



FRIEDRICH

Room Air Conditioners



Hazardgard Models

Engineered to Perform in the Harshest Conditions

North America 60 Hertz SH15M30A-B, SH20M30B-B, SH20M30SA-B,
SH24N30A-A, SH24N30AT-A

International 50 Hertz SH20N50AT-B, SH20M50B-A

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INTRODUCTION

Important Safety Information


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

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

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.

NOTICE

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.

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, Doing so may cause fire, injuries, or death.	Ne pas supprimer, 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.
- Use on a properly grounded outlet only.
- Do not cut or modify the power supply cord or remove the ground prong of the plug.
- Never operate the unit on an extension cord.
- 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.
- 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.
- Connect to a properly grounded outlet only.
- Do not remove ground prong of plug.
- Do not cut or modify the power supply cord.
- Do not use extension cords with the unit.
- 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

This service manual is designed to be used in conjunction with the installation and operation manuals provided with each air conditioning system.

This service manual was written to assist the professional service technician to quickly and accurately diagnose and repair malfunctions.

Installation procedures are not given in this manual. They are given in the Installation/Operation manual which can be acquired on the Friedrich [website](#).

Operation of Equipment in During Construction

- **OPERATION OF EQUIPMENT MUST BE AVOIDED DURING CONSTRUCTION PHASES WHICH WILL PRODUCE AIRBORNE DUST OR CONTAMINATES NEAR OR AROUND AIR INTAKE OPENINGS:**
- Wood or metal framing;
- Drywalling or sheathing,
- Spackling or applying joint compound.
- Sanding or grinding.
- Moulding or trimwork.

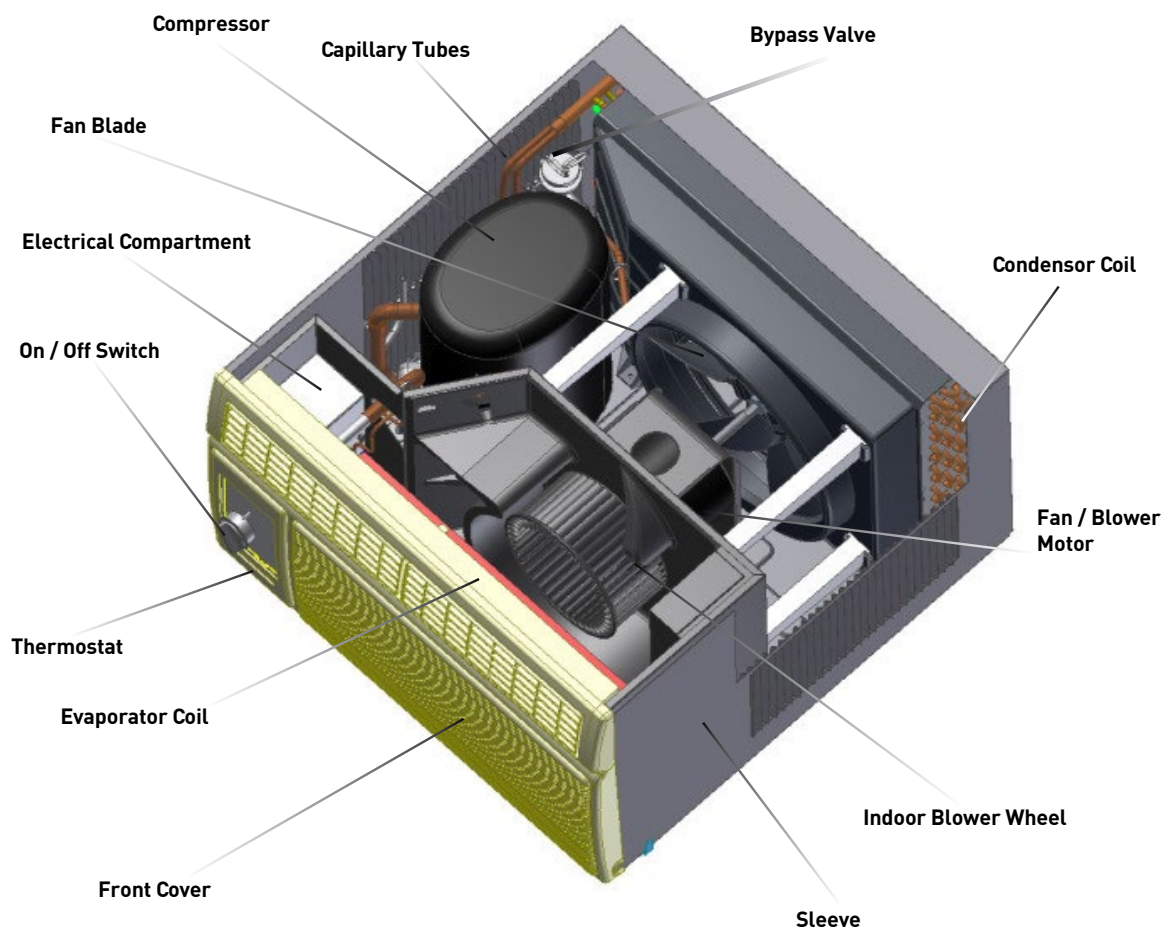
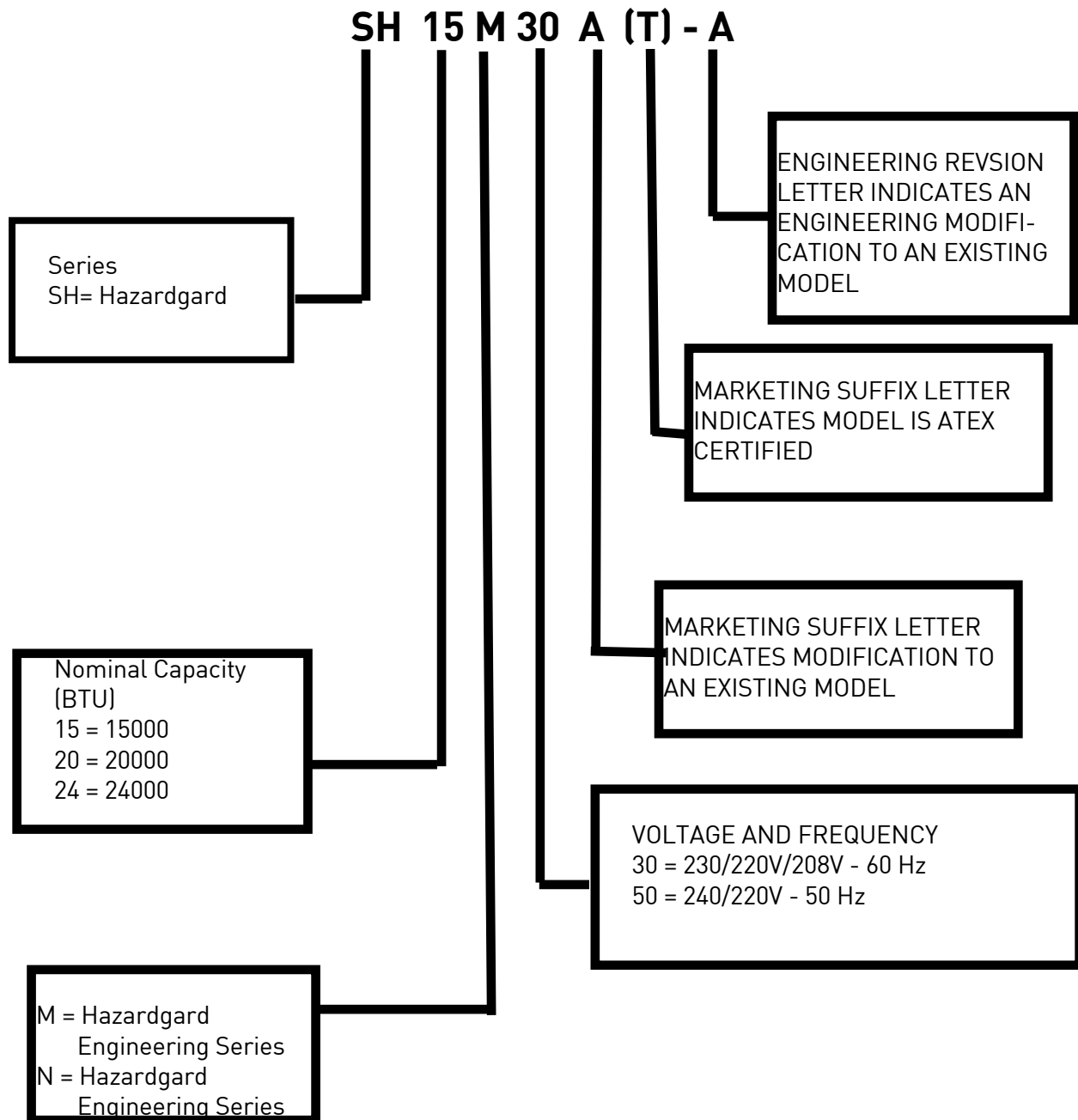


Figure 101 (Component Identification)

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 102 (Model Number Reference Guide)

INTRODUCTION

Serial Number Reference Guide

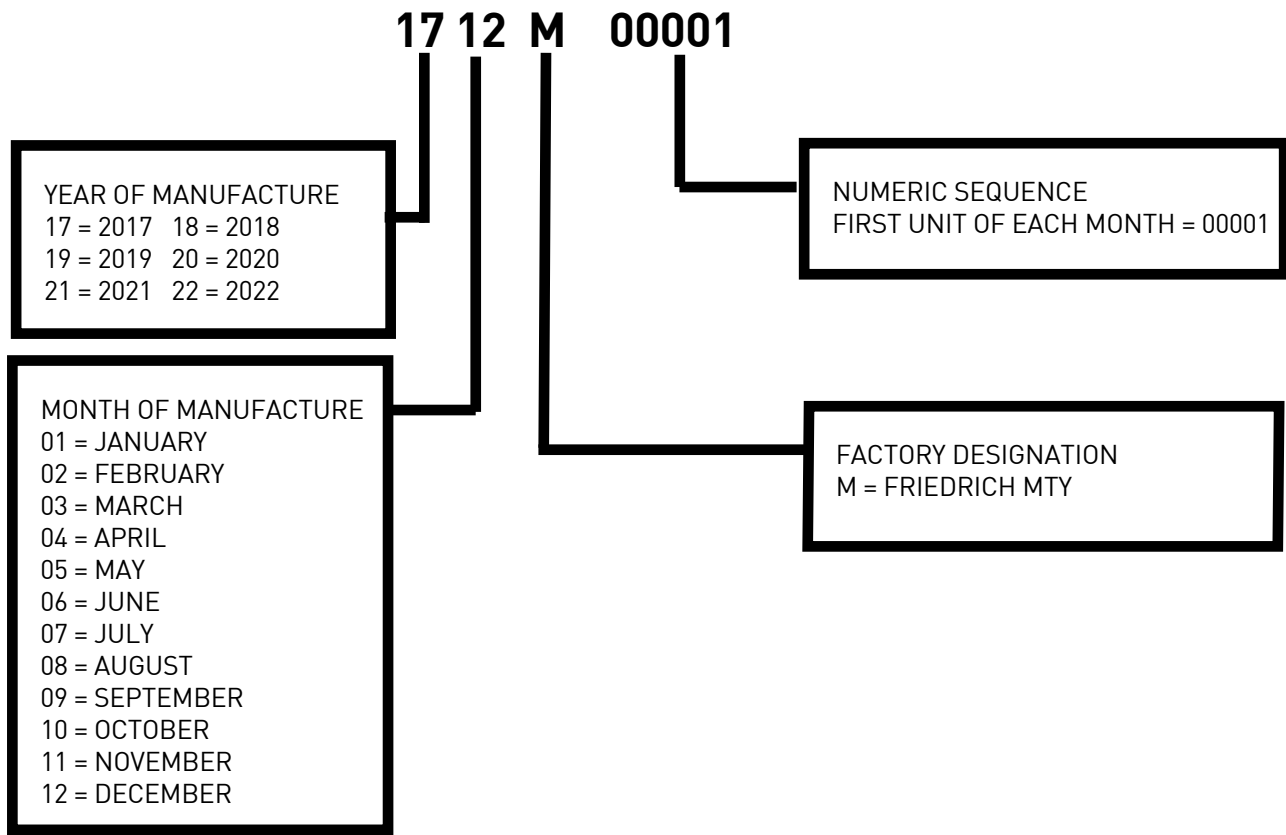


Figure 103 (Serial Number Reference Guide)

SPECIFICATIONS

	Electrical Characteristics				Circuit Rating Breaker or T - D Fuse	Energy Efficiency Ratio	Moisture Removal	Air Circulation	Refrigerant R-410A
	Cooling Capacity		Cooling	Cooling					
Model	Btu/Hr.	Volts Rated	Amps	Capacity (KW)					
	60 HERTZ								
SH15M30A	15700/15500	230/208	7.9/7.8	4.6/4.10	250V-15	10.4/10.3	4.5	325	46
SH20M30B	21600/21300	230/208	10.5/9.4	6.15/6.15	250V-15 (230V) / 250V-20 (208V)	10.4/10.4	7.0	425	47
SH20M30SA	19000/19000	220	8.5	5.57	250V-15 (230V) / 250V-20 (208V)	10.3	7.0	425	47
SH24N30AT	23500/23700	230	11.8/13.5	7.03	250V-20	9.7	8.0	385	33
SH24N30A	24000/24000	230	11.8	6.8	250V-20	9.7	8.0	385	46.8
	50 HERTZ								
SH20M50B	21000/19100	240/220	11.6/10.3	6.15/6.15	250V-15	8.8	7.0	425	40.7
SH20N50AT	19500/19100	240/220	9.8/10.3	5.72/5.60	250V-15	8.8	7.0	425	40.7

Due to continuing engineering research and technology, specifications are subject to change without notice.

U.S. MAXIMUM outdoor ambient operating temperature is 130°F. (55°C) MAXIMUM TEMPERATURE RATING FOR CLASS 1, DIVISION 2, GROUPS A, B, C, D.

Capacity and efficiency values at each climate conditions are available upon request.

NOTE: Hazardgard unit must be hard-wired.

Manufactured under Design Patent DES 368, 306 decorative front; Utility Patent 5, 662, 058.

Figure 201 (Specifications)

ELECTRICAL REQUIREMENTS

ALL FIELD WIRING MUST MEET THE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE (ANSI/NFPA 70) ARTICLE 501.


THE FIELD-PROVIDED CIRCUIT PROTECTION DEVICE (HACR CIRCUIT BREAKER OR TIME DELAY FUSE) MUST NOT EXCEED THE AMPACITY INDICATED ON THE PRODUCT NAMEPLATE.

IMPORTANT: Before you begin the actual installation of your air conditioner, check local electrical codes and the information below.

Your air conditioner must be connected to a power supply with the same A.C. voltage and frequency (hertz) as marked on the data plate located on the chassis. Only alternating current (A.C.), no direct current (D.C.), can be used.

An overloaded circuit will invariably cause malfunction or failure of the air conditioner therefore, it is extremely important that the electrical power is adequate. Consult your power company if in doubt.

⚠ 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.

NOTICE

FIRE HAZARD

Not following the above WARNING could result in fire or electrically unsafe conditions which could cause moderate or serious property damage.

Read, understand and follow the above warning.

SPECIFICATIONS

Installation Specifications

Model	Dimensions Inches						Window Width Inches		In-Wall Installation Finished Hole Inches			Weight Lbs.	
	Height	Width	Depth with Front	Depth J Box to Louvers	Minimum Extension Into Room	Minimum Extension Outside	Min.	Max.	Height	Width	Max. Depth	Net	Shipping
SH15M30A	15 15/16"	25 15/16"	27 3/8"	6"	3 1/16"	16 15/16"	27 7/8"	42"	16 3/16"	26 3/16"	6"	140	167
SH20M30B	17 15/16"	25 15/16"	27 3/8"	6"	3 1/16"	16 15/16"	27 7/8"	42"	18 3/16"	26 3/16"	6"	166	170
SH20M30SA	17 15/16"	25 15/16"	27 3/8"	6"	3 1/16"	16 15/16"	27 7/8"	42"	18 3/16"	26 3/16"	6"	166	170
SH20M50A	17 15/16"	25 15/16"	27 3/8"	6"	3 1/16"	16 15/16"	27 7/8"	42"	18 3/16"	26 3/16"	6"	171	175
SH24N20	17 15/16"	25 15/16"	27 3/8"	6"	3 1/16"	16 15/16"	27 7/8"	42"	18 3/16"	26 3/16"	6"	180	185
SH24N30AT	17 15/16"	25 15/16"	27 3/8"	6"	3 1/16"	16 15/16"	27 7/8"	42"	18 3/16"	26 3/16"	6"	180	185
SH20N50AT	17 15/16"	25 15/16"	27 3/8"	6"	3 1/16"	16 15/16"	27 7/8"	42"	18 3/16"	26 3/16"	6"	171	175

Figure 202 (Installation Specifications)

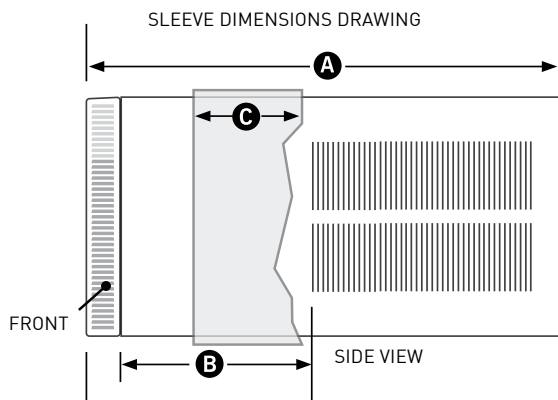


Figure 203 (Sleeve Dimensions)

Installation Clearances

Improper installation of the Air Conditioner can cause poor performance and premature wear of the unit.

Ensure that the Kuhl unit is installed with proper clearances as described below.

Ensure no obstructions, or enclosures are within clearances limits to allow for proper airflow.

Clearances


Top and Bottom of Unit - One (1) foot

Sides of Unit - One (1) foot

Front of Unit - Three (3) feet

Rear of Unit - Three (3) feet

HAZARDGARD APPLICATION



Hazardgard
Engineered to perform in the harshest conditions.


HAZARDGARD MEETS T4 TEMPERATURE CLASSIFICATION

- Unit surface temperatures will not rise above 135° C/275° F.
- Operates at low ambient conditions without freezing at outdoor ambient temperatures as low as 7° C/45° F.
- Tolerates higher outdoor temperatures up to 55° C /130° F.

[WATCH VIDEO ON HAZARDGARD APPLICATIONS](#)


For more than 30 years, industrial professionals have trusted Hazardgard to deliver safe and reliable cooling in the most extreme conditions. Hazardgard is specifically designed to cool laboratories, control rooms, living quarters, storage areas and other enclosures situated in hazardous locations; where specific volatile flammable liquids or gases are handled or used within enclosed containers or systems.

Non-ATEX certified Hazardgard[®] are rated for these conditions:

Model	Hazardous Location Classification: Gases	
SH15M30A SH20M30SA SH20M30B SH20M50B SH24N30A	National Electrical Code, NFPA 70 ARTICLE 501: Class 1, Division 2, Group A / B / C / D , Temperature Class T4 ARTICLE 505: Class 1, Zone 2, Group II C / IIB / II A , Temperature Class T4	
		

For global applications, Hazardgard cooling capacities are tested in a certified laboratory at moderate (T1) and hot (T3*) climate conditions in accordance with SASO (Saudi Arabian Standards Organization) Standard 2681. SASO Standard 2681 is adopted from ISO Standard 5151 for testing and rating for performance of non-ducted air conditioners and heat pumps. Model SH20M30SA is KSA Registered in accordance with SASO2681 and meets SASO 2663 Energy Efficiency standard.*

ATEX certified Hazardgard[®] are rated for these conditions:

Model	Hazardous Location Classification: Gases	
SH20N50AT SH24N30AT	ATEX,  II 3 G Ex nA nC IIC T4 Gc IECEx, Ex nA nC IIC T4 Gc	National Electrical Code, NFPA 70 ARTICLE 501: Class 1, Division 2, Group A/B/C/D, Temperature Class T4/T4A* ARTICLE 505: Class 1, Zone 2, Group II C/ II B/ II A, Temperature Class T4/T4A*

HAZARDGARD APPLICATION

DURABILITY & RELIABILITY

- Permanent split capacitor motor
- Hermetically sealed refrigeration system
- Environmentally sealed on/off switch and gold plated contacts in thermostat for corrosion resistance
- Solid-state control relays for compressor and fan operation
- Commercial grade, enclosed fan motor with hermetically sealed overload for arc-free operation
- Direct-wired (field supplied), 15-amp circuit with time delay fuse that will tolerate current surge without tripping the breaker
- Powder Coated 22-gauge, G60 steel air conditioner cabinet for corrosion protection and to withstand years of hard use
- Stainless Steel Fan Shaft
- Coated Coils for Corrosion Protection

COATED COILS FOR CORROSION RESISTANCE

- ElectroFin® 5-stage, immersion ecoat process, or Diamonblue Advanced Corrosion Protection® on 100% of metallic surfaces on the outdoor coil provides outstanding corrosion resistance protection and extends the life of the unit, especially in coastal or corrosive environments.

Diamonblue Advanced Corrosion Protection®

- STANDARD ON ALL MODELS (except SH24N30A AND SH24N30AT see below)
- Anti-corrosive, hydrophilic coating

ElectroFin® 5-stage, Immersion Ecoat Benefits:

MODEL SH24N30A and SH24N30AT ONLY

- Excellent adhesion characteristics
- Less than 1% thermal degradation
- Outstanding chemical resistance
- Passed 6048 hrs. ASTM B-117 Salt Spray

MEETS THE FOLLOWING:

- MIL-C-46168 Chemical Agent Resistance
-DS2, HCl Gas
- CID A-A-52474A (GSA)
- MIL-STD 810F, Method 509.4 (Sand and Dust)
- MIL-P-53084 (ME)-TACOM Approval
- MIL-DTL-12468 Decontamination Agent (STB)
- DPG (Douglas Proving Grounds) Soil & Water Exposure Tests
- GM9540P-97 Accelerated Corrosion Test (120 cycles)
- ASTM B117-G85 Modified Salt Spray (Fog) Testing-2,000 hours
- ASTM B117 Salt Spray (tested by ARL for Lockheed Martin)

DIAMONBLUE
Advanced Corrosion Protection®



5-STAGE Ecoat
Corrosion Protection

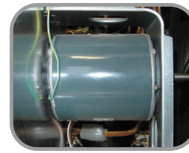


PERFORMANCE IN EXTREME CONDITIONS

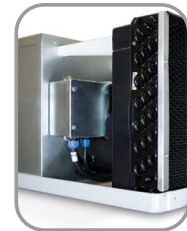
- Hot gas bypass for cooling operation at low ambient temperatures, down to 45°F / 7°C without freezing
- Designed to tolerate high ambient temperatures, allowing units to operate in T3 conditions

ATEX Models include the following features

- Hermetically sealed compressor is cooled during the refrigeration cycle, which allows the unit to tolerate higher outdoor temperatures up to 130° F / 55°



Commercial grade enclosed fan motor



Steel enclosure for solid state relays



Industrial Cable harnesses & cable glands



Molded compressor plug harnesses

Engineered to perform in the harshest environments

- Offshore oil rigs, on-shore oil company offices and refineries
- Petrochemical sites
- Propane fill-up stations
- Paint and varnish storage or processing plants
- Grain alcohol processors or storage sites
- Plant areas using strong solvents or chemicals
- Munitions plants or armories
- PVC or plastics plants and processing points
- Recycling plants
- Furniture refinishing workshops
- Office complexes where methane is a by-product
- Hazardous materials storage

HAZARDGARD SPECIAL FEATURES

- Permanent Split-Capacitor, totally enclosed fan motor to assure efficient operation even under diverse electrical conditions.
- Motor has a special stainless steel shaft to resist corrosion and a hermetically sealed overload for arc-free operation.
- High capacity compressor with internal hermetically sealed overload.
- Contains transient voltage suppressor to protect controls against transient voltage spikes. Provides solid state switches for arc-free operation.
- Hot gas bypass low ambient control to permit operation without freezing at outdoor ambient temperatures as low as 45°F (7°C).
- IP44 Environmentally sealed electrical components protect against ingress of moisture (ATEX & IECEx)
- Polyester powder finish, oven-baked for an attractive, longlasting finish
- Copper tubing/aluminum hydrophilic coated fin coils
- Galvanized steel cabinet and base pan, all bonderized.
- Slide-out chassis for easy installation in window or through-the-wall.
- Extra insulation inside, including completely insulated plenum chamber for quieter, more efficient cooling.
- Entire unit test run in environmental chamber before crating.
- Eight-way air flow control for uniform circulation
- Condensate drain with exclusive mosquito trap.
- 15amp or 20amp circuit with time-delay fuse required. Accommodates direct wiring.
- Long lasting 3/8" (10mm) thick air filter, germicidally treated, easily removed for cleaning.

Friedrich Air Conditioning quality has been proven by more than 30 years of successful experience from the Gulf of Mexico to the searing sands of the Arabian Desert.

Control Panel

Function Control (Power)

This switch is a double pole, single throw toggle switch.

ON - Turns everything on.

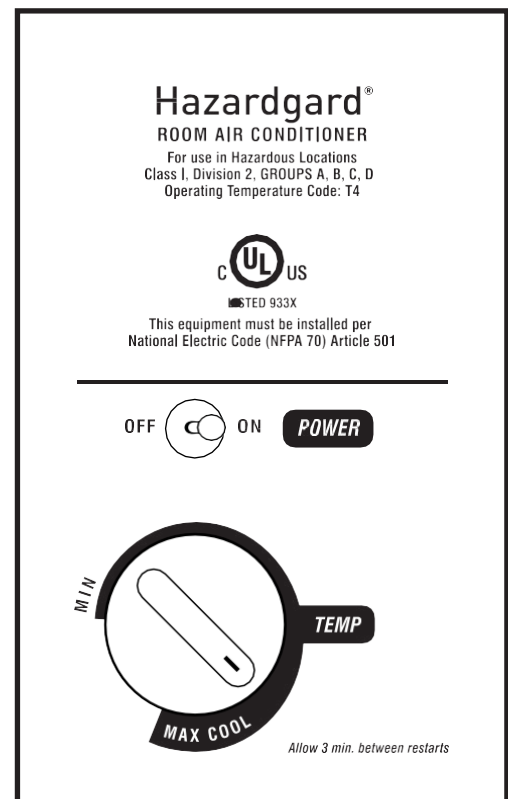
OFF - Turns everything off.

Temperature Control

The knob at the bottom is the thermostat which is a cross ambient type used to maintain the desired comfort level. The thermostat reacts only to a change in temperature at the bulb location - turn the knob clockwise to set cooler, counter-clockwise for warmer.

Friedrich leads with the first UL Listed Room Air Conditioners designed to cool living quarters and other enclosures situated in hazardous locations where specific volatile flammable liquids or gases are handled or used with enclosed containers or systems.

Friedrich Hazardgard room air conditioners are designed to meet the National Electrical Code, Article 500 requirements for Class I, Division 2, Groups A,B,C,D Hazardous locations, CERTIFIED BY UNDERWRITERS LABORATORIES FOR USE IN CLASS 1, DIVISION 2, GROUPS A,B,C,D HAZARDOUS LOCATIONS.



ATEX & ICEX STANDARDS SPECIFIC TO MODELS SH20N50AT & SH24N30AT

SH20N50AT and SH24N30AT Adhere to the following certifications:

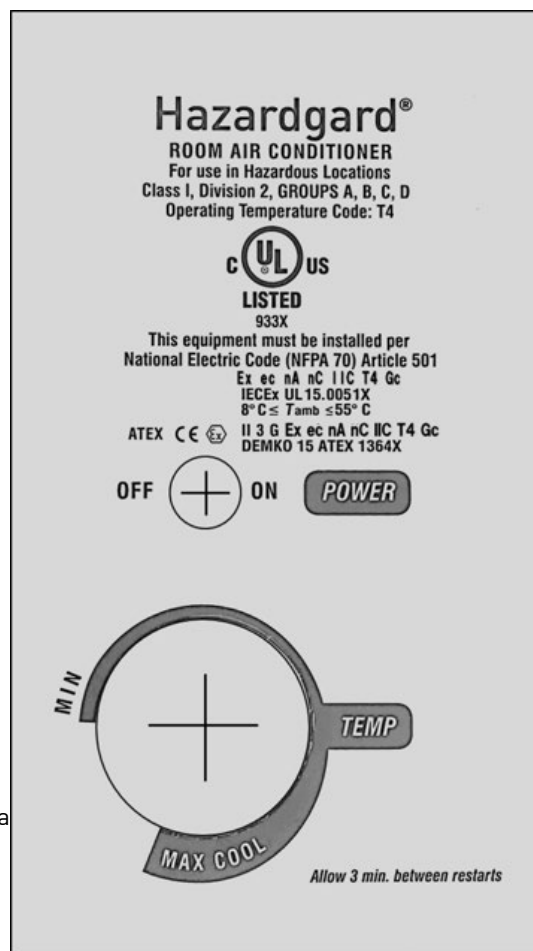
CERTIFIED PER STD. NO. ANSI/ISA 12.12.01,2013
 PER STD. NO. IEC 60079-0, 6th Edition
 PER STD. NO. IEC 60079-15, 4th Edition
 PER STD. NO. CAN/CSA C22.2 NO. 213-M1987
 PER STD. NO. CENELEC EN 60079-0: 2012 + A11: 2013
 PER STD. NO. CENELEC EN 60079-15: 2010

CERTIFICATION DEMKO 15 ATEX 1364X II 3 G Ex ec nA nC IIC T4 Gc
 IECEx UL15.0051X DEMKO 15 ATEX 1364X

SH20N50AT & SH24N30AT

Specific Conditions of Use:

- Provision shall be made to prevent the rated voltage being exceeded by the transient disturbances of more than 140% of the peak rated voltage.
- The equipment must be installed only for use in locations providing adequate protection against the entry of solid foreign objects or water capable of impairing safety.
- Only permanently wired cables may enter the cable glands. The user shall provide for the required strain relief.
- Degree of protection will be safeguarded only when sealing and cable entry fittings are properly fitted. To ensure proper protection, all wiring connections and conduit passageways must have the appropriate ATEX/IECEx certified plug or cable gland.
- Cable Glands shall be mounted into the enclosure in such a way that they are mechanically protected against impact force.
- To avoid the buildup of electrostatic charge, regularly clean the unit with a damp cloth.
- The appliance is not to be used by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction. Children to be supervised not to play with the appliance.
- The enclosure with a coating must not be used in areas affected by charge-producing processes, mechanical friction and separation process, electron emission (e.g. in the vicinity of electrostatic coating equipment), and pneumatically conveyed dust.



NOTICE: To maintain IP44 protection, the Hazardgard unit must be installed in accordance to the instructions stated in the Installation and Operation manual.

The following additional previous editions of Standards noted under the "Standards" section of this Certificate where applied to integral Components as itemized below. There are no significant safety related changes between these previous editions and the editions noted under the "Standards" section.

Junction Box, Part No. 25. 10 16 08, manufactured by Rose.	IEC 60079-7:2006- 07, IEC 60079-31:
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Electrical Ratings:

ATEX/IECEx Model Number	Rated Voltage, Frequency	Rated Cooling Amps	Compressor RLA,LRA	Motor FLA	HP	MCA	MOP
SH20N50AT	240/220, 50Hz	11.6	9.4, 50	2	1/3	13.25	20
SH24N30AT	230/208, 60 HZ	11.8	10.2, 52	1.5	1/4	14.25	20

Refrigerant System Ratings:

ATEX/IECEx Model Number	R-410a Charge, oz	High-Side Design Pressure (PSIG)	Low-Side Design Pressure (PSIG)
SH20N50AT-B	40.7	600	300
SH24N30AT-A	46.8	600	300

ROUTINE MAINTENANCE

The filter in your Friedrich removes dust, pollen and other impurities from the air as they are drawn through the unit. The filter is permanent and reusable, and has a germicidal treatment which is not affected by periodic washing. A clogged, dirty filter reduces the air flow through the unit and reduces its efficiency. You should check the filter every seven to ten days, depending on the amount your unit is used. Clean the filter regularly.

AIR FILTER

Clean the unit air intake filter at least every 300 to 350 hours of operation. Clean the filters with a mild detergent in warm water and allow to dry thoroughly before reinstalling.

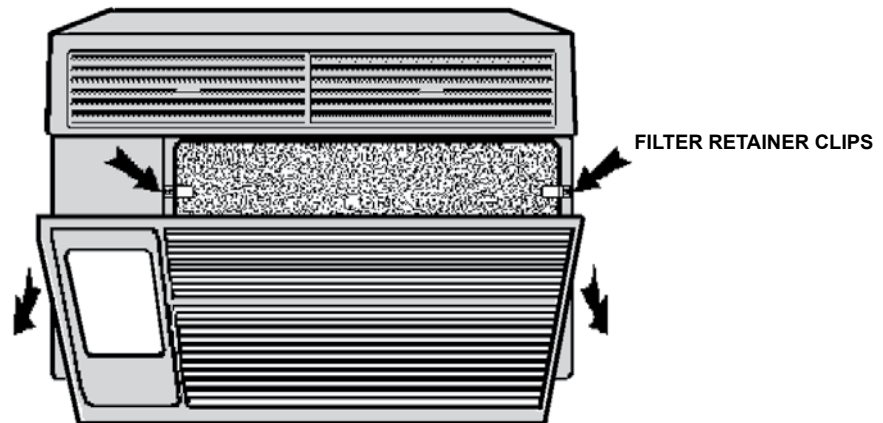


Figure 301 (Filter Removal)

The filter can be removed for cleaning by opening the front of the unit and releasing the filter from its retaining clips.

COILS AND BASE PAN

The indoor coil (evaporator coil), the outdoor coil (condenser coil) and base pan should be inspected periodically (yearly or bi-yearly) and cleaned of all debris (lint, dirt, leaves, paper, etc.). Clean the coils and base pan with a soft brush and compressed air or vacuum. If using a pressure washer, be careful not to bend the aluminium fin pack. Use a sweeping up and down motion in the direction of the vertical aluminum fin pack when pressure cleaning coils. Cover all electrical components to protect them from water or spray. Allow the unit to dry thoroughly before reinstalling it in the sleeve.

BLOWER WHEEL / HOUSING / CONDENSER FAN / SHROUD

Inspect the indoor blower housing, evaporator blade, condenser fan blade and condenser shroud periodically (yearly or bi-yearly) and clean of all debris (lint, dirt, mold, fungus, etc.). Clean the blower housing area and blower wheel with an antibacterial / antifungal 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.

ELECTRONIC / ELECTRICAL / MECHANICAL

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. Use an electronic tester to measure wet bulb temperatures indoors and outdoors.

For performance tests see Figure 303

⚠ 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



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.

NOTICE

Do not use a caustic coil cleaning agent on coils or base pan. Use a biodegradable cleaning agent and degreaser, to prevent damage to the coil and/or base pan.

ROUTINE MAINTENANCE

NOTICE

Do not drill holes in the bottom of the drain pan or the underside of the unit. Not following this notice could result in damage to the unit or condensate water leaking inappropriately which could cause water damage to surrounding property.

SLEEVE / DRAIN

Inspect the sleeve and drain system periodically (at least yearly or bi-yearly) and clean of all obstructions and debris. Clean both areas with an antibacterial and antifungal 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.

FRONT COVER

Clean the front cover when needed. Use a mild detergent. Wash and rinse with warm water. Allow it to dry thoroughly before reinstalling it in the chassis.

CLEARANCES

Inspect the surrounding area (inside and outside) to ensure that the unit's clearances have not been compromised or altered. Clearances

Top and Bottom of Unit - One (1) foot

Sides of Unit - One (1) foot

Front of Unit - Three (3) feet

Rear of Unit - Three (3) feet

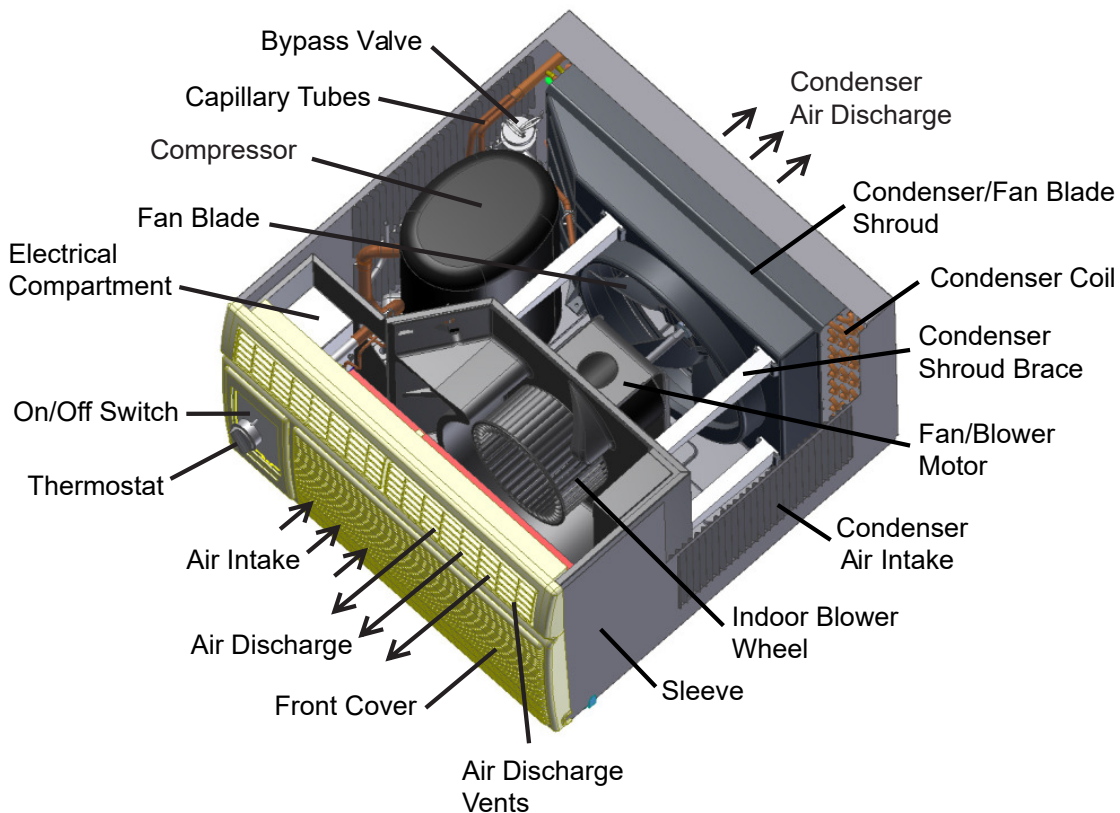


Figure 302 (Component ID)

ROUTINE MAINTENANCE

ROOM AIR CONDITIONER UNIT PERFORMANCE TEST DATA SHEET		
JOB NAME _____ TECH'S NAME _____		
DATE _____ MODEL # _____ SERIAL # _____		
CHECK THE INSTALLATION	ACCEPTABLE YES	NOT ACCEPTABLE NO
IS A CHASIS GASKET INSTALLED?	_____	_____
IS THE FRESH / EXHAUST AIR VENT OPEN?	_____	_____
IS A FRIEDRICH SLEEVE INSTALLED?	_____	_____
IS A FRIEDRICH OUTDOOR GRILLE INSTALLED?	_____	_____
IS MAINTENANCE BEING PERFORMED?	_____	_____
ELECTRICAL		
LINE VOLTAGE (STATIC)	_____	VOLTS
START UP VOLTAGE	_____	VOLTS
AMPERAGE DRAW (COOL)	_____	AMPS
AMPERAGE DRAW (HEAT)	_____	AMPS
COMPRESSOR		
LOCKED ROTOR AMPS	_____	AMPS
RUNNING AMPERAGE DRAW	_____	AMPS
INDOOR CONDITIONS		
INDOOR AMBIENT TEMPERATURE	_____	F
RELATIVE HUMIDITY (RH) INDOOR	_____	%
DISCHARGE AIR TEMPERATURE (INDOOR)(COOL)	_____	F
DISCHARGE AIR TEMPERATURE (INDOOR)(HEAT)	_____	F
RETURN AIR TEMPERATURE (INDOOR)(COOL)	_____	F
RETURN AIR TEMPERATURE (INDOOR) (HEAT)	_____	F
OUTDOOR TEMPERATURE		
OUTDOOR AMBIENT TEMPERATURE	_____	F
RH OUTDOOR RELATIVE HUMIDITY	_____	%
DISCHARGE AIR TEMPERATURE (OUTDOOR)(COOL)	_____	F
DISCHARGE AIR TEMPERATURE (OUTDOOR)(HEAT)	_____	F
INTAKE AIR TEMPERATURE (OUTDOOR)(COOL)	_____	F
INTAKE AIR TEMPERATURE (OUTDOOR)(HEAT)	_____	F
COOLING OR HEATING AREA		
AREA W _____ * L _____ = FEET SQUARED		
FOR A GENERAL GUIDE REFER TO SIZING GUIDE TO THE RIGHT		
FOR EXACT LOAD CALCULATIONS CONSULT MANUAL J OR M.		

Figure 303 (Test Data Sheet)

COOLING SIZING GUIDE

AREA TO BE CONDITIONED IN SQ. FT.	APPROXIMATE COOLING BTU REQUIRED
100 - 150	5000
150 - 250	6000
250 - 300	7000
300 - 350	8000
350 - 400	9000
400 - 450	10000
450 - 550	12000
550 - 700	14000
700 - 1000	18000
1000 - 1200	21000
1200 - 1400	23000
1400 - 1500	24000
1500 - 2000	30000
2000 - 2500	34000

Guide based on normal room insulation, average number of sun exposed windows and two person occupancy.

1. If heavily shaded, reduce cooling Btus required by 10%
2. If very sunny, increase cooling Btus required by 10%
3. Add 500 Btus per person over 2 people
4. Add 4,000 Btus if the area is a kitchen

Figure 715 (Cooling Sizing Guide)

OPERATION

Refrigeration Sequence Of Operation

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 (laws) in its operation they 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. 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.

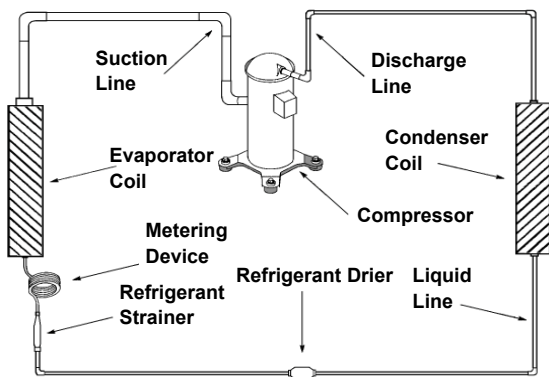
The refrigerant leaves the condenser Coil through the liquid line as a warm high pressure liquid. It next will pass through the refrigerant drier (if equipped). It is the function of the drier to trap any moisture present in the system, contaminants, and large particulate matter.

The liquid refrigerant next enters the metering device. The metering device is 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.



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.

Figure 401 (Refrigeration Sequence Of Operation)

TROUBLESHOOTING

Problem	Possible Cause	Possible Solution
Unit does not run	Power disconnected.	Check power source.
	Branch circuit fuse blown or circuit breaker tripped.	Replace fuse, reset breaker. If repeats, check fuse or breaker size. Check for shorts in unit wiring and components.
	Loose or disconnected wiring at switch.	Check wiring & connections. Connect per wiring diagram.
	Inoperative switch (On-Off).	Test for continuity, 3 and 2, 5 and 6. If bad, replace.
Compressor runs continually. Does not cycle off.	Excessive heat load.	Test cooling performance of unit. Unit undersized.
	Restriction in line.	Check for partially iced coil. Check temperature split across coil.
	Refrigerant leak.	Check for presence of oil on silver soldered connections. Check for partially iced coil. Check split across coil. Check for low running amperage.
	Thermostat contacts stuck.	Check operation of thermostat. Replace if contacts remain closed.
	Incorrect thermostat setting.	Set to correct setting.
Thermostat does not turn on compressor	Loss of charge in thermostat bulb.	Replace thermostat.
	Thermostat contacts open.	Test for continuity at terminals 1 and 2. Replace if defective.
	Incorrect wiring or loose wires.	Connect per wiring diagram. Tighten loose wires.
	System switch open.	Test for continuity at switch terminals 2 and 3.
Thermostat does not turn off compressor	Thermostat set at coldest point	Adjust.
	Thermostat contacts stuck.	Disconnect power to the unit. Remove cover of thermostat and check if contact is stuck, if so replace thermostat.
	Switch (On-Off) shorted.	Test switch for open contacts at terminals 2 and 3 with switch in "Off" position.
NOTE: If Inside Coil Freezes Up Your Friedrich Hazardgard is designed not to freeze with outdoor temperatures as low as 45°F (7°C). If the indoor coil should ice over while cooling, set the thermostat to the warmest position until the ice on the coil is gone. Setting the thermostat to a slightly warmer position will probably keep ice from forming on the coil. A dirty filter will contribute to icing.		

TROUBLESHOOTING

Problem	Possible Cause	Possible Solution
Compressor attempts to start, or runs for short periods only. Cycles on overload.	Compressor attempts to start before system pressures are equalized.	Allow a minimum of 3 minutes to allow pressures to equalize before attempting to start.
	Low or fluctuating voltage	Check voltage with unit operating. Check for other appliances on the circuit. Unit should be on separate circuit for proper voltage, and be fused separately
	Incorrect wiring	Connect per appropriate wiring diagram
	Shorted or incorrect capacitor	Replace capacitor
	Restricted or low air flow through condenser coil	Check motor fan blade.
	Compressor running abnormally hot	Check for refrigerant restriction, blocked airflow, loose wires at compressor terminals and fan motor capacitor voltage.
	Overload opens too soon.	Change compressor if all other corrections above are normal.
Compressor does not start - fan motor runs.	Thermostat contacts not closing.	Check continuity of thermostat at coldest setting. If compressor runs, replace thermostat.
	Low voltage supply.	Check for nameplate voltage. Provide proper voltage.
	Switch (On-Off) inoperative.	Test for continuity.
	Defective capacitor.	Test with analyzer, replace if needed.
	Compressor internal overload open.	Check voltage at compressor terminals. If voltage is satisfactory, replace compressor.
	Solid state relay open.	Replace relay.
	Open or shorted compressor windings.	Check windings for continuity and resistance. If open, replace compressor.

TROUBLESHOOTING

Problem	Possible Cause	Possible Solution
Does not cool, or cools only slightly.	Thermostat open or inoperative.	Set to coldest position. Test thermostat and replace if necessary.
	Dirty air filter.	Clean as recommended in Owner's Manual.
	Dirty or plugged condenser or evaporator coil.	Clean coils.
	Poor air circulation in area being cooled.	Adjust air louvers. Check application. Check for dirty filter or evap coil. Check fan motor. Correct as needed.
	Low capacity - undercharge.	Check for leak and make necessary repairs.
	Compressor not pumping properly.	Replace compressor.
Fan motor does not run.	Defective switch (On-Off)	Check continuity across terminals 2 and 3.
	Fan capacitor open.	Test with capacitor analyzer. Replace if bad.
	Inoperative fan motor.	Check power and if okay, perform continuity test. Replace if bad.
	Incorrect wiring of fan circuit.	Connect per wiring diagram.
	Solid state relay open.	Replace relay.
	Seized motor bearings.	Replace motor.
	Bound fan blade or blower wheel.	Adjust for proper clearance.
Switch (On-Off) does not cut fan motor off.	Defective (On-Off) switch or defective relay.	Replace switch or relay.
Noisy and/or vibration.	Poor installation.	Refer to Installation/ Operation Manual for proper installation.
	Fan blade striking chassis or blower wheel housing.	Adjust fan blade or blower wheel clearance.
	Compressor vibrating.	Check for deteriorated compressor grommets. Replace as needed.
	Loose cabinet parts, improperly mounted components, tubing rubbing.	Adjust and tighten as required.

TROUBLESHOOTING

Problem	Possible Cause	Possible Solution
Water leaks into room.	Evaporator drain pan overflowing. Dirty evaporator coil	Clean obstructed drain trough. Clean Coil
	Condensation forming on bottom of base pan. Dirty evaporator coil	Evaporator drain pan broken or cracked. Replace chassis seal gasket missing or defective.
	Water dripping from discharge air grilles.	Extremely high humidity conditions. Check application.
	Water in center section of base pan (compressor area).	Drain trough. Check level. Ensure 1/4" tilt toward rear.
Excessive water leaks outside.	Dirty condenser coil.	Clean with steam or detergent.

COMPONENT TESTING

COMPONENT DEFINITIONS

A. Mechanical components

Plenum assembly

Diffuser with directional louvers used to direct the conditioned airflow.

Blower wheel

Attaches to the indoor side of the fan motor shaft and is used for distributing unconditioned, room side air through the heat exchanger and delivering conditioned air into the room.

Slinger fan blade

Attaches to the outdoor side of the fan motor shaft and is used to move outside air through the condenser coil, while slinging condensate water out of the base pan and onto the condenser coil, thus lowering the temperature and pressures within the coil.

B. Electrical components

Thermostat Control

Used to maintain the specified room side comfort level.

System Switch

Used to regulate the operation of the fan motor and the compressor or to turn the unit off. For troubleshooting, refer to the wiring diagrams and schematics in the back of this service manual.

Solid State Relay

Used to energize the compressor and fan motor. Each unit has 2, 50 amp, 208/230 volt relays.

Capacitor

Reduces line current and steadies the voltage supply, while greatly improving the torque characteristics of the fan motor and compressor motor.

Fan Motor

Dual shafted fan motor operates the indoor blower wheel and the condenser fan blade simultaneously. (When unit is turned on, the fan motor runs continuously).

C. Hermetic components

Compressor

Motorized device used to compress refrigerant through the sealed system.

Low ambient bypass (hot gas bypass) valve

The Hazardgard unit is designed to operate at low outside ambient temperatures. This is accomplished by the use of a bypass valve installed in the refrigeration circuit. The valve is connected between the discharge line at the compressor and the suction process tube. The valve responds to suction pressure which, when reduced in the system, causes the valve to open and bypass hot gas from the high pressure side to the low pressure side of the system. The hot gas entering the compressor mixes with the cool gas returned through the suction line, thus increasing the suction pressure. The valve is preset to open when the suction pressure reaches 88 psig. This pressure setting cannot be altered. The system can be operated at outdoor temperatures as low as 45°F before the evaporator coil will begin to accumulate frost.

Capillary tube (All Models except SH20M30SA-B)


A cylindrical metering device used to evenly distribute the flow of refrigerant to the heat exchanger (evaporator coils).


Thermostatic Expansion Valve (TXV) (SH20M30SA-B ONLY)

The thermostatic expansion valve (TXV) is a precision device, which is designed to regulate the rate at which liquid refrigerant flows into the evaporator. This controlled flow is necessary to maximize the efficiency of the evaporator while preventing excess liquid refrigerant from returning to the compressor (floodback). One of the design features of the TXV is to separate the high pressure and low pressure sides of an air conditioning system. Liquid refrigerant enters the valve under high pressure via the system's liquid line, but its pressure is reduced when the TXV limits the amount of this liquid refrigerant entering the evaporator.

COMPONENT TESTING

Hermetic Components Check

⚠ 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.

Metering Device - Capillary Tube Systems

All units are equipped with capillary tube metering devices.

Checking for restricted capillary tubes.

1. Connect pressure gauges to unit.
2. Start the unit in the cooling mode. If after a few minutes of operation the pressures are normal, the check valve and the cooling capillary are not restricted.
4. If the operating pressures are lower than normal capillary is restricted.

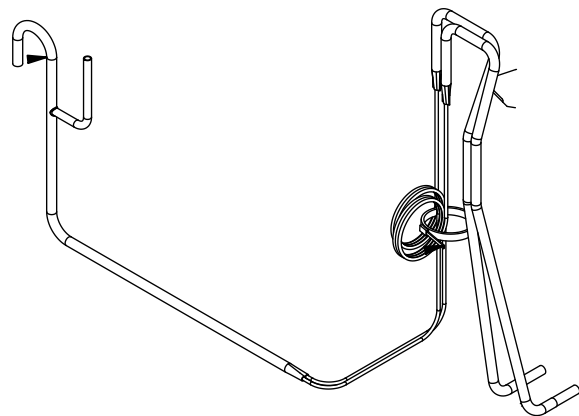


Figure 501 (Capillary Tubes)

TXV Valve

1. Determine and compare evaporator and condenser airflow before making any other adjustments.
2. Check for valve blockage. Heat TXV with a warm damp cloth to help breakdown ice or wax.
3. Check for upstream obstructions. Verify that there are no blockages upstream from the valve if flash gas is present.
4. Check refrigerant charge is at the proper level.
5. Lost bulb charge. Check by warming sensing bulb in hand or with warm damp cloth.
6. Check sensing bulb mounting. Secure using a metal strap where least affected by oil and insulate with foam tape.
7. TXV Superheat adjustment. Only make adjustment after all other possible causes have been eliminated. Make small adjustments in increments of every 10-15 minutes.

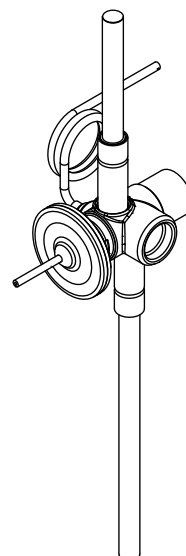



Figure 502 (TXV)

COMPONENTS TESTING

Low Ambient Bypass Valve

To determine if the valve operates, block the return air to the evaporator coil. Turn on the unit and touch the tube at the bypass valve outlet which connects to the suction process tube. When the low side pressure reaches approximately 88 psig, the valve will begin to open and the tube will get hot. This method will determine if the valve is responding to the suction pressure change.

⚠ 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.

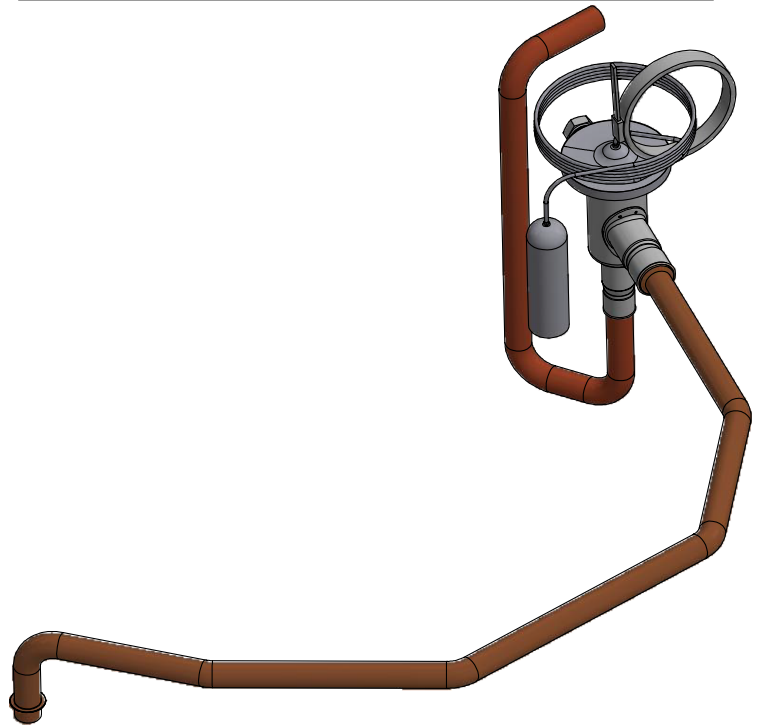




Figure 503 (Low Ambient Bypass Valve)

COMPONENT TESTING

Compressor Checks

⚠ WARNING	
	ELECTRIC SHOCK HAZARD
	Turn off electric power before service or installation.
	All electrical connections and wiring MUST be installed by a qualified electrician and conform to the National Electrical Code and all local codes which have jurisdiction. Failure to do so can result in personal injury or death.

⚠ WARNING	
	BURN HAZARD
	Proper safety procedures must be followed, and proper protective clothing must be worn when working with a torch.
	Failure to follow these procedures could result in moderate or serious injury.

Locked Rotor Voltage (L.R.V.) Test

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

Single Phase Connections

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

Determine L.R.V.

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

Amperage (L.R.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 an internal overload which is embedded into the motor winding. It 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. 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

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

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.

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."

GROUND TEST

Use an ohmmeter set on its highest scale. Touch one lead to the compressor body (clean point of contact/ copper 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.

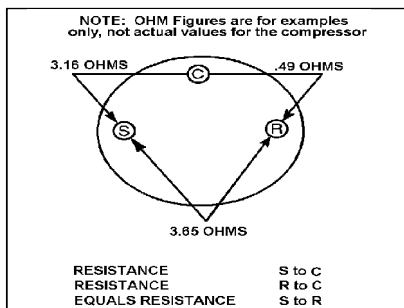


Figure 504 (Resistance Chart)

Complete evaluation of the system must be made whenever you suspect the compressor is defective. If the compressor has been operating for sometime, a careful examination must be made to determine why the compressor failed.

Many compressor failures are caused by the following conditions:

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

CHECKING COMPRESSOR EFFICIENCY

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

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



This condition can be checked as follows:



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



The compressor valves are faulty - replace the compressor.



COMPONENT TESTING

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.

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 through 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.

8. Pressurize with a combination of R-410A and nitrogen and leak test all connections with leak detector. Recover refrigerant and 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 insure no more leaks are present

9. Evacuate the system with a good vacuum pump capable of a final vacuum of 500 microns or less. The system should be evacuated through both liquid line and suction line gauge ports. 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.

10. 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.


COMPONENT TESTING

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.

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 a combination of R-410A and nitrogen and leak test all connections with an electronic or Halide leak detector. Recover refrigerant and 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

⚠ 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.


6. Evacuate the system with a good vacuum pump capable of a final vacuum of 500 microns or less. The system should be evacuated through both liquid line and suction line gauge ports. 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.

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.

ROTARY AND SCROLL COMPRESSOR SPECIAL TROUBLESHOOTING AND SERVICE

Troubleshooting and servicing rotary compressors is basically the same as on the reciprocating compressor with only one main exception:

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.


⚠ 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.

COMPONENTS TESTING

Fan Motor

A 230 volt single phase permanent split capacitor motor is used to drive the evaporator blower and condenser fan. A running capacitor is wired across the start and run terminals of the motor.

The motor is totally enclosed and is protected with a line voltage overload located internally of the motor. The motor shaft is stainless steel to resist corrosion. When the unit is turned on, the motor runs continuously.

⚠ 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.

Blower/Fan Motor

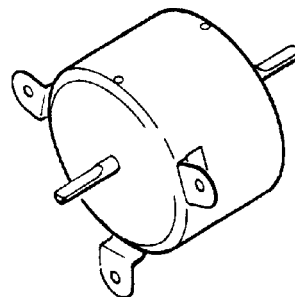


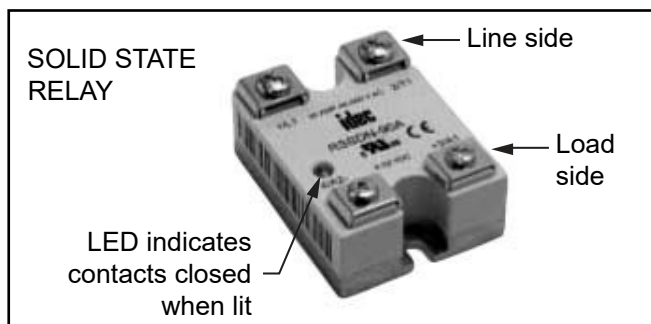
Figure 505 (Blower)

Blower / Fan Motor Test

1. Determine that the capacitor is serviceable.
2. Disconnect fan motor wires from fan speed switch or system switch.
3. Apply "live" test cord probes on black wire and common terminal of capacitor. Motor should run at high speed.
4. Apply "live" test cord probes on red wire and common terminal of capacitor. Motor should run at low speed.
5. Apply "live" test cord probes on each of the remaining wires from the speed switch or system switch to test intermediate speeds. If the control is in the "MoneySaver" mode and the thermostat calls for cooling, the fan will start - then stop after approximately 2 minutes; then the fan and compressor will start together approximately 2 minutes later.

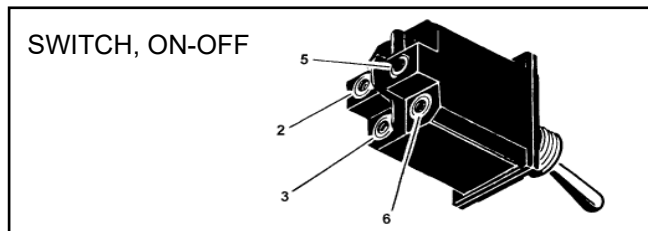
Solid State Relay

Two 50 amp rated 208/230 volt solid state relays are used to energize the compressor and fan motor. Terminals 3 and 4 are the 208/230 volt line side. Terminals 1 and 2 are load side contacts.




System Control Switch

This switch is double pole, single throw. Check for continuity between terminals 2 and 3, and 5 and 6.



COMPONENTS TESTING

Capacitor 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.

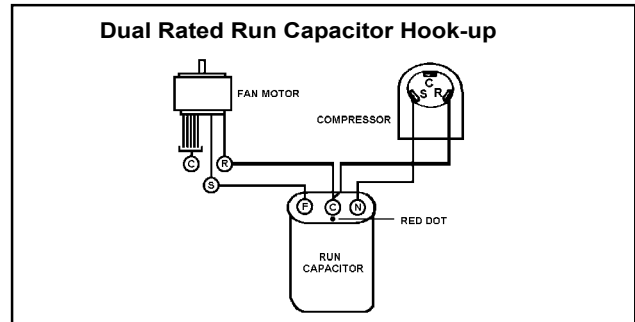


Figure 506 Dual Rated Capacitor Hook-Up

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 voltmeter 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.

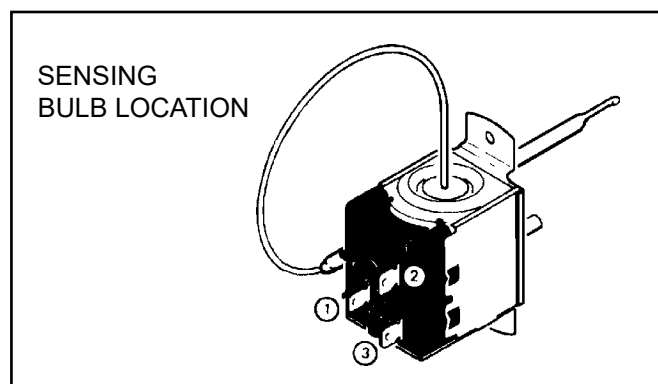
From the supply line on a typical 230 volt circuit, a 115 volt potential exists from the "R" terminal to ground through a possible short in the capacitor. However, from the "S" or start terminal, a much higher potential, possibly as high as 400 volts, exists because of the counter EMF generated in the 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.

Testing The Thermostat

Remove the wires from the thermostat. Turn the thermostat to its coldest position. Check to see if there is continuity between the two terminals. Turn the thermostat to its warmest position. Check continuity to see if the thermostat contacts open.

Note: The temperature must be within the range listed to check the thermostat. Refer to the troubleshooting section in this manual for additional information on thermostat testing.



RANGE: Thermostat
(Part No. 618-225-02)
60° F (± 2°) to 90° F (± 4°)

Figure 507 (Thermostat)

R-410A SEALED SYSTEM REPAIR

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.

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 Friedrich approved R-410A filter dryers only.

IMPORTANT

SEALED SYSTEM REPAIRS TO COOL-ONLY MODELS REQUIRE THE INSTALLATION OF A LIQUID LINE DRIER.

EQUIPMENT REQUIRED:



1. Voltmeter
2. Ammeter
3. Ohmmeter
4. E.P.A. Approved Refrigerant Recovery System
5. Vacuum Pump (capable of 200 microns or less vacuum.)
6. Acetylene Welder
7. Electronic Halogen Leak Detector capable of detecting HFC (Hydrofluorocarbon) refrigerants.
8. Accurate refrigerant charge measuring device such as:
 - a. Balance Scales - 1/2 oz. accuracy
 - b. Charging Board - 1/2 oz. accuracy
9. High Pressure Gauge - (0 to 750 lbs.)
10. Low Pressure Gauge - (-30 to 200 lbs.)
11. Vacuum Gauge - (0 - 1000 microns)
12. Facilities for flowing nitrogen through refrigeration tubing during all brazing processes.


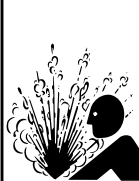
EQUIPMENT MUST BE CAPABLE OF:

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.

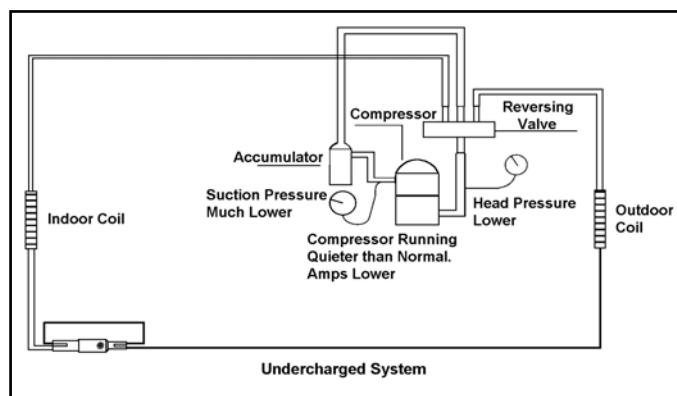
An overcharged unit will return liquid refrigerant (slugging) back to the suction side of the compressor eventually causing a mechanical failure within the compressor. This mechanical failure can manifest itself as valve failure, bearing failure, and/or other mechanical failure. The specific type of 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	
	<p>RISK OF ELECTRIC SHOCK</p> <p>Unplug and/or disconnect all electrical power to the unit before performing inspections, maintenances or service.</p> <p>Failure to do so could result in electric shock, serious injury or death.</p>

⚠ WARNING	
	<p>HIGH PRESSURE HAZARD</p> <p>Sealed Refrigeration System contains refrigerant and oil under high pressure.</p> <p>Proper safety procedures must be followed, and proper protective clothing must be worn when working with refrigerants.</p> <p>Failure to follow these procedures could result in serious injury or death.</p>



Undercharged Refrigerant Systems

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.

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.

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.

Figure 402 (Undercharged System)

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.


Overcharged Refrigerant Systems

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

NOTE: Factory sealed units 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.

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.

⚠ 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.	

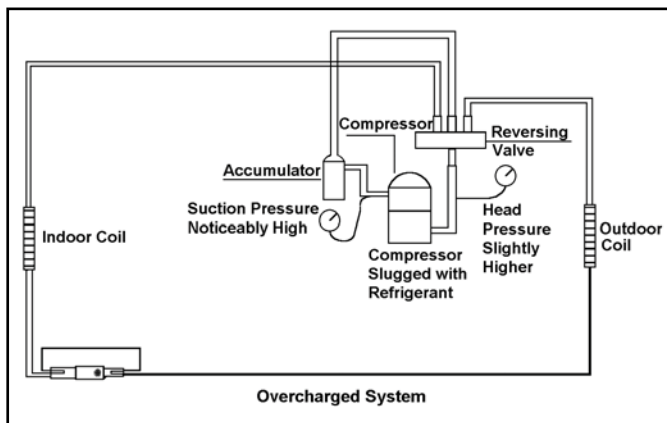


Figure 403 (Overcharged System)

R-410A SEALED SYSTEM REPAIRS

Restricted Refrigerant System

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."

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

Gauges connected to a completely restricted system will run in a deep vacuum. When the unit is shut off, the gauges will not equalize at all.

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.

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.

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

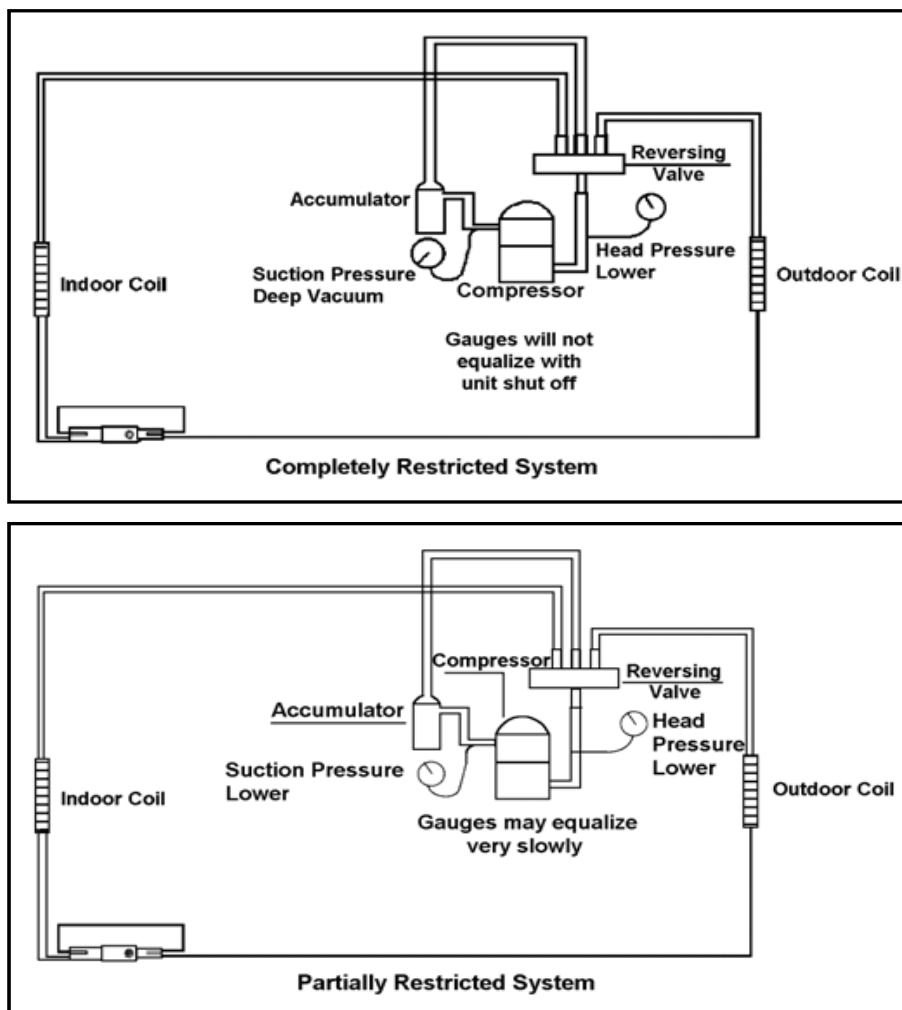






Figure 404 (Restricted System)

R-410A SEALED SYSTEM REPAIRS

Sealed System Method of Charging/ Repairs

 WARNING		 CAUTION	
	BURN HAZARD Proper safety procedures must be followed, and proper protective clothing must be worn when working with a torch.		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 moderate or serious injury.		Failure to follow these procedures could result in minor to moderate injury.

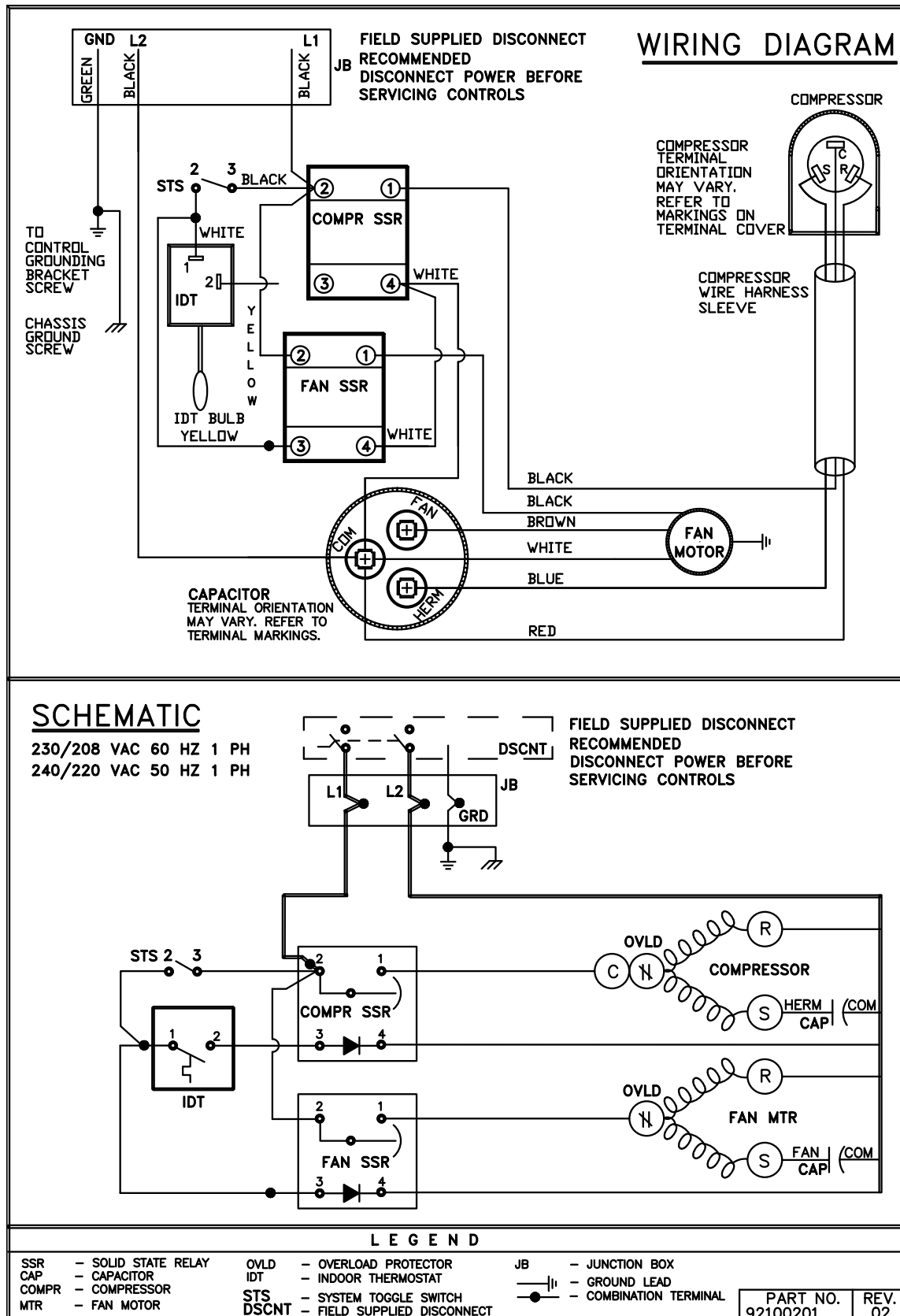
The acceptable method for charging the sealed system is the Weighed in Charge Method. The weighed in charge method is applicable to all units. It is the preferred method to use, as it is the most accurate.

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

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 system to 200 microns or less.
6. Weigh in refrigerant with the property quantity of R-410A refrigerant.
7. Start unit, and verify performance.
8. Crimp the process tube and solder the end shut.

WIRING DIAGRAMS SH15M30A-B, SH20M50B-A, SH24N20A-A

Figure 801



SH20N50AT-B, SH24N30AT-A

Figure 802
61914804

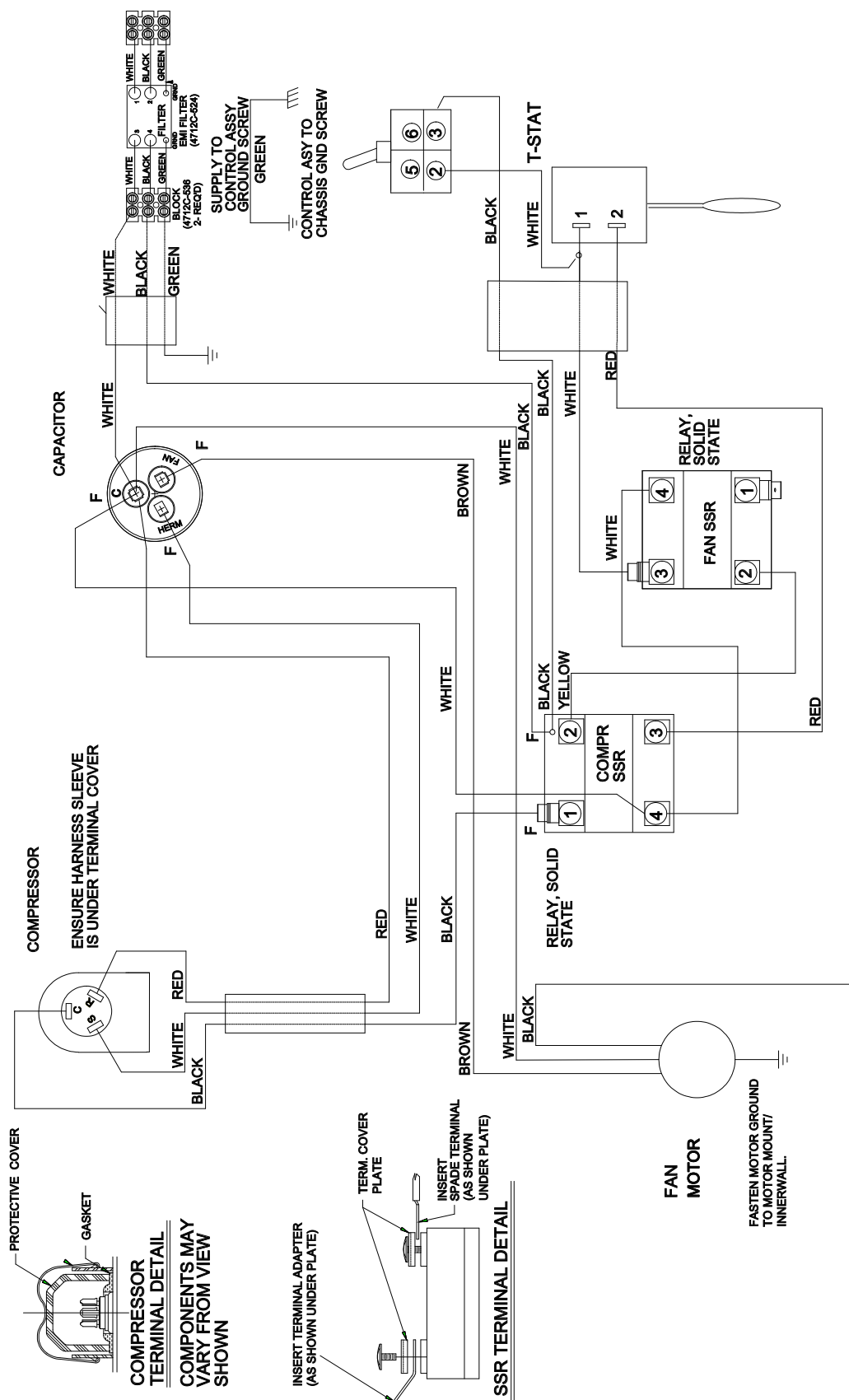



Figure 803
61914801

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SSR - SOLID STATE RELAY
CAP - CAPACITOR
COMPR - COMPRESSOR
MTR - FAN MOTOR

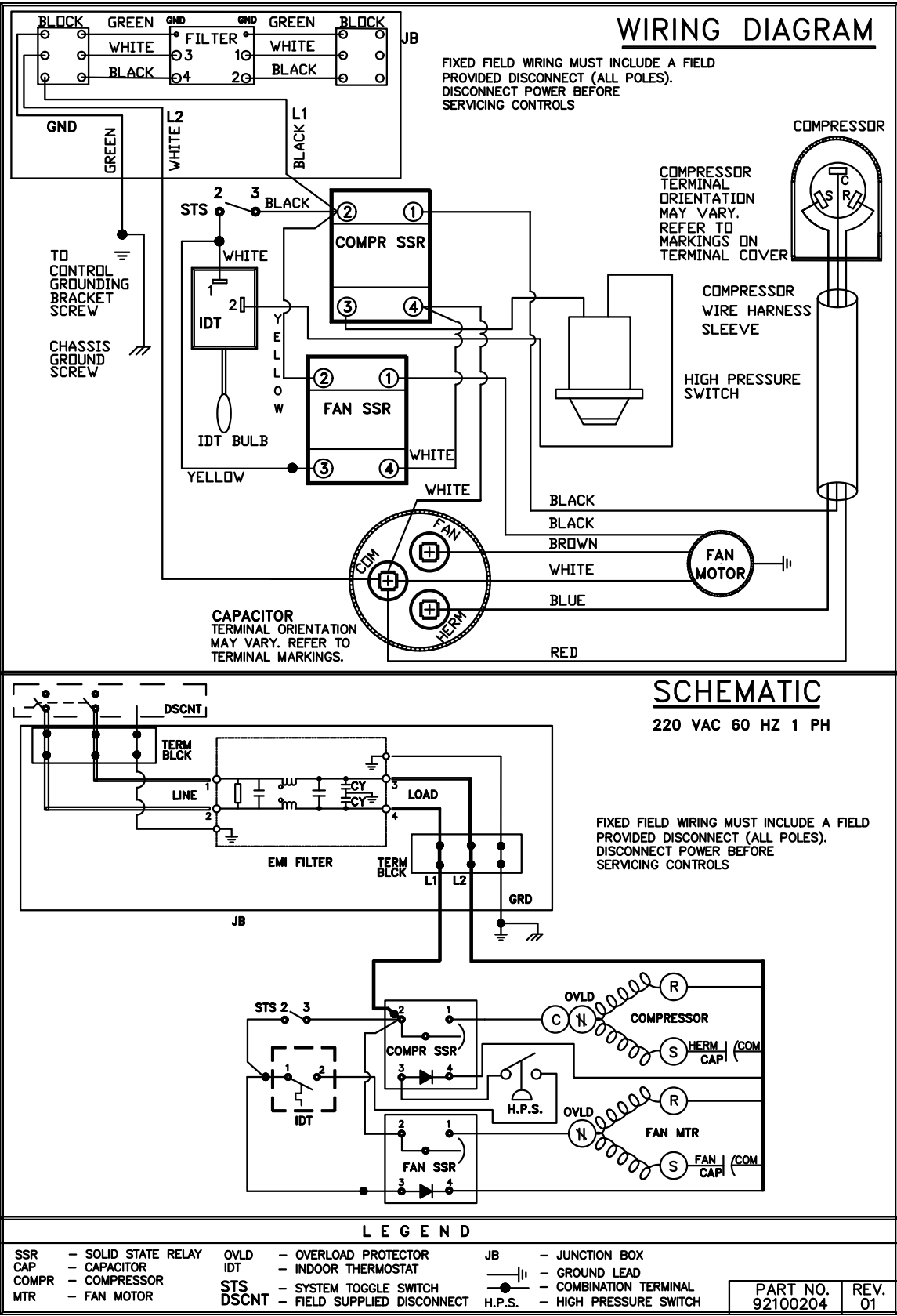
OVLD	- OVERLOAD PROTECTOR
IDT	- INDOOR THERMOSTAT
STS	- SYSTEM TOGGLE SWITCH
DSCNT	- FIELD SUPPLIED DISCON

JB - JUNCTION BOX
 - GROUND LEAD
 - COMBINATION TERMINAL
H.P.S. - HIGH PRESSURE SWITCH

PART NO. 92100202	REV. 01
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WIRING DIAGRAMS- SH20M30SA-B

Figure 804
61914803



INTERACTIVE PARTS VIEWER

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

Please click on the link below:

[Interactive Parts Viewer](#)

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



FRIEDRICH

Friedrich Air Conditioning Company

10001 Reunion Place, Suite 500

San Antonio, TX 78216

800.541.6645

www.friedrich.com

HAZARDGARD®
ROOM AIR CONDITIONERS
LIMITED WARRANTY
LIMITED ONE YEAR PARTS WARRANTY

1. Limited warranty – One year. Friedrich warrants that it will provide a replacement for any part of this HazardGard Room Air Conditioner found defective in material or workmanship for a period of one (1) year from the date of original purchase.

2. Limited warranty – One year. The Friedrich warranty also covers the cost of labor for repairing any compressor, condenser, evaporator or inter-connecting tubing found defective within the warranty period, providing the unit is returned to an authorized Friedrich Repair Station located within the Continental United States.

The Friedrich warranty does not cover:

(1) Any charges for removal, transportation or reinstallation of the unit; (2) the cost of labor to replace parts other than those described above; and (3) does not apply to any HazardGard Room Air Conditioner that has been subject to (a) accident, misuse, flood, fire, or neglect; (b) repairs or alterations outside of the Friedrich Authorized Dealer or Service Center so as to affect adversely its performance and reliability; or (c) any repairs or servicing as a result of using parts not sold or approved by Friedrich.

LIMITATIONS: This warranty is a LIMITED warranty. Anything in the warranty notwithstanding, IMPLIED WARRANTIES FOR PARTICULAR PURPOSE AND MERCHANTABILITY SHALL BE LIMITED TO THE DURATION OF THE EXPRESS WARRANTY. MANUFACTURER EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES FOR BREACH OF ANY EXPRESSED OR IMPLIED WARRANTY.

Performance of Friedrich's Warranty obligation is limited to one of the following methods:

1. Repair of the unit
2. A refund to the customer for the prorated value of the unit based upon the remaining warranty period of the unit.
3. Providing a replacement unit of equal value.

The method of fulfillment of the warranty obligation is at the sole discretion of Friedrich Air Conditioning.

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.

FRIEDRICH AUTHORIZED PARTS DEPOTS

AAA Refrigeration Service

1322 24th Street, Suite B Kenner,
Louisiana 70062

504-464-7444
877-813-7444

United Products Distributors Inc.

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

**Shivani Refrigeration & 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](https://www.totalhomesupply.com/brands/Friedrich.html)



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TECHNICAL SUPPORT CONTACT INFORMATION

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