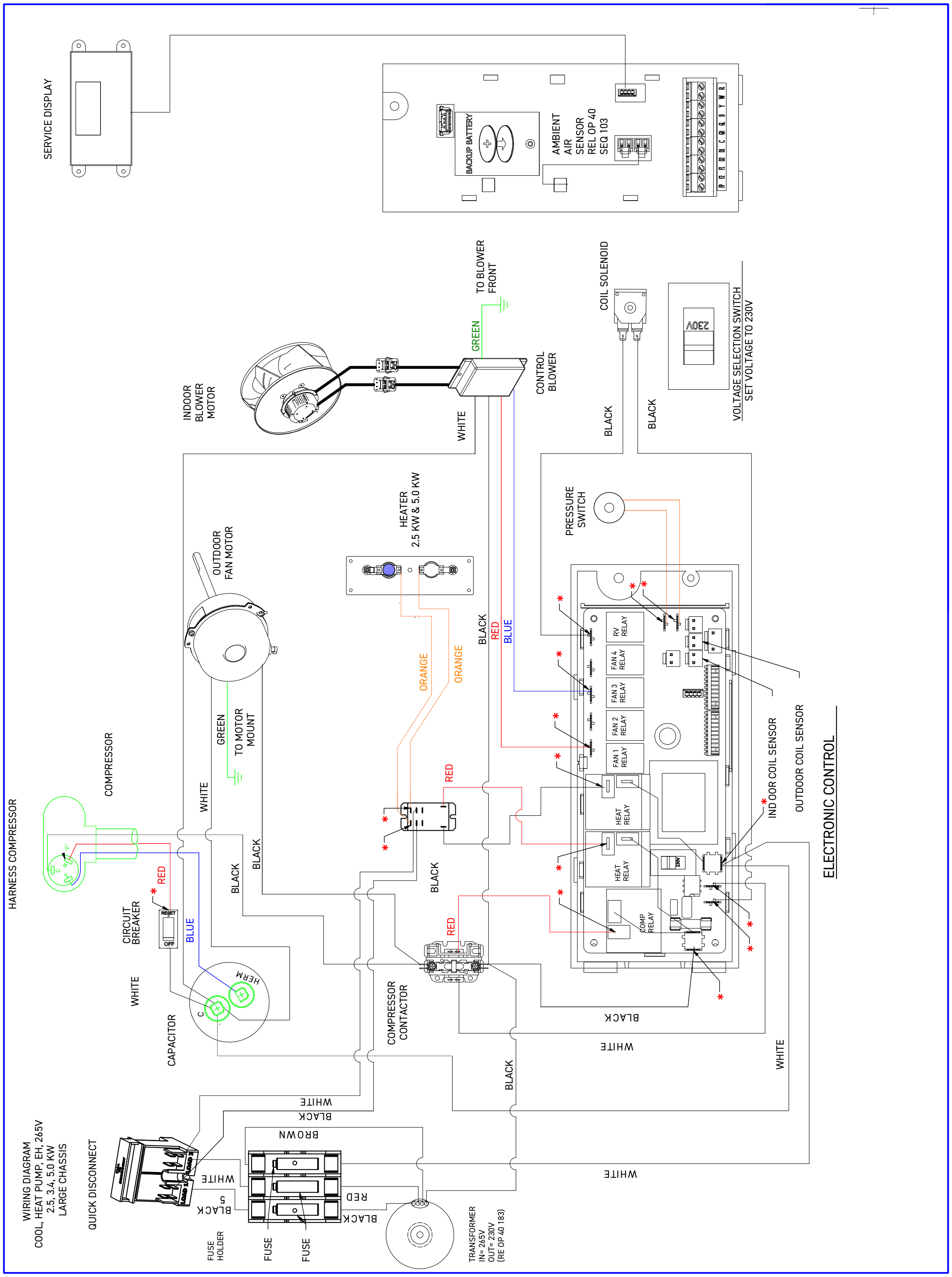


Figure 807 (80126406)

WIRING DIAGRAMS

24K 265V (7.5KW and 10KW)

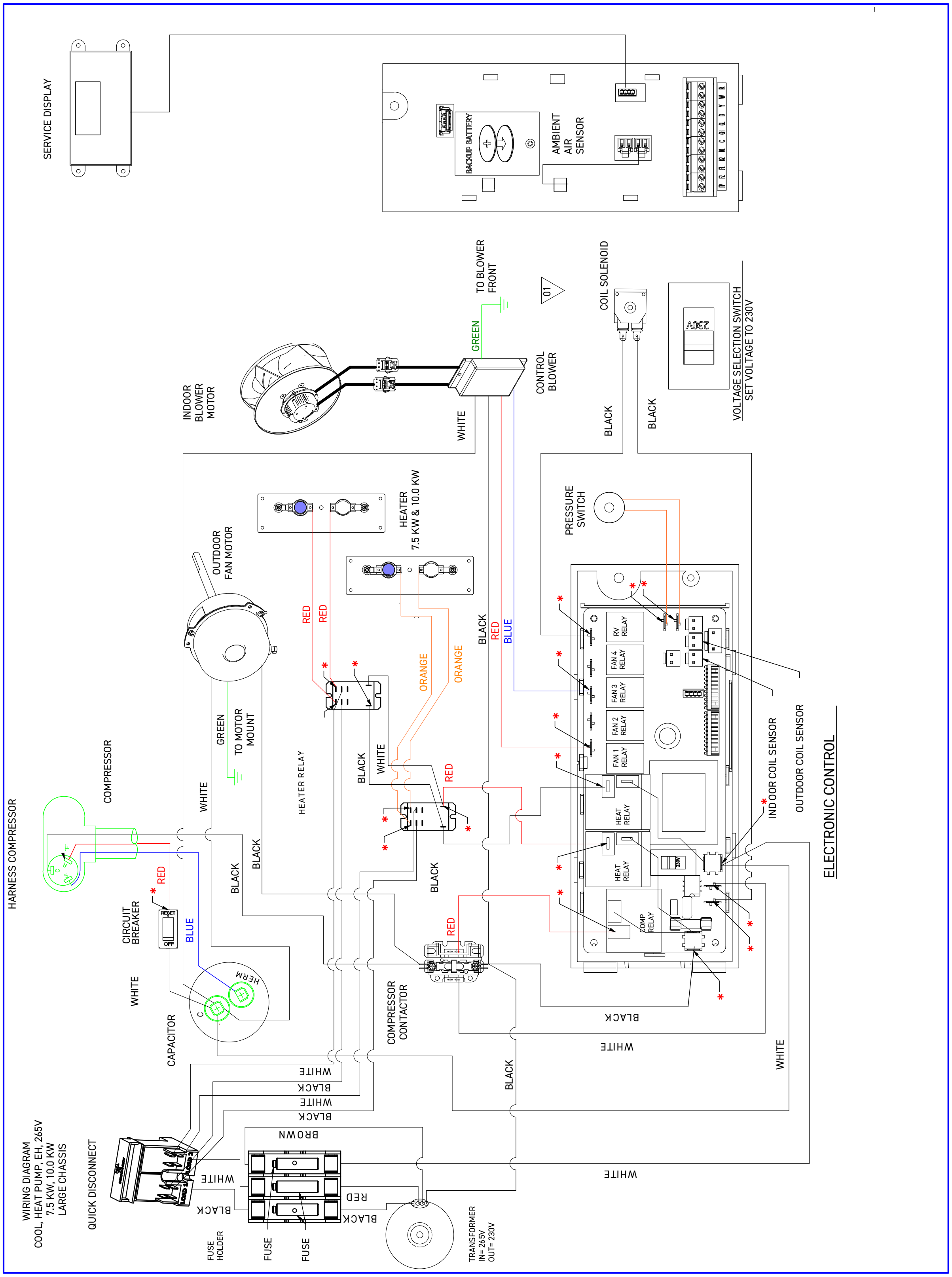


Figure 808 (80126404)

INTERACTIVE PARTS VIEWER

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

Please click on the link below:

Interactive Parts Viewer

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

APPENDIX

Appendix 1 Thermistor Resistence 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

Figure 710 Thermistor Values

CUSTOMER SATISFACTION and QUALITY ASSURANCE

Friedrich is a conscientious manufacturer, concerned about customer satisfaction, product quality, and controlling warranty costs. As an Authorized Service Provider you play a vital role in these areas. By adhering to the policies and procedures you provide us with vital information on each warranty repair you complete. This information is used to identify product failure trends, initiate corrective action, and improve product quality, thereby further reducing warranty expenses while increasing customer satisfaction levels.

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

FRIEDRICH AUTHORIZED PARTS DEPOTS

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borr@neuco.com

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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

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TECHNICAL SUPPORT CONTACT INFORMATION

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www.friedrich.com