

Copeland Scroll™

Digital

Application Guidelines

Digital Scroll™ Compressors for Air Conditioning

ZRD42K* to ZRD125K*

ZPD34K* to ZPD182K*



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About these guidelines

The purpose of these application guidelines is to provide guidance in the application of Copeland Scroll™ compressors in users' systems. They are intended to answer the questions raised while designing, assembling and operating a system with these products.

Besides the support they provide, the instructions listed herein are also critical for the proper and safe functioning of the compressors. Emerson Climate Technologies will not guarantee the performance and reliability of the product if it is misused in regard of these guidelines.

These application guidelines cover stationary applications only. For mobile applications, contact Application Engineering as other considerations may apply.

1 Safety instructions







Copeland Scroll compressors are manufactured according to the latest European and US safety standards. Particular emphasis has been placed on the user's safety.

These compressors are intended for installation in systems according to the Machinery Directive MD 2006/42/EC and to the Pressure Equipment Directive PED 97/23/EC. They may be put to service only if they have been installed in these systems according to instructions and conform to the corresponding provisions of legislation. For relevant standards please refer to the Manufacturer's Declaration, available at www.emersonclimate.eu.

These instructions should be retained throughout the lifetime of the compressor.

You are strongly advised to follow these safety instructions.

1.1 Icon explanation

 <p>WARNING This icon indicates instructions to avoid personal injury and material damage.</p>	 <p>CAUTION This icon indicates instructions to avoid property damage and possible personal injury.</p>
 <p>High voltage This icon indicates operations with a danger of electric shock.</p>	 <p>IMPORTANT This icon indicates instructions to avoid malfunction of the compressor.</p>
 <p>Danger of burning or frostbite This icon indicates operations with a danger of burning or frostbite.</p>	<p>NOTE This word indicates a recommendation for easier operation.</p>
 <p>Explosion hazard This icon indicates operations with a danger of explosion.</p>	

1.2 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 for connecting electrical and refrigeration equipment must be observed.
- The national legislation and regulations regarding personnel protection must be observed.



Use personal safety equipment. Safety goggles, gloves, protective clothing, safety boots and hard hats should be worn where necessary.

1.3 General instructions



WARNING

System breakdown! Personal injuries! Never install a system in the field and leave it unattended when it has no charge, a holding charge, or with the service valves closed without electrically locking out the system.

System breakdown! Personal injuries! Only approved refrigerants and refrigeration oils must be used.



WARNING

High shell temperature! Burning! Do not touch the compressor until it has cooled down. Ensure that other materials in the area of the compressor do not get in touch with it. Lock and mark accessible sections.



CAUTION

Overheating! Bearing damage! Do not operate compressors without refrigerant charge or without being connected to the system.



CAUTION

Contact with POE! Material damage! POE lubricant must be handled carefully and the proper protective equipment (gloves, eye protection, etc.) must be used at all times. POE must not come into contact with any surface or material that it might damage, including without limitation, certain polymers, eg, PVC/CPVC and polycarbonate.



IMPORTANT

Transit damage! Compressor malfunction! Use original packaging. Avoid collisions and tilting.

2 Product description

2.1 Common information about Copeland Scroll Digital™ compressors

The Scroll compressor has been under development at Emerson Climate Technologies since 1979. It is the most efficient and durable compressor Emerson Climate Technologies has ever developed for air conditioning and refrigeration.

These application guidelines deal with the following Copeland Scroll Digital™ compressors:

R407C

Compressor	HP	kW ^(*)	Motor
ZRD42KCE	3.6	9	PFJ/TFD
ZRD48KCE	4	10.2	PFZ/TFD
ZRD61KCE	5	12.5	TFD
ZRD72KCE	6	14.8	TFD
ZRD81KCE	6.5	16.7	TFD
ZRD94KCE	8	19.8	TFD
ZRD125KCE	10	26	TFD

R410A

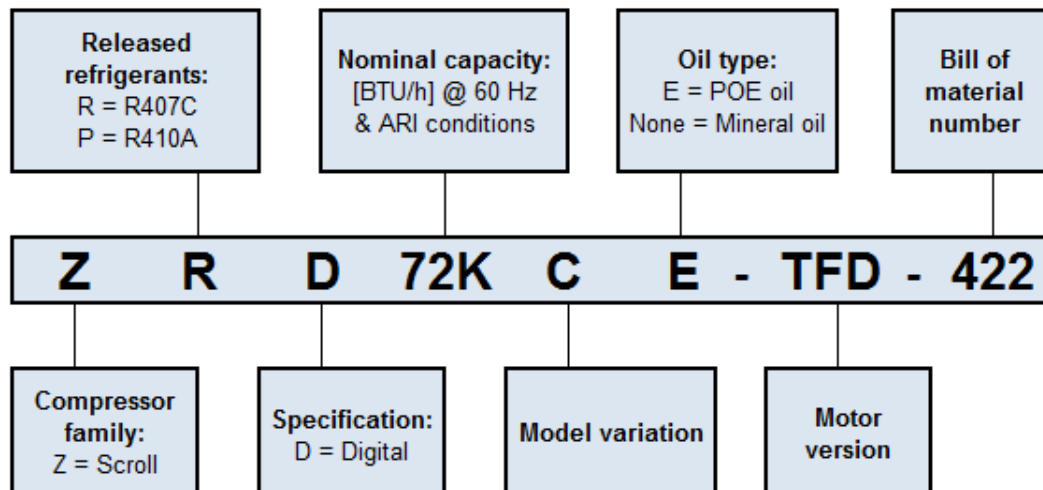
Compressor	HP	kW ^(*)	Motor
ZPD34KSE	2.8	8	PFZ/TFM
ZPD42KSE	3.5	9	PFZ/TFM
ZPD54KSE	4.6	11.8	PFZ/TFM
ZPD61KCE	5	13.3	PFZ/TFD
ZPD72KCE	6	15.4	TFD
ZPD83KCE	7	17.7	TFD
ZPD91KCE	7.5	19.3	TFD
ZPD103KCE	9	22.4	TFD
ZPD104KCE	9	22.4	TFD
ZPD120KCE	10	26	TFD
ZPD122KCE	10	26	TFD
ZPD137KCE	12	29.3	TFD
ZPD154KCE	13	32.9	TFD
ZPD182KCE	15	39.1	TFD

^(*) According to EN 12900

Copeland Scroll Digital compressors have one Scroll compression set driven by a single- or three-phase induction motor. The scroll set is mounted at the upper end of the rotor shaft of the motor. The rotor shaft axis is in the vertical plane.

2.2 Nomenclature

The model designation contains the following technical information about the compressor:



Copeland Scroll™

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ARI Conditions:

Evaporating temperature 7.2°C
 Condensing temperature54.4°C
 Suction gas superheats 11K

Liquid sub-cooling 8.3K
 Ambient temperature35°C

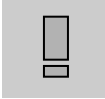
EN 12900 Conditions:

Evaporating temperature5°C
 Condensing temperature50°C
 Suction gas superheats 10K

Liquid sub-cooling 0K
 Ambient temperature35°C

2.3 Application range

2.3.1 Qualified refrigerants and oils



IMPORTANT

It is essential that the glide of refrigerant blends (primarily R407C) is carefully considered when adjusting pressure and superheat controls.

Oil recharge values can be taken from Copeland Scroll compressors brochures or Copeland™ brand products Select software at www.emersonclimate.eu.

Qualified refrigerants	R407C	R410A
Copeland brand products standard oil	Emkarate RL 32 3MAF	
Servicing oil	Emkarate RL 32 3MAF Mobil EAL Arctic 22 CC	Mobil EAL Arctic 22 CC

Table 1: Qualified refrigerants and oils

2.3.2 Application limits



CAUTION

Inadequate lubrication! Compressor breakdown! The superheat at the compressor suction inlet must always be sufficient to ensure that no refrigerant droplets enter the compressor. For a typical evaporator-expansion valve configuration a minimum stable superheat of at least 5K is required.

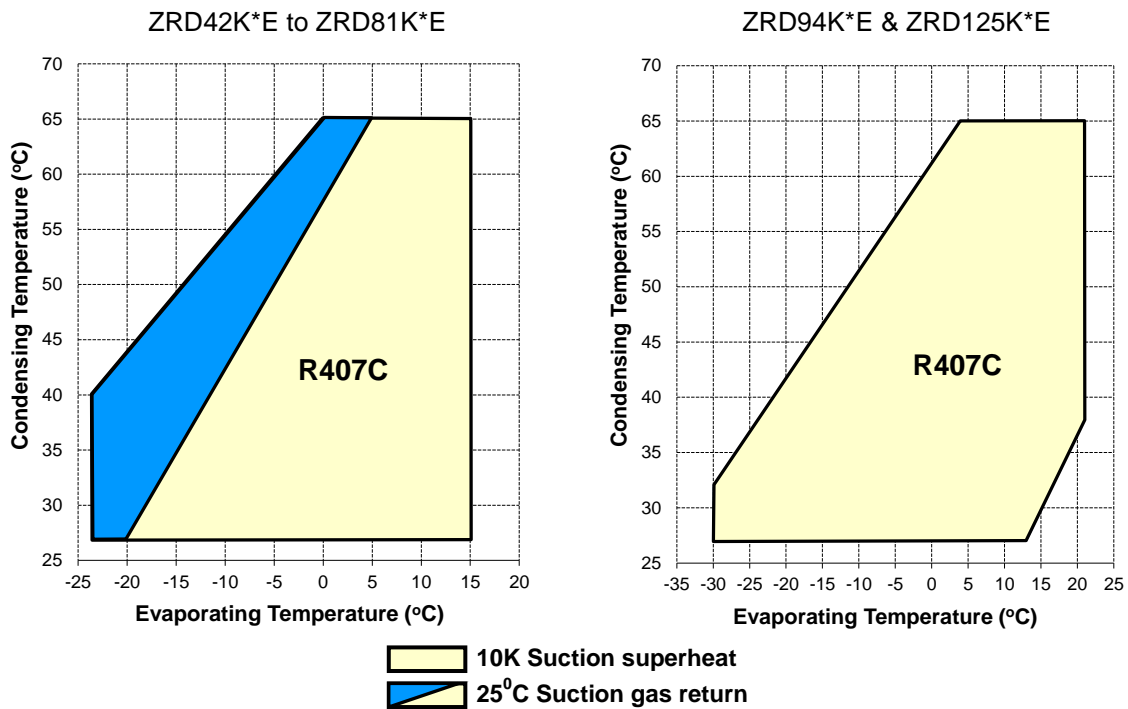


Figure 1: Application envelopes with R407C (Dew point)

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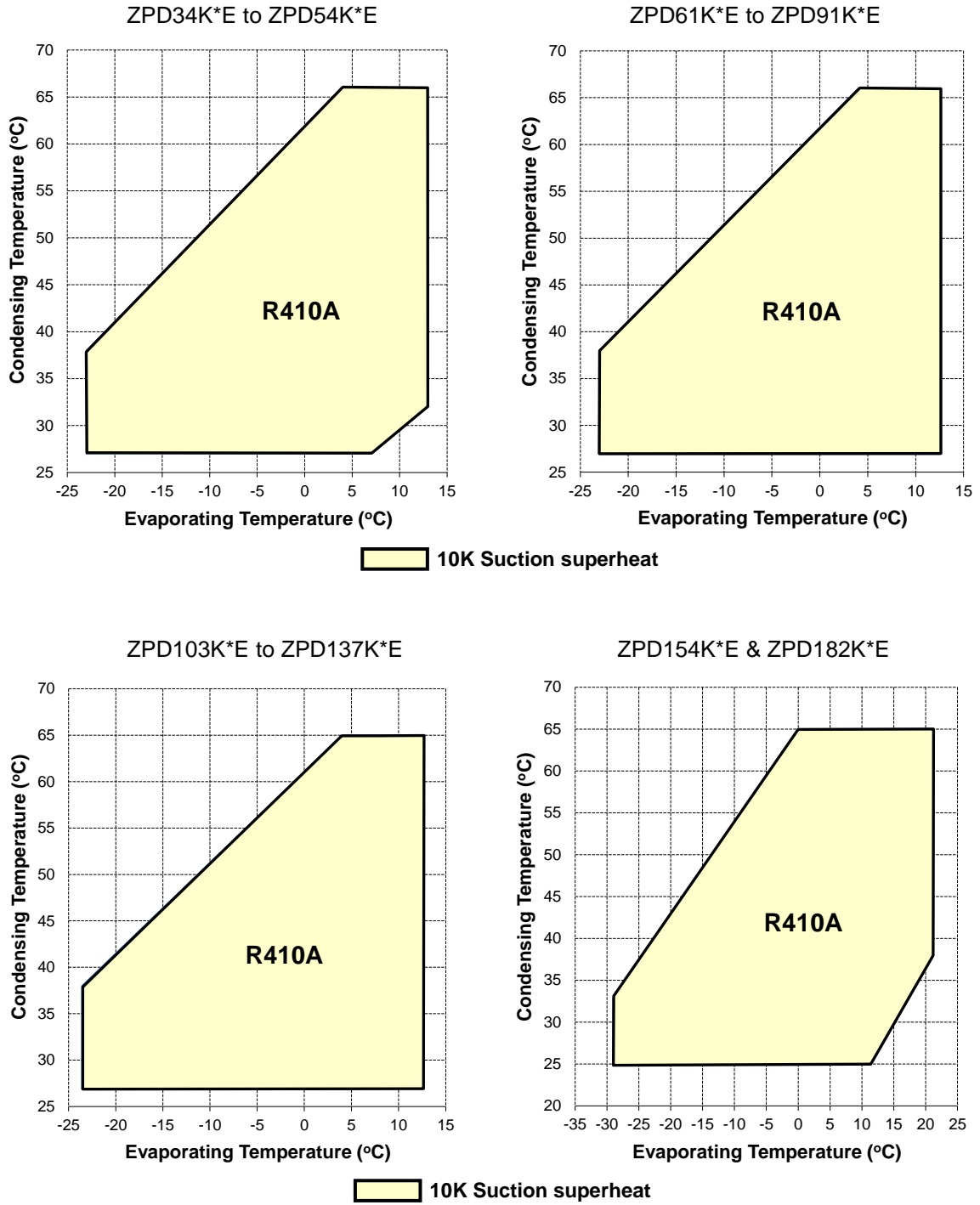


Figure 2: Application envelopes with R410A (Dew point)

Safety instructions

Product description

Installation

Electrical connection

Starting up & operation

Maintenance & repair

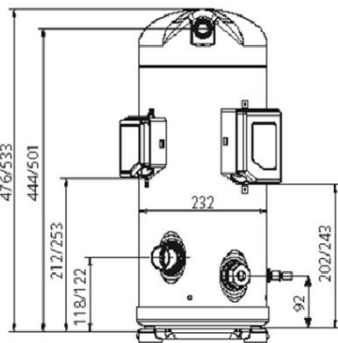
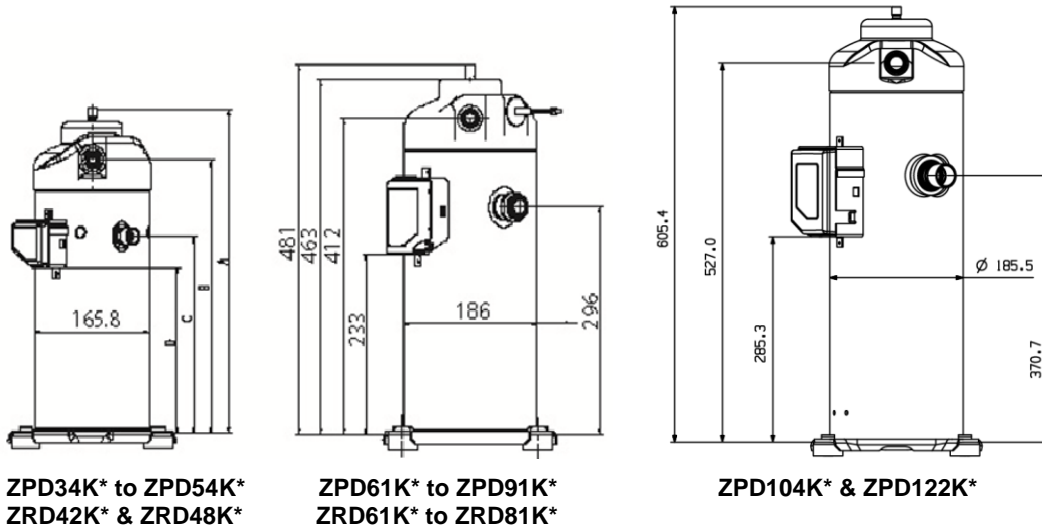
Dismantling & disposal

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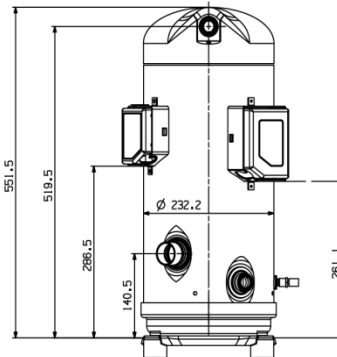
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2.4 Dimensions

Compressor model	A ± 3.0 mm	B mm	C ± 3.0 mm	D ± 3.0 mm
ZPD34K*E- PFZ/TFM	449.0	380.1	277.1	235.5
ZPD42K*E- PFZ/TFM	449.0	380.1	277.1	235.5
ZPD54K*E- PFZ/TFM	465.4	396.5	293.5	251.9
ZRD42K*E- PFJ/TFD	449.0	380.1	277.1	235.5
ZRD48K*E- PFJ/TFD	465.4	396.5	293.5	251.9



ZRD94K*^(*) & ZRD125K*
ZPD103K*, ZPD120K* & ZPD137K*



ZPD154K* & ZPD182K*

^(*) No sight glass

Figure 3: Compressor dimensions

2.5 Operation, design & performance

The Copeland Scroll Digital compressor is capable of modulating its capacity from 10% to 100%. The compressor is supplied along with an external solenoid valve. This “normally closed” (de-energized) solenoid valve is a key component for achieving modulation. When the solenoid valve is in its normally closed position, the compressor operates at full capacity. When the solenoid valve is energized, the two scroll elements move apart axially. During the unloaded state, the compressor motor continues running, but since the scrolls are separated, there is no compression. During the “loaded state”, the compressor delivers 100% capacity and during the “unloaded state”, the compressor delivers 0% capacity. A cycle consists of a “loaded state” and an “unloaded state”. By varying the time of “loaded state” and “unloaded state”, an average capacity is obtained. For instance, in a 20-second cycle, the average capacity is 75%, if the “loaded time” is 15 seconds and the “unloaded time” is 5 seconds.

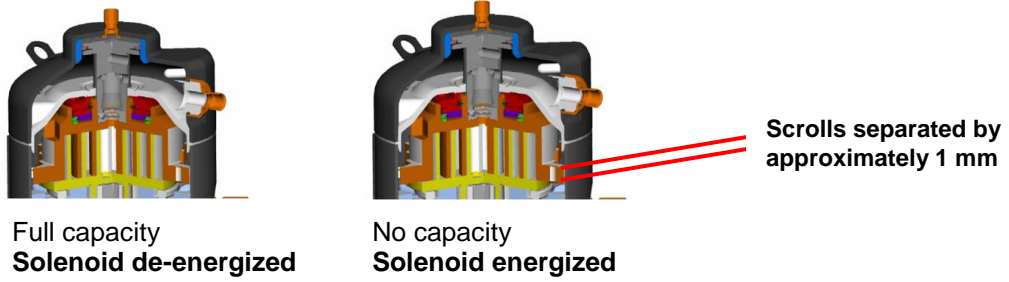


Figure 4: Modulation of Scroll models ZRD42K* to ZRD81K* and ZPD34K* to ZPD91K*

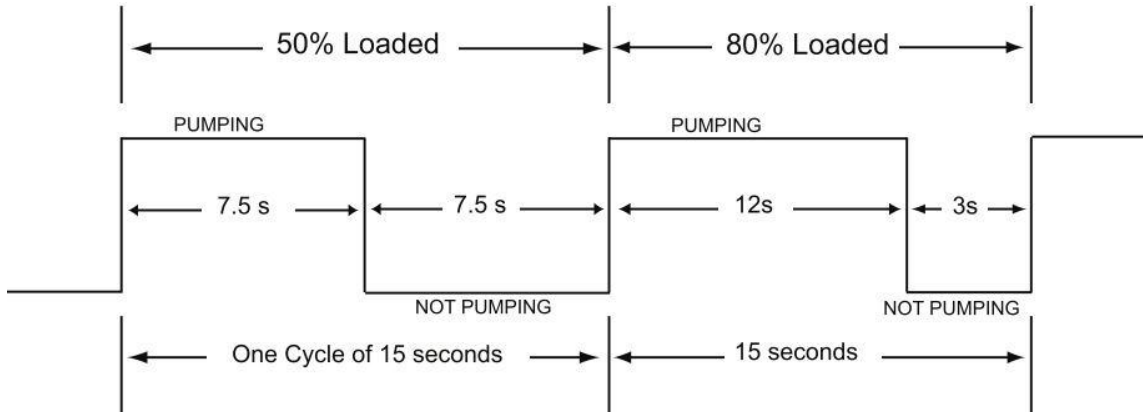


Figure 5: Example of a cycle

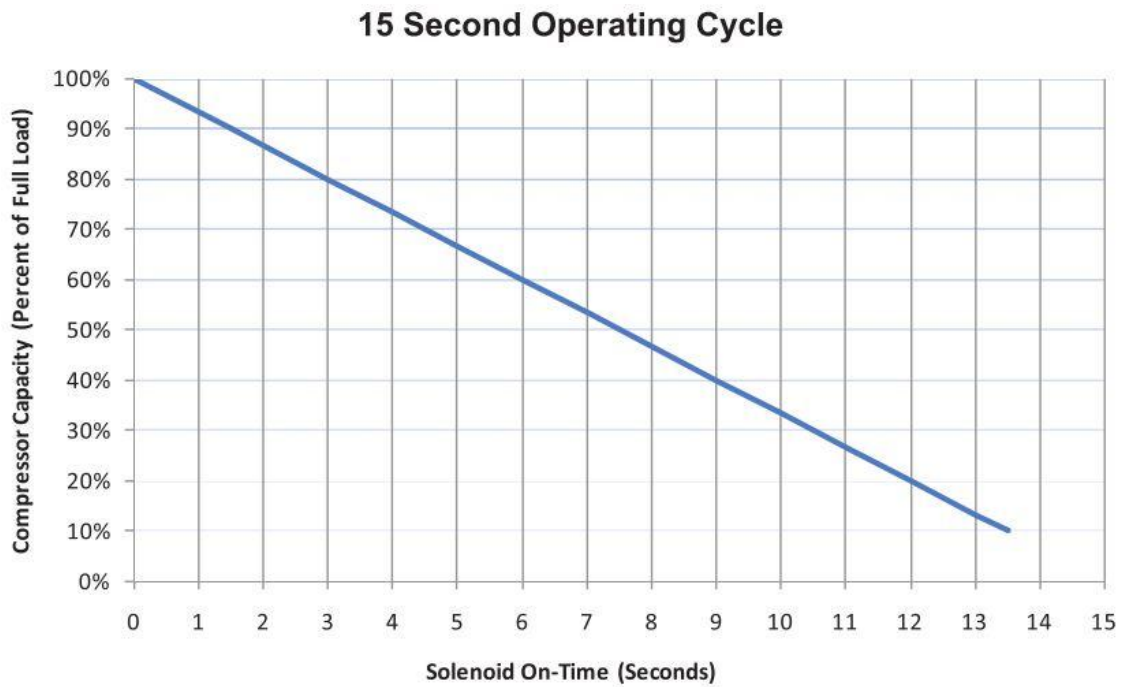
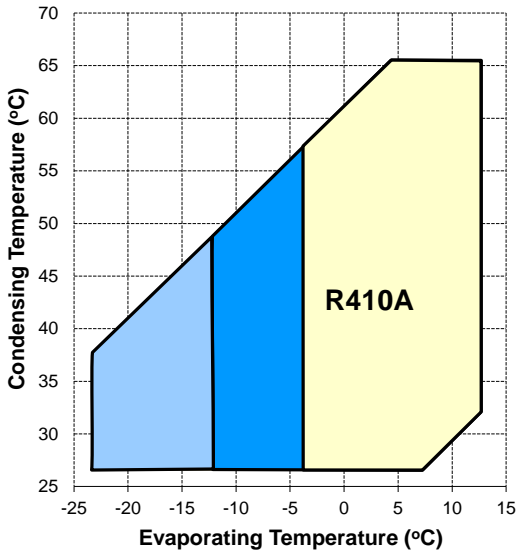


Figure 6: Solenoid opening time depending on the load in a 15-second cycle

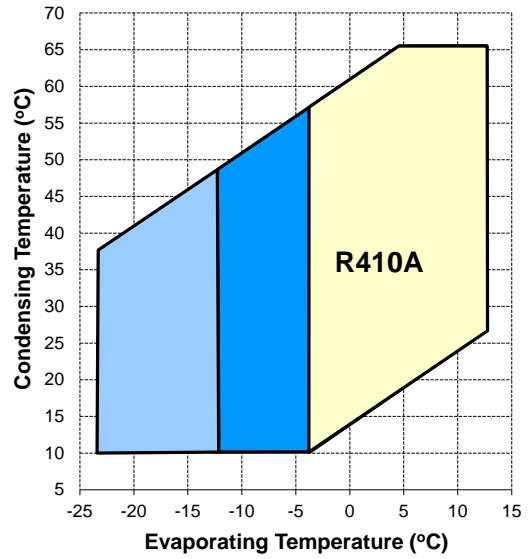
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ZPD34K*E to ZPD91K*E
ZRD42K*E to ZRD81K*E



ZPD103K*E to ZPD182K*E
ZRD94K*E & ZRD125K*E



- 10-100% recommended application range
- 50-100% recommended application range
- 75-100% recommended application range

Figure 7: Recommended capacity modulation ranges according to the operating conditions

2.6 Mechanical differences in the Digital compressor ranges

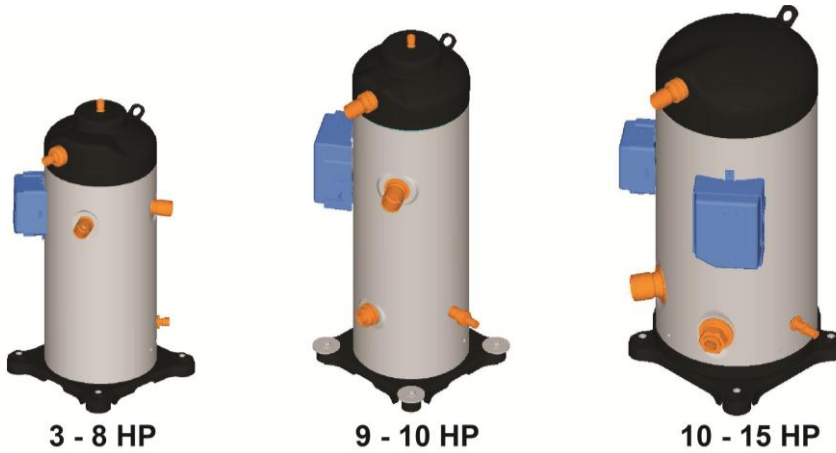


Figure 8: Single Digital Scrolls in the ZRD and ZPD ranges

The internal mechanics of the smaller and the larger models are different but functionally both approaches to modulation achieve the same results and are to be controlled in exactly the same way.

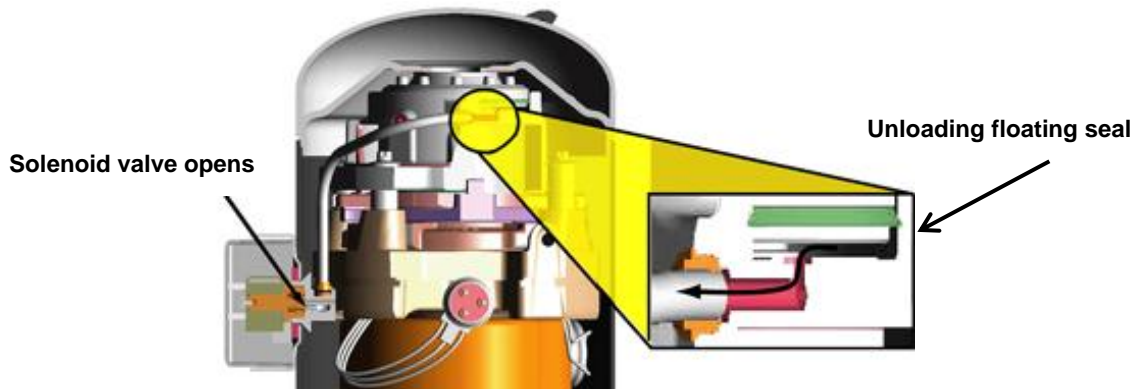


Figure 9: Modulation method in larger model ranges

3 Installation



WARNING

High pressure! Injury to skin and eyes possible! Be careful when opening connections on a pressurized item.

3.1 Compressor handling

3.1.1 Transport and storage



WARNING

Risk of collapse! Personal injuries! Move compressors only with appropriate mechanical or handling equipment according to weight. Keep in the upright position. Stack pallets on top of each other when not exceeding 300 kg. Do not stack single boxes on top of each other. Keep the packaging dry at all times.

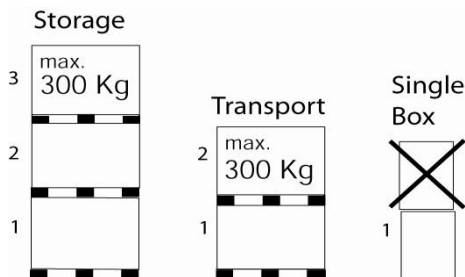


Figure 10

3.1.2 Positioning and securing



IMPORTANT

Handling damage! Compressor malfunction! Only use the lifting eyes whenever the compressor requires positioning. Using discharge or suction connections for lifting may cause damage or leaks.

It is recommended that the plugs in the compressor line connections be left in place until the compressor is set into the unit. This reduces the chance of contaminants and moisture getting into the compressor especially if the compressor is charged with the more hygroscopic POE oil.

For models ZRD94K*, ZRD125K* and ZPD103K* to ZPD182K*, because oil might spill out of the suction connection located low on the shell, the suction connection plug must be left in place until the compressor is set into the unit. If possible, the compressor should be kept vertical during handling. The discharge connection plug should be removed first before pulling the suction connection plug to allow the dry air pressure inside the compressor to escape. Pulling the plugs in this sequence prevents oil mist from coating the suction tube making brazing difficult. The copper coated steel suction tube should be cleaned before brazing. No object, eg, a swaging tool should be inserted deeper than 51 mm into the suction tube or it might damage the suction screen and motor.

3.1.3 Installation location

Ensure the compressors are installed on a solid level base.

3.1.4 Mounting parts

Four vibration absorber grommets are supplied with each compressor. They dampen the start-up surge of the compressor and minimise sound and vibration transmission to the compressor base during operation. The metal sleeve inside is a guide designed to hold the grommet in place. It is not designed as a load-bearing member, and application of excessive torque to the bolts can crush the sleeve. Its inner diameter is approximately 8.5 mm to fit an M8 screw. The mounting torque should be 13 ± 1 Nm. It is critically important for the grommet not to be compressed.

If the compressors are mounted in tandem or used in parallel, then the hard mountings (bolt M9 5/16") are recommended. The mounting torque should be 27 ± 1 Nm. It is possible to deliver these hard mounting parts as a kit, or on request to deliver the compressor with these parts instead of the rubber grommets.

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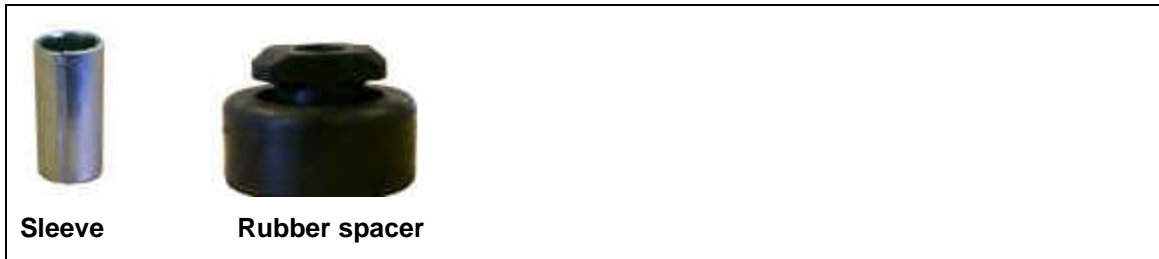


Figure 11: Rubber mounting parts for single models

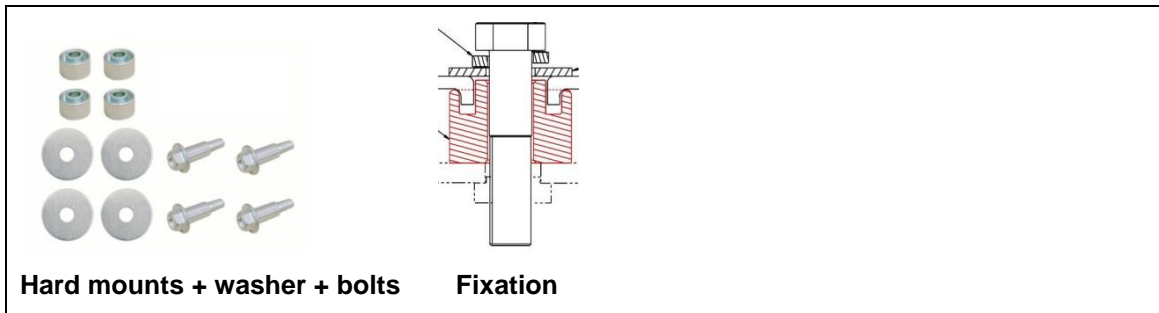


Figure 12: Rigid mounting parts for Tandem models

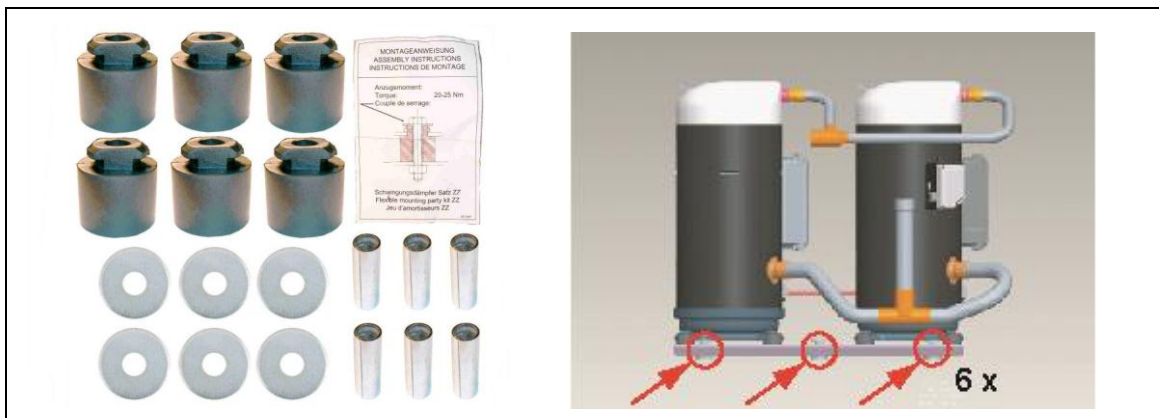


Figure 13: Rubber mounting parts rail-to-ground for Tandem models

3.2 Solenoid valves



IMPORTANT

The external solenoid valve is a critical component for proper operation of this compressor. Only the solenoid valve supplied by Emerson Climate Technologies must be used.

Care must be taken during the brazing process that no solid parts can enter the control piston compartment or the solenoid valve tubing. To prevent solid parts from entering the control valve seat, the solenoid valve kit contains a filter screen, which has to be placed into the horizontal tube of the valve before brazing the tube connections as shown in **Figures 16 & 17**.

The solenoid valve has to be fitted in such a way that the sleeve with the stem inside – which supports the solenoid coil – is fixed and aligned in an upright position.

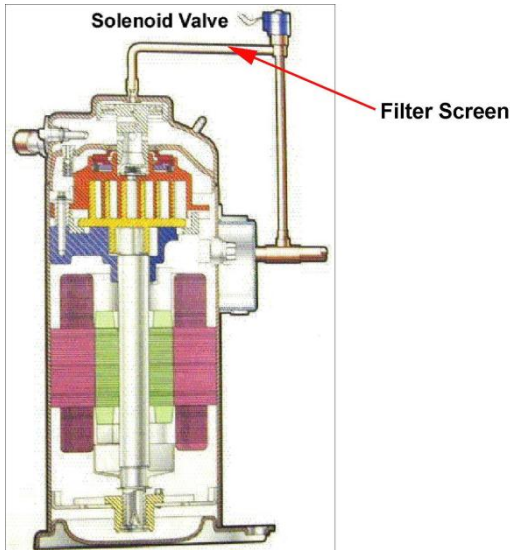


Figure 14: Position of the external solenoid valve

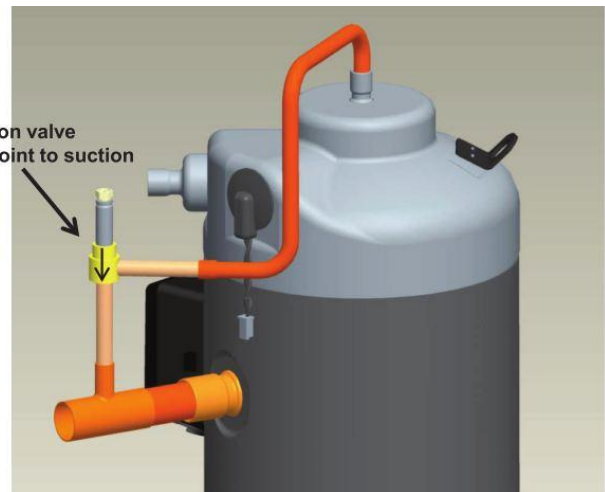


Figure 15: Recommended piping

3.3 Solenoid valve installation

3.3.1 General recommendations

- Solenoid must be mounted vertically, within $\pm 15^\circ$ of vertical. Horizontal mounting is not permitted.
- The valve operation is directional. See **Figures 18 & 19** below for inlet and outlet locations.
- Do not restrict the line size coming from or leaving the solenoid. Use 3/8" soft drawn copper.

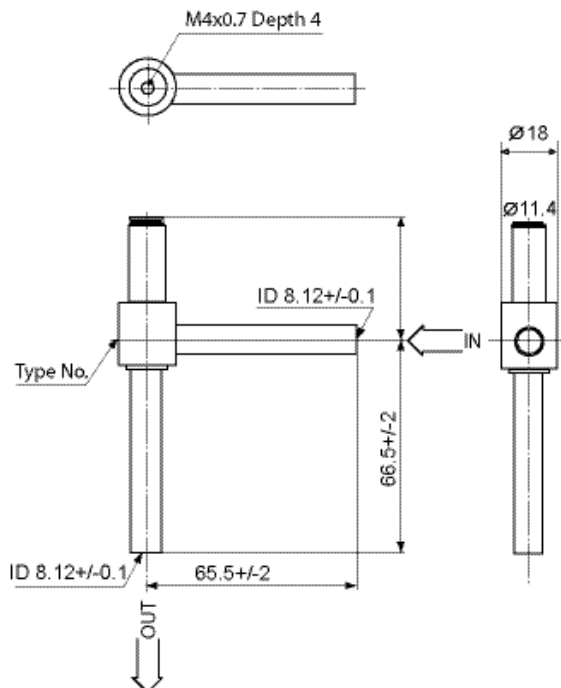


Figure 16: Control valve without coil

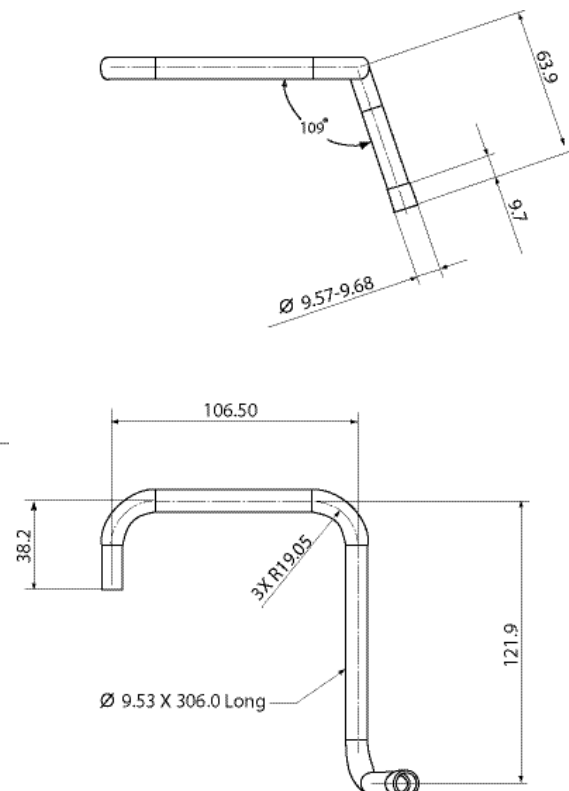


Figure 17: Control valve pipe connection

Safety
instructions

Product
description

Installation

Electrical
connection

Starting up &
operation

Maintenance &
repair

Dismantling &
disposal

3.3.2 Tubing recommendations



IMPORTANT

This tube has been tested and qualified at 50 and 60 Hz operation for running stresses and resonance in a single compressor lab environment. However, in some compressor applications such as racks and transport applications, the OEM is strongly advised to re-confirm the acceptability of the tube when the compressor is subject to additional vibration inputs.

The tube from the solenoid to the suction (**Figure 17**) should be as short as possible (less than 7.5 cm). Dimensions for a typical tube going from the top of the compressor are shown in **Figures 18 & 19**.

3.4 Tandem compressors

Copeland Scroll Digital compressors ZRD48K* to ZRD81K* and ZPD54K* to ZPD91K* can be used in a Tandem arrangement (code 422 in nomenclature), if the single compressor cannot cover the required capacities and/or there are higher fluctuations in capacity demand. The fittings for gas equalization and oil equalization must be connected between the two compressors (see **Figure 20**).



Figure 18: Tandem configurations for compressor combinations with 3 to 15 hp models (ZR and ZP ranges)

Specific dimensional drawings and technical information documents on system oil balance control to build qualified Tandem design units are available upon request from Emerson Climate Technologies.

It needs to have an OEM-system control device providing the signals for common operation, modulation as well as for single compressor operation. In general the architecture of such a system controller runs the digital compressor continuously and cycles only the standard compressor if the capacity demand drops below, eg, 40% of the total capacity.

The standard compressor should join the Digital Scroll compressor operation when the capacity demand comes to a value of about more than, eg, 60 to 65% and stays on for a defined amount of time. Any percentage of capacity modulation within the capacity range can be achieved by switching the cycle time algorithm of the Digital compressor as a reaction to the system behaviour.

Copeland Scroll Digital compressors ZRD125K* and ZPD103K* to ZPD182K* require some extra attention for tandemization in terms of oil balance. Emerson Climate Technologies has worked out a redesign of the Schraeder valve position and qualified an oil balancing system just via these connections. Models capable for this configuration must have been built from 1st of October 2009 onwards, serial number 09J...! **A combination or a mix of models built before this date is not released.** The common suction return line must have a straight height of at least 400 mm before joining the T-connector (see **Figure 21**).

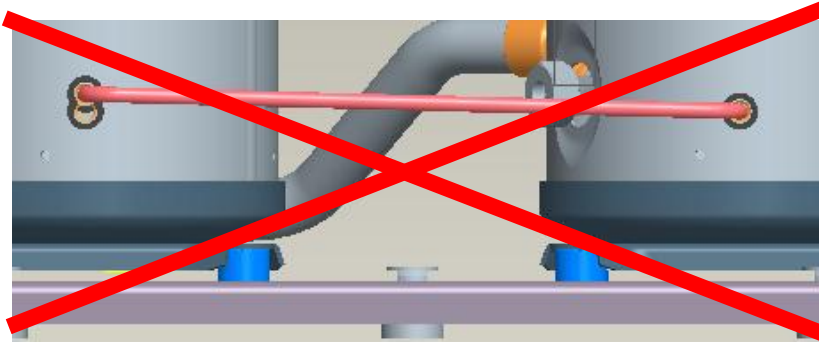


Figure 19: No slanted alignment of the oil equalization line! Use models from 09J... onwards only!

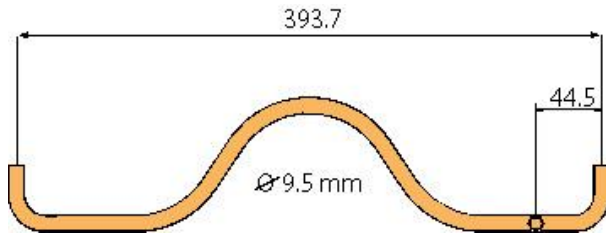


Figure 20: Oil equalization line design

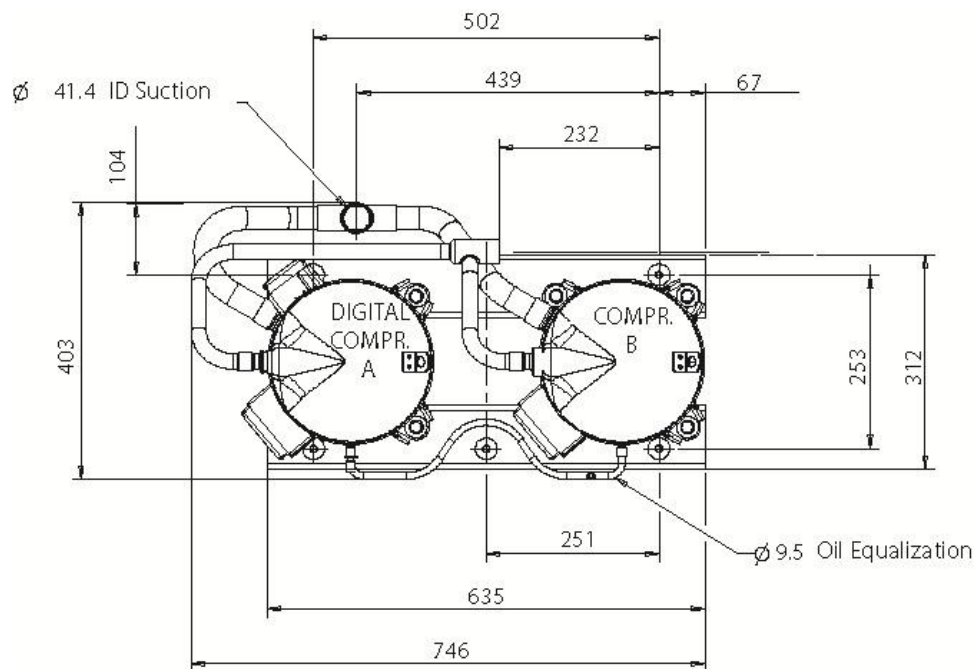


Figure 21: Top view of the piping design

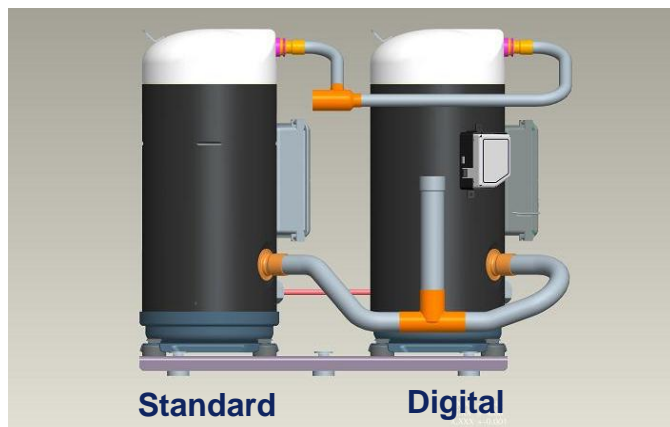


Figure 22: Tandem configuration with ZRD125K* and ZPD103K* to ZPD182K*

Safety instructions

Product description

Installation

Electrical connection

Starting up & operation

Maintenance & repair

Dismantling & disposal

Compressor model	Base compressors	Available voltages
ZPDT21MCE	ZP103KCE + ZPD103KCE	TFD
ZPDT22MCE	ZP104KCE + ZPD104KCE	TFD
ZPDT24MCE	ZP120KCE + ZPD120KCE	TFD
ZPDT25MCE	ZP122KCE + ZPD122KCE	TFD
ZPDT27MCE	ZP137KCE + ZPD137KCE	TFD
ZPDT31MCE	ZP154KCE + ZPD154KCE	TFD
ZPDT36MCE	ZP182KCE + ZPD182KCE	TFD
ZRDT25MCE	ZR125KCE + ZRD125KCE	TFD

Table 2: Tandem configurations with standard models and Digital Scroll compressors

3.5 Discharge check valve

There is **no** discharge check valve at the discharge port of Copeland Scroll Digital compressors ZRD42K* to ZRD81K* and ZPD34K* to ZPD91K* since the high-side pressure is needed to support the operation of the un-loader mechanism.

To avoid bypassing during the unloading process back to suction, a dynamic discharge valve is fitted internally on the discharge port of the fixed scroll. This discharge valve cannot be used with recycling pump-down because it is not leak-proof during the off period.

Models ZRD94K*, ZRD125K* and ZPD103K* to ZPD182K* work with an internal un-loader mechanism (see **Figures 5 & 11**) and are equipped with a check valve in the discharge fitting that will prevent backward flow of gas through the scroll when the compressor shuts off.

3.6 Brazing procedure

IMPORTANT

Blockage! Compressor breakdown! Maintain a flow of oxygen-free nitrogen through the system at very low pressure during brazing. Nitrogen displaces the air and prevents the formation of copper oxides in the system. If allowed to form, the copper oxide material can later be swept through the system and block screens such as those protecting capillary tubes, thermal expansion valves, and accumulator oil return holes.

Contamination or moisture! Bearing failure! Do not remove the plugs until the compressor is set into the unit. This minimises any entry of contaminants and moisture.

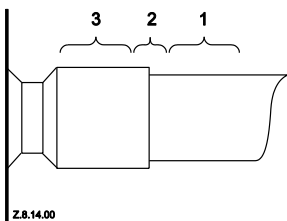


Figure 23: Suction tube brazing areas

Copeland Scroll Digital compressors have copper-plated steel suction and discharge tubes. These tubes are far more robust and less prone to leaks than copper tubes. Due to the different thermal properties of steel and copper, brazing procedures may have to be changed from those commonly used.

Refer to **Figure 25** and the procedure below for the brazing of the suction and discharge lines to a scroll compressor.

- The copper-coated steel tubes on scroll compressors can be brazed in approximately the same manner as any copper tube.
- Recommended brazing materials: any Silfos material is recommended, preferably with a minimum of 5% silver. However, 0% silver is acceptable.
- Be sure tube fitting inner diameter and tube outer diameter are clean prior to assembly.
- Using a double-tipped torch, apply heat in area 1.
- As the tube approaches brazing temperature, move the torch flame to area 2.

- Heat area 2 until braze temperature is attained, moving the torch up and down and rotating around the tube as necessary to heat the tube evenly. Add braze material to the joint while moving the torch around the joint to flow braze material around the circumference.
- After the braze material flows around the joint, move the 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.

To disconnect:

- Heat joint areas 2 and 3 slowly and uniformly until the braze material softens and the tube can be pulled out of the fitting.

To reconnect:

- Recommended brazing materials: Silfos with minimum 5% silver or silver braze used on other compressors. Due to the different thermal properties of steel and copper, brazing procedures may have to be changed from those commonly used.

3.7 Shut-off valves and adaptors



CAUTION

Leaking system! System breakdown! It is strongly recommended to periodically re-torque all pipe and fixing connections to the original setting after the system has been put into operation.

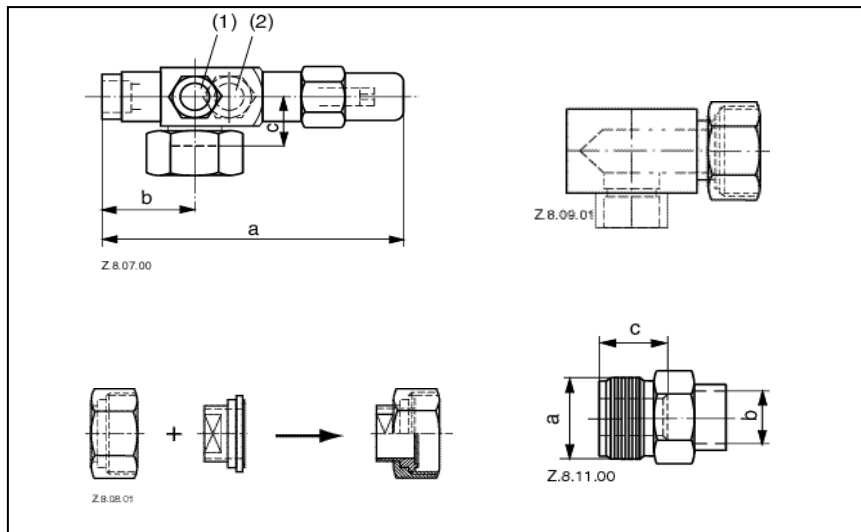


Figure 24: Adaptors and shut off valves

Braze connections can be converted to Rotalock by means of adaptors. Rotalock shut-off valves are available for the suction as well as discharge sides. Using either straight or angled adaptors provides a way to convert a Rotalock into a brazing connection.

Refer to **Table 3** for proper tightening torques:

Connection	Torque [Nm]
M10	45-55
Rotalock ¾"	40-50
Sight glass 1 ¼" Summit	100-110
Rotalock 1 ¾"	170-180
Rotalock 2 ¼"	190-200
Sight glass fitting	30-45
Mounting bolts 5/16", M9	27 max

Table 3

NOTE: More information about adaptors and shut-off valves can be found in the "Spare parts list".

3.8 Oil separator

During any operating cycle of Copeland Scroll Digital compressors, there is a loaded state during which the compressor operates at full capacity. The velocity of gas during this loaded state is sufficient to return oil back to the compressor. Laboratory tests have established that there is no problem in oil return, even when the length of interconnecting pipe used is 100 metres and the vertical elevation is 30 metres. Based on such performance, Emerson Climate Technologies does not strictly recommend the use of an oil separator.

3.9 Accumulators



CAUTION

Inadequate lubrication! Bearing destruction! Minimise liquid refrigerant returning to the compressor. Too much refrigerant dilutes the oil. Liquid refrigerant can wash the oil off the bearings leading to overheating and bearing failure.

Due to Copeland Scroll's inherent ability to handle liquid refrigerant in flooded start and defrost cycle operation, an accumulator is not required for durability in most systems. However, large volumes of liquid refrigerant which repeatedly flood back to the compressor during normal off cycles or excessive liquid refrigerant floodback during defrost or varying loads, no matter what the system charge is, can dilute the oil. As a result, bearings are inadequately lubricated and wear may occur.

To determine if the accumulator can be removed, dedicated tests must be carried out to ensure that excessive liquid does not flood back to the compressor during defrost or varying loads. The defrost test must be done at an outdoor ambient temperature of around 0°C in a high humidity environment. Liquid floodback must be monitored during reversing valve operation, especially when coming out of defrost.

Excessive floodback occurs when the sump temperature drops below the safe operation line shown in **Figure 27** for more than 10 seconds.

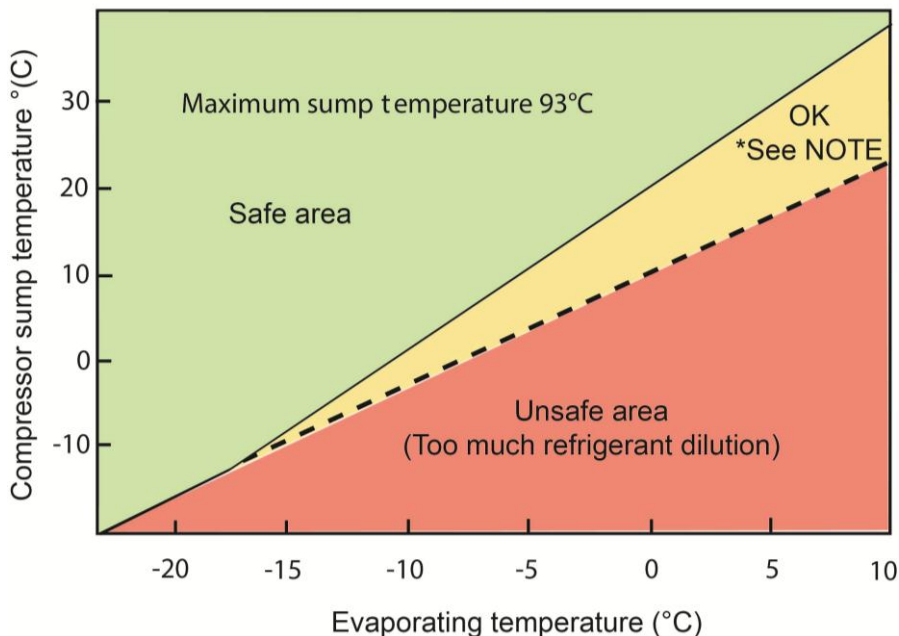


Figure 25: Bottom shell temperature

NOTE: Operation in this refrigerant dilution area is safe in air-to-air heat pump heating mode. For other applications, such as AC only, review expansion device to raise superheat. A cold sump may result in high refrigerant migration after shutdown.

If an accumulator has to be used, the oil-return orifice should be from 1 to 1.4 mm in diameter for models ZRD42K* to ZRD81K* and ZPD34K* to ZPD91K*, depending on compressor size and compressor floodback results. Models ZRD94K*, ZRD125K* and ZPD103K* to ZPD182K* should use an orifice diameter of 2.0 mm. A large-area protective screen with mesh no finer than 30 x 30 (0.6 mm openings) is required to protect this small orifice from plugging with system

debris. Tests have shown that a small screen with a fine mesh can easily become plugged causing oil starvation to the compressor bearings.

The size of the accumulator depends upon the operating range of the system and the amount of subcooling and subsequent head pressure allowed by the refrigerant control. System modelling indicates that heat pumps that operate down to and below -18°C will require an accumulator that can hold around 70% to 75% of the system charge. Ideally the suction accumulator should be connected with a slope to the suction line of the compressor, as shown in **Figure 28**. A sight tube fitted to the accumulator makes it easier to check the liquid level inside.

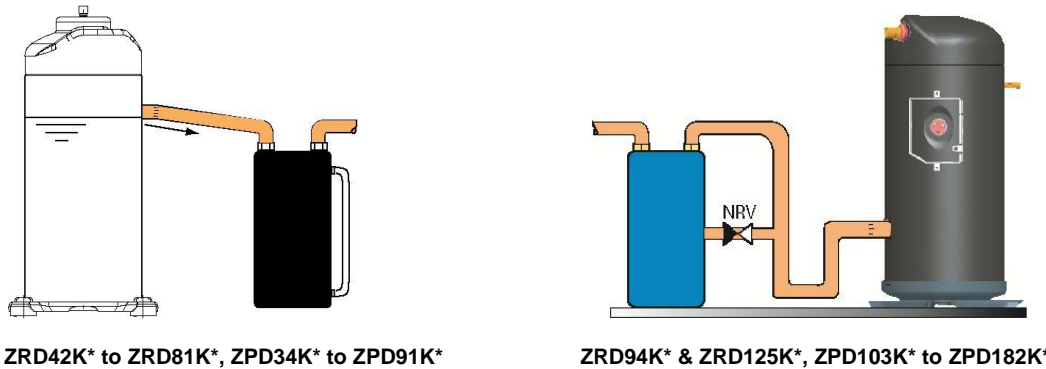


Figure 26: Suction accumulators

3.10 Screens



CAUTION

Screen blocking! Compressor breakdown! Use screens with at least 0.6 mm openings.

The use of screens finer than 30 x 30 mesh (0.6 mm openings) anywhere in the system should be avoided with these compressors. Field experience has shown that finer mesh screens used to protect thermal expansion valves, capillary tubes, or accumulators can become temporarily or permanently plugged with normal system debris and block the flow of either oil or refrigerant to the compressor. Such blockage can result in compressor failure.

3.11 Mufflers

External mufflers, normally applied to piston compressors in the past, may not be required for Copeland Scroll compressors.

Tests on individual system should be performed to verify acceptability of sound performance. If adequate attenuation is not achieved, use a muffler with a larger cross-sectional area to inlet area ratio. A ratio of 20:1 to 30:1 is recommended.

A hollow shell muffler will work quite well. Locate the muffler at minimum 15 to maximum 45cm from the compressor for the most effective operation. The farther the muffler is placed from the compressor within these ranges, the more effective.

3.12 Reversing valves

Since Copeland Digital Scroll compressors have a very high volumetric efficiency their displacements are lower than those of equivalent capacity reciprocating compressors. As a result, Emerson Climate Technologies recommends that the capacity rating on reversing valves be no more than 1.5 to 2 times the nominal capacity of the compressor in order to ensure proper operation of the reversing valve under all operating conditions.

The reversing valve solenoid should be wired so that the valve does not reverse when the system is shut off by the operating thermostat in the heating or cooling mode. If the valve is allowed to reverse at system shut off, suction and discharge pressures are reversed to the compressor. This results in a condition of system pressures equalising through the compressor which can cause the compressor to slowly rotate until the pressures equalise. This condition does not affect compressor durability but can cause unexpected sound after the compressor is turned off.

3.13 Suction line noise and vibration

Copeland Scroll compressors inherently have low sound and vibration characteristics. However in some respects the sound and vibration characteristics differ from reciprocating compressors and in rare instances could result in unexpected sound generation. One difference is that the vibration characteristic of the scroll compressor, although low, includes two very close frequencies, one of which is normally isolated from the shell by the suspension of an internally-suspended compressor. These frequencies, which are present in all compressors, may result in a low-level "beat" frequency that can be detected as noise coming along the suction line into the building under some conditions. Elimination of the beat can be achieved by attenuating either of the contributing frequencies. This is easily done by using one of the common combinations of recommended design configurations. The scroll compressor makes both a rocking and twisting motion and enough flexibility must be provided in the line to prevent vibration transmission into any lines attached to the unit. In a split system, the most important goal is to ensure minimal vibration in all directions at the service valve to avoid transmitting vibrations to the structure to which the lines are fastened.

A second difference of the Copeland Scroll is that under some conditions the normal rotational starting motion of the compressor can transmit an "impact" noise along the suction line. This may be particularly pronounced in three-phase models due to their inherently higher starting torque. This phenomenon, like the one described previously, also results from the lack of internal suspension and can be easily avoided by using standard suction line isolation techniques as described below. The sound phenomena described above are not usually associated with reversible heat pump systems because of the isolation and attenuation provided by the reversing valve and tubing bends.

Recommended configuration

- Tubing configuration:small shock loop
- Service valve: "angled valve" fastened to unit / wall
- Suction muffler:not required

Alternative configuration

- Tubing configuration:small shock loop
- Service valve: "straight through" valve fastened to unit / wall
- Suction muffler:may be required (acts as dampening mass)

4 Electrical connection

4.1 General recommendations

The compressor terminal box has a wiring diagram on the inside of its cover. Before connecting the compressor, ensure the supply voltage, the phases and the frequency match the nameplate data.

4.2 Electrical installation

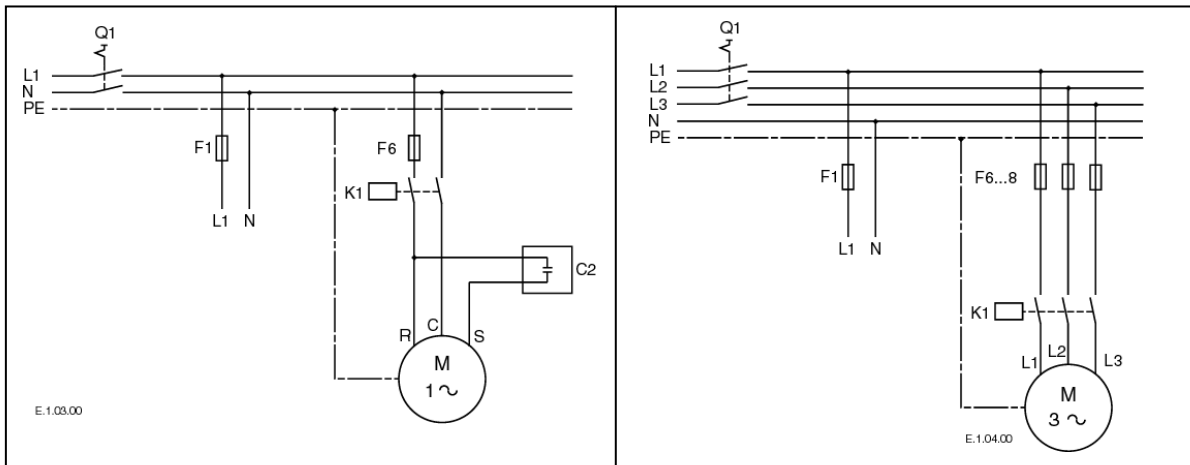


Figure 27: Power circuit single-phase

Figure 28: Power circuit three-phase

4.2.1 Terminal box

The standard terminal box is IP21 for all models with internal motor protection (TF*/PF*) and IP54 for all models with external motor protection (TW*), enclosure class according to IEC 60034-5.

Cable glands have an influence on the protection class of the terminal box. It is strongly recommended to use appropriate cable glands in order to reach the rated protection class. We advise installers/service providers to pay attention to this aspect every time they install or replace a Copeland Scroll compressor and to use cable glands according to EN 50262 or any other relevant standard of application in their country/region. Examples of correct electrical installations are shown in **Figures 31 & 32** below.



Figure 29: Correct electrical installation with cable glands for IP21 T-box

Copeland Scroll™

Digital

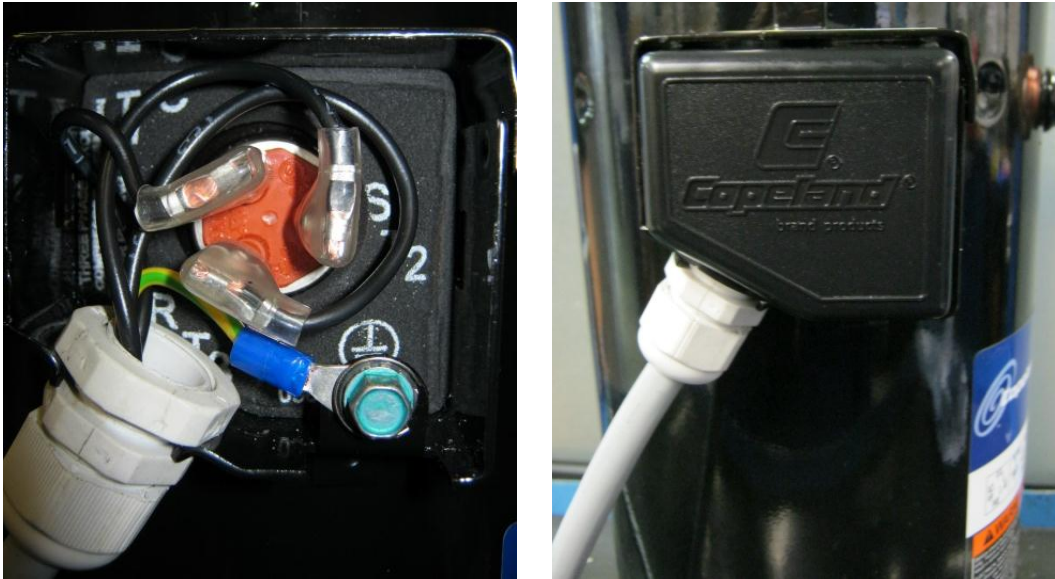


Figure 30: Correct electrical installation with cable glands for IP21 T-box for compressors ZPD34K* & ZPD42K*

4.2.2 Motor winding

The ZRD/ZPD Scroll compressors are offered with either a single-phase or a three-phase induction motor, depending on the size. Single-phase motors need a run capacitor while all three-phase motors are connected in star.

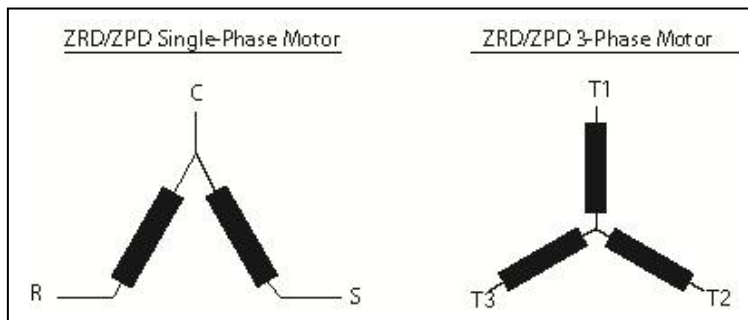


Figure 31: ZRD/ZPD motor schemes

The motor insulation material is class "B" (TF*) for the compressor models covered in these guidelines. This is according to VDE 0530, IEC 34-18-1 or DIN 57530.

4.2.3 Motor protection

For all Copeland Scroll Digital compressors, conventional inherent internal line break motor protection is provided.

4.2.4 Protection devices

Independently from the internal or external motor protection, fuses must be installed before the compressor. Selection of fuses has to be carried out according to VDE 0635, DIN 57635 IEC 269-1 or EN 60-269-1.

4.2.5 Crankcase heaters



IMPORTANT

Oil dilution! Bearing malfunction! Turn the crankcase heater on 12 hours before starting the compressor.

A crankcase heater is required for systems containing more than 120% of the compressor refrigerant charge limit listed in **Table 4** below. This includes long-line length systems where the extra charge will increase the standard factory charge above the 120% limit. Experience has shown that compressors may fill with liquid refrigerant under certain circumstances and system configurations, notably after longer off cycles when the compressor has cooled. This may cause

excessive start up clearing noise. The addition of a crankcase heater will reduce noise and dimming light complaints since the compressor will no longer have to clear out liquid during start.

A crankcase heater is required for three-phase compressors when the system charge exceeds the compressor charge limit listed in **Table 4** below.

Compressors	Refrigerant charge limit
ZRD42K* to ZRD81K* / ZPD34K* to ZPD91K*	4.5 kg
ZRD94K* & ZRD125K* / ZPD103K* to ZPD182K*	7.7 kg

Table 4

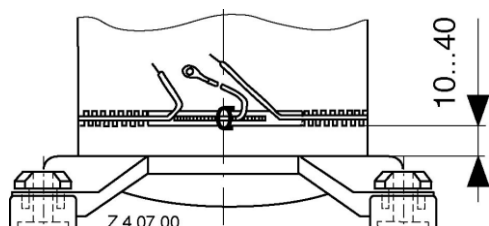


Figure 32: Crankcase heater location

Practically, for a multi evaporator system, the system charge will be much higher than for standard single evaporator systems. In order to prevent flooded start, we strongly recommend that all Digital Scroll applications use a crankcase heater.

The crankcase heater must be turned on a minimum of 12 hours prior to starting the compressor and must remain energised during compressor off cycles.

The crankcase heater must be mounted below the oil Schraeder valve located on the bottom shell (see **Figure 34**).

The crankcase heater should be wired in such a way that it is turned on whenever the compressor is switched off.

4.3 Pressure safety controls

4.3.1 IPR valve (Internal Pressure Relief valve)

The internal pressure relief valves for models ZRD42K* to ZRD81K* and ZPD34K* to ZPD91K* are located between the high and low sides of the compressor. They are designed to open when the discharge-to-suction differential pressure exceeds 26-31 bar. When the valve opens, hot discharge gas is routed back into the area of the motor protector to cause a trip. During developmental blocked fan testing, it is sometimes noted that the valve opens, but the compressor does not shut off while the discharge pressure continues to climb. This condition is normally caused by floodback and may be corrected by using a more restrictive expansion device or reducing the refrigerant charge.

Compressors ZRD94K*, ZRD125K* and ZPD120K* to ZPD182K* do not have internal pressure relief valves. To ensure safe operation, a high-pressure control must be used in all applications with these compressors.

The high-pressure control should have a manual reset feature for the highest level of system protection. Recommended cut-out setting for R407C is 29.5 bar, 45 bar for R410A. This pressure control will act independently from the digital controller.

4.3.2 High-pressure control

A high-pressure control with a maximum cut-out setting of 30 bar(g) for ZRD models or 45 bar(g) for ZPD models respectively is recommended.

The high-pressure cut-out should have a manual reset feature for the highest level of system protection.

4.3.3 Low-pressure control



IMPORTANT

Loss of system charge! Loss of lubrication! Bearing malfunction and compressor breakdown! A low-pressure control is highly recommended for loss of charge protection. Do not bridge or by-pass the low-pressure limiter.

Heat pumps in some geographical areas have to operate at low evaporating pressure because of the low ambient temperatures, sometimes combined with a high level of relative humidity. Good evaporator sizing and adequate defrost strategy control should prevent the system from

operating outside the operating envelope published by Emerson Climate Technologies, whatever the climatic conditions and the heating demand.

However, in some extreme cases – for example loss of system charge, extreme heat transfer restriction at the evaporator, any defect or blocked flow control component (expansion valve, screens...) – the evaporating conditions may be such that the compressor will tend to operate outside the published operating envelope limits. All those conditions may starve the compressor in refrigerant and oil, and may result in compressor failure.

Therefore, Emerson Climate Technologies strongly recommends the installation of a low pressure limiter in the suction line that will shut down the compressor when it operates outside the published envelope limits.

4.4 Discharge temperature protection

Internal discharge temperatures can reach unacceptable values under some extreme operating conditions (such as operation outside the approved application limits, improper control operation or loss of refrigerant injection charge). This could cause compressor damage.

Discharge gas temperature protection is required for any application with Copeland brand compressors in order to guarantee positive compressor protection. This protection must not be used as an operating envelope controller but as a safety device.

For some digital scroll compressors, an internal discharge temperature protector is included in the compressor standard delivery. Otherwise an external discharge temperature protector must be installed.

Models ZRD42K* to ZRD48K*, ZRD94K*, ZRD125K* and ZPD34K* to ZPD182K* do not have internal temperature protection and therefore require an external thermostat or a discharge temperature sensor (NTC thermistor) mounted as close as possible to the discharge fitting in order for the Digital Scroll controller to operate properly. For best response the sensor should be insulated. Emerson Climate Technologies provides the correct thermostat and the NTC thermistor as accessories to fit the discharge line of these compressors.

Models ZRD61K* to ZRD81K* come with an internal discharge temperature sensor (NTC thermistor) that is embedded in the top cap of the compressor. The output of the NTC thermistor is used in the protection module of the Digital Scroll controller.

The resistance curve for the NTC thermistor is provided in **Table 5** below:

Temperature (°C)	Resistance (kOhm)	Temperature (°C)	Resistance (kOhm)
-40	2889.60	75	12.73
-35	2087.22	80	10.79
-30	1522.20	85	9.20
-25	1121.44	90	7.87
-20	834.72	95	6.77
-15	627.28	100	5.85
-10	475.74	105	5.09
-5	363.99	110	4.45
0	280.82	115	3.87
5	218.41	120	3.35
10	171.17	125	2.92
15	135.14	130	2.58
20	107.44	135	2.28
25	86.00	140	2.02
30	69.28	145	1.80
35	56.16	150	1.59
40	45.81	155	1.39
45	37.58	160	1.25
50	30.99	165	1.12
55	25.68	170	1.01
60	21.40	175	0.92
65	17.91	180	0.83
70	15.07		

Table 5: Digital Scroll thermistor temperature / resistance values

4.5 Low ambient cut-out

A low ambient cut-out is not required to limit air-to-air heat pump operation. Air-to-water heat pumps must be reviewed since this configuration could possibly run outside of the approved operating envelope causing overheating or excessive pressure ratio operation.

4.6 High-potential testing



WARNING

Conductor cables! Electrical shock! Shut off power supply before high-potential testing.



CAUTION

Internal arcing! Motor destruction! Do not carry out high-voltage or insulation tests if the compressor housing is under vacuum.

Emerson Climate Technologies subjects all Scroll compressors to a high-voltage test after final assembly. Each motor phase winding is tested, according to EN 0530 or VDE 0530 part 1, at a differential voltage of 1000V plus twice the nominal voltage. Since high-voltage tests lead to premature ageing of the winding insulation further additional tests of that nature are not recommended.

If it has to be done for any reason, a lower voltage must be used. Disconnect all electronic devices, eg, motor protection module, fan speed control, etc prior to testing.

5 Starting up & operation



WARNING

Diesel effect! Compressor destruction! The mixture of air and oil at high temperature can lead to an explosion. Avoid operating with air.



IMPORTANT

Oil dilution! Bearing malfunction! Turn the crankcase heater on 12 hours before starting the compressor.

5.1 Strength pressure test

The compressor has been strength-tested in the factory. It is not necessary for the customer to strength- or leak-test the compressor again although the compressor will normally be exposed to the testing made as part of system testing.

5.2 Tightness/pressure test



WARNING

High pressure! Personal injuries! Consider personal safety requirements and refer to test pressures prior to test.



WARNING

System explosion! Personal injuries! DO NOT USE other industrial gases.



CAUTION

System contamination! Bearing malfunction! Use only dry nitrogen or dried air for pressure testing.

If using dry air do not include the compressor in the pressure test – isolate it first. Never add refrigerant to the test gas (as leak indicator).

5.3 Preliminary checks – Pre-starting

Discuss details of the installation with the installer. If possible, obtain drawings, wiring diagrams, etc.

It is ideal to use a check-list but always check the following:

- Visual check of the electrics, wiring, fuses etc.
- Visual check of the plant for leaks, loose fittings such as TXV bulbs etc.
- Compressor oil level
- Calibration of HP & LP switches and any pressure actuated valves
- Check setting and operation of all safety features and protection devices
- All valves in the correct running position
- Pressure and compound gauges fitted
- Correctly charged with refrigerant
- Compressor electrical isolator location & position

5.4 Charging procedure



CAUTION

Low suction pressure operation! Compressor damage! Do not operate with a restricted suction. Do not operate with the low-pressure cut-out bridged. Do not operate compressor without enough system charge to maintain at least 0.5 bar(g) suction pressure. Allowing pressure to drop below 0.5 bar(g) for more than a few seconds may overheat scrolls and cause early drive bearing damage.

The system should be liquid-charged through the liquid-receiver shut-off valve or through a valve in the liquid line. The use of a filter drier in the charging line is highly recommended. Because R410A and R407C are blends and scrolls have discharge check valves, systems should be liquid-charged on both the high and low sides simultaneously to ensure a positive refrigerant

pressure is present in the compressor before it runs. The majority of the charge should be placed in the high side of the system to prevent bearing washout during first-time start on the assembly line.

5.5 Initial start-up



CAUTION

Oil dilution! Bearing malfunction! It is important to ensure that new compressors are not subjected to liquid abuse. Turn the crankcase heater on 12 hours before starting the compressor.



CAUTION

High discharge pressure operation! Compressor damage! Do not use the compressor to test opening set point of high-pressure cut-out. Bearings are susceptible to damage before they have had several hours of normal running in.

Liquid and high pressure loads could be detrimental to new bearings. It is therefore important to ensure that new compressors are not subjected to liquid abuse and high-pressure run tests. It is not good practice to use the compressor to test the high-pressure switch function on the production line. Switch function can be tested with nitrogen prior to installation and wiring can be checked by disconnecting the high-pressure switch during the run test.

5.6 Rotation direction

Copeland Scroll compressors, like several other types of compressors, will only compress in one rotational direction. The direction of rotation is not an issue with single-phase compressors since they will always start and run in the proper direction. Three-phase compressors will rotate in either direction depending upon phasing of the power. Since there is a 50-50 chance of connecting power in such a way as to cause rotation in the reverse direction, **it is important to include notices and instructions in appropriate locations on the equipment to ensure proper rotation direction when the system is installed and operated.**

Observing that suction pressure drops and discharge pressure rises when the compressor is energized allows verification of proper rotation direction. There is no negative impact on durability caused by operating three-phase Copeland Scroll compressors in the reversed direction for a short period of time (under one hour) but oil may be lost. Oil loss can be prevented during reverse rotation if the tubing is routed at least 15 cm above the compressor. After several minutes of operation in reverse, the compressor's protection system will trip due to high motor temperature. The operator will notice a lack of cooling. However, if allowed to repeatedly restart and run in reverse without correcting the situation, the compressor will be permanently damaged.

All three-phase scroll compressors are identically wired internally. Therefore, once the correct phasing is determined for a specific system or installation, connecting properly phased power leads to the identified compressor terminals will ensure proper rotation direction.

5.7 Pressure fluctuations

During the normal operation of the Digital Scroll compressor, there is a fluctuation in the suction and the discharge pressures. This fluctuation will be in the range of 2 to 3.5 bar. During the unloaded state, discharge pressure will start to drop and suction pressure will start to rise. This is normal. This pressure fluctuation has no effect on the reliability of any system components.

NOTE: Models ZRD42K* to ZRD81K* and ZPD34K* to ZPD91K* require a minimum of 3.5 bar differential between the suction pressure and the discharge pressure to unload properly.

5.8 Starting sound

During the very brief start-up, a clicking sound is audible, resulting from initial contacting of the spirals and is normal. Due to the design of the Copeland Scroll compressors, the internal compression components always start unloaded even if system pressures are not balanced. In addition, since internal compressor pressures are always balanced at start-up, low-voltage starting characteristics are excellent for Copeland Scroll compressors.

5.9 Deep vacuum operation



CAUTION

Vacuum operation! Compressor damage! Scroll compressors should never be used to evacuate an air-conditioning system.



IMPORTANT

Vacuum operation! Bearing damage! Vacuum operation causes damage to the drive bearing of the scrolls. Copeland Scroll compressors are able to pull vacuum very quickly and this should be avoided.

The scroll compressor can be used to pump down refrigerant in a unit as long as the pressures remain within the operating envelope. Low suction pressures will result in overheating of the scrolls and permanent damage to the compressor drive bearing. ZPD and ZRD scrolls incorporate internal low vacuum protection; the floating seal unloads when the pressure ratio exceeds approximately 10:1.

5.10 Shell temperature

The top shell and discharge line can briefly but repeatedly reach temperatures above 177°C if the compressor cycles on its internal protection devices. This only happens under rare circumstances and can be caused by the failure of system components such as the condenser or evaporator fan or loss of charge and depends upon the type of expansion control. Care must be taken to ensure that wiring or other materials that could be damaged by these temperatures do not come in contact with the shell.

5.11 Minimum run time

Emerson Climate Technologies recommends a maximum of 10 starts per hour. There is no minimum off time because scroll compressors start unloaded even if the system has unbalanced pressures. The most critical consideration is the minimum run time required to return oil to the compressor after start-up. To establish the minimum run time obtain a sample compressor equipped with a sight tube (available from Emerson Climate Technologies) and install it in a system with the longest connecting lines that are approved for the system. The minimum on time becomes the time required for oil lost during compressor start-up to return to the compressor sump and restore a minimal oil level that will ensure oil pick-up through the crankshaft. Cycling the compressor for a shorter period than this, for instance to maintain very tight temperature control, will result in progressive loss of oil and damage to the compressor.

5.12 Sound characteristics

For the Copeland Scroll Digital compressor the sound spectrum of the loaded state and that of the unloaded state are quite different. The unloaded sound power is normally 2 dB(A) higher than the loaded sound power. If sound variability is an issue, we recommend the use of a sound cover.

5.13 Shut-off sound

Scroll compressors incorporate a device that minimizes reverse rotation. The residual momentary reversal of the scrolls at shut off will cause a clicking sound, but it is entirely normal and has no effect on compressor durability.

5.14 Frequency

There is no general release of standard Copeland Scroll compressors for use with variable speed AC drives. There are numerous issues that must be considered when applying Scroll compressors with variable speed, including system design, inverter selection, and operating envelopes at various conditions. Only frequencies from 50 Hz to 60 Hz are acceptable. Operation outside this frequency range is possible but should not be done without specific Application Engineering review. The voltage must vary proportionally to the frequency.

If the inverter can only deliver a maximum voltage of 400V, the amps will increase when the speed is above 50 Hz, and this may give rise to nuisance tripping if operation is near the maximum power limit and/or compressor discharge temperature limit.

5.15 Oil level control

Oil return tests are very critical for multi-evaporator applications and so **during development testing, it is mandatory to use a Copeland Scroll Digital sample with a sight tube.** The sight tube has graduation marks on the outside that show the oil level. However, it must be ensured that this minimum oil is not diluted by refrigerant liquid inside the compressor. For safe operation, the maximum oil dilution allowed is 10%. Oil dilution means the amount of refrigerant in a certain volume of oil. Please refer to the oil dilution chart in **Figure 25** to ensure that the Copeland Scroll Digital compressors operate in the safe zone.

5.16 Digital system control

Due to the pulsing characteristic of Copeland Scroll Digital compressors superheat control needs to be performed by qualified solutions in order to ensure the stability, reliability and good performance of the system.

Currently qualified solutions are:

- ALCO Gated Logic Control
 - Superheat driver: EC3-D72 / EC3-D73
 - Electronic expansion valve: EX4 / EX5 / EX6
- CAREL Optimised Digital Control
 - 1Tool software module

5.17 Power factor

During the loaded state, when the Copeland Scroll Digital compressor operates at full capacity, the power factor is almost the same as with a standard scroll. However, when the scrolls are unloaded, the power factor is lower.

6 Maintenance & repair

6.1 Exchanging the refrigerant

Qualified refrigerants and oils are given in section 2.4.1.

It is not necessary to replace the refrigerant with new unless contamination due to an error such as topping up the system with an incorrect refrigerant is suspected. To verify correct refrigerant composition, a sample can be taken for chemical analysis. A check can be made during shut down by comparing the refrigerant temperature and pressure using precision measurements at a location in the system where liquid and vapour phases are present and when the temperatures have stabilised.

In the event that the refrigerant needs replacing, the charge should be recovered using a suitable recovery unit.

6.2 Rotalock valves

If Rotalock valves are fitted, they should be periodically retorqued to ensure that leak tightness is maintained.

6.3 Replacing a compressor



CAUTION

Inadequate lubrication! Bearing destruction! Exchange the accumulator after replacing a compressor with a burned out motor. The accumulator oil return orifice or screen may be plugged with debris or may become plugged. This will result in starvation of oil to the new compressor and a second failure.

6.3.1 Compressor replacement

In the case of a motor burnout, the majority of contaminated oil will be removed with the compressor. The rest of the oil is cleaned through the use of suction and liquid line filter driers. A 100% activated alumina suction line filter drier is recommended but must be removed after 72 hours. **It is highly recommended that the suction accumulator be replaced if the system contains one.** This is because the accumulator oil return orifice or screen may be plugged with debris or may become plugged shortly after a compressor failure. This will result in starvation of oil to the replacement compressor and a second failure. When a single compressor or tandem is exchanged in the field, it is possible that a major portion of the oil may still be in the system. While this may not affect the reliability of the replacement compressor, the extra oil will add to rotor drag and increase power usage.

6.3.2 Start-up of a new or replacement compressor

Rapid charging only on the suction side of a scroll-equipped system or condensing unit can occasionally result in a temporary no start condition for the compressor. The reason for this is that, if the flanks of the compressor happen to be in a sealed position, rapid pressurisation of the low side without opposing high-side pressure can cause the scrolls to seal axially. As a result, until the pressures eventually equalise, the scrolls can be held tightly together preventing rotation. The best way to avoid this situation is to charge on both the high and low sides simultaneously at a rate which does not result in axial loading of the scrolls.

A minimum suction pressure of 1.75 bar must be maintained during charging. Allowing pressure to drop below 0.5 bar for more than a few seconds may overheat scrolls and cause early drive bearing damage. Never install a system in the field and leave it unattended when it has no charge, a holding charge, or with the service valves closed without securely electrically locking out the system. This will prevent unauthorised personnel from accidentally operating the system and potentially ruining the compressor by operating with no refrigerant flow. **Do not start the compressor while the system is in a deep vacuum.** Internal arcing may occur when a scroll compressor is started in a vacuum causing burnout of the internal lead connections.

6.4 Lubrication and oil removal



WARNING

Chemical reaction! Compressor destruction! Do not mix up ester oils with mineral oil and/or alkyl benzene when used with chlorine-free (HFC) refrigerants.

The compressor is supplied with an initial oil charge. The standard oil charge for use with refrigerants R407C and R410A is a polyolester (POE) lubricant Emkarate RL 32 3MAF. In the field the oil level could be topped up with Emkarate RL 32 3MAF or Mobil EAL Arctic 22 CC if 3MAF is not available. See nameplate for original oil charge shown in litres. A field recharge is from 0.05 to 0.1 litre less.

One disadvantage of POE is that it is far more hygroscopic than mineral oil (**Figure 35**). Only brief exposure to ambient air is needed for POE to absorb sufficient moisture to make it unacceptable for use in a refrigeration system. Since POE holds moisture more readily than mineral oil it is more difficult to remove it through the use of vacuum. Compressors supplied by Emerson Climate Technologies contain oil with low moisture content, and it may rise during the system assembling process. Therefore it is recommended that a properly sized filter-drier is installed in all POE systems. This will maintain the moisture level in the oil to less than 50 ppm. If oil is charged into a system, it is recommended to use POE with moisture content no higher than 50 ppm.

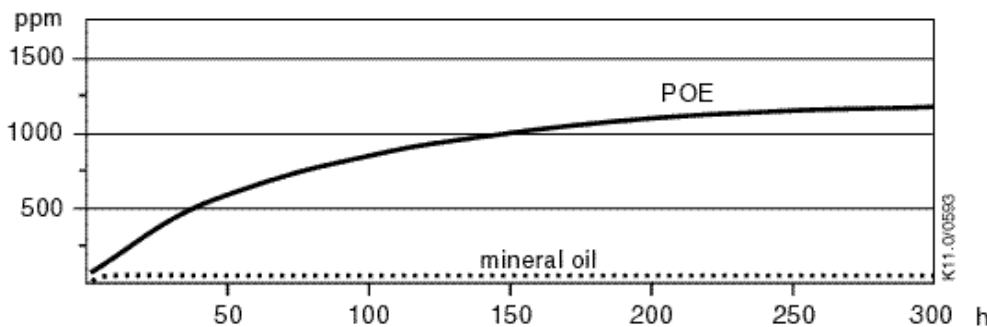


Figure 33: Absorption of moisture in ester oil in comparison to mineral oil in ppm by weight at 25°C and 50% relative humidity (h=hours)

If the moisture content of the oil in a refrigeration system reaches unacceptably high levels, corrosion and copper plating may occur. The system should be evacuated down to 0.3 mbar or lower. If there is uncertainty as to the moisture content in the system, an oil sample should be taken and tested for moisture. Sight glass/moisture indicators currently available can be used with the HFC refrigerants and lubricants; however, the moisture indicator will just show the moisture content of the refrigerant. The actual moisture level of POE would be higher than the sight glass indicates. This is due to the high hygroscopicity of the POE oil. To determine the actual moisture content of the lubricant, samples have to be taken from the system and analysed.

6.5 Oil additives

Although Emerson Climate Technologies cannot comment on any specific product, from our own testing and past experience, we do not recommend the use of any additives to reduce compressor bearing losses or for any other purpose. Furthermore, the long term chemical stability of any additive in the presence of refrigerant, low and high temperatures, and materials commonly found in refrigeration systems is complex and difficult to evaluate without rigorously controlled chemical laboratory testing. The use of additives without adequate testing may result in malfunction or premature failure of components in the system and, in specific cases, in voiding the warranty on the component.

Safety instructions

Product description

Installation

Electrical connection

Starting up & operation

Maintenance & repair

Dismantling & disposal

6.6 Unbrazing system components



WARNING

Explosive flame! Burning! Oil-refrigerant mixtures are highly flammable. Remove all refrigerant before opening the system. Avoid working with an unshielded flame in a refrigerant charged system.

Before opening up a system it is important to remove all refrigerant from both the high and low sides of the system. If the refrigerant charge is removed from a scroll-equipped unit from the high side only, it is 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 while the low side shell and suction line contain pressure, the pressurized refrigerant and oil mixture could ignite when it escapes and contacts the brazing flame. To prevent this occurrence, it is important to check both the high and low sides with manifold gauges before unbrazing. Instructions should be provided in appropriate product literature and assembly (line repair) areas. If compressor removal is required, the compressor should be cut out of system rather than unbrazed.

7 Dismantling & disposal



Removing oil and refrigerant:

Do not disperse in the environment.

Use the correct equipment and method of removal.

Dispose of oil and refrigerant properly.

Dispose of compressor properly.

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