EMERSON
Application Engineering
COPELAND
BULLETIN

AE4-1305 R24 **February 2023**

Application Guidelines for Copeland™ AF, AR & AS Refrigeration Hermetic Compressors For Refrigerants R-22, R-134A, R-404A, R-507, R-290, R-450A, R-513A, R-448A, R-449A

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(February 2023)

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Updated and Revised Safety Information Sheet

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(September 2019)

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Revision Tracking R22
(September 2018)

Pg. 6 – POE oil warning label updated.
Pg. 16 – Table 1: “Approved Refrigerants/Lubricants” updated.
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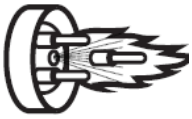
IMPORTANT SAFETY INFORMATION

Those involved in the design, manufacture, and installation of a system, system purchasers, and service personnel may need to be aware of hazards and precautions discussed in this section and throughout this document. OEMs integrating the compressor into a system should ensure that their own employees follow this bulletin and provide any necessary safety information to those involved in manufacturing, installing, purchasing, and servicing the system.

Responsibilities, Qualifications and Training

- OEMs are responsible for system design, selection of appropriate components, integration of this component into the system, and testing the system. OEMs must ensure that staff involved in these activities are competent and qualified.
- OEMs are also responsible for ensuring that all product, service, and cautionary labels remain visible or are appropriately added in a conspicuous location on the system to ensure they are clear to any personnel involved in the installation, commissioning, troubleshooting or maintenance of this equipment.
- Only qualified and authorized HVAC or refrigeration personnel are permitted to install, commission, troubleshoot and maintain this equipment. Electrical connections must be made by qualified electrical personnel.
- Observe all applicable standards and codes for installing, servicing, and maintaining electrical and refrigeration equipment.

Terminal Venting and Other Pressurized System Hazards



If a compressor's electrical terminal pin loses its seal, pressurized oil, refrigerant, and debris may spray out. This is called "terminal venting".

The ejected debris, oil, and refrigerant can injure people or damage property. The oil and refrigerant spray can be ignited by electrical arcing at the terminal or any nearby ignition source, producing flames that may project a significant distance from the compressor. The distance depends on the pressure and the amount of refrigerant and oil mixture in the system. The flames can cause serious or fatal burns and ignite nearby materials.

Each compressor has a terminal cover or molded plug that covers electrical connections. The cover or plug helps to protect against electric shock and the risks of terminal venting. If terminal venting occurs, the cover or plug helps contain the spray of refrigerant and oil and reduces the risk of ignition. If ignition occurs, the plug or cover helps contain the flames. However, neither the terminal cover nor the molded plug can completely eliminate the risk of venting, ignition, or electric shock.

See www.*Climate.Emerson.com/terminal* for more details about terminal venting.

Additionally, a compressor's refrigerant lines keep refrigerant and oil under pressure. When removing or recharging refrigerant from this component during service, this can pose a pressurized fluid hazard.

Flammable Refrigerant Hazards

If flammable refrigerant is released from a system, an explosive concentration can be present in the air near the system. If there is an ignition source nearby, a release of flammable refrigerant can result in a fire or explosion. While systems using flammable refrigerant are designed to mitigate the risk of ignition if the refrigerant is released, fire and explosion can still occur.

See *Climate.Emerson.com/flammable* for more information on flammable refrigerant safety.

Electrical Hazards

Until a system is de-energized, and capacitors have been discharged, the system presents a risk of electric shock.

Hot Surface and Fire Hazards

While the system is energized, and for some time after it is deenergized, the compressor may be hot. Touching the compressor before it has cooled can result in severe burns. When brazing system components during service, the flames can cause severe burns and ignite nearby combustible materials.

Lifting Hazards

Certain system components may be very heavy. Improperly lifting system components or the compressor can result in serious personal injury. Use proper lifting techniques when moving.

POE Oil Hazards

This equipment contains polyolester (POE) oils. Certain polymers (e.g., PVC/CPVC and polycarbonate) can be harmed if they come into contact with POE oils. If POE oil contacts bare skin, it may cause an allergic skin reaction.

Precautions

- Always wear personal protective equipment (gloves, eye protection, etc.).
- Keep a fire extinguisher at the jobsite at all times.
- Keep clear of the compressor when power is applied.
  - IMMEDIATELY GET AWAY if you hear unusual sounds in the compressor. They can indicate that terminal pin ejection may be imminent. This may sound like electrical arcing (sizzling, sputtering or popping). However, terminal venting may still occur even if you do not hear any unusual sounds.
- Never reset a breaker or replace a blown fuse without performing appropriate electrical testing
  - A tripped breaker or blown fuse may indicate an electrical fault in the compressor. Energizing a compressor with an electrical fault can cause terminal venting. Perform checks to rule out an electrical fault.
- Disconnect power and use lock-out/tag-out procedures before servicing.
  - Before removing the terminal cover or molded plug, check that ALL electrical power is disconnected from the unit. Make sure that all power legs are open. (*Note: The system may have more than one power supply*.)
  - Discharge capacitors for a minimum of two minutes

- Always use control of hazardous energy (lock-out/tag-out) procedures to ensure that power is not reconnected while the unit is being serviced.

- Allow time for the compressor to cool before servicing.
  - Ensure that materials and wiring do not touch high temperature areas of the compressor.
- Keep all non-essential personnel away from the compressor during service.
- Remove refrigerant from both the high and low side of the compressor. Use a recovery machine and cylinder designed for flammable refrigerants. Do not use standard recovery machines because they contain sources of ignition such as switches, high and low pressure controls, and relays. Only vent the refrigerant into the atmosphere if the system is in a well-ventilated area.
- Never us a torch to remove the compressor. Only tubing cutters should be used.
- Use an appropriate lifting device to install or remove the compressor.
- Never install a system and leave it unattended when it has no charge, a holding charge, or with the service valves closed without electrically locking out the system.
- Always wear appropriate safety glasses and gloves when brazing or unbrazing system components.
- Charge the system with only approved refrigerants and refrigeration oils.
- Keep POE oils away from certain polymers (e.g., PVC/CPVC and polycarbonate) and any other surface or material that might be harmed by POE oils. Proper protective equipment (gloves, eye protection, etc.) must be used when handling POE lubricant. Handle POE oil with care. Refer to the Safety Data Sheet (SDS) for further details.
- Before energizing the system:
  1. Securely fasten the protective terminal cover or molded plug to the compressor, and
  2. Check that the compressor is properly grounded per the applicable system and compressor requirements.

Signal Word Definitions

The signal word explained below are used throughout the document to indicate safety messages.

DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury

1. Introduction

Hermetic compressors have been developed for the 1/8 hp to 1 hp refrigeration applications. These compressors are designed to operate safely and reliably in the high, medium and extended medium temperature ranges. In addition, some of the extended medium temperature compressors have the ability to operate in the low temperature range with SPECIAL APPLICATION ENGINEERING APPROVAL. It must be noted however, that under low evaporating conditions the operating envelope for these models is restricted.

2. Nomenclature

The HFC/HFO compressor model numbers include the nominal capacity at the standard ARI 60Hz rating conditions. The HCFC models still refer to the nominal horsepower, (hp). Please refer to product literature for specific model number details. See **Figure 1 (**page 11).

3. Operating Envelope

There are several refrigerants that have been approved for use with the A family of compressors, see **Table 1** page 17. These models are intended for refrigeration type duty. The approved operating envelopes are depicted in Error! Reference source not found.**8** through **Figure 168**. Published performance tables and coefficients will only contain data to 90ºF condensing temperature. However, the compressors are approved to operate to 70°F condensing.

The envelopes are defined by the following compressor limitations:

- Discharge line temperature 225°F
- Discharge valve backer 275°F
- Oil sump 200°F
- Motor windings 275°F

If the system design is such that operation within these guidelines cannot be guaranteed, then the following additional controls must be added:

1. Discharge line thermostat – Located 6" from the compressor and set to cut-out the compressor at 225°F maximum.
2. Low pressure control – Refer to **Table 2** for recommended low pressure cut-out settings based on the various refrigerants.

Note: For additional data on the proper use of R-290, please reference Application Bulletin **AE4-1380**.

DANGER

R-290 is flammable and should be handled by qualified personnel in accordance with appropriate care for safe use. Emerson Climate Technologies highly recommends that service personnel use spark proof tools, anti-static gloves for hand and anti-static clothes. Avoid the build-up of electrostatic charge, work in a well-ventilated area. Fire and smoking is forbidden!

There are only a limited number of R-290 compressors available at this time; the compressor's nomenclature will be designated with a "U" in the eighth character for R-290 application. Example: ASE18C4U-IAA

Compressors designed for the use of R-290 will not be charged with a positive dry air charge but will have a slight vacuum from the factory.

4. Superheat Requirements

In order to assure that liquid refrigerant does not return to the compressor during the running cycle, attention must be given to maintaining proper superheat at the compressor suction inlet. Emerson recommends a minimum of 20°F (11°C) superheat, measured on the suction line 6 inches (152mm) from the suction valve, to prevent liquid refrigerant flood back.

Another method to determine if liquid refrigerant is returning to the compressor is to accurately measure the temperature difference between the compressor oil crankcase and the suction line. During continuous operation we recommend that this difference be a minimum of 50°F (27°C). This ‘crankcase differential temperature’ requirement supersedes the minimum suction superheat requirement in the last paragraph. To measure oil temperature through the compressor shell, place a thermocouple on the bottom center (not the side) of the compressor shell and insulate from the ambient.

During rapid system changes, such as defrost or ice harvest cycles, this temperature difference may drop rapidly for a short period of time. When the crankcase temperature difference falls below the recommended 50°F (27°C), our recommendation is the duration should not exceed a maximum (continuous) time period of two

minutes and should not go lower than a 25°F (14°C) difference.

Contact your Emerson representative regarding any exceptions to the above requirements.

5. Suction Accumulator

The addition of a suction accumulator can be an effective method to prevent damage to the compressor due to continuous flood back. Through extensive testing, Emerson recommends the use of suction accumulators if the system refrigerant charge exceeds the following limits as shown in **Table 3.**

6. Discharge Line Check Valve

On pre-charged units that use AF, AR, or AS compressors with charge levels greater than the charge limits listed for each model on **Table 3**, a check valve is required in the discharge line close to the compressor. This will reduce the potential for liquid refrigerant migrating to the compressor during transport and storage. The addition of a crankcase heater on pre-charged units will also assist in forcing any refrigerant that might have migrated to the compressor sump during an extended off or storage time. It is recommended that the crankcase heater be energized a minimum of 4 hours before initial startup.

7. Crankcase Heaters

Crankcase heaters are recommended on all outdoor applications or indoor applications below 40°F. A crankcase heater is also required on any system with an accumulator. Reference **AE22-1182** for liquid refrigerant control in refrigeration and air conditioning systems.

8. Lubricants

Compressors that are approved for use with HFC/HFO refrigerants are charged with polyol ester lubricant (POE). HFC/HFO refrigerants require the use of a POE lubricant to provide proper miscibility and lubricity. The model nomenclature denotes if the compressor is charged with a POE lubricant. If the eighth character in the model nomenclature is the letter 'E' then the compressor is charged with a POE lubricant, example AFE13C4E-IAA.

R-22 models are supplied with alkylbenzene oil. The Alkylbenzene models will not have the 'E' designation for oil in the nomenclature. example: AFE13C-IAA

⚠ WARNING

POE may cause an allergic skin reaction and must be handled carefully and the proper protective equipment (gloves, eye protection, etc.) must be used when handling POE lubricant. POE must not come into contact with any surface or material that might be harmed by POE, including without limitation, certain polymers (e.g. PVC/ CPVC and polycarbonate). Refer to the Safety Data Sheet (SDS) for further details.

In the event lubricant needs to be added to the system, the proper approved lubricant must be used. See **Table 1** or reference **Form 93-11**, *Refrigerants/Lubricants Approved for Use in Copeland™ Compressors,* for a complete list of approved lubricants. The compressor recharge is 2 oz. less than the oil charge listed on the nameplate.

9. Practical Considerations

The application restrictions imposed on these models may require careful system design. Some considerations for the designer are as follow:

1. Units operating at low evaporator temperatures will be susceptible to overheating with dirty condensers and/or restricted air flow. Large condensers (with low TD's) should be designed into systems using these compressors and proper condenser coil maintenance will be more critical. System Air flow across the compressor and condenser should be designed to maintain a Discharge line temperature (Measured 6 inches from the compressor) below 225°F while functioning within the approve operating envelope of each compressor. Minimum suction line pressure drops will be important to maintain SST limits at the compressor.
2. Traditional superheat settings at the TXVs may be too high to maintain the return gas temperature limits specified.
3. Suction lines should be well insulated.
4. Suction to liquid heat exchangers may not be desirable if return gas temperatures specified are to be maintained.

5. Minimum suction line pressure drops will be important to maintain saturated suction temperature limits at the compressor.

6. AF model compressors are not approved for remote outdoor applications using R-448A and R-449A. The AF model compressor may be used for low temperature indoor, and indoor remote applications using R-448A and R-449A if the required compressor superheat settings can be met. To assist in keeping the compressor cool the following recommendation should be followed:

- A 220°F discharge line temperature cut out is required to be applied 6" from the compressor on the discharge line when applying R-448A and R-449A refrigerants. **Table 5**. Highly insulated suction lines from the evaporator to the compressor may be required to reduce superheat gains.
- Liquid line to suction line heat exchangers are not recommended.

10. Use of R-450A and R-513A Refrigerants

WARNING

Note: Refrigerant migration of R-450A and R-513A into the compressor crankcase could cause low oil viscosity, which could lead to compressor damages.

When using R-450A and R-513A it is critical to meet the following requirements:

- Maintain adequate superheat settings with a minimum superheat of 20°F at the compressor.
- No liquid refrigerant migration into the compressor at any time, especially during standstill or during or after defrost.
- Pump down recommended.
- The use of a crankcase heater is recommended.
- Retrofit to R450A and R513A is only allowed for compressors which are approved for these refrigerants.

11. Use of R290 / General Information

R-290 (Propane) refrigerant can be used as a Hydrocarbon refrigerant alternative for traditional HCFC/HFC low or medium temperature applications. **R-290 CANNOT be used as a retrofit refrigerant, it is only to be used in new systems specifically designed for R-290.**

Before supplying compressors for use with R-290, it is first necessary to perform an evaluation of the risks involved with the use of this refrigerant. The customer should perform a risk assessment to ensure proper knowledge about the handling and use of the R-290 in the refrigerant system (for further information please contact the Emerson Climate Technologies Application Engineering Department). It is recommended that manufacturers of refrigeration systems using flammable refrigerants such as R-290, develop accurate charging, leak testing and system testing methods to guarantee that all necessary safety procedures have been met.

Safety standards have been developed for the use of hydrocarbons, including leakage simulation tests and specifications for several electrical components which may encounter leaking refrigerants. The following set of UL and international standards, from the International Electrotechnical Commission, on electrical safety contains rules for the design and testing of appliances operating with flammable refrigerants:

12. Starting Characteristics

The ASM R290 compressor models are all Low Starting Torque by design. Meaning the suction and discharge pressures need to be balanced or within 1 bar (14.5 PSIG) of each other at compressor start up. This can be achieved by either applying a cap tube or a balanced port TXV that can bleed off the pressure prior to start up.

- **UL-471**
- **IEC 60335-2-24**: Household refrigerators and freezers
- **IEC 60335-2-34**: Motor compressors
- **IEC 60335-2-89**: Commercial refrigerators and freezers
- **IEC 60335-2-40**: Heat pumps, air conditioners and dehumidifiers

The US Significant New Alternatives Policy (SNAP) The SNAP ruling for hydrocarbon is divided into two components:

Refrigerators and freezers: the charge limitations are 57g (2.0 ounces) in any refrigerator, freezer, or combination refrigerator and freezer.

Retail food refrigerator and freezers: the charge limitation for propane R-290 is 150g (5.29 ounces). (For more information, visit http://www.epa.gov/ozone/snap)

13. Application Instructions

Contact System OEM for specific application instructions.

For general compressor guidelines, please reference AE4-1380 (Guide for the Use of R-290 Refrigerant in Copeland™ Refrigeration Compressors) and AE4-1344 (*Application Guidelines for RFT, RRT, RST Compressors*).

Contact Application Engineering for any further information.

14. Deep Vacuum Operation

WARNING ***Never attempt to start a compressor while it is in a vacuum; always break the vacuum with a refrigerant charge before applying power. Operating a compressor in a deep vacuum could cause electrical arcing inside the compressor.***

A low pressure control is required for protection against deep vacuum operation. Refrigerant compressors are not designed for and should not be used to evacuate a refrigeration or air conditioning system. See AE24-1105 for proper system evacuation procedures.

15. High Potential (Hipot) Testing

Many of the Copeland brand compressors are configured with the motor below the compressor. As a result when liquid refrigerant is within the compressor shell the motor can be immersed in liquid refrigerant to a greater extent than with compressors with the motor mounted above the compressor. When Copeland brand compressors are Hipot tested and liquid refrigerant is in the shell, they can show higher levels of leakage current than compressors with the motor on top because of the higher electrical conductivity of liquid refrigerant than refrigerant vapor and oil. This phenomenon can occur with any compressor when the motor is immersed in refrigerant. The level of current leakage does not present any safety issue. To lower the current leakage reading the system should be operated for a brief period of time to redistribute the refrigerant to a more normal configuration and the system Hipot tested again. See bulletin AE4-1294 for Megaohm testing recommendations. Under no circumstances should the Hipot or Megaohm test be performed while the compressor is under a vacuum.

WARNING

High Potential (Hipot) Testing/Megaohm Testing with R-290

Special attention should be taken when using a Hipot/ Megaohm reading on an R-290 compressor. These tests can induce an electrical arc and cause a potential fire/explosion hazard. Compressors removed from an R-290 system will need to have the oil drained and a nitrogen purge introduced to flush any remaining R-290 from the compressor prior to Hipot /Megaohm testing.

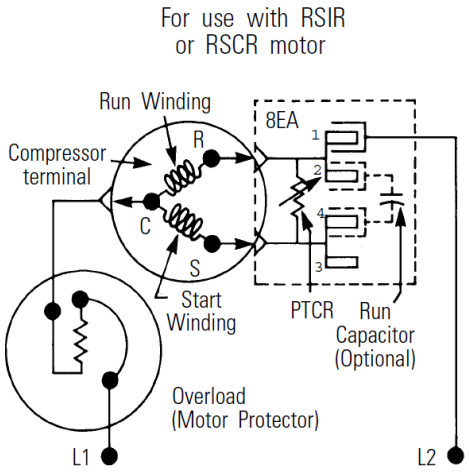
16. Electrical Connections

WARNING

Only use Emerson Climate Technologies listed start components for R-290 compressor applications, as only these components have been tested to and meet the safety guidelines set forth by UL.

17. Positive Temperature Coefficient (PTC) Starter

The Positive Temperature Coefficient (PTC) Starter is a low-cost alternative to electro-mechanical relays. The PTC device mounts directly to the compressor terminal pins and is fully enclosed within the compressors terminal box. The motor protector plugs into the common terminal and the PTC device plugs into the remaining 2 pins.



17.1. PTC Performance

When power is first applied to the compressor the PTC is in a low resistances state. Current flows through the

PTC device to the start winding, causing a beneficial phase angle shift between the start and main windings, and resulting in an increase in the starting torque.

Emerson recommends a 5-7-minute off time between starts to allow for proper cooling of the PTC device and reliable compressor starting characteristics.

17.2. Application Notes

1) The surface and the terminals of the PTC device can reach high temperatures during normal running conditions. Any material in contact with the PTC device and its terminals, including wire and connectors should have a minimum temperature rating of 105°C (221°F). Adequate spacing should be provided to insulate lower rated materials from this heat source.

2) The PTC device should be protected from potential sources of liquid, such as evaporator trays and water connections.

3) Certain materials such as chlorine (Cl) containing gasses, can degrade the characteristics of the PTC device. The PTC device should not be exposed to Sulphur (S) or Chlorine (Cl) containing gases, and must be kept away from materials that can generate them. In particular, avoid the use of polyvinyl chlorine (PVC) insulation in contact with the PTC device and its terminals.

4) The PTC device is designed to be used in conjunction with a terminal box cover.

17.3. PTCR Dimensional Drawing

Single phase motor connections are shown in **Error! Reference source not found.** through **Error! Reference source not found.**.

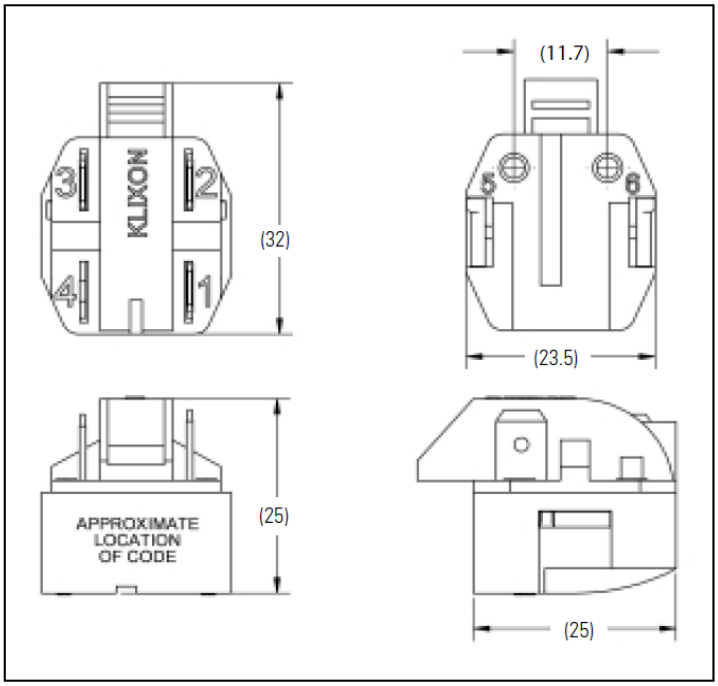
It is recommended that insulated terminal connectors be used within the compressor's terminal box whenever possible. Ensure that the terminal connections do not interfere with the closing of the terminal box cover.

Terminal covers must be installed properly prior to energizing the compressor.

18. Mounting

The AF, AR and AS compressors are internally spring mounted to reduce vibrations. Resilient type mounts have been developed specifically for these compressors. See **Table 4**. Typical mounting assemblies are shown in **Figure 6** and **Figure 7 .**

Dimensional Drawings (mm)



A Family Nomenclature

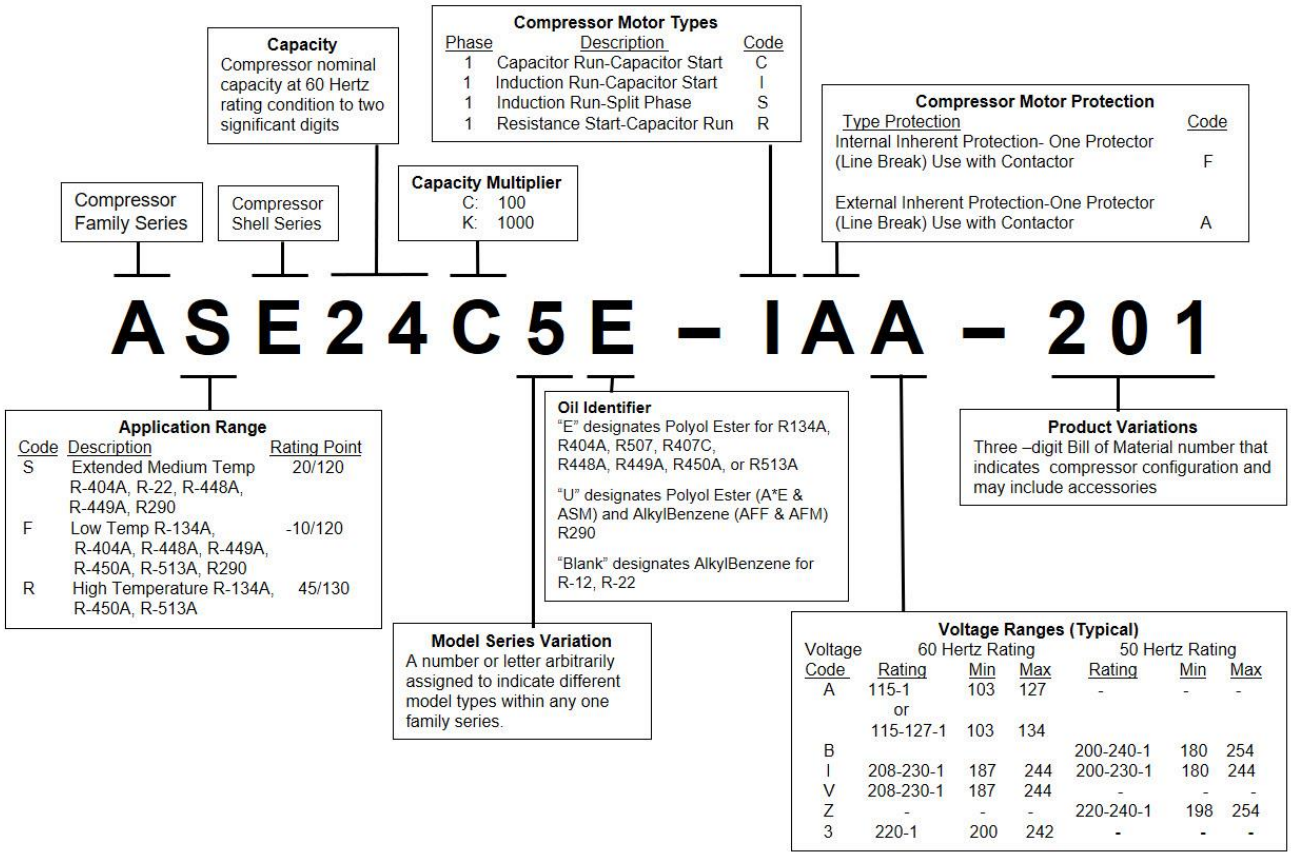


Figure 1 - A*E Nomenclature

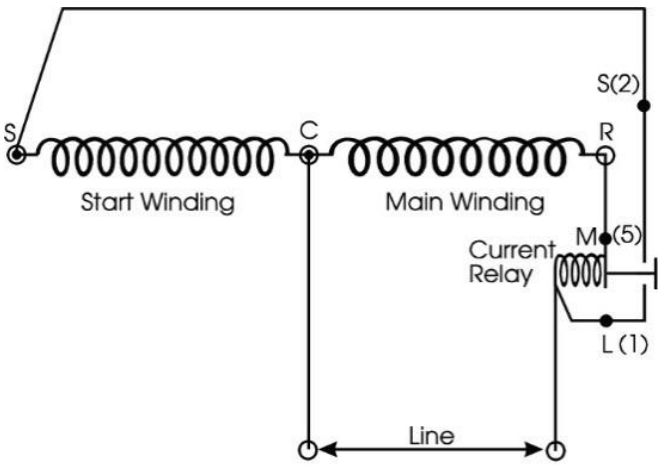


Figure 2 – Split Phase Motor

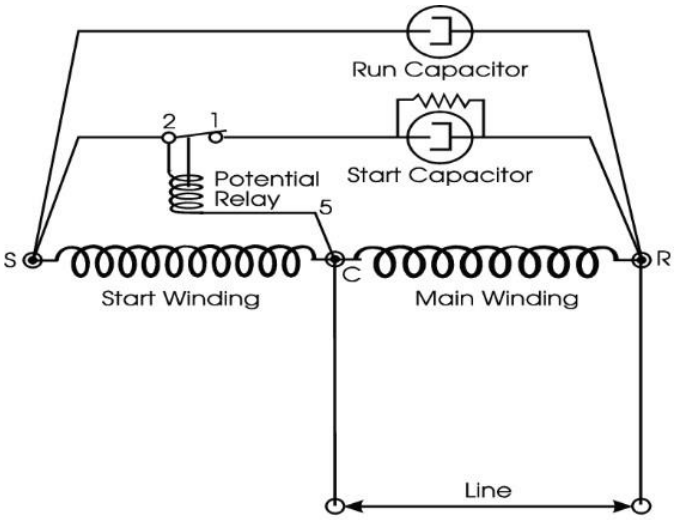


Figure 3 - Capacitor Start - Capacitor Run Motor (CSCR)

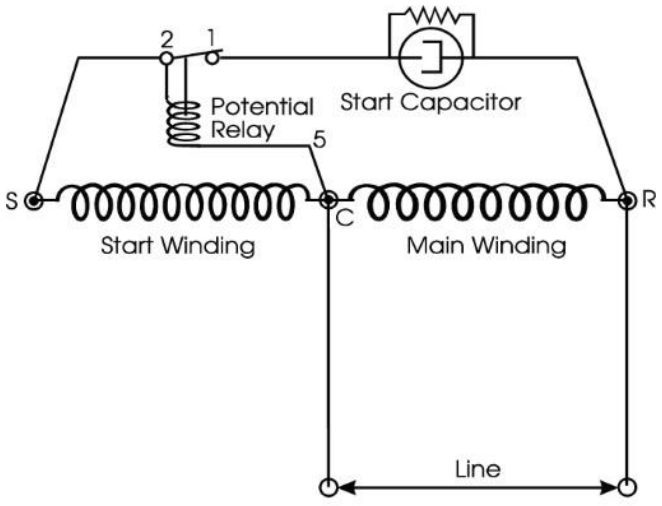


Figure 4 - Capacitor Start - Induction Run Motor (CSIR)

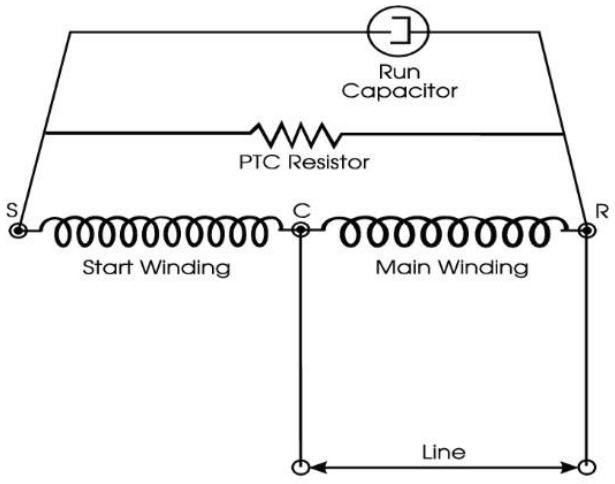


Figure 5 - Permanent Split Capacitor Motor (PSC) with PTC Start Assist

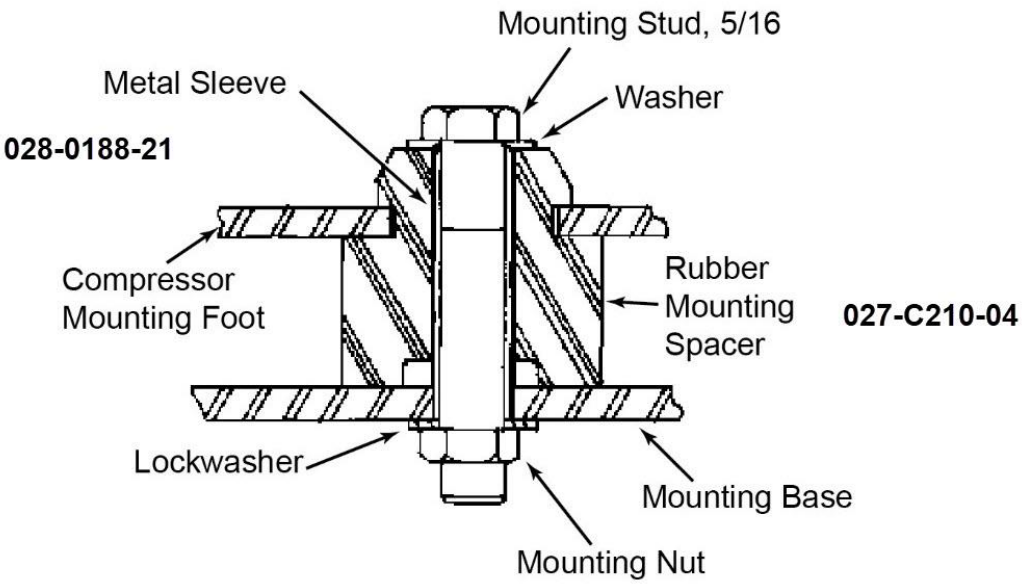


Figure 6 - Mounting Kit 527-C001-00
Durometer:47-56 HS.

Note: Refer to **Table 3** for recommended kits.

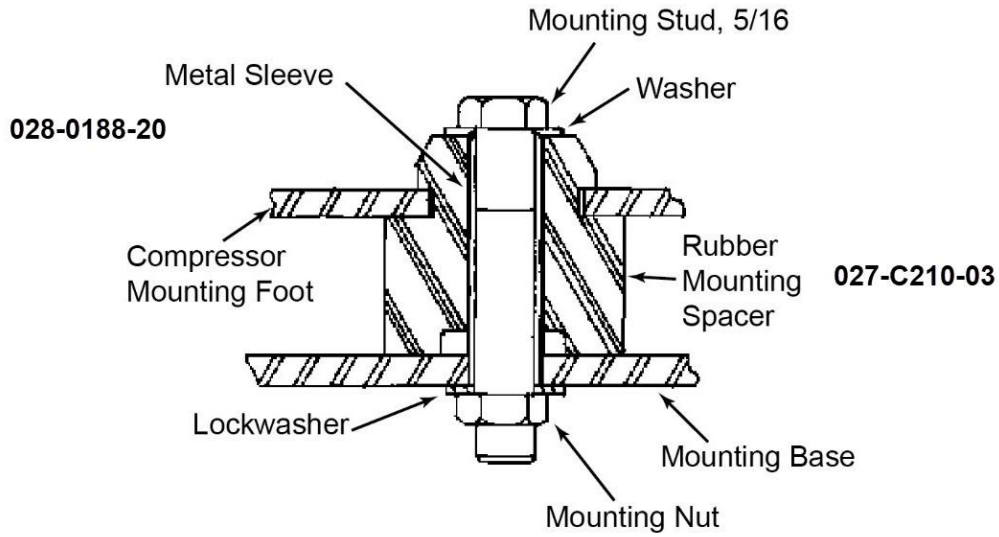


Figure 7 - Mounting Kit 527-C001-02
Durometer: 35-45 HS.

Note: Refer to **Table 3** for recommended kits.

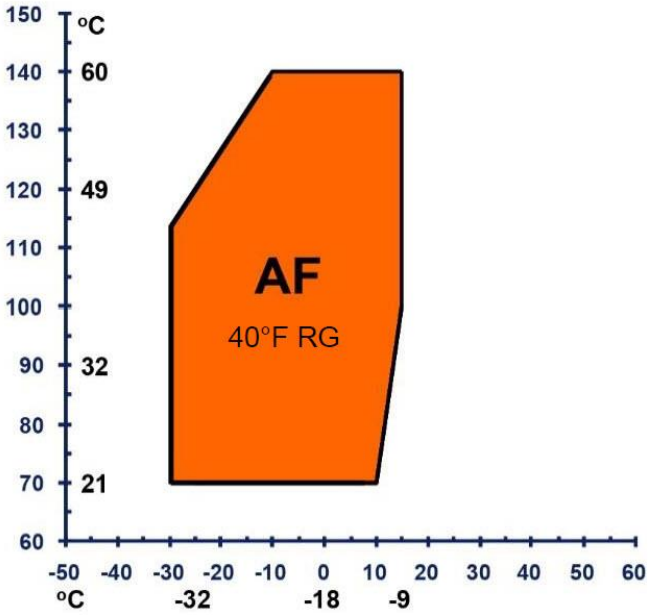


Figure 8 R-404A / R-507 / R-290* EXT. MED TEMP.

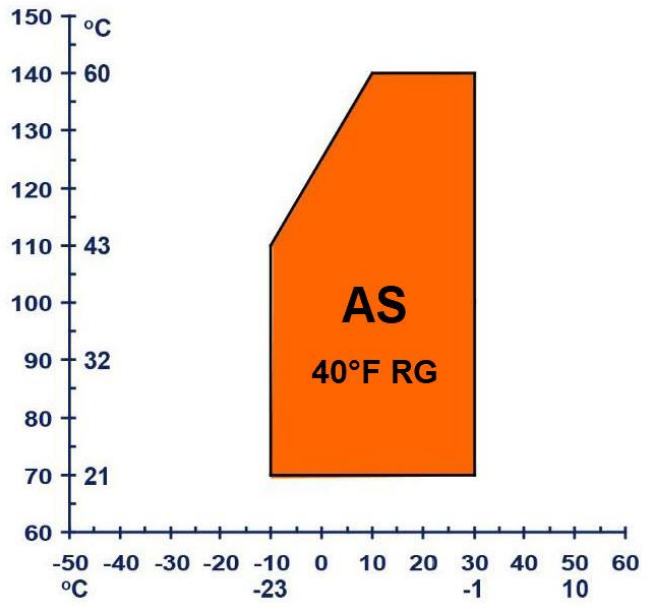


Figure 9 - R-404A / R-449A / R-448A / R-507 / R-290* - MED TEMP.

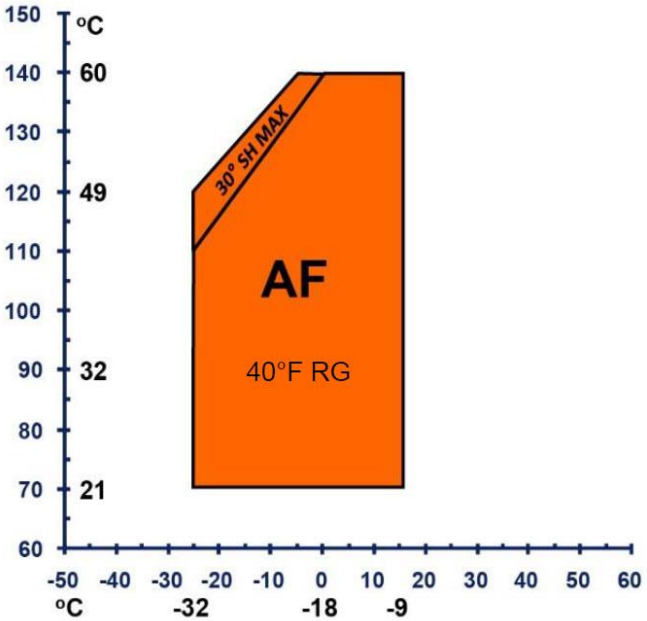


Figure 10 - R-448A / R-449A – LOW TEMP

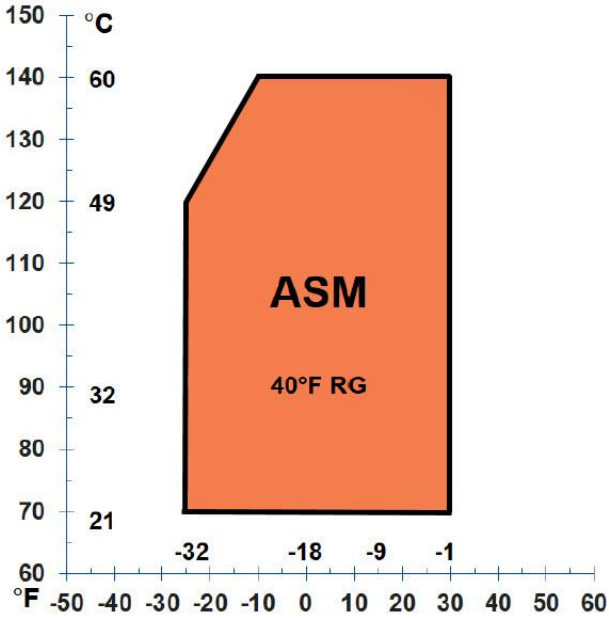


Figure 11 - R-290 Extended Medium Temp

Note: See additional restrictions under *Practical Considerations*, item #6, on page 8 of this document.

CAUTION

Standard refrigeration compressors cannot be used in R-290 applications under any circumstances!

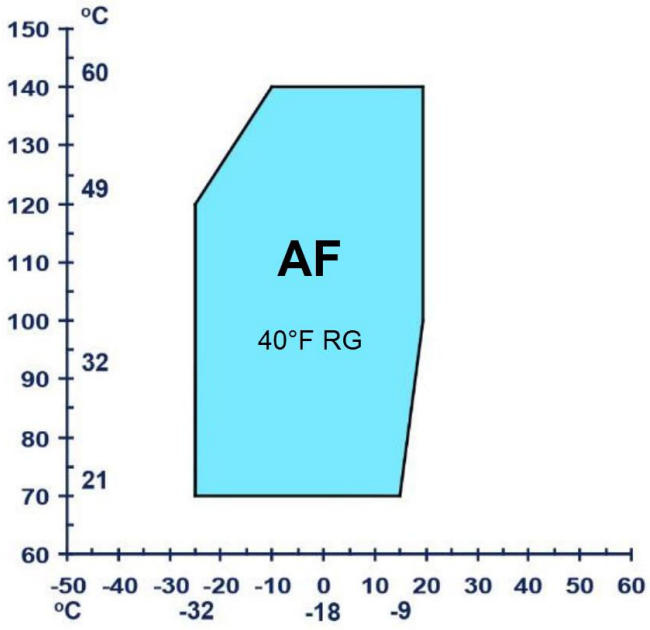


Figure 12 - R-134a / R-450A / R-513A – EXT. MED TEMP

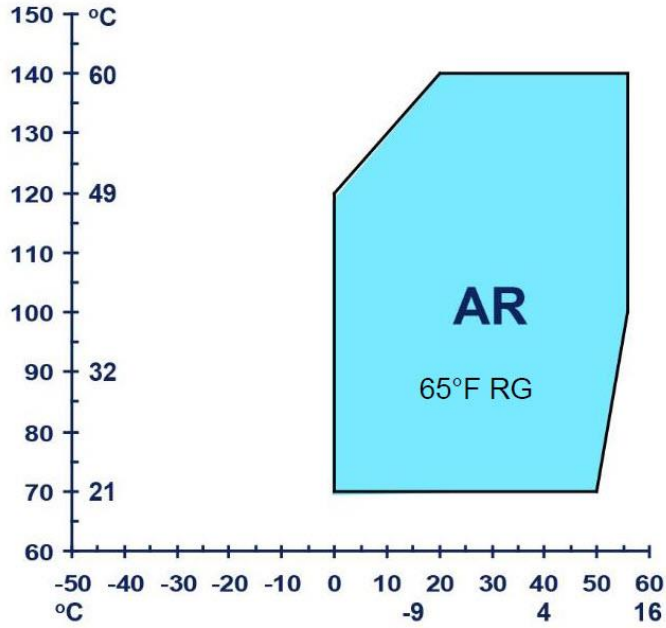


Figure 13 - R-134a / R-450A / R-513A – HIGH TEMP

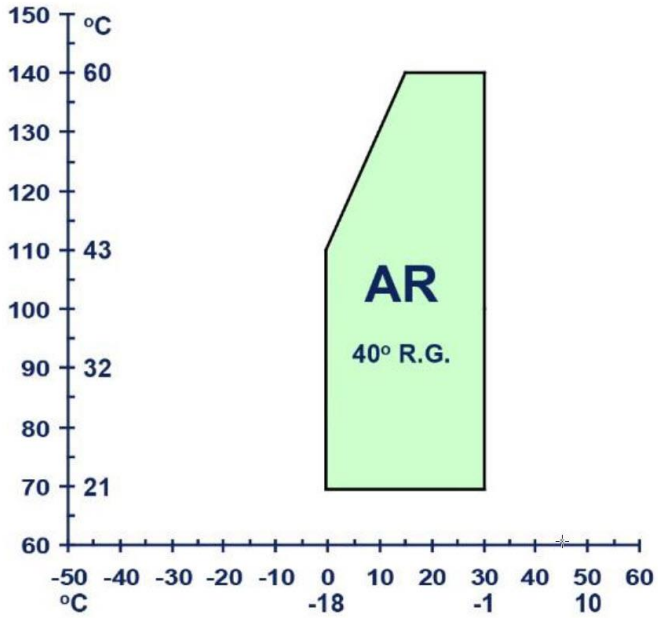


Figure 14 - R-22 – MED TEMP

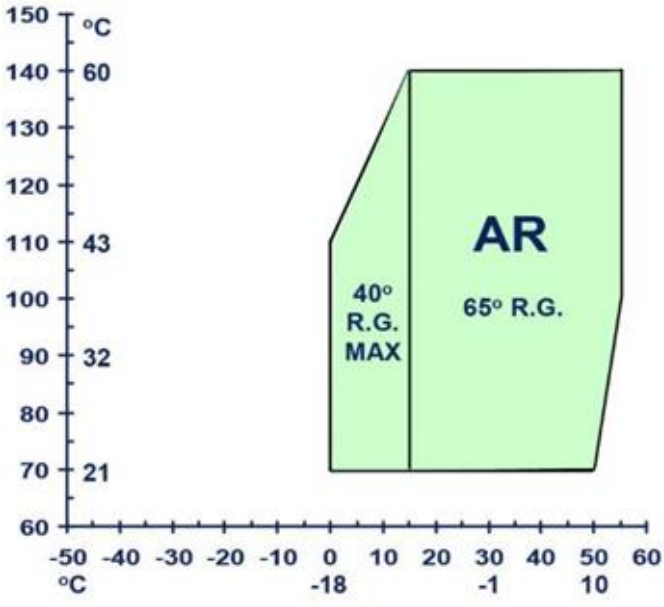


Figure 15 - R-22 – HIGH TEMP

CAUTION

Standard refrigeration compressors cannot be used in R-290 applications under any circumstances!

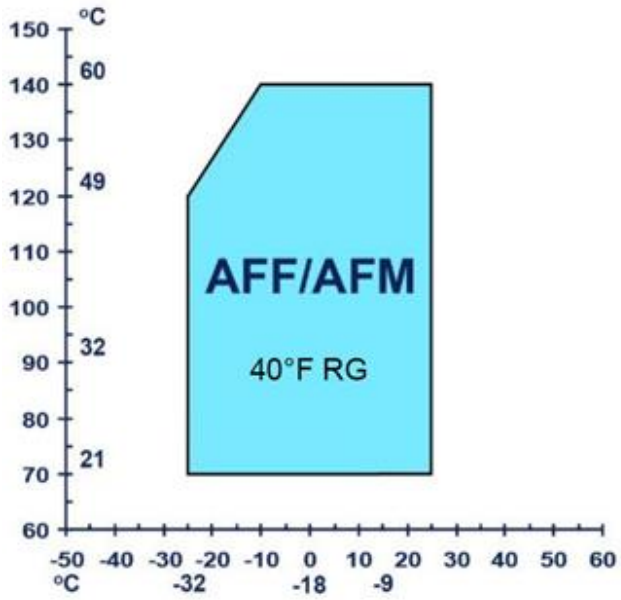


Figure 16 - R-134a / R-290 / R-450A / R-513A – EXT. MED TEMP

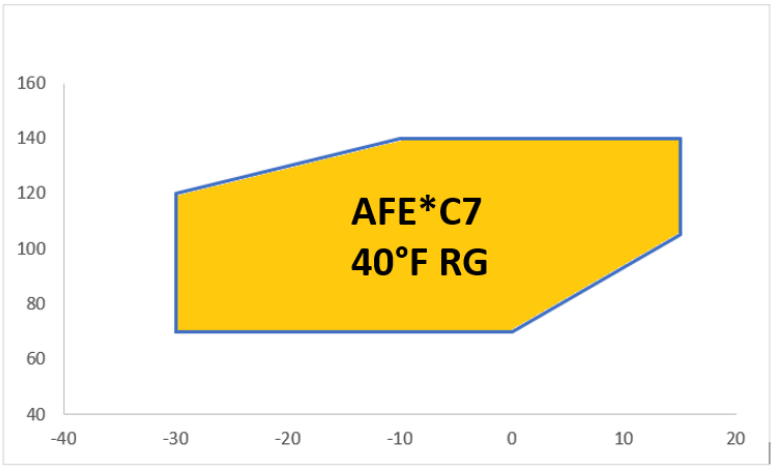


Figure 17 - R290 - LOW TEMP

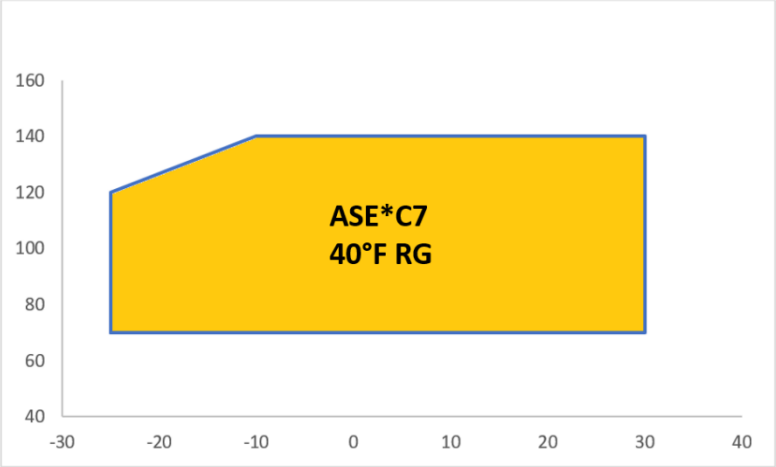


Figure 18 - R290 - EXT. MED.TEMP

Table 1 - Approved Refrigerants/Lubricants

Compressor Model	Refrigerant	Lubricant	Operating Envelope
AF	R-404A, R-507, R-290*	Emkarate RL22HB/POE	**Figure 8**
AS	R-404A, R-448A, R-449A, R-507, R-290	Emkarate RL22HB/POE	**Figure 9**
AFE**C7	R-290	Emkarate RL32HB/POE	**Figure 17**
ASE**C7	R-290	Emkarate RL32HB/POE	**Figure 18**
ASE29C7U-IFA	R-290	Emkarate RL22HB/POE	**Figure 18**
AF	R-448A, R-449A	Emkarate RL22HB/POE	**Figure 10**
AF	R-134A, R-450A, R-513A		**Figure 12**
AR	R-134A, R-450A, R-513A		**Figure 13**
AR	R22	AB46/Alkyl Benzene	**Figure 14 and Figure 15**
ASM	R-290	CP 2910E	**Figure 11**
AFF07, AFF08, AFF10	R-134A, R-450A, R-513A	CP 2910E	**Figure 16**
AFF13	R-134A, R-450A, R-513A	CP 2922E	
AFF, AFM for R-290	R-290	Alkyl Benzene CPI-4708-32	

CAUTION

Standard refrigeration compressors cannot be used in R-290 applications under any circumstances!

Table 2 - Low Pressure Control Settings

Application	R-404A	R-22	R-448A / R-449A	R-134a	R-450A	R-513A	R-290
Low / Extended Med Temp (AFE / ASM)	6.8 PSIG	4.2 PSIG	4.2 PSIG	9.8 in. HG Min	12.6 in. HG Min	6.6 in. HG Min	4.2 PSIG
Medium Temp (ASE)	19.6 PSIG	21.4 PSIG	14.5 PSIG	N/A	N/A	N/A	N/A
High Temp (ARE)	N/A	21.4 PSIG	N/A	4.3 PSIG	1.6 PSIG	6.6 PSIG	N/A

Table 3 - Refrigerant Charge Limits

Third Character Designation Compressor Shell	Refrigerant Type	Refrigerant Charge Limitations (ounces)
AF(B)	R-404A	10.6
AR(B)	R-134a / R-22	10.6
AS(B)	R-404A / R-507	10.6
AF(E)	R-134a / R-450A / R-513A / R-404A / R-448A / R-449A / R-507 / R-290*	10.6
AR(E)	R-134a / R-22 / R-450A / R-513A	10.6
AS(E)	R-404A / R-448A / R-449A / R-507 / R-290*	10.6
AF(T)	R-134A / R-404A / R-507	14.1
AR(T)	R-134a / R-22	14.1
AS(T)	R-404A / R-507	14.1
AF(J)	R-404A / R-507	29.0
AR(J)	R-134A	29.0
ARD	R-22	10.6
ARF	R-22	10.6
ARG	R-22	10.6
ARN	R-22	14.1
ARM	R-22	14.1
AF(F)	R-134a / R-450A / R-513A / R-290*	12.3
AF(M) / AS(M)	R-290*	10.6

CAUTION

Standard refrigeration compressors cannot be used in R-290 applications under any circumstances! R-290 charge limits are limited to 150 grams (5.3 ounces) in retail food refrigerators and freezers and 57 grams (2.0 ounces) in residential refrigerators and freezers.

Table 4 - Mounting Kits

Third Character Designation Compressor shell series	Emerson Part Number	Frequency
AF(B)	527-C001-02	50 & 60 Hertz
AR(B)	527-C001-02	
AS(B)	527-C001-02	
AF(E)	527-C001-02	
AR(E)	527-C001-02	
AS(E)	527-C001-02	
AF(T)	527-C001-00	
AR(T)	527-C001-00	
AS(T)	527-C001-00	
ARD	527-C001-02	
ARF	527-C001-02	
ARG	527-C001-02	
AF(F)	527-C001-00	
AF(M)	527-C001-00	
AS(M)	527-C001-00	

Table 5 - DLT Controls

Discharge Line Temperature Cut Out (220°F cut out)		
Tube Size (in.)	**Kit #**	**Part #**
1/4	998-7022-08	085-7022-13
3/8	998-7022-01	085-7022-07