Installation Guide

Start to Finish™ R-410A Scroll Compressors

Model Numbers:

SFCOM090***4PSNAD	SFCOM181***4PSNAD	SFCOM300***4PSNAN
SFCOM109***4PSNAD	SFCOM182***4PSNAN	SFCOM301***4PSNAN
SFCOM121***4PSNAD	SFCOM183***4PSNAN	SFCOM360***4PSNAN
SFCOM145***4PSNAD	SFCOM240***4PSNAN	SFCOM361***4PSNAN
SFCOM156***4PSNAD	SFCOM241***4PSNAN	

⚠SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

August 2020 **PART-SVN234B-EN**

Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

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

⚠CAUTION Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.

NOTICE Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants—including industry replacements for CFCs and HCFCs such as saturated or unsaturated HFCs.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified. The Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.

⚠WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labeling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

⚠WARNING

Follow EHS Policies!

Failure to follow instructions below could result in death or serious injury.

- **All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Trane personnel should always follow local regulations.**

⚠WARNING

R-410A Refrigerant under Higher Pressure than R-22!

Failure to use proper equipment or components as described below, could result in equipment failing and possibly exploding, which could result in death, serious injury, or equipment damage. The units described in this manual use R-410A refrigerant which operates at higher pressures than R-22. Use ONLY R-410A rated service equipment or components with these units. For specific handling concerns with R-410A, please contact your local Ingersoll Rand representative.

⚠WARNING

Hazard of Explosion and Deadly Gases!

Failure to follow all proper safe refrigerant handling practices could result in death or serious injury.
Never solder, braze or weld on refrigerant lines or any unit components that are above atmospheric pressure or where refrigerant may be present. Always remove refrigerant by following the guidelines established by the EPA Federal Clean Air Act or other state or local codes as appropriate. After refrigerant removal, use dry nitrogen to bring system back to atmospheric pressure before opening system for repairs. Mixtures of refrigerants and air under pressure may become combustible in the presence of an ignition source leading to an explosion. Excessive heat from soldering, brazing or welding with refrigerant vapors present can form highly toxic gases and extremely corrosive acids.

⚠WARNING

Hazard of Explosion!

Failure to follow instructions below could result in death or serious injury or equipment or property-only damage. Use only dry nitrogen with a pressure regulator for pressurizing unit. Do not use acetylene, oxygen or compressed air or mixtures containing them for pressure testing. Do not use mixtures of a hydrogen containing refrigerant and air above atmospheric pressure for pressure testing as they may become flammable and could result in an explosion. Refrigerant, when used as a trace gas should only be mixed with dry nitrogen for pressurizing units.

⚠WARNING

Hazardous Service Procedures!

Failure to follow all precautions in this manual and on the tags, stickers, and labels could result in death or serious injury.
Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks.

⚠WARNING

Hazardous Conditions!

Failure to follow these instructions could result in death or serious injury or damage to the equipment. Observe and follow the "Warning" and "Notices" labels on the compressor.

NOTICE

Use Proper Charging and Crankcase Heater Operation Procedures!

Failure to utilize proper charging and crankcase heater procedure will result in compressor failure. Refer to unit *Installation, Operation, and Maintenance* manual and this manual for the proper procedures.

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Revision History

Updated for Trane Technologies.

Table of Contents

Model Number Descriptions

Digit 1, 2 — Brand

SF = Start to Finish™

Digit 3, 4, 5 — Unit Type

COM= Scroll Compressor

Digit 6, 7, 8 — Nominal Capacity

090 = 85 MBtu/h
109 = 101 MBtu/h
121 = 117 MBtu/h
145 = 137 MBtu/h
156 = 158 MBtu/h
181 = 178 MBtu/h
182 = 176 MBtu/h, 115/230V Module
183 = 176 MBtu/h, 24V Module
240 = 237 MBtu/h, 115/230V Module
241 = 237 MBtu/h, 24V Module
300 = 298 MBtu/h, 115/230V Module
301 = 298 MBtu/h, 24V Module
360 = 359 MBtu/h, 115/230V Module
361 = 359 MBtu/h, 24V Module

Digit 9, 10, 11 — Electrical Code

230 = 200–230/60/3
460 = 460/60/3
575 = 575/60/3

Digit 12 — Refrigerant

2 = R-22
4 = R-410A

Digit 13 — Lubricant

M = Mineral Oil
P = Polyolester (POE) Oil

Digit 14 — Connection Type

R = Rotolock
S = Stub Tube

Digit 15 — Motor Protection

E = External Protection
N = Internal Protection

Digit 16 — Revision Level

A = Initial Release

Digit 17 — Bill of Material

D
N

Overview

The purpose of this document is to provide installation and service information for Start to Finish™ R-410A compressors.

This document is not meant to be provide a step-by-step procedure, but is intended to identify procedures or precautions that may be unique to a Start to Finish R-410A compressor and should be taken into account to properly and safely remove, install, and troubleshoot the compressor.

Each installation has its unique set of circumstances which also must be taken into account by the service technician.

Table 1. Available Start to Finish™ compressors

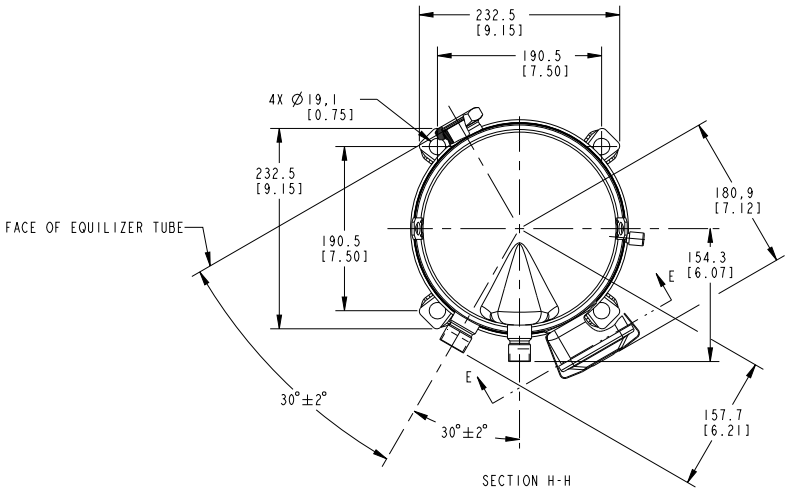
Model Number	Service Part Number
SFCOM0905754PSNAD	SFCOM090-5754AD
SFCOM0902304PSNAD	SFCOM090-2304AD
SFCOM0904604PSNAD	SFCOM090-4604AD
SFCOM1095754PSNAD	SFCOM109-5754AD
SFCOM1092304PSNAD	SFCOM109-2304AD
SFCOM1094604PSNAD	SFCOM109-4604AD
SFCOM1215754PSNAD	SFCOM121-5754AD
SFCOM1212304PSNAD	SFCOM121-2304AD
SFCOM1214604PSNAD	SFCOM121-4604AD
SFCOM1455754PSNAD	SFCOM145-5754AD
SFCOM1452304PSNAD	SFCOM145-2304AD
SFCOM1454604PSNAD	SFCOM145-4604AD
SFCOM1565754PSNAD	SFCOM156-5754AD
SFCOM1562304PSNAD	SFCOM156-2304AD
SFCOM1564604PSNAD	SFCOM156-4604AD
SFCOM1815754PSNAD	SFCOM181-5754AD
SFCOM1812304PSNAD	SFCOM181-2304AD
SFCOM1814604PSNAD	SFCOM181-4604AD
SFCOM1825754PSNAN	SFCOM182-5754AN
SFCOM1832304PSNAN	SFCOM183-2304AN
SFCOM1822304PSNAN	SFCOM182-2304AN
SFCOM1834604PSNAN	SFCOM183-4604AN
SFCOM1824604PSNAN	SFCOM182-4604AN
SFCOM2415754PSNAN	SFCOM241-5754AN
SFCOM2405754PSNAN	SFCOM240-5754AN
SFCOM2412304PSNAN	SFCOM241-2304AN
SFCOM2402304PSNAN	SFCOM240-2304AN
SFCOM2414604PSNAN	SFCOM241-4604AN
SFCOM2404604PSNAN	SFCOM240-4604AN
SFCOM3005754PSNAN	SFCOM300-5754AN
SFCOM3012304PSNAN	SFCOM301-2304AN
SFCOM3002304PSNAN	SFCOM300-2304AN
SFCOM3014604PSNAN	SFCOM301-4604AN
SFCOM3004604PSNAN	SFCOM300-4604AN
SFCOM3615754PSNAN	SFCOM361-5754AN
SFCOM3605754PSNAN	SFCOM360-5754AN

Table 1. Available Start to Finish™ compressors

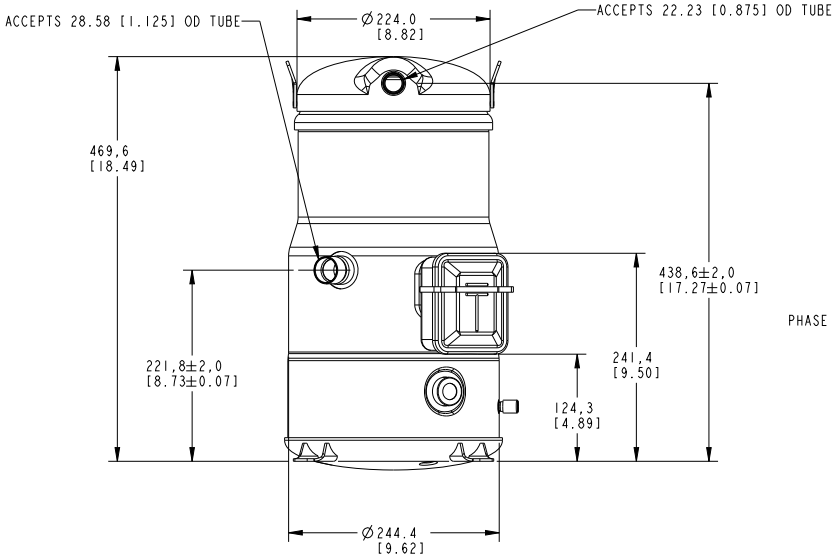
Model Number	Service Part Number
SFCOM3612304PSNAN	SFCOM361-2304AN
SFCOM3602304PSNAN	SFCOM360-2304AN
SFCOM3614604PSNAN	SFCOM361-4604AN
SFCOM3604604PSNAN	SFCOM360-4604AN

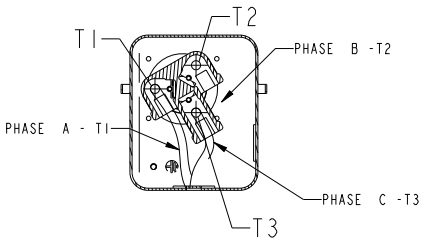
Dimensional Data

Figure 1. SFCOM090 compressors



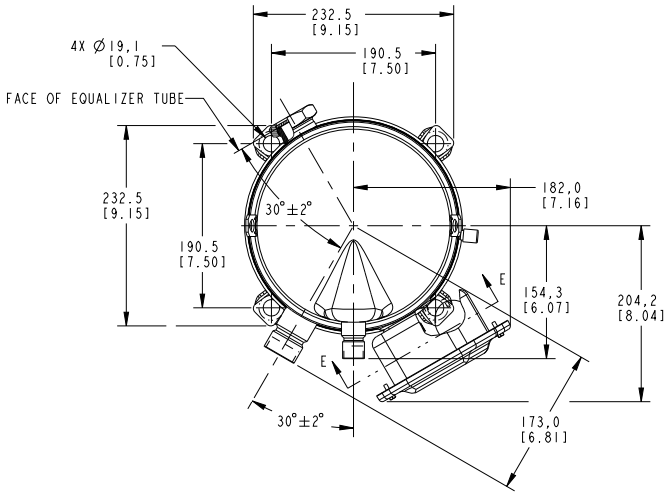
APPLICATION	SFCOM090
REFRIGERANT	R410A
U.L. RECOGNIZED USA & CANADA	
RATED PERFORMANCE @45°/130°/20°/15°	
CAPACITY (MBTU/HR)	85.1
POWER INPUT (KW)	8.67
EER (BTU/W-HR)	9.82



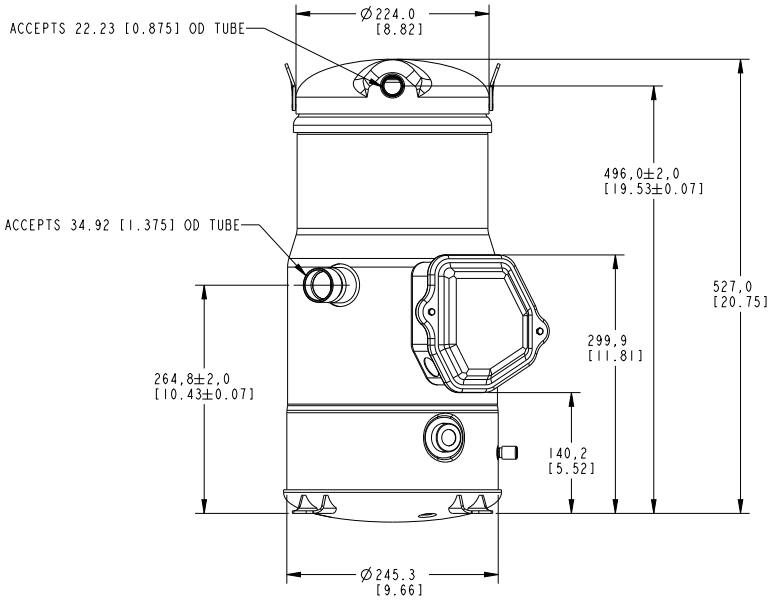


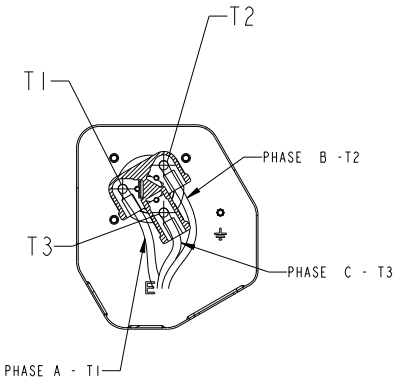
Note: *Fittings and connection part descriptions are shown in Figure 13 and Figure 14, p. 19.*

Figure 2. SFCOM109 and SFCOM121 compressors



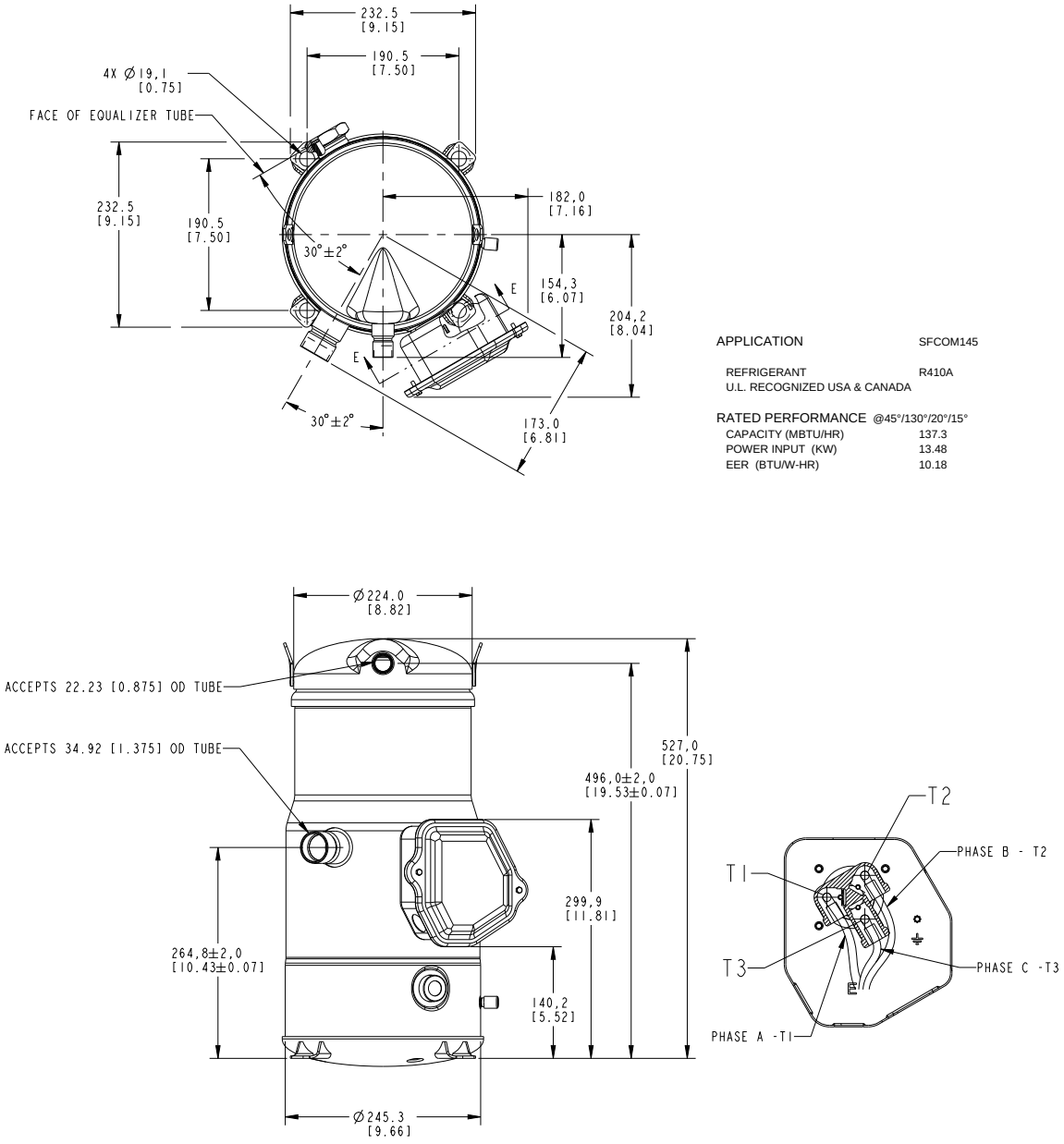
APPLICATION	SFCOM109	SFCOM121
REFRIGERANT	R410A	R410A
U.L. RECOGNIZED USA & CANADA		
RATED PERFORMANCE @45°/130°/20°/15°		
CAPACITY (MBTU/HR)	101.0	117.1
POWER INPUT (KW)	10.15	11.58
EER (BTU/W-HR)	9.95	10.11





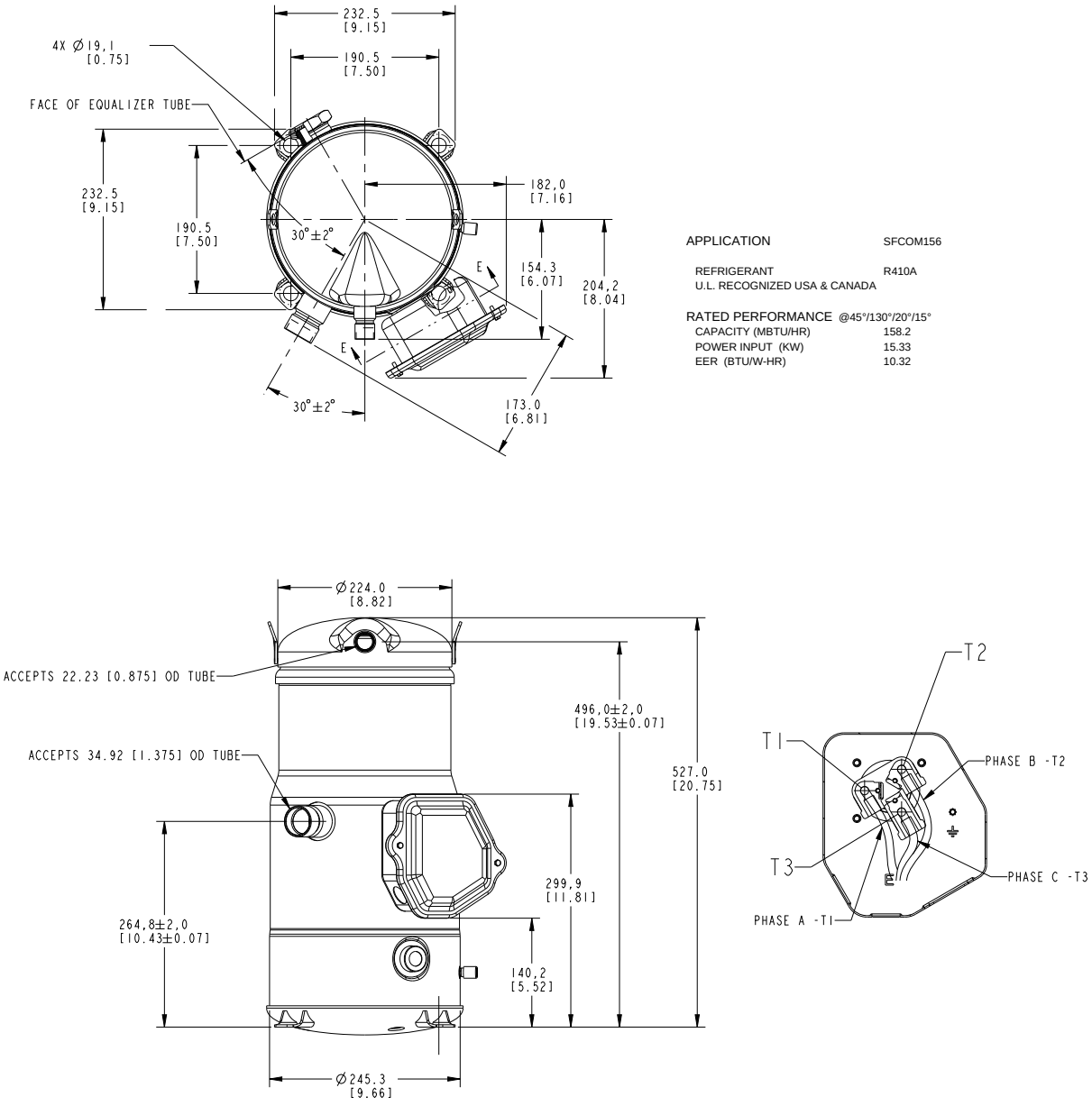
Note: *Fittings and connection part descriptions are shown in Figure 13 and Figure 14, p. 19.*

Figure 3. SFCOM145 compressors



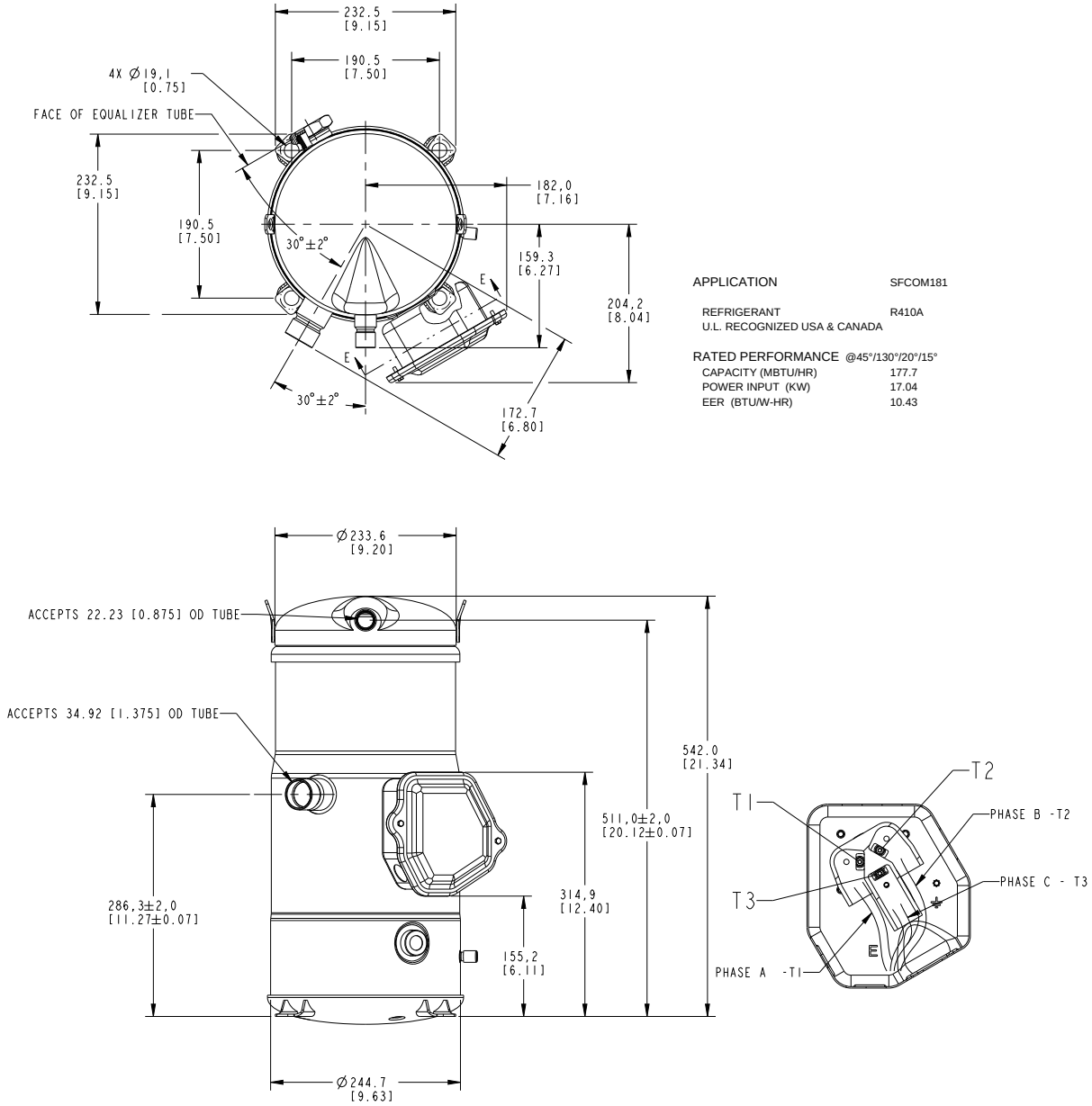
Note: *Fittings and connection part descriptions are shown in Figure 13 and Figure 14, p. 19.*

Figure 4. SFCOM156 compressors



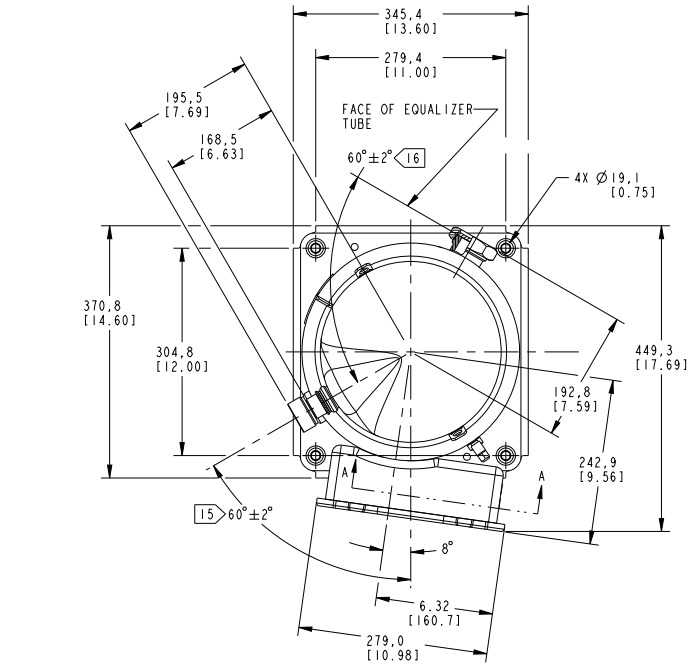
Note: *Fittings and connection part descriptions are shown in Figure 13 and Figure 14, p. 19.*

Figure 5. SFCOM181 compressors

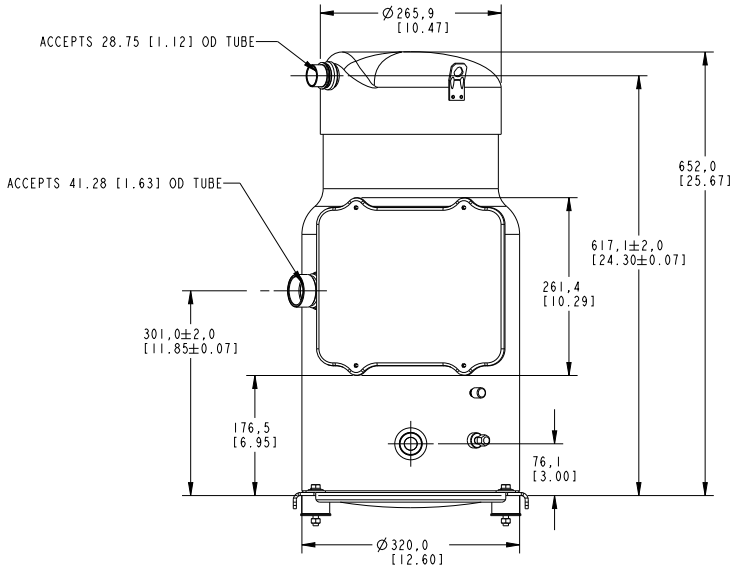


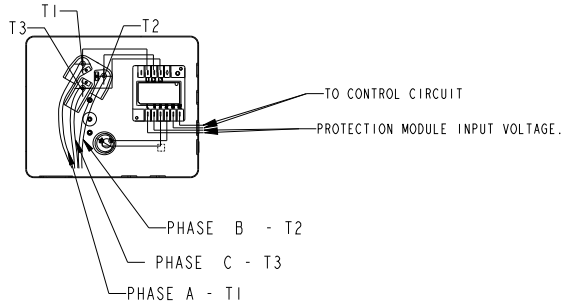
Note: *Fittings and connection part descriptions are shown in Figure 13 and Figure 14, p. 19.*

Figure 6. SFCOM182 and SFCOM183 compressors



APPLICATION	SFCOM182	SFCOM183
REFRIGERANT	R410A	R410A
U.L. RECOGNIZED USA & CANADA		
RATED PERFORMANCE @45°/130°/20°/15°		
CAPACITY (MBTU/HR)	176.2	176.2
POWER INPUT (KW)	17.36	17.36
EER (BTU/W-HR)	10.15	10.15
PROTECTION CONTROL MODULE		
VAC	115/230	24

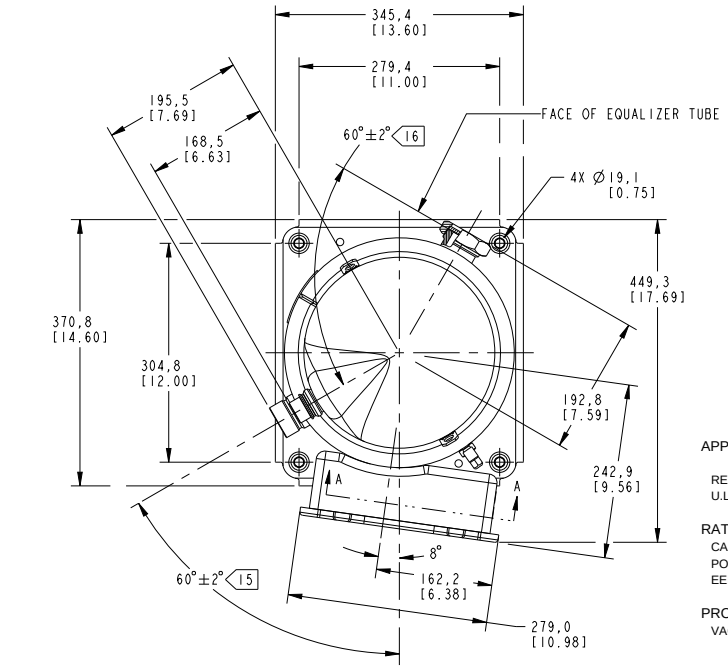




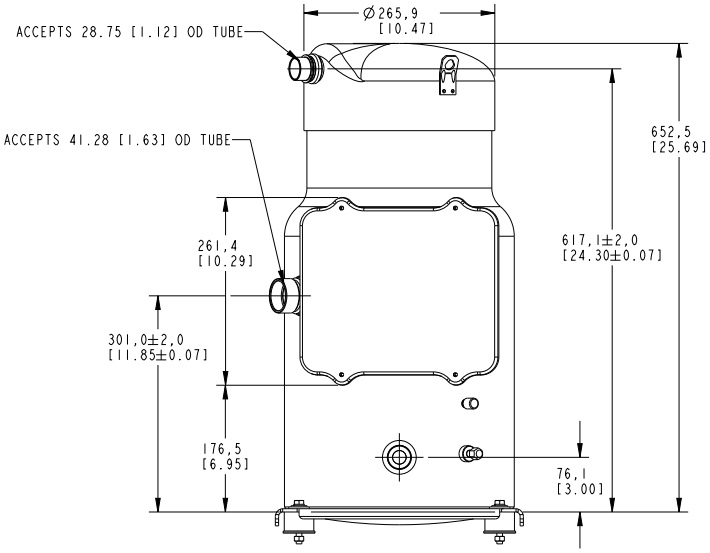
Note: *Fittings and connection part descriptions are shown in Figure 13 and Figure 14, p. 19.*

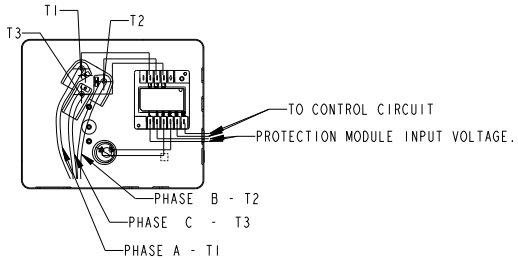
Dimensional Data

Figure 7. SFCOM240 and SFCOM241 compressors



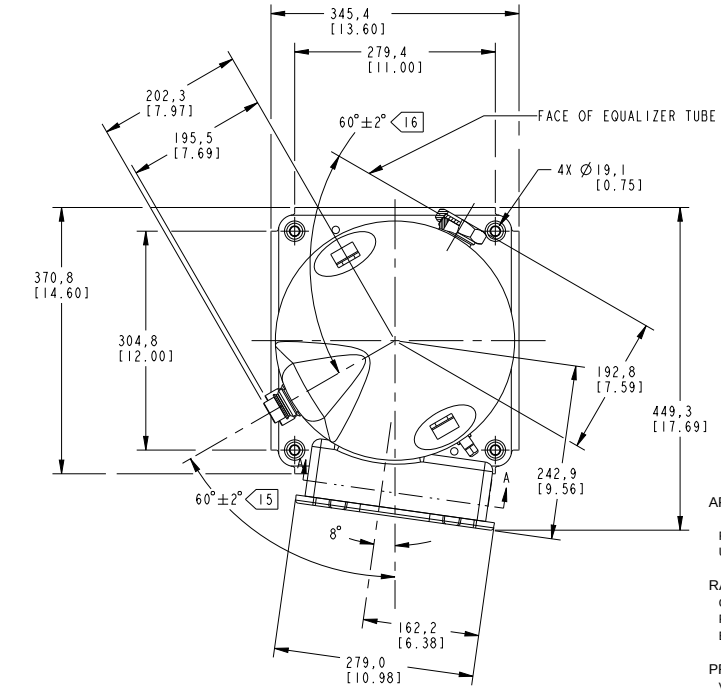
APPLICATION	SFCOM240	SFCOM241
REFRIGERANT U.L. RECOGNIZED USA & CANADA	R410A	R410A
RATED PERFORMANCE @45°/130°/20°/15°		
CAPACITY (MBTU/HR)	237.4	237.4
POWER INPUT (KW)	23.46	23.46
EER (BTU/W-HR)	10.12	10.12
PROTECTION CONTROL MODULE		
VAC	115/230	24



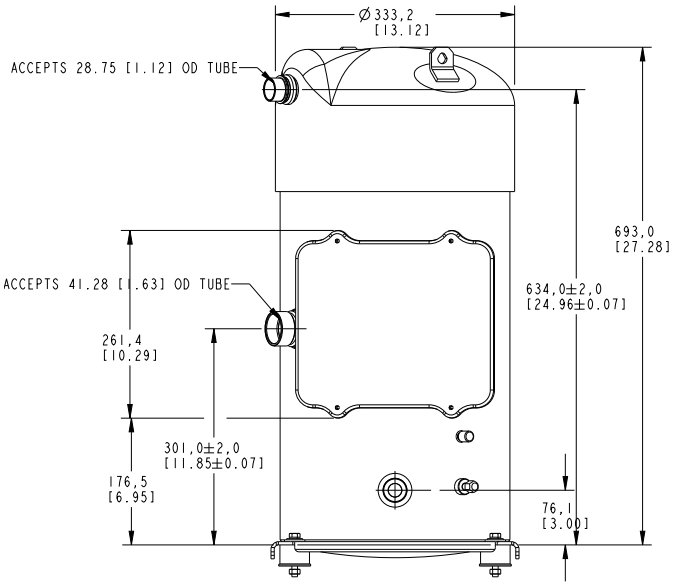


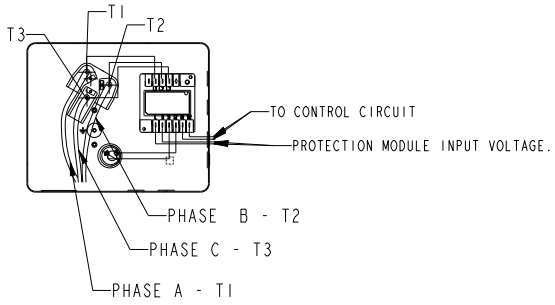
Note: *Fittings and connection part descriptions are shown in Figure 13 and Figure 14, p. 19.*

Figure 8. SFCOM300 and SFCOM301 compressors



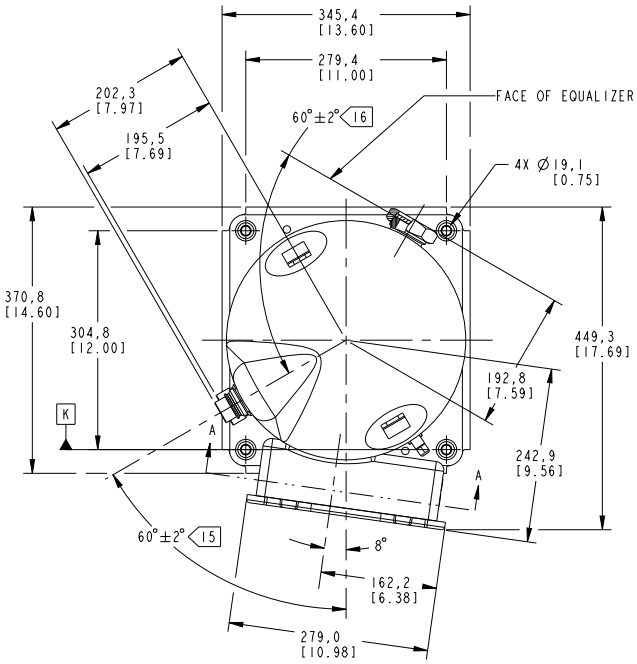
APPLICATION	SFCOM300	SFCOM301
REFRIGERANT	R410A	R410A
U.L. RECOGNIZED USA & CANADA		
RATED PERFORMANCE @45°/130°/20°/15°		
CAPACITY (MBTU/HR)	298.2	298.2
POWER INPUT (KW)	29.75	29.75
EER (BTU/W-HR)	10.02	10.02
PROTECTION CONTROL MODULE		
VAC	115/230	24



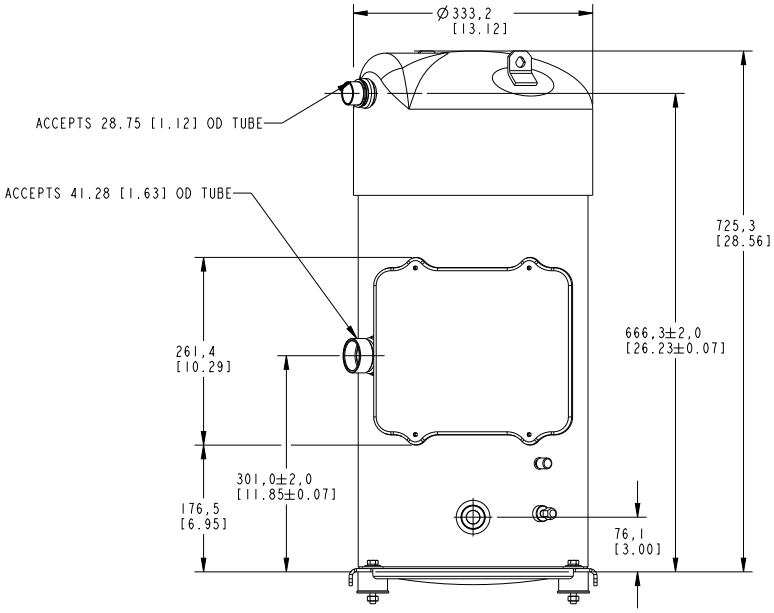


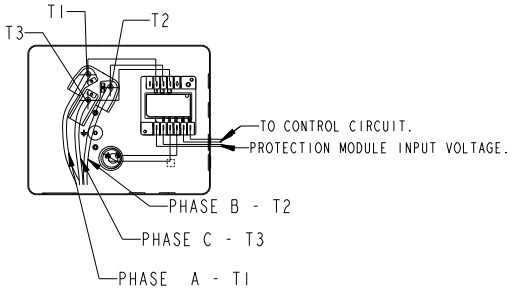
Note: *Fittings and connection part descriptions are shown in Figure 13 and Figure 14, p. 19.*

Figure 9. SFCOM360 and SFCOM361 compressors



APPLICATION	SFCOM360	SFCOM361
REFRIGERANT	R410A	R410A
U.L. RECOGNIZED USA & CANADA		
RATED PERFORMANCE @45°/130°/20°/15°		
CAPACITY (MBTU/HR)	358.9	358.9
POWER INPUT (KW)	36.10	36.10
EER (BTU/W-HR)	9.94	9.94
PROTECTION CONTROL MODULE		
VAC	115/230	24





Note: *Fittings and connection part descriptions are shown in Figure 13 and Figure 14, p. 19.*

General Information

Table 2. Torque values

Item	Torque
Rotolock equalizer nut 1-3/4 and 2-1/4	133 ± 10 N·m; 98 ± 7 ft·lb
Terminal screws #10-32 X 0.5 in	2.75 ± 0.25 N·m; 25 ± 2 in·lb
Terminal stud	2.75 ± 0.25 N·m; 30 ± 2 in·lb
Terminal stud nut	3.4 ± 0.25 N·m; 30 ± 2 in·lb
Ground screw	1.90 ± 0.25 N·m; 17 ± 2 in·lb
Terminal box cover	2.15 ± 0.25 N·m; 19 ± 2 in·lb

Note: *With Rotolock fittings, always use two wrenches: one to back-up on the sleeve and one to tighten the nut. Proper torquing of the Rotolock nut is important to ensure a leak-free joint.*

POE Oil

Table 3. Factory oil charge

Nominal Capacity	Pints	Liters	Part Number
090	6.3	3.0	OIL00078, OIL00080
109–156	7.0	3.3	OIL00078, OIL00080
181	7.6	3.6	OIL00078, OIL00080
182–301	14.2	6.7	OIL00078, OIL00080
360–361	15.2	7.2	OIL00078, OIL00080

Notes:
1. OIL00078—1 quart container
2. OIL00080—1 gallon container
3. Oil amount and type is also printed on the nameplate.

Oil Handling

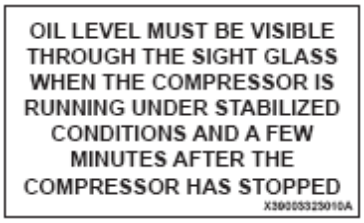
POE oil is very hygroscopic, which means it absorbs moisture very readily. Therefore, it is important to properly handle the oil.

POE Oil handling guidelines

- Always use the smallest container size required for the job requirements.
- Always leave the oil container tightly sealed until time of use.
- Do not reuse oil that has been opened.

Oil Level

Figure 10. Compressor oil label



The oil should be visible through the oil sightglass both during operation and when the compressor(s) is off. Oil level slightly below the sightglass, but still visible is acceptable.

Single compressor. The oil level should be stable in the sightglass.

Tandem and trio compressors. •**Operation**—The oil level will vary depending on the operating condition.

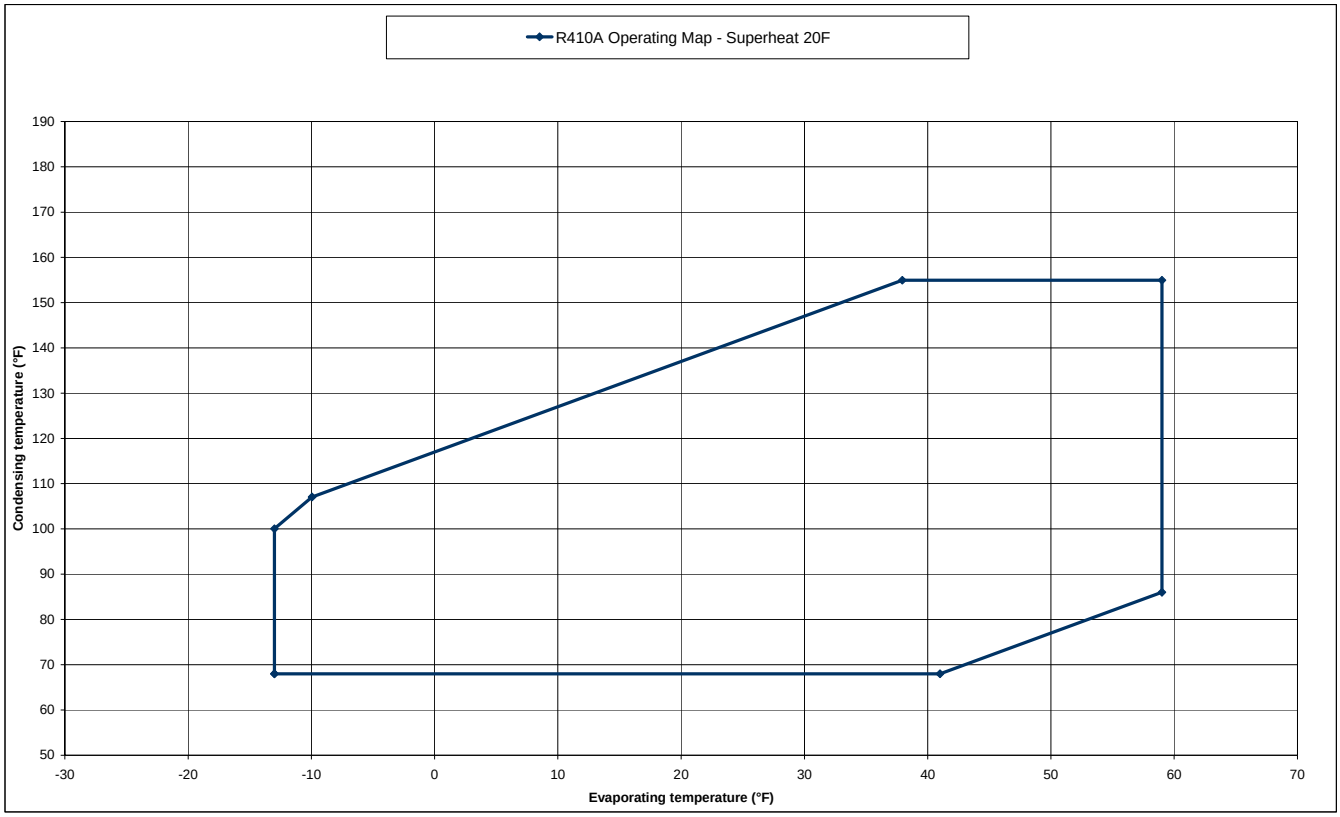
- **Unloaded condition**—The running compressor will have a higher oil level than the off compressor(s).
- **Loaded condition**—Oil should be visible through all of the compressor sight glasses. Some may have a higher level than others, but this is not abnormal.
- **Off**—After several minutes, the oil levels should be the same in each compressor and should be visible in the sightglass. This is the best method to determine if the system has sufficient oil.

Units overcharged with oil will operate with degraded performance and could lead to compressor damage.

Operating Envelope

The compressor must be operated within the published operating envelope.

Figure 11. Operating envelope



Refrigerant Type

Start to Finish™ compressors are approved for use with R-410A refrigerant only. Any use of hydrocarbon refrigerants or air is strictly prohibited!

Transportation, Handling, and Storage

The compressor must be handled in the vertical position (maximum 15-degree offset from vertical). Should the compressor be handled in an upside down position, its suitability for its use can not be guaranteed.

NOTICE

Improper Handling!

Improper handling of the compressor resulting from being handled or transported in the upside position, dropped or tipped over could result in internal damage to the compressor and it is recommended that the compressor not be put into service.

Damage to compressor or packaging should be reported to the shipper immediately.

Use a proper method of lifting the compressor, both lifting ears must be used with a spreader bar.

⚠WARNING

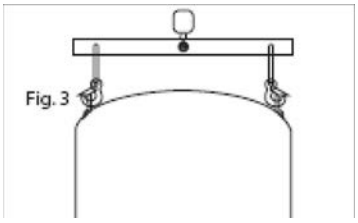
Heavy Objects!

Failure to follow instructions below or properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury, and equipment or property-only damage. Ensure that all the lifting equipment used is properly rated for the weight of the unit being lifted. Each of the cables (chains or slings), hooks, and shackles used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift.

For approximate compressor weight, see Table 4, p. 19.

Spreader bar use is recommended to better balance the compressor.

Figure 12. Lifting compressor with spreader bar



Use lifting hooks with close clasps.

Table 4. Compressor weight with full oil charge

Nominal Capacity	Weight (lb)
090	128
109–121	142
145	148
156	152
181	155
182–183	234
240–241	238
300–301	337
360–361	362

The compressor and its packaging must not be exposed to rain and/or corrosive, flammable atmosphere.

The compressor must not be stored in an environment less than -31°F (-35°C) or to exceed +160°F (+71°C).

Pre-Installation Inspections

Check the following before using the compressor:

- Compressor for visible shipping damage.
- Compressor is the correct model/part number.
- Compressor is the correct voltage.
- Compressor ship-with items:
  - Restrictors for use with tandem and trio compressors.
  - Oil equalizer Teflon® gaskets.

⚠WARNING

R-410A Refrigerant under Higher Pressure than R-22!

Failure to use proper equipment or components as described below, could result in equipment failing and possibly exploding, which could result in death, serious injury, or equipment damage. The units described in this manual use R-410A refrigerant which operates at higher pressures than R-22. Use ONLY R-410A rated service equipment or components with these units. For specific handling concerns with R-410A, please contact your local Ingersoll Rand representative.

Figure 13. Nominal capacity 182–361

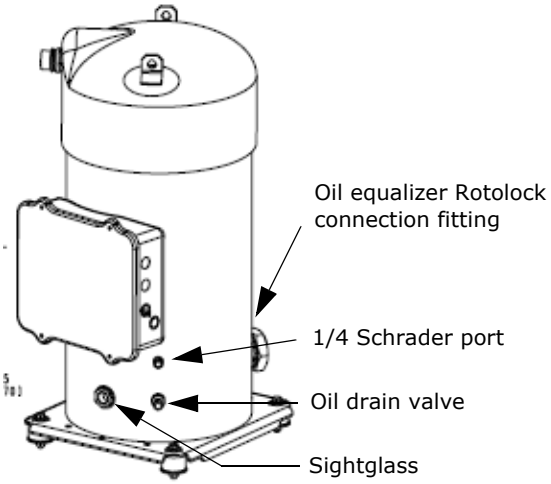


Figure 14. Nominal capacity 090–181

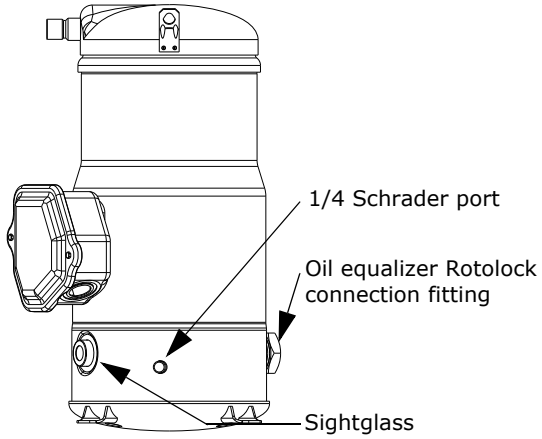
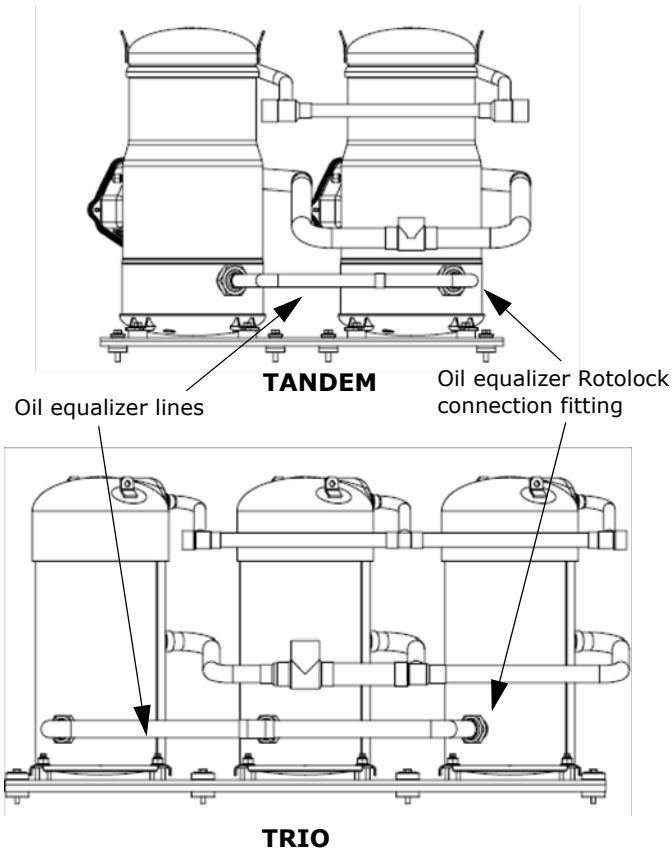


Figure 15. Tandem and Trio



Repair Recommendations

⚠WARNING

Hazard of Explosion and Deadly Gases!

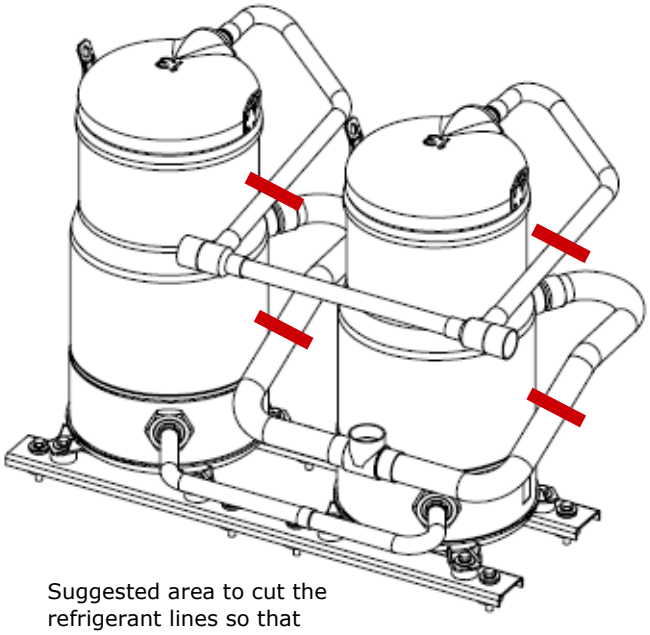
Failure to follow all proper safe refrigerant handling practices could result in death or serious injury. Never solder, braze or weld on refrigerant lines or any unit components that are above atmospheric pressure or where refrigerant may be present. Always remove refrigerant by following the guidelines established by the EPA Federal Clean Air Act or other state or local codes as appropriate. After refrigerant removal, use dry nitrogen to bring system back to atmospheric pressure before opening system for repairs. Mixtures of refrigerants and air under pressure may become combustible in the presence of an ignition source leading to an explosion. Excessive heat from soldering, brazing or welding with refrigerant vapors present can form highly toxic gases and extremely corrosive acids.

Mechanical Failure

Replace only the failed compressor in a tandem or trio set.

Important: *On tandem or trio assemblies, the suction and discharge lines must NOT be modified, except for the use of slip joint couplings. Other modification may cause oil return issues and lead to compressor failure. Cut the lines in a convenient place, remove the compressor, and then unbraze the lines from the compressor. On reinstallation, reinstall lines to compressor and reassemble the cut lines utilizing a slip coupling. See Figure 16 for suggested area to cut the discharge and suction line.*

Figure 16. Suggested areas to cut refrigerant lines



Minimize system and compressor open times to avoid excessive moisture absorption by the POE oil. Maximum suggested open time is 15 minutes.

Drain and replace oil in all the non-failed compressors.

Note: *For 090–181 nomnial capacity compressors, this requires removing oil using a suction device through the oil equalizer Rotolock fitting (see Figure 14, p. 19). Use a dedicated device for removing oil. It is good practice to flush the suction device with clean oil prior to use.*

The 182–361 nominal capacity compressor has an oil drain with a Schrader® valve that can be used to remove the oil (see Figure 13, p. 19).

Replace unit liquid line filter-drier. This is a very important part of controlling moisture in R-410A POE oil systems.

Reuse the compressors mounting isolators or mounting spacers that are used with the existing compressor assembly.

Braze the compressor into the system. Compressor connections are copper-plated steel. Use BAg-28, 40% silver, with paste flux to make the copper tube connections to the compressor.

Proceed as described in the following sections:

- "Leak Detection," p. 26
- "Vacuum Testing and Evacuation," p. 27
- "Charging the System," p. 28
- "Verification Before Start-Up," p. 28

Electrical Failure

Replace only the failed compressor in a tandem or trio set.

Drain and replace the oil in all the non-failed compressors.

Reuse the compressors mounting isolators or mounting spacers that are used with the existing compressor assembly.

Braze compressor into the system. Compressor connections are copper-plated steel. Use BAg-28, 40% silver, with paste flux to make the copper tube connections to the compressor.

Important: *On tandem or trio assemblies, the suction and discharge lines must not be modified, except for the use of slip joint couplings. Other modification may cause oil return issues and lead to compressor failure. Cut the lines in a convenient place, remove the compressor then unbraze the lines from the compressor. On reinstallation, reinstall lines to compressor and reassemble the cut lines with a slip coupling. See Figure 16, p. 20 for suggested area to cut the discharge and suction line.*

Minimize system and compressor open times to avoid excessive moisture absorption by the POE oil. Maximum suggested open time is 15 minutes.

Test the acid condition of the oil in the compressors using an acid test kit. Use Part Numbers KIT06815, CHM00414, and KIT06754.

Two Types of Motor Failures

Light. If oil test kit is negative and oil is only slightly discolored, treat in the same manner as a mechanical failure.

Severe. If oil test kit is positive with strong pungent odor and dark oil, drain and replace oil in all of the non-failed compressors.

Reuse the compressor mounting isolators or mounting spacers that are used with the existing compressor assembly.

This type of failure requires changing both the suction and liquid line filter-driers. Use replaceable filter-drier cores to facilitate changing filter-driers, if required.

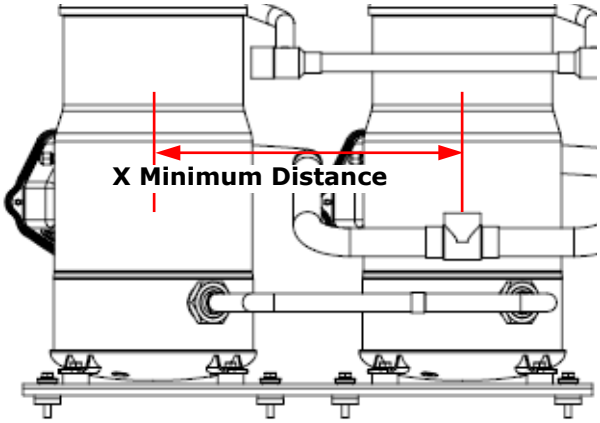
Install the suction filters no closer than the distance listed in the table following Figure 17. The distance is measured from the centerline of the suction inlet tee (see Figure 16, p. 20).

Braze compressor into the system. Compressor connections are copper-plated steel. Use BAg-28, 40% silver, with paste flux to make the copper tube connections to the compressor.

Proceed as described in the following sections:

- "Leak Detection," p. 26
- "Vacuum Testing and Evacuation," p. 27
- "Charging the System," p. 28
- "Verification Before Start-Up," p. 28

Figure 17. Minimum distance before installation of suction line filter



Nominal Capacity	"X" Distance
090–181	10 inches
182–361 tandem	16 inches
182–361 trio	25 inches

1. Use acid removal type filter-drier cores in both the suction filter and liquid line filter drier.
2. Change when the pressure drop exceeds 4 psig.

182–361 nominal capacity models

Test oil after 24 hours of operation. Change filter-drier again if required. If oil is still acid, drain and replace oil in all the non-failed compressors.

After system is clean, test kit indicates okay, remove the suction clean up filter-drier and replace the liquid line drier with standard filter drier cores.

090–181 nominal capacity models

Since these compressors do not have an oil drain valve, it is recommended that after 24 hours of operation, the filter-drier cores be replaced with acid removal filter-drier cores. Operate the system for another 24 hours before changing to remove the suction filter-drier and install a standard filter-drier in the liquid line.

Removal and Installation

⚠WARNING

Refrigerant under High Pressure!

Failure to follow instructions below could result in an explosion which could result in death or serious injury or equipment damage. System contains oil and refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit nameplate for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives.

⚠WARNING

Contains Refrigerant!
R-410A Refrigerant under Higher Pressure than R-22!

Failure to use proper equipment or components as described below, could result in equipment failing and possibly exploding, which could result in death, serious injury, or equipment damage. The units described in this manual use R-410A refrigerant which operates at higher pressures than R-22. Use ONLY R-410A rated service equipment or components with these units. For specific handling concerns with R-410A, please contact your local Ingersoll Rand representative.

⚠WARNING

Hazard of Explosion and Deadly Gases!

Failure to follow all proper safe refrigerant handling practices could result in death or serious injury. Never solder, braze or weld on refrigerant lines or any unit components that are above atmospheric pressure or where refrigerant may be present. Always remove refrigerant by following the guidelines established by the EPA Federal Clean Air Act or other state or local codes as appropriate. After refrigerant removal, use dry nitrogen to bring system back to atmospheric pressure before opening system for repairs. Mixtures of refrigerants and air under pressure may become combustible in the presence of an ignition source leading to an explosion. Excessive heat from soldering, brazing or welding with refrigerant vapors present can form highly toxic gases and extremely corrosive acids.

Only qualified personnel should install or repair refrigeration systems. If you are not qualified, seek the services of qualified personnel. The steps listed below are not meant to be an exact step-by-step procedure, but are intended to identify procedures or precautions that may be unique to a Start to Finish™ compressor and should be taken into account to properly and safely remove and install the compressor. Each installation has its unique set of circumstances which must be considered by the service technician to perform a safe and successful compressor replacement.

Removal

⚠WARNING

Pressurized Burning Fluid!

Failure to follow these instructions could result in death or serious injury. Before opening a system, you must remove refrigerant from both the high and low sides of the system. If the pressure is not removed from both sides of the system, pressure could still exist in the system. If a torch is used to unbraze the tubing, the refrigerant and oil mixture could ignite.

⚠WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury. Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. Verify with an appropriate voltmeter that all capacitors have discharged.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06-EN.*

- *Prior to removing the compressor*, open the unit disconnect and place a lock on the disconnect to prevent someone else from accidentally applying power to the unit while it is under repair.
- Completely recover the refrigerant from the refrigerant circuit being repaired. Do not release refrigerant to the atmosphere! Use Responsible Refrigerant Practices. If adding or removing refrigerant, the service technician must comply with all Federal, State, and local laws.

Before removing the electrical connections on the compressor use a voltmeter to check for the absence of power on:

- Compressor power terminals.
- Compressor motor protection module.
- After confirming the absence of power, remove the electrical connections.
  - Mark the electrical wires so they can be placed back on the same terminal on the replacement compressor to prevent improper phasing.
  - 090–181 nominal capacity compressor terminal blocks are marked: T1 is marked red, T2 is marked blue, and T3 has no mark (see Figure 21, p. 26).
- Remove oil prior to compressor removal:
  - 182–361 Nominal Capacity Compressors
    - 182–361 nominal capacity compressors have an oil drain valve (see Figure 13, p. 19) that allows

oil to be drained out of the compressor. After the refrigerant has been recovered, pressurize the system with nitrogen to help remove oil from the compressor.

- If the compressor is in a tandem or trio set, place a catch pan under the oil equalizer Rotolock connection on the compressor to catch the oil from the oil equalizer tube or compressor when the oil equalizer tube is removed.

– 090–181 Nominal Capacity Compressors

Note: *For excess oil removal, the Schrader valve in the lower part of the compressor shell can be used. If more oil or the complete oil charge needs to be removed, use the following procedure.*

- For 090–181 nominal capacity compressors, oil removal requires using a suction or pump device through the oil equalizer Rotolock fitting, see Figure 14, p. 19. Flush the suction device with clean oil prior to use.
- If the compressor is in a tandem set, place a catch pan under the oil equalizer Rotolock connection fitting on the compressor to catch the oil from the compressor when the oil equalizer tube is removed. Refer to Figure 14, p. 19 for the location of the oil equalizer Rotolock connection fitting.

Tip: *Before removing the existing tubing from the compressor, apply flux to the joint. This will aid in the flow of the braze material and help keep the joint clean for rebrazing. After fluxing, heat the joint evenly to slightly higher temperature than the melting temperature of the filler material. At this point, the two parts of the assembly should be easily separated.*

- Refrigerant Connection Removal
  – Single compressor—Cut the refrigerant lines in a convenient location that allows reassembly with slip couplings. Then, unbraze the line from the compressor and reuse it when the replacement is installed.
    - When removing the compressor use both hooks on the cap of the compressor with a spreader bar (see Figure 12, p. 19).
    - The lifting device must be rated to handle the weight compressor as listed in Table 4, p. 19.

Compressor Replacement—Tandem and Trio Compressor Sets

Definitions:

- **Tandem**—Two compressors on a single refrigerant circuit.
- **Trio**—Three compressors on a single refrigerant circuit.

There are special considerations that are unique to replacing compressors in a tandem or trio set:

1. Only replace the failed compressor.
2. On tandem or trio assemblies, the suction and discharge lines must not be modified, except for the use of slip-joint couplings. Other modifications may cause oil return issues and lead to compressor failure. Cut the lines in a convenient place, remove the compressor, and then unbraze the lines from the compressor. On re-installation, reinstall lines to compressor and reassemble the cut lines using a slip coupling. Refer to Figure 16, p. 20 for suggested area to cut the discharge and suction line.

Tip: *Before removing the existing tubing from the compressor, apply flux to the joint. This will aid in the flow of the braze material and help keep the joint clean for re-brazing. After fluxing, heat the joint evenly to slightly higher temperature than the melting temperature of the filler material. At this point, the two parts of the assembly should be easily separated.*

3. Change oil in all compressors in the tandem or trio compressors whenever there is a failure.
   a. 182–361 Nominal Capacity—Use the oil charging valve on the compressor.
   b. 090–181 Nominal Capacity—Remove the oil equalizer fitting and use a suction or pump device to remove the oil from the compressor through the oil equalizer tube opening. A suction type device should be used to remove oil from the compressor.

Important: *Some multiple compressor configurations require a restrictor be placed in the suction inlet to balance the oil levels. Refer to unit* Installation, Operation, and Maintenance *manual for correct size and location of restrictor. The restrictors are packaged in a bag with a label with the part number and diameter required (see Figure 18, p. 24). The part number is X17311028010 and the internal diameter in millimeters is Ø31. The restrictor is also marked on the face with both the extension number, last three digits of the part number, and diameter. For the previous example, the restrictor would be marked 010-31. Without the proper restrictor installed, the compressor oil level balance will not be correct.*

NOTICE

Incorrect Restrictor Size and Location!

Failure to install the correct size restrictor or in the correct position will lead to improper oil levels in the compressor. This could result in a compressor failure due to low oil level.

4. It will be necessary to use an oil catch pan under the oil equalizer connection to catch the oil when the connection is loosened and removed.

Figure 18. Restrictor label

Installation

⚠WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury. Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. Verify with an appropriate voltmeter that all capacitors have discharged.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06-EN.*

⚠WARNING

Hazard of Explosion and Deadly Gases!

Failure to follow all proper safe refrigerant handling practices could result in death or serious injury. Never solder, braze or weld on refrigerant lines or any unit components that are above atmospheric pressure or where refrigerant may be present. Always remove refrigerant by following the guidelines established by the EPA Federal Clean Air Act or other state or local codes as appropriate. After refrigerant removal, use dry nitrogen to bring system back to atmospheric pressure before opening system for repairs. Mixtures of refrigerants and air under pressure may become combustible in the presence of an ignition source leading to an explosion. Excessive heat from soldering, brazing or welding with refrigerant vapors present can form highly toxic gases and extremely corrosive acids.

- Only qualified personnel should install or repair refrigeration systems. If you are not qualified, seek the services of qualified personnel.
- Pressure tests must be performed by qualified personnel.
- The replacement compressor contains a nitrogen charge of 5 psig. Before opening the connections on the compressor, connect a 1/4-inch service hose to the Schrader fitting on the shell to slowly release the nitrogen charge in the compressor.
- Remove the suction plug before the discharge plug to avoid oil spray while opening the compressor.
- Keep exposure to the atmosphere at a minimum due to POE oil. Remove the rubber plugs only when ready to install the compressor. Plug other compressor on tandem or trio compressors.
- *Before removing the oil equalizer connection cap*, place a can pan under the Rotolock fitting as the compressor oil level is above the Rotolock connection. Oil must be added to the compressors after installation.

  a. Removal Instructions

Tip: *Before removing the existing tubing from the compressor, apply flux to the joint. This will aid in the flow of the braze material and help keep the joint clean for rebrazing. After fluxing, heat the joint evenly to slightly higher temperature than the melting temperature of the filler material. At this point, the two parts of the assembly should be easily separated.*

  b. Installation

  c. Preparation:

    i. For proper capillary action to occur, the tube and the fitting must be free of oil, grease, burrs, and oxide contamination. To remove the oil and grease a commercial solvent or denatured alcohol can be used. The surface may be properly cleaned by brushing with a stainless shell brush or by a stiff rubbing with emery cloth. Wipe the joint clean to remove small foreign particles such as emery dust, by wiping the surface with a clean cloth. Once the surfaces are clean, be careful not to touch them as oil from the skin will contaminate the surfaces.

    ii. Pre-fit the existing tubing into the compressor to check that it has full insertion into the compressor fitting. For compressors that have a suction restrictor located in the suction inlet, ensure that the tube is inserted completely such that the suction restrictor fits tightly against the end of the compressor suction connection.

    iii. Apply flux with a brush to the outside of the compressor connecting tubing, taking care to evenly apply the flux around the entire diameter. Care must also be taken not to get the flux inside of the tubing as this may result in contamination of the refrigerant system.

    iv. Reinsert the tube into the compressor connection. If the tubing does not stay fully inserted, it must be restrained to prevent it from backing out of the compressor connection during the brazing process.

  d. Brazing Technique

    i. If possible, use a double-side torch while brazing.

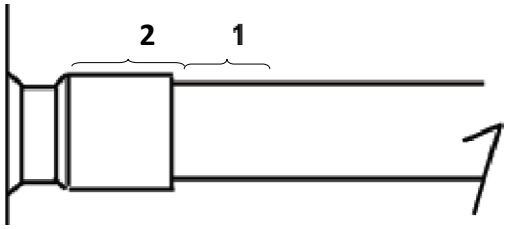
ii. Use 40% silver brazing alloy with flux.

iii. Start heating the tube first. Evenly heat the tube, location 1 (see Figure 19), until it reaches a dull red color. When using flux, this color is also a good indicator of when the proper brazing temperature has been reached. Continue heating the tube until the flux passes the "bubbling" temperature range and becomes quiet, completely fluid, and transparent—it should have the appearance of clear water.

iv. Direct the flame from the tube to the fitting, evenly heating it until the flux that may be remaining in the fitting is also completely fluid.

v. Sweep the torch between the fitting and the tube, locations 1 and 2 (see Figure 19), with most of the heat being applied to the heavier and slower-heating fitting until the tube and fitting reach and maintain a uniform heat in both parts.

Figure 19. Brazing locations 1 and 2



vi. Pull the flame slightly back and feed the brazing material in between the fitting and the tube. If the joint has been properly heated, the braze material should flow around and into the joint.

Important: *The heated base metal should melt the filler; the heat from the torch flame should not be what melts the filler.*

vii. Once the braze material has flowed around and into the joint, briefly move the torch around the fitting to ensure complete capillary action into the joint.

viii. Check the joint to visually ensure that the braze material is completely around the joint.

e. Post-Braze

NOTICE

Clean Flux From Joint!

Flux is corrosive and could lead to long-term problems and equipment damage if not properly removed. Quench the joint with water or a wet rag while the joint is still hot—but below 900°F—to shock off the flux. If not cleaned off, flux could hide leaks.

- Tandem (two compressors) and trio combinations (three compressors) with uneven compressor combinations requires the use of restrictor(s) to balance the oil level in the compressor. Refer to unit *Installation, Operation, and Maintenance* manual for proper size and location of the restrictor.
- When brazing refrigerant connections, protect compressor body and terminal box from torch heat damage.
- When brazing, always use a nitrogen purge to prevent the formation of copper oxide contamination that can damage the compressor.
- The 182–361 nominal capacity compressor has an internal check valve. When pressurizing the system, it is important to never allow the low-side pressure to exceed the high-side pressure by more than 5 bar (72 psig). Such a pressure differential could result in compressor damage. Also, slowly raise the pressure over a two-minute time period to allow sufficient time for the internal pressures in the compressor to equalize.

Electrical Connections

⚠WARNING

Hazard of Explosion and Deadly Gases!

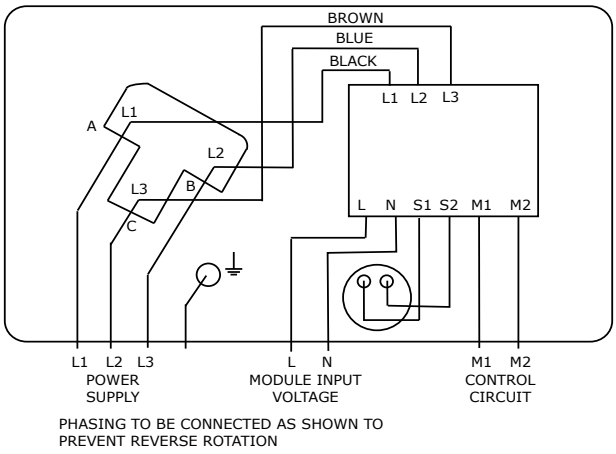
Failure to follow all proper safe refrigerant handling practices could result in death or serious injury. Never solder, braze or weld on refrigerant lines or any unit components that are above atmospheric pressure or where refrigerant may be present. Always remove refrigerant by following the guidelines established by the EPA Federal Clean Air Act or other state or local codes as appropriate. After refrigerant removal, use dry nitrogen to bring system back to atmospheric pressure before opening system for repairs. Mixtures of refrigerants and air under pressure may become combustible in the presence of an ignition source leading to an explosion. Excessive heat from soldering, brazing or welding with refrigerant vapors present can form highly toxic gases and extremely corrosive acids.

182–361 Nominal Capacity

- *Before removing wires*, mark them so that they can be put back on the same terminal when the new compressor is installed.
- Ensure that the compressor model terminals are installed on the correct terminals (see Figure 20).
- If the compressor is not wired properly, it will shut off within five seconds.
- Proper torque for the terminal screws is 25 in·lb.

  Note: *When equipped with terminal stud with a nut, torque the nut to 30 ± 2 in·lb.*
- *Before starting the compressor*, check the electrical phasing with a phase sequence meter similar to an Ideal-Sperry Model 61-520.

Figure 20. 182–361 nominal capacity wiring diagram

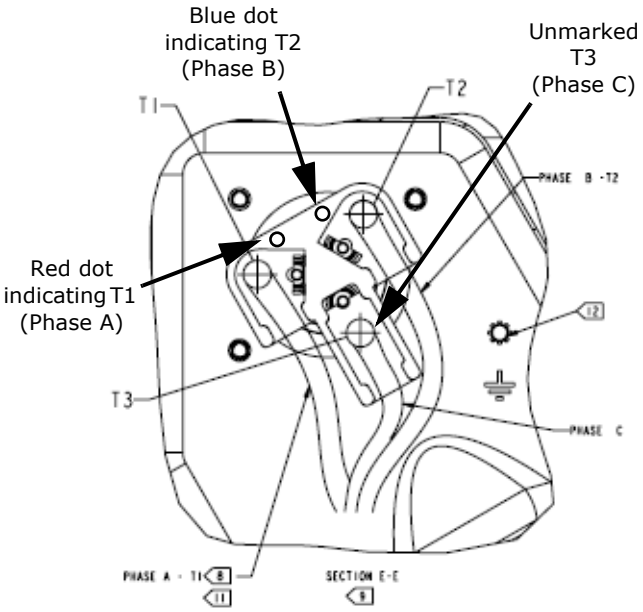


090–181 Nominal Capacity

The terminal blocks are marked with red and blue dots for phase identification. Compressor terminal T1 is red, compressor terminal T2 is blue, and compressor terminal T3 is unmarked. Depending on the unit type, several methods of marking the wires may be used, colored wires, wire color marks on the wire or wire numbers to indicated the proper location of the wire on the compressor terminal block.

If the wires are not marked, ensure that you mark them prior to removing them so that they can be reinstalled in the same position.

Figure 21. 090–181 nominal capacity wiring diagram



- Ensure that the compressor model terminals are installed on the correct terminals (see Figure 21).
- Proper torque for the terminal screws is 25 in·lb.

  Note: *When equipped with terminal stud with a nut, torque the nut to 30 ± 2 in·lb.*

NOTICE

Improper Power Phasing!

Operating the compressor with improper phasing could cause compressor failure. Check phasing before starting compressor.

- *Before starting the compressor*, check the electrical phasing with a phase sequence meter similar to an Ideal-Sperry Model 61-520.

Leak Detection

⚠WARNING

Hazard of Explosion!

Failure to follow instructions below could result in death or serious injury or equipment or property-only damage. Use only dry nitrogen with a pressure regulator for pressurizing unit. Do not use acetylene, oxygen or compressed air or mixtures containing them for pressure testing. Do not use mixtures of a hydrogen containing refrigerant and air above atmospheric pressure for pressure testing as they may become flammable and could result in an explosion. Refrigerant, when used as a trace gas should only be mixed with dry nitrogen for pressurizing units.

⚠WARNING

Hazardous Pressures!

Failure to properly regulate pressure could result in a violent explosion, which could result in death or serious injury or equipment or property-only-damage. When using dry nitrogen cylinders for pressurizing units for leak testing, always provide a pressure regulator on the cylinder to prevent excessively high unit pressures. Never pressurize unit above the maximum recommended unit test pressure as specified in applicable unit literature. See maximum recommended unit test pressure below.

Pressure Testing

- Use industry-standard and EPA-accepted techniques for testing.
- Pressure tests must be performed by qualified personnel.
- Use tools especially designed for leak testing.
- Do not exceed the high-side and low-side pressures listed on the unit nameplate.
- If no test pressure value is listed on the nameplate of the unit, a pressure of no more than 150 psig is acceptable.

NOTICE

Overpressure Damage!

Failure to follow these instructions could result in compressor damage. Do not pressurize the low side of the compressor by more than 5 bar (72 psig) higher than the high side of the compressor within less than two minutes.

- The 182–361 nominal capacity compressor has an internal check valve. When pressurizing the system, it is important to never allow the low side pressure to exceed the high side pressure by more than 5 bar (72 psig). Greater pressure differential could result in compressor damage. Also slowly raise the pressure over a 2-minute time period to allow sufficient time for internal pressures in the compressor to equalize.
- Pressure decay testing can be used to check for gross leaks but will not be able to detect the location of a leak.
- After pressurizing the system use an R-410A leak detection device to detect and locate leaks.

Vacuum Testing and Evacuation

- Use the procedure as described in the unit *Installation, Operation, and Maintenance* manual.
- If no other information is available, use the following information.

⚠WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury. Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. Verify with an appropriate voltmeter that all capacitors have discharged.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06-EN.*

NOTICE

Compressor Motor Damage!

Failure to follow instructions below could cause compressor motor damage. Never use the compressor as a vacuum pump. Never meg-ohm test or apply power to the compressor while it is in a vacuum.

- Ensure that there is no voltage being applied to the compressor terminals.
- Evacuate the unit to 500 microns.
- Hold vacuum for 30 minutes.
- Rapid pressure rise indicates a leak; locate and repair the leak.
- Slow pressure rise indicates one of two possibilities:
  - A small leak, indicated by a continuous rise in pressure.
  - Moisture in the system, indicated by a slow rise in pressure and leveling-out at a pressure equivalent to the moisture level. If this occurs, break the vacuum with dry nitrogen and repeat evacuation process to 500 micron.
- Once system is leak-tight, connect compressor repeat the vacuum procedure, break vacuum with dry nitrogen and evacuate to 500 microns. The vacuum should be able to be maintained for four hours. Isolate the vacuum pump so that the vacuum gauge only reads the system pressure.
- Vacuum must be measured in the refrigeration system and not at the vacuum pump.

Charging the System

⚠WARNING

Hazardous Pressures!

Failure to follow safety precautions below could result in a sudden rise of pressure possibly resulting in a violent explosion which could result in death or serious injury. If a heat source is required to raise the tank pressure during removal of refrigerant from cylinders, use only warm water or heat blankets to raise the tank temperature. Do not exceed a temperature of 150°F. Do not, under any circumstances apply direct flame to any portion of the cylinder.

Use R-410A refrigerant only! Follow the instructions in the unit *Installation, Operation, and Maintenance* manual for proper charging methods.

If there are no instructions available, use these guidelines:

- Evacuate the unit as described in "Vacuum Testing and Evacuation," p. 27.
- Ensure that the oil level is at least 1/2-sight glass in the compressor
- Do not use the compressor to pull refrigerant into the system.
- Charge liquid refrigerant into the high-side of the unit—either into the condenser or liquid receiver, if so equipped.
- Charge as much of the unit refrigerant charge as possible before starting the compressor.
- Do not charge liquid refrigerant into the low side of the compressor without the compressor running. Small amounts of liquid may be metered through refrigerant gauges into the suction line while the compressor is operating.
- If the unit is equipped with suction and discharge service valves, close them during the charging procedure.
- *Water chiller units*—Always operate the chilled water pumps while charging the unit to prevent freezing the evaporator.

Verification Before Start-Up

Follow the instructions in the unit *Installation, Operation, and Maintenance* manual. If there are no instructions available, use these guidelines:

- *Before starting the unit*, verify that all service valves are open.
- Energize the crankcase heater a minimum of 8 hours before starting the compressor

NOTICE

Improper Crankcase Heater Operation! Exception to 8-hour Minimum Crankcase Heater Operation Time!

Failure to follow this instruction could result in a compressor failure. Apply power to the crankcase heater for a minimum of 8 hours prior to startup of the compressor!

If the compressor is a replacement for a failed compressor and has been charged in accordance with either the procedures in the unit IOM or "Charging the System," p. 28 in this manual, the compressor could be immediately started after charging the system. The reason for this is that the refrigerant has not had sufficient time to migrate to the compressor and cause potential damage upon startup. The system should set for no more 8 hours or overnight with a refrigerant charge without crankcase heater operation. If the time exceeds 8 hours or the unit sits overnight, the crankcase heater must be operational for a minimum of 8 hours prior to starting the compressor.

If liquid refrigerant was charged into the suction or low side during the charging procedure, damage could still occur.

Startup

Follow the instructions in the unit *Installation, Operation, and Maintenance* manual. If there are no instructions available, use these guidelines:

NOTICE

Equipment Damage!

Failure to follow guidelines below could result in equipment damage.

- Never start the compressor without refrigerant in the system.
- Never bypass the low pressure switch to start the unit.
- Monitor oil level for 60 minutes to ensure that oil returns from the system.
- Check system pressures and temperatures to ensure they are in line with unit design pressures. Refer to the unit *Installation, Operation, and Maintenance* manual for this information.
- To top off the unit, charge liquid refrigerant may added by slowly throttling it into the suction line. This must be done only when the compressor is operating.
- Do not overcharge the unit.
- Recommended system full load superheats—unless specified differently in the unit *Installation, Operation, and Maintenance* manual—is 16°F–20°F.
- Measure the oil sump superheat. Oil sump superheat should be greater than 20°F. Oil sump superheat is calculated as follows:

  Oil Sump Superheat = Oil Sump Temperature – Saturated Suction Temperature
- Measure the oil sump temperature by placing a thermocouple on the bottom of the compressor, preferably in the center, and insulate it. Calculate sump superheat. If less than 20°F, recheck the expansion valve superheat and increase it. Low sump superheat is indicated by foaming compressor oil.
- After fully charging the unit, recheck all pressure, temperatures, and electrical readings.
- Ensure that the compressor protection module and power supply wires are installed on the correct terminals (see Figure 20, p. 26 and Figure 21, p. 26).
- Proper torque for the terminal screws is 25 in·lb.

  Note: *When equipped with terminal stud with a nut, torque the nut to 30 ± 2 in·lb.*

Maintenance

Check the unit *Installation, Operation, and Maintenance* manual for specific instructions.

Operating conditions must always remain within the operating range of the compressor. This includes:

- Operating pressures (suction and discharge pressure).
- Operating temperatures (suction, discharge, and liquid).
- Operating parameters (compressor superheat, subcooling, oil sump superheat, voltage, and amperage).
- Check all of the following on a regular basis:
  - System operating conditions.
  - System refrigerant charge level.
  - Oil levels and oil color.

⚠WARNING

Hazardous Voltage w/Capacitors!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury. Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. Verify with an appropriate voltmeter that all capacitors have discharged.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06-EN.*

- Check electrical connections (prior to startup each season).
- Check unit operating controls.

Troubleshooting

Important: *Check the unit* Installation, Operation, and Maintenance *manual for additional information regarding diagnosis and causes.*

⚠WARNING

Hazardous Service Procedures!

Failure to follow all precautions in this manual and on the tags, stickers, and labels could result in death or serious injury.
Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks.

Compressor will not start

- Refer to the unit *Installation, Operation, and Maintenance* manual for possible diagnostics codes and corrective action.
- Verify:
  - Compressor voltage is correct.
  - *182–361 nominal capacity compressors*—Motor protection module is the correct voltage.
  - All safety switches are closed.
  - All the contacts on the contactor are pulled in.
  - *090–181 nominal capacity compressors*—The internal motor overloads may be open. Disconnect power to the unit and disconnect the wires from the compressor terminals. With an ohm meter, check to ensure that there is resistance between T1-T2 and T3.

Compressor will not build up pressure

- *090–181 nominal capacity compressor is wired incorrectly*—It will be noisy and draw 1/2 the expected amps. Shut the compressor off immediately. Running in this condition for more than 5 seconds may damage the compressor.
- *182–361 nominal capacity compressor is wired incorrectly*.
- Check to ensure that any bypass valves in the system are not open.
- Four-way reversing valve may be stuck and not switched properly bypassing from the high side to the low side of the system; this situation is indicated by an extremely warm suction inlet to the compressor.
- *360–361 nominal capacity compressors contain an internal pressure relief that may have opened.* It may take two to three hours to reset. The oil sump will be very warm and the compressor will be tripped out on the motor protection module. This is caused by a very high 625–715 psid difference between the high side and low side of the system. This could occur with either a blocked high side or low side.

Abnormal running noise

- Compressor is running backwards—Immediately shut off the compressor and check wiring and proper phasing.
- Excessive floodback—The superheat should be a minimum of 16°F at full load and oil sump temperature should be at least 20°F above the saturated suction temperature. Measure the sump temperature at the bottom center of the compressor. Chillers with electronic expansion valves may operate with lower superheats; check the unit *Installation, Operation, and Maintenance* manual for proper operating superheats.
- Compressor is full of liquid on startup—The crankcase heater either was not energized for a minimum of eight hours, or it is defective.
- Mechanical damage to the compressor has occurred—Check compressor amperage. It may also trip the compressor motor protection module or other unit electrical protection devices such as circuit breakers.

High-pressure control opens

- Check the unit *Installation, Operation, and Maintenance* manual for possible diagnostics codes and corrective action.
- Also check for:
  - Defective condenser fan motors or controls.
  - Dirty air-cooled or water-cooled condensers.
  - Restricted air flow.
  - Insufficient water flow.
  - System overcharged with refrigerant. Check superheat and system subcooling.
  - Non-condensables in the system.

Low-pressure control opens

- Check the unit *Installation, Operation, and Maintenance* manual for possible diagnostics codes and corrective action.
- Also check for:
  - Defective evaporator fan motors, belts, or controls.
  - Defective TXV valve.
  - Plugged liquid line filter.

- Liquid line solenoid valve does not open (if so equipped).
- Dirty evaporators, either air-to-air or water-to-air.
- Restricted airflow.
- Insufficient evaporator water flow.
- System undercharged with refrigerant. Check system superheat and subcooling.

Compressor short cycling

- Check the unit *Installation, Operation, and Maintenance* manual for possible diagnostics codes and corrective action.
- Also check for:
  - Defective unit controls—maximum 12 starts per hour.
  - Compressors cycling on safety controls.
  - Unit oversized.
  - Building load is light—this is likely to occur *prior to building occupancy*.

Motor protector module resets

- Type: Manual

  Fault modes:
  - Phase sequence
  - Phase loss
  - Multiple motor temperature overload cycles.

  Reset—Remove power from module for five seconds.
- Type: Auto with five-minute delay (sensors exceed 4500 ohms)

  Fault modes:
  - Over current
  - Running phase loss
  - Motor over temperature (manual reset required after 2-5 auto reset cycles)

  Reset—Auto-reset occurs when motor temperature sensors resistance drops below 2750 ohms. Although module will reset automatically the compressor(s) may not because the protection module may be wired in a safety lockout circuit.

Incorrect phase sequence

Incorrect phase sequence protection—compressor will run approximately five seconds and trip off, pending the motor protection module is correctly wired into the system safety circuit. If the motor is believed to be incorrectly phased; change two of the three wires.

PTC Overheat (motor over temperature/over current)

- Compressor motor drawing too much current.
- Defective compressor; look for dark oil in the sightglass.
- Low voltage (voltage outside the ±10% range from nominal voltage); voltage utilization range is printed on compressor nameplate.
- Unbalanced voltage—must not exceed 2% imbalance.
- Motor PTC thermistor resistance above 4500 ohms will cause the motor protector to open. The motor protector will reset at resistance below 2750 ohms. A five-minute time delay is active after cool down until the maximum number of auto reset cycles has been reached. The module will then be locked out until it is manually reset.

NOTICE

Excessive Voltage on PTC Sensors!

Failure to follow these instructions could cause thermistor failure, resulting in a compressor replacement. Do not measure the motor PTC sensors with a device rated at more than 3 Vdc.

- When measuring the PTC sensors, do not use a meter with greater than 3 Volt.
- 360–361 nominal capacity compressor internal relief valve has opened.
- Phase loss.
- Defective contactor.
- Loose or poor electrical connections at the compressor or contactor.

182–361 Nominal Capacity Compressor Motor Protection Module Diagnosis

⚠WARNING

Hazardous Service Procedures!

Failure to follow all precautions in this manual and on the tags, stickers, and labels could result in death or serious injury.
Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks.

If M1-M2 contacts are open, proceed as follows:

1. Check motor protection module for the correct input voltage on terminals L and N. Voltage applied to

module must match module input voltage as printed on module nameplate.

2. Check wire connection tightness.
3. Try to reset the module (interrupt power for five seconds).
4. If, after reset, module M1-M2 closes, determine which fault caused module to trip.
5. If M1-M2 remains open, proceed as follows:

   Disconnect PTC thermistors from S1and S2 terminals, and measure the resistance of the PTC using a device with a maximum output of 3 volts.

   - Resistance = ∞.

     Open PTC open; replace compressor.

   - Resistance = 0 ohms

     PTC shorted; replace compressor.

   - Resistance >2750 ohm

     Wait until the motor has cooled down and resistance is less than 2750 ohms; reconnect and try to reset motor protector. Diagnose problem that caused motor over temperature.

   - Resistance = 150 ohms < R< 1250 ohms

     Normal resistance value for PTC ambient temperature.

Test the module within the terminal box

1. Disconnect L-N voltage supply.
2. Disconnect S1-S2 PTC circuit on the module.
3. Disconnect M1-M2 safety circuit control contacts.
4. Apply a resistance between 150 and 1250 ohms across S1-S2. This simulates a functional, cool motor.
5. Reconnect L-N voltage supply. Ensure that the voltage to L-N has been disabled for at least 5 seconds. This will reset the module.
6. Check M1-M2 with ohmmeter.
7. M1-M2 closed—Module okay.
8. M1-M2 open—Module defective.

Log Sheet

Replacement Scroll Compressors

Complete and retain a record in the job file for future reference.

Log Sheet for Installers

Job Name:
Job Address:
Equipment Model Number:
Equipment Serial Number:
Compressor Model Number:
Compressor Serial Number:
Startup Date:

Table 5. System operating data

Refrigeration Data	Circuit 1	Circuit 2	Circuit 3	Circuit 4
Suction Pressure/Saturation Temp				
Suction Line Temperature				
Suction Superheat (2-1)				
Discharge Pressure				
Discharge Line Temp				
Liquid Line Pressure/Saturation Temp				
Liquid Line Temp				
Liquid Subcooling (6-7)				

Table 6. Electrical data

Unit Voltage	L1-L2	L2-L3	L1-L3

Table 7. Compressor Amperage

Compressor	#1	#2	#3	#4	#5	#6	#7	#8
T1 amps								
T2 amps								
T3 amps								
Compressor Model 8 Digit Number								

Table 8. Oil sight glass (when available)

Compressor	#1	#2	#3	#4	#5	#6	#7	#8
Level								
Condition								
M=Manifold/S=Single								
Compressor Model 8 Digit Number								

Table 9. Condenser

Type	Air Cooled	Water Cooled
Entering Temperature		
Leaving Temperature		
Ambient		*Not Applicable*
Number of Fans ON		*Not Applicable*
Clean (Yes/No)		

Table 10. Evaporator

Type	DX-Air	DX-Water
Entering Temperature		
Leaving Temperature		
CFM/GPM		
Clean (Yes/No)		
Chiller pressure drop	*Not Applicable*	

Systems Check

☐ Suction Line Filter Drier Installed
☐ Pressure Drop After 1 Hour:
☐ PSIG After 4 Hours:
☐ Liquid Line Filter Changed
☐ Oil Changed
☐ Acid Check
☐ *If System Includes Liquid Line Solenoid*, Verify Proper Opening/Closing

Operating Controls Check

☐ Low Pressure Control
☐ High Pressure Control
☐ Contactor
☐ Replaced
☐ Checked
☐ Verify Proper Cycling of Unit Via Temperature Controls

Observations

Service Technician:	Date:

Trane - by Trane Technologies (NYSE: TT), a global climate innovator - creates comfortable, energy efficient indoor environments for commercial and residential applications. For more information, please visit trane.com or tranetechnologies.com.

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