



Application Guidelines for ZSKAE Refrigeration
Copeland Scroll™ Compressors 1.3-4.5 HP**

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Safety Instructions

Copeland Scroll™ compressors are manufactured according to the latest U.S. and European Safety Standards. Particular emphasis has been placed on the user's safety. Safety icons are explained below and safety instructions applicable to the products in this bulletin are grouped on Page 3. These instructions should be retained throughout the lifetime of the compressor. **You are strongly advised to follow these safety instructions.**

Safety Icon Explanation



DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.



WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.



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



NOTICE is used to address practices not related to personal injury.



CAUTION, without the safety alert symbol, is used to address practices not related to personal injury.

Instructions Pertaining to Risk of Electrical Shock, Fire, or Injury to Persons

 WARNING	<p>ELECTRICAL SHOCK HAZARD</p> <ul style="list-style-type: none"> • Disconnect and lock out power before servicing. • Discharge all capacitors before servicing. • Use compressor with grounded system only. • Molded electrical plug must be used when required. • Refer to original equipment wiring diagrams. • Electrical connections must be made by qualified electrical personnel. • Failure to follow these warnings could result in serious personal injury.
 WARNING	<p>PRESSURIZED SYSTEM HAZARD</p> <ul style="list-style-type: none"> • System contains refrigerant and oil under pressure. • Remove refrigerant from both the high and low compressor side before removing compressor. • Use appropriate back up wrenches on rotalock fittings when servicing. • 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. • Use only approved refrigerants and refrigeration oils. • Personal safety equipment must be used. • Failure to follow these warnings could result in serious personal injury.
 WARNING	<p>BURN HAZARD</p> <ul style="list-style-type: none"> • Do not touch the compressor until it has cooled down. • Ensure that materials and wiring do not touch high temperature areas of the compressor. • Use caution when brazing system components. • Personal safety equipment must be used. • Failure to follow these warnings could result in serious personal injury or property damage.
 CAUTION	<p>COMPRESSOR HANDLING</p> <ul style="list-style-type: none"> • Use the appropriate lifting devices to move compressors. • Personal safety equipment must be used. • Failure to follow these warnings could result in personal injury or property damage.

Safety Statements

- Refrigerant compressors must be employed only for their intended use.
- Only qualified and authorized HVAC or refrigeration personnel are permitted to install, commission and maintain this equipment.
- Electrical connections must be made by qualified electrical personnel.
- All valid standards and codes for installing, servicing, and maintaining electrical and refrigeration equipment must be observed.

INTRODUCTION

The ZS**KAE Copeland Scroll™ compressor represents the latest generation of compliant scroll technology for the refrigeration industry.

Nomenclature

The refrigeration scroll model numbers include the nominal capacity at standard 60HZ ARI rating conditions for medium temperature (20/120°F). For additional information on this product, please refer to the Online Product Information accessible from the Emerson Climate Technologies web site at www.emersonclimate.com.

Z = Scroll

S = Extended Medium Temperature Application

09K = nominal Capacity (x 1,000 Btu/hr)

A = Compressor Generation

E = POE Oil

Operating Envelope

The ZS**KAE refrigeration scroll compressor models can be used with a variety of refrigerants depending on the model selected and the lubricant used. (See **Table 1**.)

The ZS**KAE models are intended for extended medium and high temperature refrigeration type duty. The approved operating envelopes for these models are such that they are ideally suited for applications such as ice machines, bulk milk and frozen carbonated beverage/frozen uncarbonated beverage. The models and operating envelopes are depicted in **Figures 1A, 1B and 1C**.

APPLICATION CONSIDERATIONS

Accumulators

Due to the scrolls' inherent ability to handle liquid refrigerant in flooded start and defrost cycle operation conditions, accumulators may not be required. An accumulator is required on single compressor systems when the charge limitations exceed those values listed in **Table 2**. On systems with defrost schemes or transient operations that allow prolonged uncontrolled liquid return to the compressor, an accumulator is required unless a suction header of sufficient volume to prevent liquid migration to the compressor is used.

Excessive liquid flood back or repeated flooded starts

will dilute the oil in the compressor causing inadequate lubrication and bearing wear. Proper system design will minimize liquid flood back, thereby ensuring maximum compressor life.

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 floodback.

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 Climate Technologies representative regarding any exceptions to the above requirements.

Crankcase Heaters

Crankcase heaters are required on all ZS**KAE scroll compressors where the system charge exceeds charge limit.

The listed crankcase heaters are intended for use only when there is limited access (See **Table 3**). The heaters are not equipped for use with electrical conduit. Where applicable, electrical safety codes require lead protection, a crankcase heater terminal box should be used. Recommended crankcase heater terminal box and cover kit numbers are listed in **Table 3A**. If there

are any questions concerning their application, contact your Emerson Climate Technologies representative.

Discharge Line Thermostat

Figures 1A, 1B and 1C show the operating maps based on refrigerant for the ZS**KAE scroll. Operation beyond these limits can cause high compression ratios or excessive internal compressor temperatures. This will result in overheating the scroll members, causing excessive wear resulting in premature compressor failure.

If the system is designed where operation within these guidelines cannot be guaranteed, then the discharge line thermostat is required in the compressor control circuit.

The thermostats have a cut out setting that will insure discharge line temperatures below the 275°F maximum limit. It should be installed approximately 6 inches from the discharge tube outlet. If a service valve is installed at the discharge tube, the thermostat should be located 5 inches from the valve braze.

Kits have been set up to include the thermostat, retainer, and installation instructions. These thermostats must be used with ½" O.D. discharge lines to ensure proper thermal transfer and temperature control. They work with either 120 or 240-volt control circuits and are available with or without an alarm circuit capability. See **Table 4** for a list of discharge line thermostat kit numbers.

Pressure Controls

Both high and low-pressure controls are required on all models. See **Table 5** for set points.

Pump Down Recommendations

All the ZS**KAE scrolls have an internal spring loaded low-leak discharge check valve suitable for pump down application. This valve prevents system pressures from equalizing and pump down can be achieved. However, during laboratory testing, we have observed a potential short cycling condition on the ZS09KAE through ZS33KAE models. This phenomenon can be attributed to several factors:

1. Location of low-pressure control sensor. If it is located right at the suction inlet of the compressor, it will be more sensitive to pressure spikes.
2. Actual low-pressure setting. Refer to our

recommended setting in **Table 5**. If the differential pressure setting is too close, this will increase the possibility of short cycling.

3. Type of Low-pressure control can have an effect on cycling. The encapsulated non-adjustable type is more susceptible to causing excessive cycling due to tolerances.
4. If short cycling cannot be avoided, using a 3-minute time delay will limit the cycling of the compressor to an acceptable level.

IPR Valve

Refrigeration scroll compressors (1.3 - 4.5 hp) ZS09-33KAE have internal pressure relief valves, which open at a discharge to suction differential pressure of 375 to 450 psi. This action will trip the motor protector and remove the motor from the line.

Internal Temperature Protection

Refrigeration scroll compressors (1.3 - 4.5 hp) ZS09-33KAE incorporate a thermo disc which is a temperature-sensitive snap disc device located at the muffler plate port. It is designed to open and route hot discharge gas back to the motor protector thus removing the compressor from the line.

Motor Protection

Conventional inherent internal line break motor protection is provided.

Oil Types

Polyol ester lubricants must be provided if the scroll compressor is to be used with HFC refrigerants. See **Form 93-11** for a complete list of all Emerson approved lubricants.

CAUTION

POE 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).

Oil Charges

The recommended oil charges for these compressors are shown in **Table 6**.

Compressor Tubing and Mounting

Compressor mounting must be selected based on application. Consideration must be given to sound reduction and tubing reliability. Some tubing geometry or “shock loops” may be required to reduce vibration transferred from the compressor to external tubing.

Starting Characteristics

Single-phase scroll compressors are designed with permanent split capacitor (PSC) type motors and therefore will start without the need of start assist devices in most applications. However, if low voltage conditions exist at start up, protector trips can result. Therefore, start assist devices (start capacitors and relays) are available to maximize starting characteristics under abnormal conditions. See **Table 8** for voltage ranges.

Fusite

Fusite pin molded orientation for single-phase and three-phase refrigeration scroll compressors are shown in **Figure 4**.

Shell Temperature

System component failure may cause the top shell and discharge line to briefly reach temperatures above 300°F. Wiring or other materials, which could be damaged by these temperatures, should not come in contact with the shell.

Connection Fittings

Scroll compressors are provided only with sweat connections. (Consult your Emerson Climate Technologies representative for details).

See section on **New Installation** for suggestions on how to properly braze these fittings.

Three-Phase Rotation Direction

Scroll compressors are directional dependent: i.e., they will compress in one rotational direction only. On single-phase compressors, this is not an issue since they will only start and run in the proper direction (except as described in the Labeled Brief Power Interruptions). Three-phase scrolls, however, will rotate in either direction depending on the power of the phasing. So there is a 50/50 chance of connected power being “backwards.” Contractors should be warned of this. Appropriate instructions or notices should be provided by the Original Equipment Manufacturer.

Verification of proper rotation can be made by observing that the suction pressure drops and the discharge pressure rises when the compressor is energized. Additionally, if operated in reverse the compressor is noisier and its current draw is substantially reduced compared to tabulated values.

Although operation of scroll in reverse direction for brief periods of time is not harmful, continued operation could result in failure.

All three-phase compressors are wired identically internally. Once the correct phasing is determined for a specific system or installation, connecting properly phased power leads to the same fusite terminals will maintain the proper rotation.

Brief Power Interruptions

Brief power interruptions (less than ½ second) may result in powered reverse rotation of single-phase refrigeration scroll compressors. High-pressure discharge gas expands backward through the scrolls at power interruption causing the scroll to orbit in the reverse direction. If power is reapplied while this reversal is occurring, the compressor may continue to run noisily in the reverse direction for several minutes until the compressor internal protector trips. This has no negative effect on durability. When the protector resets, the compressor will start and run normally.

Emerson strongly encourages the use of a timer which can sense brief power interruptions and lock the compressor out of operation for two minutes. A typical timer circuit is shown in **Figure 5**.

No time delay is required on three phase models to prevent reverse rotation due to power interruptions.

Deep Vacuum Operation



Do not run a refrigeration scroll compressor in a deep vacuum. Failure to heed this advice can result in permanent damage to the compressor.

A low-pressure control is required for protection against deep vacuum operation. See the section on pressure controls for the proper set points. (See **Table 5**)

Scroll compressors (as with any refrigeration compressor) should never be used to evacuate refrigeration or air conditioning systems. See **AE24-**

1105 for proper system evacuation procedures.

ZS**KAE COMPRESSORS IN COPELAND™ CONDENSING UNITS

The new FFAP Copeland condensing units will offer the latest technology utilizing the efficient ZS**KAE scroll product along with incorporating the Emerson Electronic Unit Controller (EUC) on all models.

In **Table 7** are the approved refrigerants along with the minimum operating temperature ranges based on the refrigerants applied.

Performance data along with the applicable nomenclature information can be found on the www.emersonclimate.com website.

Features

All condensing units come equipped from the factory with the Electronic Unit Controller. The controller has a minimum low pressure cutout setting of 0 psig. See **Table 5** for the recommended pressure control settings based on refrigerant.

Condensing Unit Mounting

For 1.3 - 4.5 H.P. refrigeration scroll condensing unit applications, soft mounts are recommended. See **Figures 2A** and **2B**.

Bump Start Protection

The bump start function has been enabled in the EUC so whenever power is applied or re-applied to the unit the system will energize the compressor for 2 seconds on and 5 seconds off. This will occur for 3 cycles, and then continuous power will be supplied to the system for normal operation.

Brief Power Interruptions

As part of the EUC control, a two minute time delay has been programmed into the controller on all condensing units which will sense a brief power interruption and lock the compressor / unit out of operation for two minutes.

Headmaster Refrigerant Selection Instructions

Incorporated into the **SINGLE FAN FFAP** condensing unit is a dual pressure setting headmaster which will allow for the unit to operate in low ambient conditions with the approved refrigerants outlined in **Table 1**. Please follow the instructions provided below after the refrigerant selection is made, failure to do so will cause the system to operate outside of its approved

compressor operating envelope.

The Headmaster Control Valve has a dual pressure setting feature which allows a choice between two fixed settings; The DS element has an internal spring which is set to maintain the lower setting. The element is then charged with air to obtain the higher setting (180 psig) and the capillary tube is pinched and fused. If the capillary tube is left intact, the valve will maintain a 180 psig setting. If the capillary tube is clipped and fused again, the valve will maintain a 100 psig setting.

It is important to fuse the capillary tube tip after clipping to prevent moisture from entering the element.

Tubing Considerations – Proper tube design must be taken into consideration when designing the tubing connecting the scroll to the remaining system. The tubing should provide enough “flexibility” to allow normal starting and stopping of the compressor without exerting excessive stress on the tube joints. In addition, it is desirable to design tubing with a natural frequency away from the normal running frequency of the compressor. Failure to do this can result in tube resonance and unacceptable tubing life. **Figure 3** shows examples of acceptable tubing configurations.

CAUTION

These examples are intended only as guidelines to depict the need for flexibility in tube designs. In order to properly determine if a design is appropriate for a given application, samples should be tested and evaluated for stress under various conditions of use including voltage, frequency, and load fluctuations, and shipping vibration. The guidelines above may be helpful; however, testing should be performed for each system designed.

Rack Applications

ZS**KAE Compressors are not approved for rack or parallel applications because the compressors do not have sight glasses and cannot be equipped with oil equalization devices.

ASSEMBLY LINE PROCEDURES

Unbrazing System Components

CAUTION

If the refrigerant charge is removed from a scroll unit by bleeding the high side only, it is sometimes possible for the scrolls to seal, preventing pressure equalization

through the compressor. This may leave the low side shell and suction line tubing pressurized. If a brazing torch is then applied to the low side, the pressurized refrigerant oil mixture could ignite as it escapes and contacts the brazing flame. It is important to check both the high and low sides with manifold gauges before unbrazing. In the case of an assembly line repair, remove the refrigerant from both the high and low sides. Instructions should be provided in appropriate product literatures and assembly areas.

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 Megohm testing recommendations. Under no circumstances should the Hipot or Megohm test be performed while the compressor is under a vacuum.

SERVICE PROCEDURES

Copeland Scroll Functional Check

Refrigeration scroll compressors do not have internal suction valves. It is not necessary to perform functional compressor tests to check how low the compressor will pull suction pressure. This type of test may damage a scroll compressor. The following diagnostic procedure should be used to evaluate whether a Copeland Scroll compressor is functioning properly.

1. Verify proper unit voltage.
2. Normal motor winding continuity and short to ground checks will determine if the inherent overload motor protector has opened or if an internal short to ground has developed. If the protector has opened, the compressor must cool

sufficiently to reset.

3. With service gauges connected to suction and discharge pressure fittings, turn on the compressor. If suction pressure falls below normal levels, the system is either low on charge or there is a flow blockage.

4a. Single-Phase Compressors

If the suction pressure does not drop and the discharge pressure does not rise to normal levels the compressor is faulty.

4b. Three-Phase Compressors

If the suction pressure does not drop and the discharge pressure does not rise, reverse any two of the compressor power leads and reapply power to make sure the compressor was not wired to run in the reverse direction.

The compressor current draw must be compared to published compressor performance curves at the compressor operating conditions (pressures and voltages). Significant deviations ($\pm 15\%$) from published values may indicate a faulty compressor.

NOTICE

Note that the ZS09-19KAE-(TFD, TFE, TF7, TF5) three phase motors use a modified "Scott-T" connection and don't have equal resistance on all three windings. Two windings will have equal resistances and the third winding will be lower than the other two. See **Figure A**. Carefully compare measured motor resistance values to the two different published resistance values for a given compressor model before replacing the compressor as being defective. Due to the nature of the Scott-T construction there is an inherent current imbalance in the motors that is much larger than what is seen in a standard 3-phase motor. Effectively you will have two terminals drawing similar currents while the third will draw a higher current. The current draw on the Scott -T motors as shown in the performance data and in the operating envelope (available online at www.emersonclimate.com under the Online Product Information link) comes from the 2 main windings. The larger ZS21-33KAE compressors have conventional three-phase motors with equal resistances in each winding.

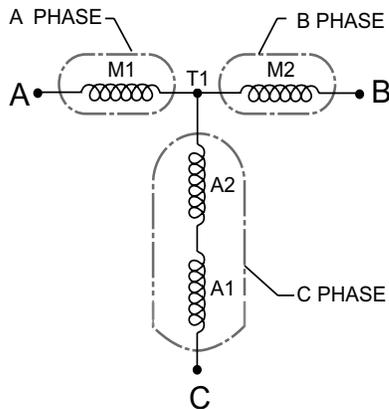


Figure A
Scott-Tee Three Phase

New Installation

- The copper-coated steel suction, discharge, and injection tubes on scroll compressors can be brazed in approximately the same manner as any copper tube.
- Recommended brazing material – Any Silfos material is recommended, preferably with a minimum of 5% silver. However, 0% silver is acceptable.
- Use of a dry nitrogen purge to eliminate possibility of carbon buildup on internal tube surfaces is recommended.
- Be sure process tube fitting I.D. and process tube O.D. are clean prior to assembly.
- Apply heat in Area 1. As tube approaches brazing temperature, move torch flame to Area 2. (See **Scroll Tube Brazing** figure below.)
- Heat Area 2 until braze temperature is attained, moving torch up and down and rotating around tube as necessary to heat tube evenly. Add braze material to the joint while moving torch around circumference.
- After braze material flows around joint, move torch to heat Area 3. This will draw the braze material down into the joint. The time spent heating Area 3 should be minimal.
- As with any brazed joint, overheating may be detrimental to the final result.

Field Service

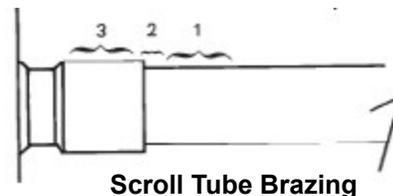
To disconnect:

- Recover refrigerant from both the high and low side of the system. Cut tubing near compressor.

To reconnect:

- Recommended brazing materials – Silfos with minimum 5% silver or silver braze material with flux.
- Reinsert tubing fitting.
- Heat tube uniformly in Area 1, moving slowly to Area 2. When joint reaches brazing temperature, apply brazing material. (See figure below)
- Heat joint uniformly around the circumference to flow braze material completely around the joint.
- Slowly move torch in Area 3 to draw braze material into the joint.

Do not overheat joint.



Scroll Tube Brazing

**Table 1
Compressor Models and Approved Refrigerants/Lubricants**

Model	HP	Refrigerant	Lubricant
ZS09KAE	1.3	R-22/R-404A/R-507/R-134a/R-407A/R-407C/R-448A/R-449A	POE
ZS11KAE	1.5	R-22/R-404A/R-507/R-134a/R-407A/R-407C/R-448A/R-449A	POE
ZS13KAE	1.9	R-22/R-404A/R-507/R-134a/R-407A/R-407C/R-448A/R-449A	POE
ZS15KAE	2.1	R-22/R-404A/R-507/R-134a/R-407A/R-407C/R-448A/R-449A	POE
ZS19KAE	2.5	R-22/R-404A/R-507/R-134a/R-407A/R-407C/R-448A/R-449A	POE
ZS21KAE	3.2	R-22/R-404A/R-507/R-134a/R-407A/R-407C/R-448A/R-449A	POE
ZS26KAE	3.5	R-22/R-404A/R-507/R-134a/R-407A/R-407C/R-448A/R-449A	POE
ZS29KAE	4	R-22/R-404A/R-507/R-134a/R-407A/R-407C/R-448A/R-449A	POE
ZS33KAE	4.5	R-22/R-404A/R-507/R-134a/R-407A/R-407C/R-448A/R-449A	POE

See Emerson Climate Technologies Form 93-11 for a complete list of all Emerson approved lubricants.

Table 2 – Charge Limitations

Model Family	Charge Limits
ZS09, 11, 13, 15, 19KAE	8lbs
ZS21, 26, 29, 33KAE	10lbs

Table 3 – Crankcase Heater

Model	Part No.	Volts	Watts	Length (in.)
ZS09, 11, 13, 15, 19KAE	018-0094-00	240	40	21
	018-0094-01	120	40	21
	018-0094-03	480	40	21
ZS21, 26, 29, 33KAE	018-0095-04	240	70	48
	018-0095-05	480	70	48
	018-0095-06	575	70	48
	018-0095-07	120	70	48

**Table 3A –
Conduit Ready Heater Terminal Box Kits**

Model Number	Kit Number
ZS09-19KAE	998-0358-00
ZS21-33KAE	998-7026-00

**Table 4
Discharge Thermostat Line Kits**

Kit Number	Conduit Lead Connector	Alarm Contact
998-0540-00	NO	NO
998-0548-00	NO	YES
998-7022-02	YES	NO

Table 5 – Pressure Control Settings

Model Type	Pressure Control	R-404A/ R-507	R-134a	R-22	R-407A/ R-448A/R-449A	R-407C
ZS*KAE	Low	8 PSIG min.	4 PSIG min.	17 PSIG min.	6 PSIG min.	1in Hg min.
	High	450 PSIG max.	340 PSIG max.	425 PSIG max.	428 PSIG max.	425 PSIG max.

Table 6 – Recommended Oil Charges by Model Family

Model Family	Initial	Recharge	Frame Size
ZS09-19KAE	25	19	53
ZS21-33KAE	42	34	63

Table 7 – FFAP Condensing Unit Operating Envelopes

Refrigerant	Extended Medium Temp (-30 F to 25 F)	Medium Temp (0 F to 25 F)	High Temp (25 F to 45 F)
R-22		X	X
R-407C		X	X
R-404A	X		X
R-134a		X	X
R-407A			X

Table 8 – Voltage Ranges (Typical)

Voltage	60 Hertz Rating			50 Hertz Rating		
	Code	Rating	Min.	Max.	Rating	Min.
C	208/230-3	187	253	200-3	180	220
D	460-3	414	506	380/420-3	342	462
E	575-3	518	633	500-3	450	550
V	208/230-1	197	253	200-1	180	220
V*	208/230-1	187	253	200-1	180	220
5	200/230-3	180	253	200/220-3	180	242
7	380-3	342	418	X	X	X
J	265-1	239	292	220/240-1	198	264
R	X	X	X	220/240-3	180	264

* The typical voltage range is (+/-) 10 % from rated voltage with the exemption of the 208/230 dual rated **V models which are -5% +10% (197 min to 253 max voltage) from nominal as shown in the above table. The following ZS**KAE models are now approved to operate within the full (+/-)10% range with a minimal voltage of 187 and a maximum voltage of 253 (ZS09,11,13,15,19, 21, 26KAE-PFV). The following models are not qualified to the full (+/-) 10% at this time, ZS29KAE-PFV and ZS33KAE-PFV.

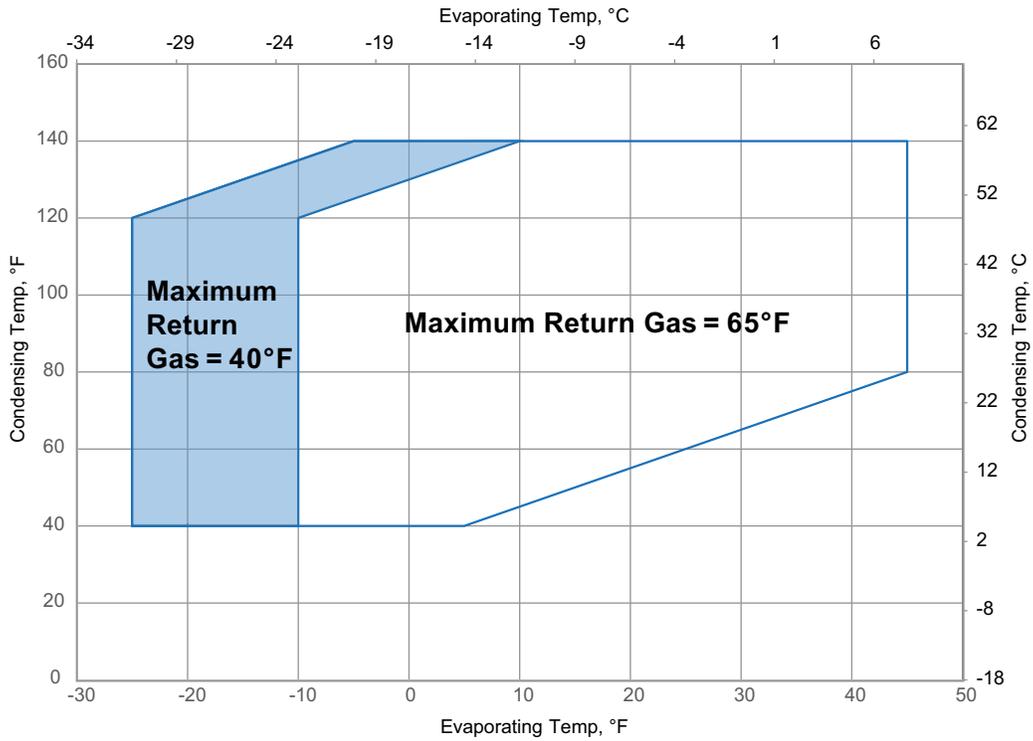


Figure 1A – ZS*KAE Application Envelope for R-404A/R-507 (Extended Medium Temp)

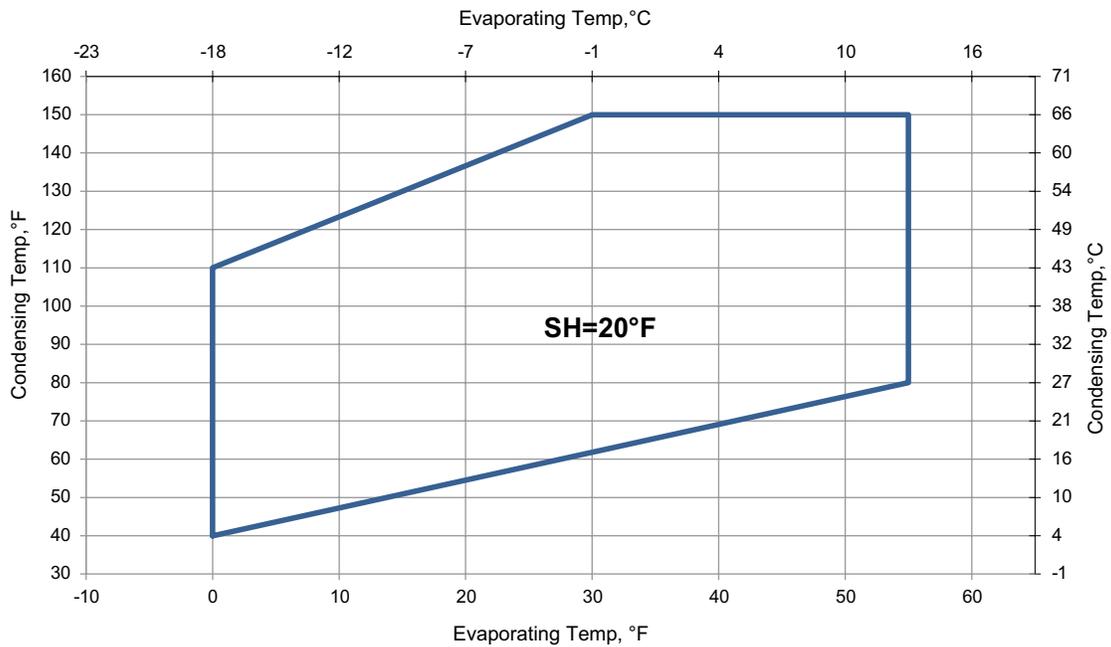


Figure 1B – ZS*KAE Application Envelope for R-22 (Medium/High Temp)

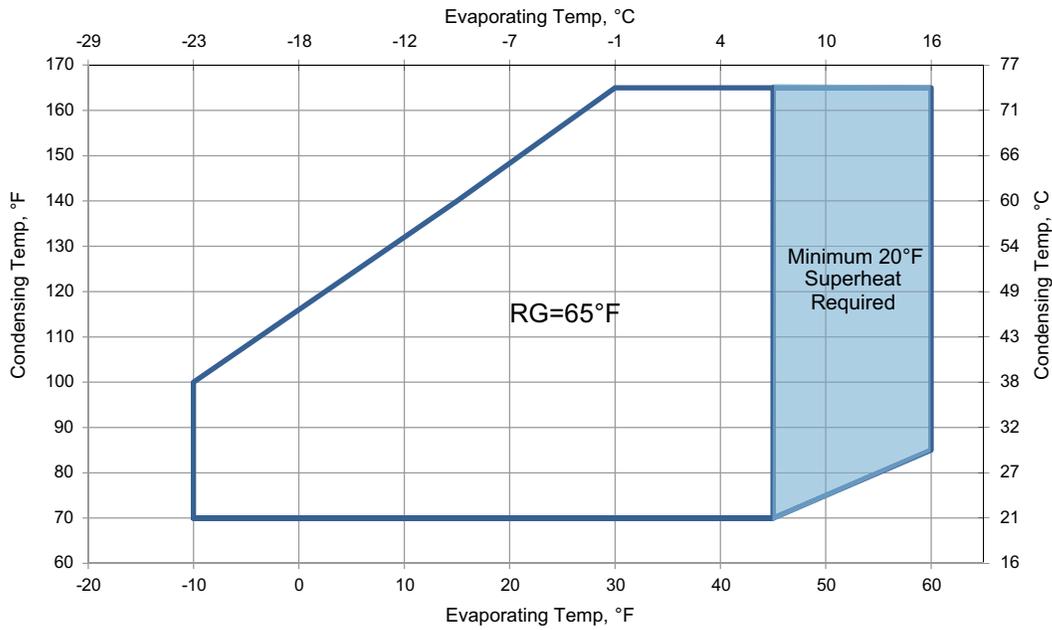


Figure 1C – ZS*KAE Application Envelope for R-134A (Medium/High Temp)

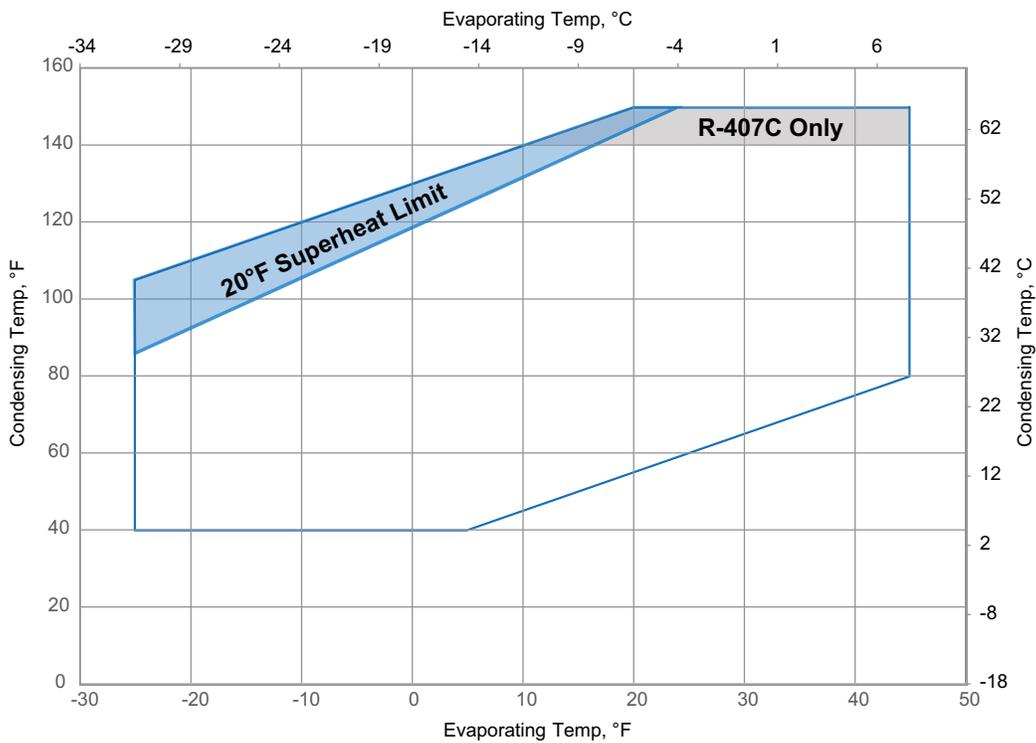


Figure 1D - ZS*KAE Application Envelope for R-407A/407C/R-448A/R-449A (Extended Medium Temp)

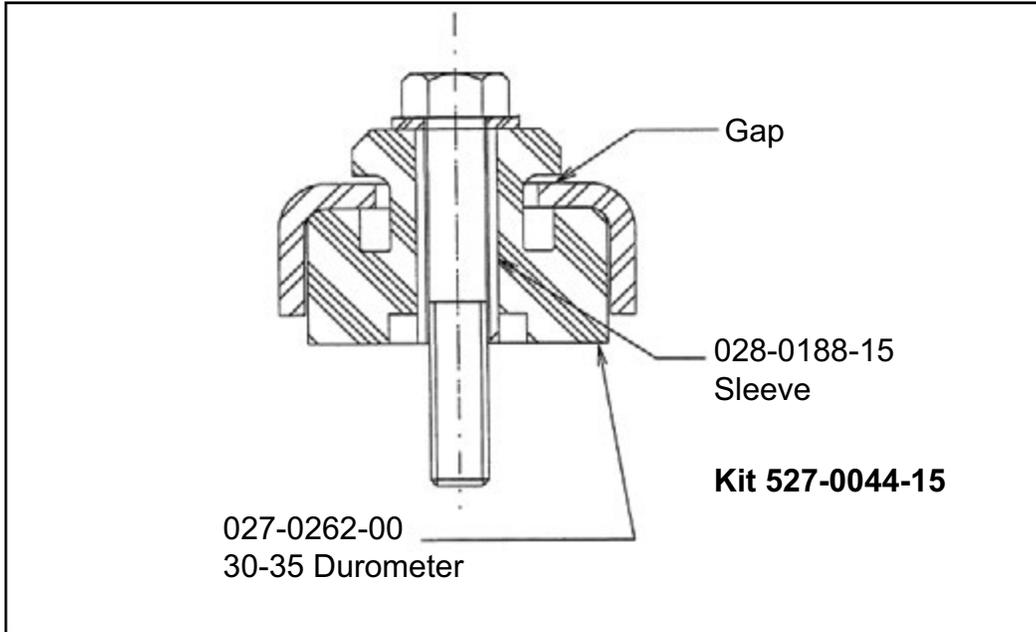


Figure 2A
ZS09KAE to ZS19KAE Refrigeration Scroll 53 Frame Condensing Unit Mounting

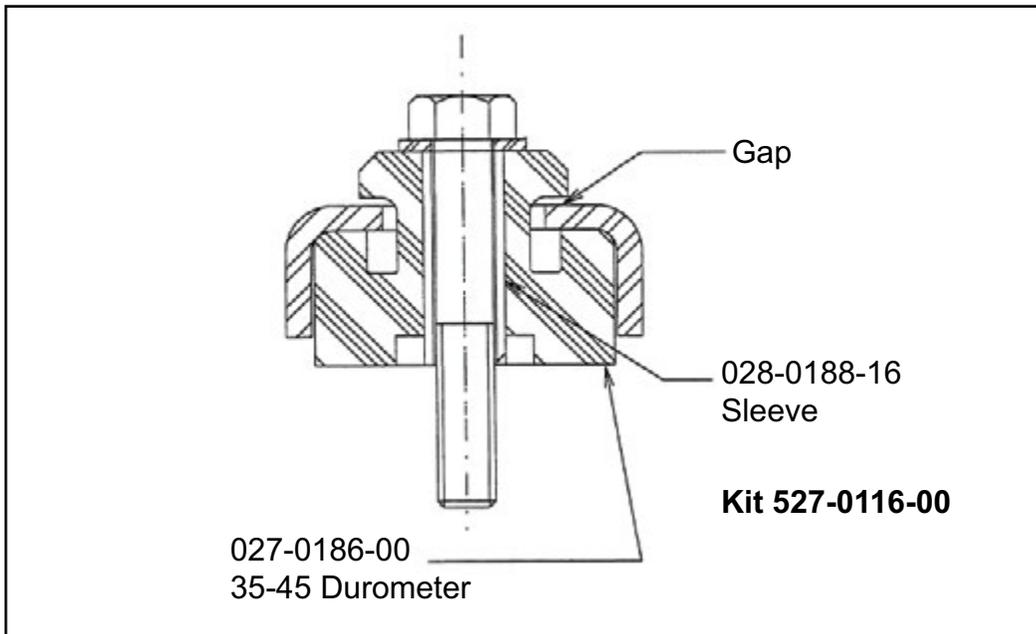


Figure 2B
ZS21KAE to ZS33KAE Refrigeration Scroll 63 Frame Condensing Unit Mounting

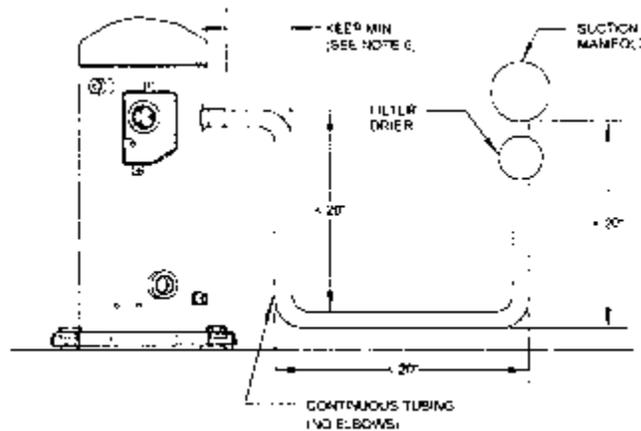


Figure 3
Typical Suction Tubing

NOTES:

1. The above tubing configurations are guidelines to minimize tube stress.
2. Follow similar guidelines for discharge tubing and oil return tubing as needed.
3. If a run of over 20" is required, intermediate clamps may be necessary.
4. Do not hang weights on tubing (e.g. filter drier on suction tubing) except after clamps or close to the header.
5. Tube runs of less than 8" are not recommended.
6. This dimension should be made as short as possible (e.g. 2" or less) but still insuring a proper braze joint.
7. The above tubing recommendations are based on "no elbow joints". The use of continuous tubing is preferred.

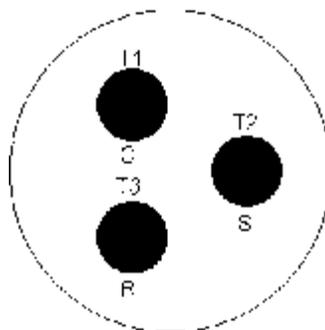


Figure 4
Motor Terminal (Fusite) Connections for
Single Phase and Three Phase Scrolls

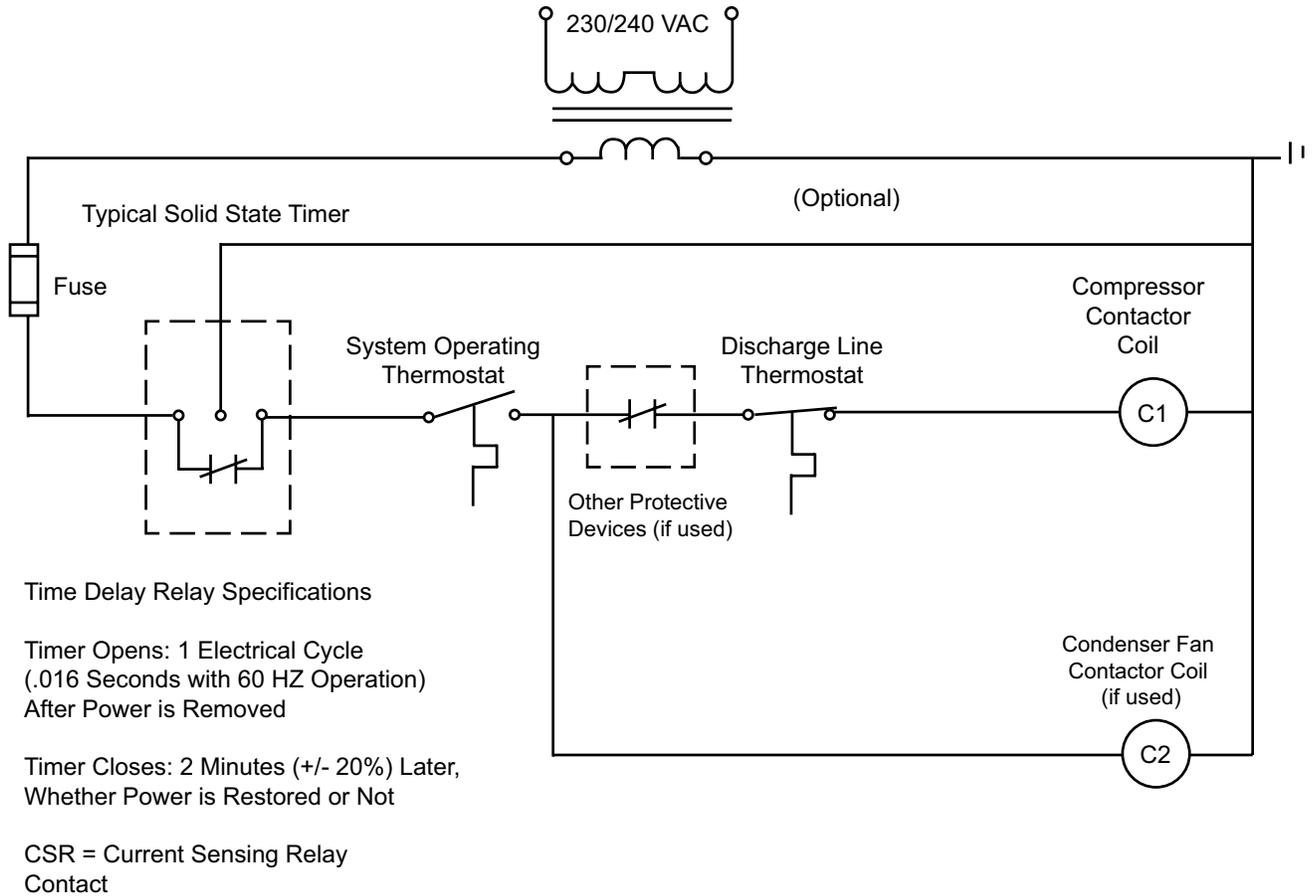


Figure 5
Scroll Wiring Schematic

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