

# Contractor Service Tips



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## R-12 and Polyol Ester Oil

There seems to be a misunderstanding about using R-12 and POE oil. Many contractors and end users believe it is OK to use them together, but in truth, they may be setting themselves up for some real problems.

Through numerous laboratory and field tests, Copeland has discovered that when moisture is induced into a system using R-12 refrigerant and POE oil, the refrigerant becomes acidic and may plug cap tubes and orifices. For this reason, Copeland does not recommend using R-12 and POE oil together.

Please refer to the “Copeland Accepted Refrigerants/Lubricants Chart” Form No. 93-11-R11 on the back of this card for further information.

## Copeland Accepted Refrigerants/Lubricants

	Refrigerants	Source	Application				Lubricant Choices			Comments
			Similar To	Retroof	New	Preferred	Alternate #1	Alternate #2		
Ozone Depleting	CFC-R-12 CFC-R-502 HCFC-R-22	Many Many Many		LM LM LMH	LM LM LMH	MO MO MO	AB & MO AB & MO AB & MO	POE POE POE	Phaseout by 1996 Phaseout by 1996 Phaseout by 2020	
Interims	HCFC-R-401A HCFC-R-401B HCFC-R-402A HCFC-R-408A HCFC-R-409A	Dupont/Allied Dupont/Allied Dupont Atochem Atochem	R-12 R-12 R-502 R-502 R-12	MH LM LM LM LM	N/A N/A N/A N/A N/A	AB & MO AB & MO AB & MO AB & MO AB & MO	POE & MO POE & MO POE & MO POE & MO POE & MO	POE POE POE POE POE	Service on Suva® MP39 Service on Suva® MP66 Service on Suva® HP80 Service only FX10 Service only FX56	
Non-Ozone Depleting	HFC-R-134a HFC-R-404A HFC-R-507 HFC-R-407C HFC-R-410A	Many Many Allied Dupont/Allied/ICI Allied/Dupont	R-12 R-502 R-502 R-22	MH LM LM MH	MH LM LM MH	POE POE POE POE			Suva® HP62 Forane® FX70 Genetron® AZ50 Suva® 9000/KLEA 66 Genetron® AZ20/Suva® 9001 **	

**Legend:**

MO = Mineral Oil (3CS or Equivalent)  
 AB = Alkyl Benzene (Copeland/Ultra 200 or Shreve Zerol 200 TD or Soltek AB 200A or Thermal Zone 200)  
 POE = Copeland Ultra 22CC  
 or Mobil EAL™ Arctic 22 or ICI Emkarate™ RL32CF  
 or Thermal Zone 22CC  
 POE & MO = Minimum 50% Alkyl Benzene  
 AB & MO = Minimum 50% Alkyl Benzene (Shell 22-12)  
 Nde: Shell 22-12 is a 70/30 mixture of AB & MO  
 Copeland Ultra 200, Zerol 200 TD, and Soltek AB 200A are 100% AB

**Refer to the following Application Bulletins for additional information:**

- 4-1295 HFC-134a Refrigerant Guidelines
- 17-1248 Refrigeration Oils
- 25-1177 Safe Handling of Compressed Gases
- 93-02 CFC-12 to R-401A\*
- 93-03 CFC-12 to R410B\*
- 93-04 CFC-12 to HFC-124a
- 93-05 R-502 to R-402A\*
- 94-15 R-502 to R-404A/R-507\*
- 95-14 R-22 to R-407C\*\*

\*Refrigerant Changeover Guidelines

\*\*New equipment only

For specific product availability and performance data refer to Copeland Sales Literature

# Contractor Service Tips



## Single Phase Burns

Extensive Copeland testing and field experience has proven that single phase motor burns are caused by the malfunction or misapplication of the system contactor(s).

Contactors play a role in any compressor overload protection scheme, but are particularly important when they are part of a pilot-operated protection system.

Contactors have a limited life and should be inspected during routine maintenance and replaced every time a compressor is installed.

The Copeland warranty does not extend to external electrical components furnished by others, and the failure of such components resulting in compressor failure will be taken into consideration by Copeland in determining the warranty status of returned compressors.

Please refer to Copeland Contactor Application Specifications on the back of this card for additional information.

## Contactor Selection Guide

### Copeland Contactor Application Specifications

*The following Copeland Contactor Application Specifications are based on contactor ratings as listed with U.L.*

- A. The contactor must meet the operational and test criteria in ARI (Air Conditionings and Refrigeration Institute) Standard 780-78, "Standard For Definite Purpose Contactors."
- B. The contactor must be certified by the manufacturer to close at 80% of the lowest nameplate voltage at normal room temperatures (166 Volts for contactors used on 208/230 Volt rated equipment).
- C. On single contactor applications, the rating of the contactor for both full load amperes and locked rotor amperes (LRA) must be greater than the corresponding nameplate amperage rating of the compressor motor RLA, plus the nameplate amperage ratings of any fans or other accessories also operated through the contactor.
- D. For two contactor applications, each contactor must have a part winding locked rotor rating equal to or exceeding the half winding locked rotor rating of the compressor.

Since half the winding LRA is larger than 50% of the compressor full winding LRA, some definite purpose contactor manufacturers oversize their contactors for two contactor applications. Check with the contactor manufacturer to determine if larger contactors are needed for two-contactor applications.

### Time Delay Relays

For part winding start applications, a time delay relay is required between contactors with a setting of 1 second plus or minus 1/10 second. The operation of a delay relay can be affected by low voltage.

In order to insure reliability, time delay relays listed as meeting Copeland specifications for nominal 208/230 Volt control systems must be guaranteed by the manufacturer to function properly at 170 Volts in a -40°F ambient.

*For information on time delay relays, see AE Bulletin 10-1244.*

# Contractor Service Tips



## Compressor Overheat

Overheat is has been a major cause of compressor failures. Temperatures in the compressor head and cylinder become so hot that the oil thins and loses its ability to lubricate. This may cause rings, pistons, and cylinders to wear resulting in blow by, leaking valves and metal debris in the oil. It can also cause the stator to ground due to a spot burn.

Cylinder temperatures exceeding 300°F will begin the breakdown of oil and at 350°F oil will be vaporized. To measure cylinder temperature, place your temperature gauge no more than six inches out on the discharge line from the compressor. For most applications the temperature should be below 225°F. This factors in a 50-75 degree temperature drop from the cylinder to the measured point.

To correct for overheat:

1. Correct abnormally low load conditions
2. Correct high discharge and low suction pressure conditions
3. Insulate suction lines, clean dirty condensers
4. Provide proper compressor cooling
5. Check low pressure control settings

Pressure controls can help to identify or remedy system problems.

## Copeland Pressure Controls

Copeland Kit #	Control	Connection	Range	Differential	Settings
985-CP1A-1K	Single Low Pressure	3/6" Capillary w/ 1/4" Flare Nut	20" to 42 psig	5 to 30 psid, adjustable	Cut-out 15 psig Cut-in 25 psig
985-CP1A-3K	Single Low Pressure	3/6" Capillary w/ 1/4" Flare Nut	15" to 100 psig	7 to 70 psid, adjustable	Cut-out 15 psig Cut-in 25 psig
985-CP1A-3A	Single Low Pressure	1/4" SAE Male Flare	15" to 100 psig	7 to 70 psid, adjustable	Cut-out 15 psig Cut-in 25 psig
985-CP1A-5K	Single High Pressure/ Fan Cycle	4/8" Capillary w/ 1/4" Flare Nut	100 to 450 psig	30 to 200 psid, adjustable	Cut-out 385 psig Cut-in 335 psig
985-CP1A-5A	Single High Pressure/ Fan Cycle	1/4" SAE Male Flare	100 to 450 psig	30 to 200 psid, adjustable	Cut-out 385 psig Cut-in 335 psig
985-CP1U-5A	Single High Pressure/ Limit	1/4" SAE Male Flare	100 to 450 psig	Fixed 50 psid, Auto/Man.	Cut-out 385 psig Cut-in Convertible Auto/Man
985-CP1U-5K	Single High Pressure/ Limit	3/6" Capillary w/ 1/4" Flare Nut	100 to 450 psig	Fixed 50 psid, Auto/Man.	Cut-out 385 psig Cut-in Convertible Auto/Man
985-CP2M-7K	Dual Pressure	4/8" Capillary w/ 1/4" Flare Nut	Low Pressure: 15" to 100 psig High Pressure: 100 to 450 psig	Low Pressure: 7 to 70 psig High Pressure Fixed 50 psid Auto/Man.	Cut-out 385 psig Cut-in Convertible Auto/Man
985-CP2M-7A	Dual Pressure	1/4" SAE Male Flare	Low Pressure: 15" to 100 psig High Pressure: 100 to 450 psig	Low Pressure: 7 to 70 psig High Pressure Fixed 50 psid Auto/Man.	Cut-out 385 psig Cut-in Convertible Auto/Man

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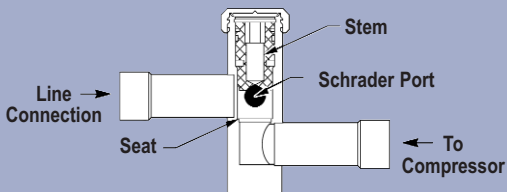
# Contractor Service Tips

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## Service Valves

The typical service valve is composed of four essential parts:

- Line connection
- Service opening or gauge port
- Valve stem
- Compressor connection



Typically, the service valve has a common connection that is always open. When the valve is back-seated (the stem is all the way out), the gauge port is open and the valve is open, allowing refrigerant to flow through the system. If the valve is front-seated (stem all the way in), the gauge port is closed to the compressor connection and the refrigerant line (suction or discharge) connection is open. At the gauge port, you can check system pressure and charge or reclaim refrigerant.

### **When brazing a service valve:**

The heat from brazing a fully front-seated or back-seated valve can cause the button of the valve stem (inside the valve) to 'weld' to the seating area on the inside of the body of the valve.

Apply heat absorbing paste or heat sink product between the service valve and the braze joint. Also, wrap the service valve with heat sink material or a wet cloth.

### **When opening a service valve:**

Open the suction service valve **first** to prevent oil from being drawn into the TXV.

Use the right tools! Service valves on condensing units have a torque requirement of 22-25 ft lbs in order to have a leak free seal when the units leave our plant. You will only be able to open a service valve with the appropriately sized service valve wrench. Using improper tools may round the valve stem edges and the valve will be useless.

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## TXV Selection

### Q: How do I select a TXV for a particular application?

In order to make an accurate TXV selection it is necessary to match the flow rate (in tons) of the TXV to the tonnage rating of the evaporator coil. The following procedure is recommended:

- Determine system refrigerant
- Determine tonnage rating of the evaporator coil at the operating temperature
- Determine liquid refrigerant temperature at the TXV inlet
- Calculate the pressure drop across the TXV by subtracting suction (low side) pressure from condensing (high side) pressure. Also subtract pressure drop from a distributor, if one is used. The difference is pressure drop across the TXV.
- Find the proper extended capacity table in the catalog for the correct refrigerant at the proper evaporator temperature. Then locate the closest pressure drop column and find the nearest flow rate in tons (to the evaporator tonnage). Go to the left to select the nominal tonnage rated valve. You will have to recalculate the flow rate in tons using the Liquid Correction Factor Table if the actual liquid temperature is different from 100F used as the standard rating point.



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# Contractor Service Tips



## Suction Accumulators

**Q: What is the purpose of a suction accumulator?**

A suction accumulator is used to prevent liquid refrigerant flood-back to the compressor. Accumulators are commonly used on heat pumps, transport refrigeration, low-temp supermarket refrigeration systems and any place that liquid refrigerant is a concern.

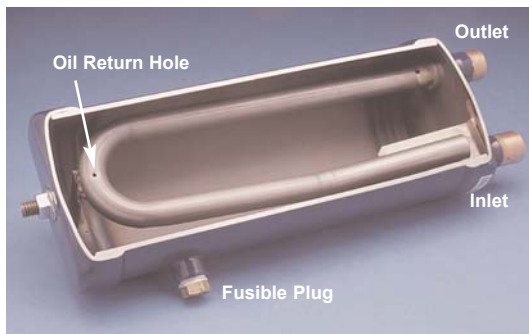
The accumulator is installed in the suction line close to the compressor. It usually is a vertical container with top connections. An internal U-tube reaching down near the bottom is installed on the compressor outlet connection so that the inlet of the tube is near the top of the container. This allows the accumulator to be almost completely full before flood-back can occur.

A small diameter hole is drilled in the U-tube near its lowest point. This hole allows controlled metering of any liquid refrigerant or oil back to the compressor by a siphoning action.



To work best, it is sometimes advisable to have a source of heat on the vessel to assist in evaporating the liquid refrigerant. This may be either an electric heat tape or pad. Some accumulators have connections so that a liquid line loop can be piped into the bottom of the accumulator. This improves the performance of the system by subcooling the liquid refrigerant and protects the compressor against liquid slugging by providing additional superheat to the suction gas.

### Cutaway of Typical Accumulator



# Contractor Service Tips



## Expansion Valves

**Q: What is the difference between an 'automatic expansion valve' and a 'thermal expansion valve'?**

The automatic expansion valve was the first valve developed to eliminate the need of having a refrigeration engineer manually adjust a hand-operated expansion valve. The valve is designed to maintain a constant pressure at the outlet of the valve. By keeping the pressure constant, it indirectly controls the temperature as well.

There are however two major disadvantages to this type of valve. First, as the load decreases (causing a drop in evaporator pressure) the valve will tend to open so as to maintain the outlet pressure. In doing so however, excess refrigerant is fed to the evaporator resulting in liquid slugging and potentially damaging the compressor. Second, as the load increases (causing an increase in evaporator pressure) the valve will tend to close so as to maintain the outlet pressure. Unfortunately this results in starving of the evaporator at a time when the load is highest.

These disadvantages have resulted in the automatic expansion valve being replaced by thermal expansion valves (TXV) in most applications. The TXV responds to the superheat at the outlet of the evaporator and as a result is more responsive to the actual load resulting in a more efficient system.

**Q: So, is there ever an appropriate application for an automatic expansion valve?**

There remain some applications where automatic expansion valves offer an advantage. In applications where it is important to prevent the evaporator pressure (and temperature) from getting too low, the Automatic Expansion Valve is a natural. Some examples of this include water coolers and drink dispensing equipment. If the evaporator of a water cooler were allowed to drop below 32 degrees F, it would freeze and potentially rupture, much like the water pipes in your home. To prevent this, Automatic Expansion Valves are often used in these type applications. They are adjusted so as to maintain an operating pressure several psi above the freezing point thereby eliminating the need for secondary controls.

# Contractor Service Tips



## Sensing Bulb Location

**Q: What is the correct position for the TXV sensing bulb?**

The placement of the remote sensing bulb of the TXV onto the suction line is critical to proper TXV performance. The important points to follow are:

- Clean the suction line near the outlet of the evaporator
- The entire length of the sensing bulb must be in contact with the cleaned portion of the suction line
- The sensing bulb should be placed several inches upstream of the external equalizer connection
- The sensing bulb should be attached at 12 o'clock on any suction line of 7/8" diameter or smaller. On lines larger than 7/8" diameter the bulb should be placed at either 4 or 8 o'clock. The bulb should never be placed at 6 o'clock
- Always insulate the sensing bulb after installation
- A sensing bulb can be installed on a vertical suction line if necessary but never place bulb downstream of a trap. Bulb placement before a trap (upstream) is recommended.

*See graphic on reverse side of card.*

## POSITIONING THE TXV SENSING BULB



- On suction lines less than  $7/8$ " diameter, position bulb at 12:00 o'clock
- On suction lines greater than  $7/8$ " diameter, position bulb at 4 or 8 o'clock

# Contractor Service Tips



## Evacuation

**Q: What is the purpose for 'evacuating' a refrigeration system?**

Evacuating a refrigeration system serves two primary objectives:

1. Removes non-condensables
2. Dehydrates (removes water vapor)

If non-condensables such as air are not removed, the system will operate at higher than normal condensing pressures. This happens because the air is trapped at the top of the condenser, effectively reducing the condenser capacity. Increasing the condensing pressure results in higher compression ratios and higher discharge temperatures, both of which decrease system efficiency and can lead to decreased reliability.

Water vapor must be removed from refrigeration systems for several reasons. The water vapor can cause a 'freeze-up' at the expansion device (TXV or capillary tube) causing a complete loss of refrigeration effect. Moisture, refrigerant and heat can also combine to form acids. These acids mix with oil and metal wear particles resulting in the formation of sludge. This sludge tends to collect at the hottest areas, usually the discharge valve plate and if allowed to build up can prevent the discharge valves from properly sealing.

**Q: Does evacuation actually pull liquid water out of the system?**

No, evacuation will not pull liquid water out of the system. When you evacuate a system you are actually dropping the pressure sufficiently to allow water to "boil" at room temperature. As the water boils, it of course changes to the vapor state, and this vapor is drawn out by the vacuum pump.



**Q: How low a vacuum do I need to properly evacuate my system?**

Modern deep vacuum pumps should be used for this purpose. These pumps have the ability to evacuate down to 20 Microns in field situations. Equipment manufacturers should be consulted to determine their recommended vacuum levels, however, if a vacuum of 250 Microns can be achieved, that is usually considered adequate.

Care must be taken to assure that the vacuum measured at the gauge is equal to the vacuum level in the system being evacuated. Use as large a hose as possible to connect the evacuation equipment to the refrigeration system. It is also advisable to remove any Schrader cores prior to connecting evacuation lines so as to eliminate large pressure drops. Once the system is evacuated, it is also advisable to isolate the pump from the system and observe if the system holds its low vacuum. Some increase is acceptable (up to about 500 microns) but if the system vacuum level exceeds that a second and even third evacuation may be needed. If during the equalization time the system vacuum level goes back to atmospheric it is an indication that a leak is present.

If a vacuum pump is no longer able to pull a deep vacuum, it is usually an indication that the oil in the pump is contaminated and must be replaced. Be sure to use oil specifically produced for vacuum pump applications. This oil has a much lower vapor pressure than conventional oils. It is advisable to replace the vacuum pump oil at regular intervals usually after each use to make certain a low vacuum level can be achieved. The oil should be replaced while still warm enabling better drainage.

**Q: What is a micron?**

A micron is a metric measure and is defined as 1 millionth of a meter or 1 thousandth of a millimeter.

Most people in the US think of a perfect vacuum as 30 inches of Mercury (Hg). The last inch (from 29-30) of vacuum is equal to 25,400 microns. The micron then is a much more precise method for measuring deep vacuums.

Micron = 0.001 mm Hg = 0.000039 inches of Hg = 1 millitorr

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## Evaporator Vs. System Superheat

**Q: What is the difference between evaporator superheat and system superheat?**

Superheat varies within the system depending on where it is being measured. The superheat that the thermal expansion valve is controlling is the evaporator superheat. This is measured at the outlet of the evaporator. The refrigerant gains superheat as it travels through the evaporator, basically starting at 0 as it enters the evaporator and reaching a maximum at the outlet as the refrigerant travels through the evaporator absorbing heat.

System superheat refers to the superheat entering the suction of the compressor. Some people confuse system superheat with 'return gas temperature.' It should be remembered that superheat varies as the saturated suction pressure of the refrigerant varies. Return gas temperature is a temperature value measured by a thermometer or other temperature-sensing device. It does not vary because of pressure changes.

**Q: How much system superheat should I see at the compressor inlet?**

Compressor manufacturer's like to see a minimum of about 20 degrees of superheat at the compressor inlet. This is to assure them that no liquid refrigerant is entering the compressor.



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## Flooding

### Q: What is meant by 'flooding'?

Flooding (also known as 'flood back') is the term used to describe the condition when liquid refrigerant reaches the compressor. This occurs when the amount of liquid fed to the evaporator is more than can be evaporated. There are a number of possible causes of flooding including:

- TXV oversized for the application
- TXV misadjusted (superheat too low)
- System overcharged with refrigerant
- Insufficient airflow through evaporator
- Dirty evaporator
- Evaporator fans not operating
- TXV bulb not properly attached

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## Migration

### Q: What is 'migration'?

Migration is the term used to describe when refrigerant moves some place in the system where it is not supposed to be, such as when liquid 'migrates' to the compressor sump. This phenomenon occurs because refrigerant will always migrate to the coldest part of a system. As an example, in a split air-conditioning system with the compressor/condenser outside, liquid refrigerant from the evaporator will migrate to the compressor during winter months due to the compressor being colder than the indoor (evaporator) temperature. If this is not prevented, then upon start-up in the spring, compressor slugging and damage may occur.

### Q: How can I prevent migration?

There are two common methods used to prevent migration:

- Use of a 'pump down system'
- Use of crankcase heaters to 'drive off' any liquid refrigerant

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## Oil Separators

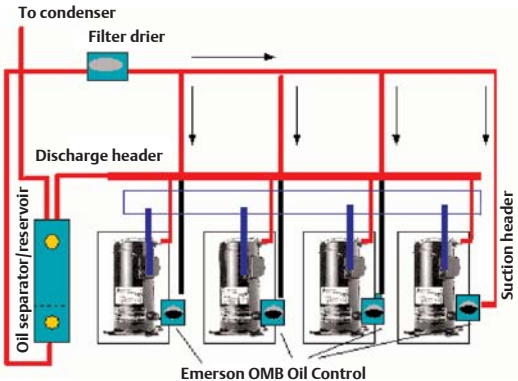
**Q: What is the purpose of oil separators and how do they operate?**

Oil separators are used on refrigeration systems where it is difficult for the oil to return from the evaporator. These typically are field built-up systems, such as in supermarkets, and ultra-low temperature systems.

Oil separators are installed in the compressor(s) discharge line. They are usually a vertical container with the discharge gas connections at the top and an oil return port at the bottom. This return line may be piped directly to the suction line on single compressor units or on multiple compressor racks would be piped to a holding tank called an oil reservoir. Some oil separators have a reservoir built into the bottom portion of the container with the upper portion being the separator.

From the reservoir, the oil is then returned to the compressors by use of a mechanical or electronic oil level control fastened to the compressor crankcase.

Oil separators use various modes of oil separation methods to remove the oil from the discharge gas as it leaves the compressor. These methods include reduction of velocity, impingement, centrifugal action, or coalescing elements. Oil separators vary in capacity and efficiency depending upon the mass flow that is being pumped through them and no oil separator is 100% efficient.



**Typical System Oil Piping Schematic**

# Contractor Service Tips



## Pump Down Systems

**Q: What is a 'pump down' system and when should it be used?**

A pump-down system consists of a normally closed solenoid valve installed in the liquid line and a low-pressure control that senses suction pressure. The system operation is as follows:

- A thermostat is wired to the liquid line solenoid valve. On a call for cooling, the thermostat contacts close. This causes the solenoid coil to be energized, opening the valve. Liquid refrigerant flows into the evaporator and the suction pressure rises above the low-pressure control 'set-point.' The contacts on the low pressure control close and the compressor begins to run.
- When the thermostat is satisfied, its contacts open, causing the solenoid valve to close. This stops refrigerant flow into the evaporator. As the compressor continues to run, refrigerant is pumped out of the evaporator coil and suction pressure falls.

When the suction pressure reaches the 'cut-out' setting on the low-pressure control its contacts open, stopping the compressor. This removes all refrigerant from the low side of the system during the 'off-cycle.'

**Q: What is the advantage of the pump down system?**

The advantage of a pump-down system is that all the liquid refrigerant is stored in the receiver and condenser when the compressor is not operating. This prevents liquid migrating to the compressor crankcase during the off cycle and the ensuing possibility of liquid slugging at compressor start-up.

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## Subcooling

### **Q: What is meant by subcooling?**

Subcooling is the condition where the liquid refrigerant is colder than the minimum temperature (saturation temperature) required to keep it from boiling and, hence, change from the liquid to a gas phase.

The amount of subcooling, at a given condition, is the difference between its saturation temperature and the actual liquid refrigerant temperature.

### **Q: Why is subcooling desirable?**

Subcooling is desirable for several reasons.

1. It increases the efficiency of the system since the amount of heat being removed per pound of refrigerant circulated is greater. In other words, you pump less refrigerant through the system to maintain the refrigerated temperature you want. This reduces the amount of time, which the compressor must run to maintain the temperature. The amount of capacity boost, which you get with each degree of subcooling, varies with the refrigerant being used.



2. Subcooling is beneficial because it prevents the liquid refrigerant from changing to a gas before it gets to the evaporator. Pressure drops in the liquid piping and vertical risers can reduce the refrigerant pressure to the point where it will boil or 'flash' in the liquid line. This change of phase causes the refrigerant to absorb heat before it reaches the evaporator. Inadequate subcooling prevents the expansion valve from properly metering liquid refrigerant into the evaporator resulting in poor system performance.

# Contractor Service Tips



## Superheat

**Q: What is 'superheat'?**

Superheat refers to the number of degrees a vapor is above its saturation temperature (boiling point) at a particular pressure.

**Q: How do I measure superheat?**

Superheat is determined by taking the low side pressure gauge reading, converting that pressure to temperature using a PT chart, and then subtracting that temperature from the actual temperature measured (using an accurate thermometer or thermocouple) at the same point the pressure was taken.

**Q: Why is it important to know the superheat of a system?**

Superheat gives an indication if the amount of refrigerant flowing into the evaporator is appropriate for the load. If the superheat is too high, then not enough refrigerant is being fed resulting in poor refrigeration and excess energy use. If the superheat is too low then too much refrigerant is being fed possibly resulting in liquid getting back to the compressor and causing compressor damage.

### Q: When should I check the superheat?

The superheat should be checked whenever any of the following take place:

- System appears not to be refrigerating properly
- Compressor is replaced
- TXV is replaced
- Refrigerant is changed or added to the system

Note: The superheat should be checked with the system running at a full load, steady state condition.

### Q: How do I change the superheat?

Turning the adjustment stem on the TXV changes the superheat.

Clockwise - increases the superheat

Counter clockwise - decreases the superheat

Valve Family	Total Turns	Degrees of SH Per Turn					
		R-22		R-134a	R-404A/507		R-410A
		+20 F	-20F	+20F	+20F	-20F	+40F
TCLE	32	0.8	1.5	1.0	0.5	1.0	N/A
HF	10	2.2	4.2	3.8	1.8	3.2	N/A
A	8	3.0	5.0	4.5	2.0	4.0	2.0
TRAE	10	2.2	4.2	3.8	1.8	3.2	N/A

**Note:** To return to approximate original factory setting, turn adjustment stem counterclockwise until the spring is completely unloaded (reaches stop or starts to 'ratchet'). Then turn it back in ½ the 'Total Turns' shown on the chart.

# Contractor Service Tips



## Alternative Refrigerants and Oils

**Q: What is the right oil to use with the new refrigerants?**

With the introduction of HFC refrigerants as alternatives to CFC and HCFC refrigerants, the question of the proper oil to use still comes up.

The generally preferred oil for use with HFCs is a polyolester (POE) which has an additive package for refrigeration applications. Mineral oil (MO) is not recommended because oil return is considered to be compromised.

**Q: Do I have to remove all the MO from the system when retrofitting?**

If retrofitting a system to an HFC refrigerant, current recommendations are to remove the mineral oil so that 5% or less is all that remains in the system before changing to POE oil. The percentage can be measured by using a refractometer.

**Q: What about alkyl benzene oils?**

Most interim HCFC refrigerants can also use alkyl benzene (AB) oil if approved by the compressor manufacturer. If in doubt about which oil to use with the refrigerant you are using, always consult the compressor manufacturer. (See chart for an example of one manufacturer's recommendation)

# Copeland Accepted Refrigerants/Lubricants

	Refrigerants	Source	Application				Lubricant Choices			Comments
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Ozone Depleting	CFC-R-12 CFC-R-502 HCFC-R-22	Many Many Many		LM LM LMH	LM LM LMH	MO MO MO	AB & MO AB & MO AB & MO	POE POE POE	Phaseout by 1996 Phaseout by 1996 Phaseout by 2020	
Interims	HCFC-R-401A HCFC-R-401B HCFC-R-402A HCFC-R-408A HCFC-R-409A	Dupont/Allied Dupont/Allied Dupont Atochem Atochem	R-12 R-12 R-502 R-502 R-12	MH LM LM LM LM	N/A N/A N/A N/A N/A	AB & MO AB & MO AB & MO AB & MO AB & MO	POE & MO POE & MO POE & MO POE & MO POE & MO	POE POE POE POE POE	Service on Suva® MP39 Service on Suva® MP66 Service on Suva® HP80 Service only FX10 Service only FX56	
Non-Ozone Depleting	HFC-R-134a HFC-R-404A HFC-R-507 HFC-R-407C HFC-R-410A	Many Many Allied Dupont/Allied/ICI Allied/Dupont	R-12 R-502 R-502 R-22	MH LM LM MH	MH LM LM MH	POE POE POE POE			Suva® HP62 Forane® FX70 Genetron® AZ50 Suva® 9000/KLEA 66 Genetron® AZ20/Suva® 9001 **	

**Legend:**

MO = Mineral Oil (3CS or Equivalent)  
 AB = Alkyl Benzene (Copeland/ Ultra 200 or Shreve Zerol 200 TD or Soltek AB 200A or Thermal Zone 200)  
 POE = Copeland Ultra 22CC  
 or Mobil EAL™ Arctic 22 or ICI Emkarate™ RL32CF  
 or Thermal Zone 22CC  
 POE & MO = Minimum 50% Alkyl Benzene  
 AB & MO = Minimum 50% Alkyl Benzene (Shell 22-12)  
 Note: Shell 22-12 is a 70/30 mixture of AB & MO  
 Copeland Ultra 200, Zerol 200 TD, and Soltek AB 200A are 100% AB

**Refer to the following Application Bulletins for additional information:**

- 4-1295 HFC-134a Refrigerant Guidelines
- 17-1248 Refrigeration Oils
- 25-1177 Safe Handling of Compressed Gases
- 93-02 CFC-12 to R-401A\*
- 93-03 CFC-12 to R410B\*
- 93-04 CFC-12 to HFC-124a
- 93-05 R-502 to R-402A\*
- 94-15 R-502 to R-404A/R-507\*
- 95-14 R-22 to R-407C\*\*

\* Refrigerant Changeover Guidelines

\*\* New equipment only

For specific product availability and performance data refer to Copeland Sales Literature

# Contractor Service Tips

A yellow starburst graphic containing the text "Tip Card 18".

Tip Card  
18

## Bi-Flow TXV

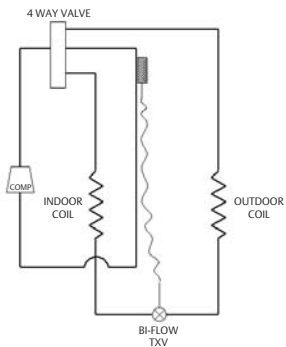
**Q: Does an HFES (or other balanced port TXV) bi-flow for use on a heat pump system?**

The HFES series (or other balanced port valve) will meter the flow of refrigerant in either direction. The sensing bulb in such a case would have to be located on a common suction line, such as the center tube of a 4-way valve (see figure 1).

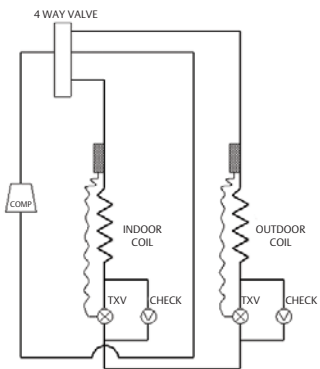
Also, for such a system to work properly, the system would have to be “close coupled,” meaning that the evaporator and condenser would have to be physically located in close proximity to one another, such as in a packaged system.

For “split” type systems, the long length of tubing between the TXV and the coils makes it impractical to utilize an approach of this type.

For such systems, two expansion valves must be used: one on the indoor and one on the outdoor coil.



**Figure 1 - Bi-Flow System**



**Figure 2 -Check Valve Bypass System**

# Contractor Service Tips



## Checking Power Elements of TXV

**Q: How can I determine if a TXV still has the proper charge in the power element?**

A valve with a low charge (or no charge) in the power element will tend to starve the evaporator. This is because the pressure on top of the diaphragm (opening force) is reduced.

To check for this, the following procedure is recommended:

1. On a valve with an external superheat adjustment, turn the adjustment nut to the full counterclockwise position. Verify that the superheat is still too high before proceeding to the next step.
2. Remove the bulb from the suction line and hold it in your hand for several minutes to warm it up. Observe the suction pressure. If the valve has charge, you should see an increase in suction pressure.
3. If no change in suction pressure occurs, it is reasonable to conclude the valve has lost its charge and must be replaced.

Note: Some valve types have removable power elements which can be replaced in lieu of replacing the entire valve.

If the power element can be removed, the bulb charge can be checked by trying to depress the diaphragm with your thumb. You should NOT be able to depress this by hand. If you can, the valve has lost its charge.

# Contractor Service Tips



Tip Card  
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## Global Warming

### Q: What is global warming?

The Environmental Protection Agency (EPA) defines global warming as ‘an increase in the near surface temperature of the earth.’

Global warming has occurred in the distant past as the result of natural influences, but the term is most often used today to refer to the climatic warming predicted to occur as a result of increased emissions of ‘greenhouse gases.’ The release of refrigerants into the atmosphere is considered to be a significant factor in contributing to the increase in global warming. Scientists generally agree that the earth's surface has warmed by about 1 degree Fahrenheit in the past 140 years. While this may not seem like much of a change, atmospheric scientists are concerned about this general warming trend and the impact that this has on many aspects of our lives such as economic prosperity, agricultural production, and pollution.

### Q: What is meant by ‘direct’ and ‘indirect’ global warming?

Direct global warming is the measure of global warming potential (GWP) that each greenhouse gas contributes to the warming process if it is released ‘directly’ into the atmosphere.

Indirect global warming considers the amount of contributing effect to global warming by the manufacture of greenhouse gases and their efficiency of operation. In other words, it takes energy from power plants, which also emit greenhouse gases, to manufacture the gases and operate the equipment that the greenhouse gases are used in. An example of such equipment would be an air conditioner with a SEER of 10 versus one with a SEER of 13. The 10 SEER unit would have a higher Indirect Warming Potential since it would not operate as efficiently.

**Q: What is 'total equivalent warming impact' (TEWI)?**

TEWI is the sum of a greenhouse gas's direct and indirect GWP. This value takes into consideration both the factor of direct release of the gas into the atmosphere and the indirect factor of the manufacture and lifetime operation of the system in which the gas is used. This factor is important because some greenhouse gases may have a low direct GWP but require more energy to manufacture or do not operate as efficiently as other gases with a higher direct GWP.

# Contractor Service Tips



## Internal or External Equalized TXV

**Q: What is the difference between an 'internally' equalized and 'externally' equalized TXV?**

An internally equalized TXV uses evaporator inlet pressure to create the 'closing' force on the valve. An externally equalized valve uses the evaporator outlet pressure' thereby compensating for any pressure drop through the evaporator.

If an internally equalized valve is used in a system with a large pressure drop through the evaporator, the pressure below the diaphragm will be higher, causing the valve to go in a more 'closed' position and resulting in a superheat higher than desired (starving).

**Q: When should I use an externally equalized TXV?**

1. On any large system, generally over 1 ton capacity
2. On any system utilizing a distributor

Note: For field replacement you can always replace an internally equalized valve with an externally equalized type; however, you should never replace an externally equalized valve with an internal type.

**Q: If I need to replace an internally equalized valve and all that is available is an externally equalized type, can I simply 'cap' the equalizer fitting?**

No, the equalizer must be connected to the suction line near the thermal bulb. Capping the equalizer line will prevent the valve from operating properly.

**Q: Will an externally equalized TXV allow system pressures to 'equalize' during off cycles?**

No, an externally equalized valve will NOT allow system high and low sides to 'equalize' during the off cycle. The only way this can be accomplished is through the use of a 'bleed' type TXV.

**Q: Where should the external equalizer be installed?**

The external equalizer line should be installed on top of the suction line before any traps and located within 6 inches of the sensing bulb position. If this is not possible, and a different location is required, it must first be confirmed that the pressure at the desired location is identical to the pressure at the bulb.

**Q: What happens if the equalizer tube becomes 'kinked'?**

If the equalizer line becomes 'kinked' the pressure sensed at the underside of the diaphragm will no longer correspond to the evaporator outlet pressure and the valve will not be able to operate as intended.

**Q: I have seen some equalizer tubes 'frosted.' Is that normal?**

Frost on the equalizer line is an indication that the packing seal has failed, allowing higher pressure refrigerant to leak past and expand into the equalizer line. Depending on the valve type, either the cage assembly or the entire valve should be replaced.

# Contractor Service Tips

Tip Card  
22

## Liquid-to-Suction Heat Exchangers

**Q: What is the benefit to using a liquid-to-suction heat exchanger?**

A liquid-to-suction heat exchanger is beneficial in the following ways:

1. It provides subcooling to the liquid refrigerant prior to it entering the expansion valve. This eliminates the possibility of 'flash gas' forming in the liquid line and enables the expansion valve to operate with greater stability.
2. The added subcooling which is provided to the liquid refrigerant increases the efficiency of the system.
3. The heat which is transferred from the liquid to the suction increases the superheat of the suction gas thereby reducing the possibility of liquid "floodback" to the compressor. Liquid floodback is considered one of the major causes of compressor failure, so any steps taken to minimize this will result in improved compressor reliability.

Form No. 2005FC-258 R1 Issued 2/06

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# Contractor Service Tips

Tip Card  
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## Moisture Indicators and Sight Glasses

**Q: I have a new HMI sight glass right out of the box that is showing a wet condition. Can I use this in my system and will it give the proper moisture indication?**

The element in the sight glass senses the moisture of the atmosphere that it is in. In this case, the air has enough moisture to turn the sensing element pink (wet).

Once a sight glass is put into an operating refrigeration system, it will over time adjust its color to indicate the moisture level of the refrigerant. This change can take several hours to occur...it will not happen instantaneously.

**Q: If I pull a vacuum on the system with the wet sight glass, will that change its color back to dry?**

Pulling a vacuum by itself will not remove enough moisture from the HMI indicator to effect a color change in a short period of time.

The recommended procedure is to install the HMI in the system with a new EK filter drier and clean, dry refrigerant, and operate the system. Within several hours the indicator will show the moisture condition of the refrigerant. It is recommended however, to allow the system to operate for 12 hours to attain complete equilibrium.



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## Maximum Operating Pressure (MOP)

**Q: What does MOP (Maximum Operating Pressure and/or Motor Overload Protection) mean on an expansion valve?**

MOP refers to the maximum value that the suction pressure is allowed to rise to before the expansion valve tends to close off and restrict a further increase in flow. This is accomplished at the point where the gas in the expansion valve's power element charge has become superheated and can exert only slightly more opening pressure as the temperature rises.

The purpose of MOP is to prevent the suction pressure from rising so high that the compressor motor cannot start due to too high of an initial load.

An MOP type valve tends to serve the same function as a crankcase pressure regulating (CPR) valve; however, it will not control as precisely as the CPR valve. It usually is not recommended to use both a CPR and an MOP type valve on the same system as there is a possibility that they will 'fight' each other as they both try to control.



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## System Clean-Up After Motor Burn

**Q: What type of filter-drier is recommended for cleaning a system after a compressor motor burn?**

After a burn, both the liquid and suction line cores (if provided) should be replaced with special 'burnout blocks.' These cores have an 'HH' in their model nomenclature. The system is then operated with these cores in place until the refrigerant and oil are clean and free of acids. Once this condition is attained, the liquid core must be replaced with a standard type core (UK48 or H48). The suction core should also be replaced with an F-48 filter.

**Q: My system does not have a removable suction core and there isn't enough space to install one. What should I do?**

On smaller self-contained systems, where a removable suction core cannot be installed, you should put in a hermetic type suction line filter-drier (ASK-HH). This must only be left in the system until the refrigerant and oil have been cleaned and then either be removed or replaced with a new one so as to prevent excessive pressure drop.

**Q: How do I know when the suction core needs to be replaced?**

A wet indication in the sight glass or a pressure differential greater than the equipment manufacturer's recommendation dictates the need for replacement. If the equipment manufacturer's recommendation is not available, the following maximum pressure drops are suggested:

System Type	Permanent Installation		Temporary Installations	
	R-22	R-12	R-22	R-12
	R-404A/507	R-134A	R-404A/507	R-134A
HIGH TEMP (A/C)	3	2	8	6
MEDIUM TEMP	2	1.5	4	3
LOW TEMP	1	0.5	2	1

**MAXIMUM RECOMMENDED SUCTION LINE FILTER-DRIER PRESSURE DROP (PSI)**

The pressure drops indicated in the columns titled 'TEMPORARY INSTALLATIONS' should only be used during the clean-up operation as an indication when the core needs to be replaced. During normal operation, the pressure drop should not exceed those shown in the column 'PERMANENT INSTALLATION.' Operating with high pressure drop across a suction filter-drier will decrease system efficiency and must be avoided.

# Contractor Service Tips

Tip Card  
26

## TXVs and SEER

**Q: What Increase in SEER rating is achieved going from a flow-rater (fixed metering device) to an expansion valve, provided all else stays the same?**

To explain why a system's SEER rating is improved by using a Thermal Expansion Valve (TXV) instead of a fixed orifice device we need to first understand how the SEER is determined. The SEER (Seasonal Energy Efficiency Ratio) is a measure of how efficiently an Air Conditioner or Heat Pump will operate over an entire cooling season instead of only a single operating condition.

For single speed systems, the SEER is calculated as follows:

$$SEER = EER_b * (1 - C_d/2)$$

Where:

$EER_b$  = Energy Efficiency Ratio at 95/75F (DB/WB) Outdoor Temp and 80/67F Indoor Temp

$C_d$  =Cyclic Degradation Coefficient determined through two dry coil tests (one steady state, the other cyclic). This factor quantifies the Part Load (cycling) efficiency of the system.

In order to improve SEER, it is important to keep the  $C_d$  as low as possible. This can be achieved by minimizing the amount of refrigerant entering the evaporator during the 'off' cycle. With a fixed orifice device, the high and low sides of the system equalize during the off cycle resulting in a high  $C_d$ . In comparison, a non-bleed TXV closes tightly when the compressor shuts off preventing equalization and thereby minimizing the  $C_d$ . It is for this reason, that TXVs will typically increase the rating of a HVAC system by approximately 0.5 SEER.

It should be noted that a system can be designed with a fixed orifice and liquid line solenoid to achieve a SEER rating equal to that with a TXV. However, such a system would not be as efficient over the entire operating range of the equipment as it would with a TXV. The TXV regulates the flow of refrigerant to maximize the efficiency of the evaporator at all operating conditions, whereas a fixed orifice can only be optimized at one particular condition. For this reason, if energy efficiency is the goal, a system incorporating a TXV should be specified.

# Contractor Service Tips



## Solenoid Valves

**Q: What does the “MOPD” rating on solenoid valves mean?**

Solenoid valves are rated in terms of Maximum Operating Pressure Differential (MOPD) against which the valve will open. For example, with the valve closed against an inlet pressure of 250 psi and an outlet pressure of 50 psi, the pressure differential across the valve is 250-50 or 200 psi.

The MOPD rating for the valve is the maximum pressure differential against which the valve will reliably operate. If the pressure differential is higher than the rated MOPD for the valve, the valve will not operate.

The temperature of the coil winding and the applied voltage has a significant affect on the MOPD rating. The MOPD is reduced as the coil temperature increases or the voltage decreases. For this reason the MOPD rating is established by operating the valve at 85% of rated voltage after the coil has attained its maximum temperature by operating at full rated voltage.

**Q: Why do some valves have a “Min OPD” rating and what does this mean?**

“Min OPD” stands for Minimum Operating Pressure

Differential. All pilot operated valves (like our 200 and 240 series) require a small amount of pressure differential to enable the piston or diaphragm to raise off the main seat. Typically, 2 to 5 psig differential is needed to accomplish this. If the pressure differential is less than the Min OPD, then the valve will not open when actuated or will fail to remain open.

If a valve is greatly oversized for the application it can suffer from this affect since the pressure drop across the valve with low flow rates can be below the Min OPD.

Direct operating solenoids (like our 50RB and 100RB) do not have a Min OPD specification since they do not rely on system pressures for operation.

**Q: What are some typical problems I can expect with a solenoid valve and how do I recognize it?**

### Solenoid Valves Troubleshooting Chart

<b>PROBLEM</b>	<b>CAUSE</b>
Won't Open	Valve Oversized Not within 10% Rated Voltage Coil Burnout Bent Enclosing Tube Improper Wiring
Won't Close	Broken internal Parts Installed Backwards Foreign Material In Orifice Area Manual Stem Front-Seated
Intermittent Operation	Transformer Undersized Valve Oversized For Application (Pressure Drop Below MinOPD)

# Contractor Service Tips

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## Metering Device

Many air conditioning systems incorporate a TXV style metering device as the standard. It is extremely important for the HVAC technician to understand the design and operation of these valves. If proper service practices are not followed, severe system damage will result.

When charging a system, follow the manufacturer's recommendations. If extra charge is required due to long line sets and the system incorporates a TXV metering device, charging should be done with respect to subcooling at highest load. The greatest chance for a TXV to lose control of the evaporator load is during this time. If subcooling is present during highest load, enough refrigerant is circulating throughout the system to control the evaporator loads.

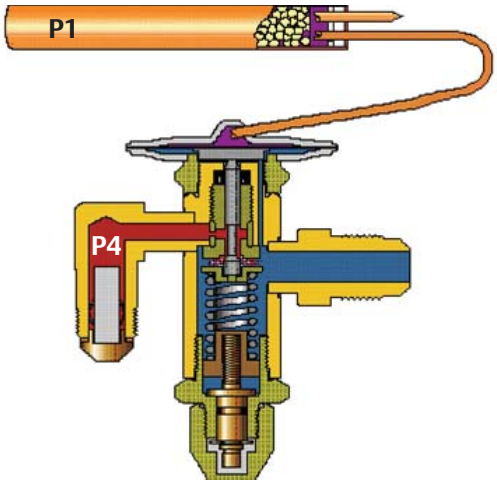
To adjust evaporator coil superheat, follow the manufacturer's recommendations. If these are not available, the following guide lines could apply, depending upon the system design temperature:

High Temp	8°F - 12°F
Medium Temp	5°F - 8°F
Low Temp	2°F - 6°F



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# Thermostatic Expansion Valve



- P1 = Bulb Pressure (Opening Force)
- P2 = Evaporator Pressure (Closing Force)
- P3 = Superheat Spring Pressure (Closing Force)
- P4 = Liquid Pressure (Opening Force)

TXV Pressure Balance Equation

$$\mathbf{P1 + P4 = P2 + P3}$$

# Contractor Service Tips



## Scroll Compressor Safety Controls

Many air conditioning systems incorporate a scroll compressor as the standard. It is extremely important for the HVAC technician to understand the design and operation of scroll compressors. If proper service practices are not followed severe system damage will result.

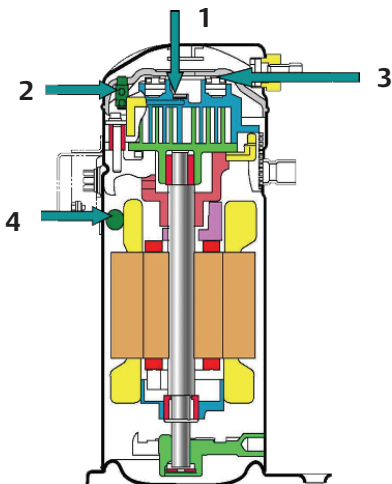
Scroll compressors incorporate a variety of internal safety controls. It is important to understand these safety features because they actuate the internal line break motor protection. Safety features that you could find in the air conditioning scroll under 7 tons may be:

- (1) Temperature Operated Disc (TOD) - This is a bimetallic disc that senses the discharge temperature and opens at approximately 270°F internal plenum temperature.
- (2) Internal Pressure Relief (IPR) - This opens at approximately 400 +/-50 pounds differential for R-22. If this pressure differential is exceeded, the IPR will open. On a ZP scroll for R-410A, the IPR differential is set higher, 550 to 625 PSID.
- (3) Floating Seal - This separates the high side from the low side, but also can prevent the compressor from drawing into a deep vacuum and damaging the Fusite® electrical terminal.
- (4) Internal Motor Protector - This is an inherent protector, sensing both internal temperature and amperage. A compressor with a tripped motor protector will exhibit a high shell temperature. Allow the compressor to cool in order to reset the motor protector.



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## Scroll Compressor Protection



- 1 = Temperature Operating Disc**
- 2 = Internal Pressure Relief**
- 3 = Floating Seal**
- 4 = Motor Protector**

2005ES-169 R3 (7/07)

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# Contractor Service Tips



## Refrigerants

Many air conditioning systems incorporate an HFC refrigerant as the standard. It is extremely important for the HVAC technician to understand the properties of these refrigerants. If proper service practices are not followed severe system damage will result.

The Air Conditioning market is converting to the new, environmentally friendly refrigerant, R-410A, with the phase-out of R-22 in 2010. R-410A will represent one third of the market in 2006, in conjunction with the new higher efficiency regulation of 13 SEER.

Since R-410A is classified as an HFC, the only recommended oil is polyol ester (POE) oil. POE oil is extremely hygroscopic and will absorb moisture at a rapid rate. Testing has shown that POE oil can be moisture saturated in less than 15 minutes if exposed to a 90% relative humidity environment.

The "Emerson Climate Technologies, Inc. Accepted Refrigerants and Lubricants" chart lists approved combinations of common refrigerants and lubricants. To maintain compressor warranty, please ensure these combinations are respected when installing or retrofitting a system.



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## Refrigerants/Lubricants Approved For Use In Copeland® Brand Compressors

	Refrigerants	Similar To	Application			Lubricant Choices		Comments
			Retrofit	New	Preferred	Alternate #1	Alternate #2	
Ozone Depleting	CFE R-12		LM	LM	MIN	AB & MIN	Phasor Out In 1996	
	CFE R-502		LM	LM	MIN	AB & MIN	Phasor Out In 1996	
Inert	HFC R-22		LMH	LMH	MIN	AB & MIN	Phasor Out By 2020	
	HFC R-401A	R-12	MH	N/A	AB & MIN	POE & MIN	Service Only Svaib® MP39	
	HFC R-401B	R-12	LM	N/A	AB & MIN	POE & MIN	Service Only Svaib® MP66	
	HFC R-402A	R-502	LM	N/A	AB & MIN	POE & MIN	Service Only Svaib® HP90	
	HFC R-402B	R-502	LM	N/A	AB & MIN	POE & MIN	Service Only Svaib® HP91	
	HFC R-408A	R-502	LM	N/A	AB & MIN	POE & MIN	Service Only FX10	
	HFC R-409A	R-12	LM	N/A	AB & MIN	POE & MIN	Service Only FX56	
	HFC R-134a	R-12	MH	MH	POE			
	HFC R-404A	R-502	LM	LM	POE		Svaib® HP62, Forane® FX70	
	HFC R-507	R-502	LM	LM	POE		Genetron® AZ50 Svaib® 9000/RL EA 66	
Non-Ozone Depleting	HFC R-407C	R-22	MH	MH	POE			
	HFC R-410A		MH	MH	POE			
	HFC R-134a		MH	MH	POE		Genetron® AZ20/Svaib® 9100**	
Copeland Screw™ Compressors Only	HFC R-407C					SOLEST 170		
	HFC R-507					SOLEST 170		
	HFC R-404A					SOLEST 170	SC Models Only	
	HFC R-22					CP4214 320 CP4214 150 or Ultra A100EP SH Models Only		

### Legend:

- MIN = Mineral Oil (Copeland® 46MMNO\*, Genetron Surtiso 365, Emerson/Texas Copella WR-32 and Calumet R0115)
  - AB = Alkyl Benzene (Solvax zeol) 200 TD, Solvax AS200A, Complant Surtiso A9B 200A or Fluids Rensio SP46)
  - POE = Copeland® brand Ultra 32 C.C. Copeland® brand Ultra 32, MAVE, Mobil EAL™ Arctic 22 CC or Uniqema RL32-3MAF
  - POE & MIN = Minimum 50% POE
  - AB & MIN = Minimum 50% Alkyl Benzene (Shell 22-12 or Fluids Rensio Tiken MS46)
  - L = Low temperature application
  - M = Medium temperature application
  - H = High temperature application
- For specific product availability and performance data refer to Emerson Climate Technologies, Inc. Sales Literature
- Refrigerant Chargeover Guidelines  
 \*Chargeover is permitted only for R-22 applications and is equivalent to Complant Surtiso 365.  
 \*\*see machine applications only

Refer to the following Application Bulletins for additional information:

- 4-1-286 HFC-134a Refrigerant Guidelines
- 27-1-308, 27-1-309 and 27-1-322 for Copeland Screw™ Compressors
- 25-1177 Safe Handling Of Compressed Gases
- 93-02 CF-C-12 To R-401A\*
- 93-04 CF-C-12 To R-401B\*
- 93-04 CF-C-12 To HFC-134d\*
- 93-05 R-502 To R-402AR-408A\*
- 94-15 R-502 To R-404AR-507\*
- 95-14 R-22 To R-407C\*

MSDS sheets are available at EmersonClimate.com.

Compressor nomenclatures identify both the oil type and oil amount.

- MIN = Mineral Oil
- POE= Polyol Ester Oil
- AB = Alkylbenzene

Form No. 93-11 R4 (07/07)  
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# Contractor Service Tips



## Single Phase Motor Terminal ID

Many air conditioning systems incorporate a hermetic (welded body) compressor as the standard. It is extremely important for the HVAC technician to identify the correct electrical terminals. If the electrical terminals are not wired correctly, severe compressor or system damage will result.

A standard has been developed for single phase welded compressors. The standard terminal designation is read like a book, from left to right and from top to bottom. The order of these terminals is Common (C) - Start (S) - Run (R).

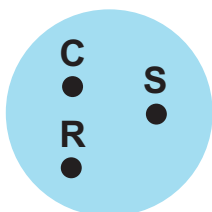
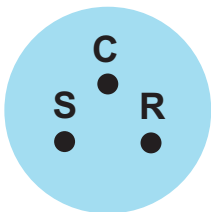
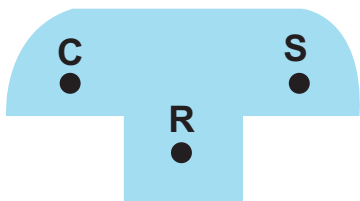
While protectors are very reliable and do a good job of protecting a compressor motor against normal overload situations, they cannot protect motors against miswiring and defective external components. Miswiring a compressor can cause a motor to burn in as little as 25 seconds. Any motor miswired or used with defective components will ultimately fail.

Be sure to check or replace any electrical components including but not limited to the contactor, run capacitor, relay, and start capacitor. Any of these components could also cause compressor failure.



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# Motor Terminal Identification



On single phase hermetic compressors, the order of these terminals is C - S - R. This is read like a book, from left to right and from top to bottom. The “Common” terminal is always first, followed by “Start” and then “Run”.