R-410A
R-410A Facts

- Ozone friendly- No Chlorine
- Replacement for R-22, NOT a drop in!
- Higher Pressure Range-50 to 75% higher than R-22
- Requires Special Lubricants
It’s a Blended Refrigerant.

50% R-32 and 50% R-125.

This blend is a near-azeotrope, not a true azeotrope like R-502.

A true azeotrope is a mixture that maintains its composition through both the liquid and vapor phase.
The Future Refrigerant R-410A

Azeotrope/Near Azeotrope

Temperature Glide

Fractionation

The Future Refrigerant R-410A
For a near-azeotrope, the individual refrigerants evaporate or condense at different temperatures.

The differences between these saturation temperature points with mixed refrigerants is called: “TEMPERATURE GLIDE”

When temperature glide is high the refrigerants can separate during evaporation or condensation.

This changes the composition of the resulting vapor and liquid.

This separation is called: “FRACTIONATION”
The temperature glide of R-410A is very low, thus it acts very much like a single refrigerant.

Fractionation is very low.

R-410A does not significantly separate in the system and the composition of the refrigerant has very minor changes if a leak occurs.

But the fact that some fractionation occurs, means that charging techniques must be adjusted.
Another significant difference between R-410A and R-22 is its saturation pressure range.

R-410A has a higher pressure range curve than R-22.

Remember, R-410A is a near azeotrope that is subject to some fractionation. At any specific temperature it has a higher vapor pressure than R-22 when saturated.
# Expanded Cooling Data

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Outdoor Ambient Temperature

Entering Indoor Wet Bulb Temperature
Components that needed to be redesigned for R-410A

- Compressor
- Condenser Coil
- Filter Drier
- Expansion Device
- Evaporator
- Pressure Switches
Compressors

- Copeland Compressors
- R 410a  ZP or ZPS
- R 22    ZR or ZRS
Pressure Switches

Pressure Switches have to be at higher settings

Low Pressure  R-410A = 50psi

High Pressure R-410A = 610psi
What Should Be None If Using Old R 22 Line Set

- Cut and remove old equipment
- Remove any old oil traps
- Blow through the line set forward and backward
- Use some type of flush like RX 11
- Braze in new equipment with dry nitrogen
What Happens If Line Set Is Not Cleaned

• Clogs Filter/Driers
• Damages Reversing Valves
• Clogs Metering Devices Flowrators, TXV
• Mixes With POE Oil/ Low Miscibility
• Does Not Lubricate System
• Compressor Bearing Surface Not Lubricated
Mineral Oil Sludge clogging a R410a TXV
Using Existing Line Sets

• This TXV was removed from a R410A replacement installation that failed shortly after startup.
• The dealer did not clean the existing line set and did not bleed nitrogen thru the system during brazing.
• R410A is a very good solvent and will wash all contamination into the TXV, filter drier and on heat pump the reversing valve pilot tubes.
Clogged

Desiccant Full
Leak Detectors

-Leak detectors should be checked to see that they are designed to properly detect R410A.

-The detector should have adjustable sensitivity to allow leaks to be pinpointed in areas where background vapor might cause false readings.
Refrigerant Hoses

- The 600psi rating of standard hoses is NOT adequate for R410A.
- Hoses need to be rated for a 800psi working pressure, with a 4000psi bursting rating.
- A 5 to 1 safety margin is necessary to prevent dangerous hose ruptures.
Cylinders

• Most R-410A cylinders have an internal dip tube which allows the feeding of liquid when the cylinder is in an upright position. They must be inverted for vapor flow.

• Color is rose (pink).

• The cylinder has to have minimum cylinder pressure requirement of 400 psig rating (DOT 4B400 or DOT 4BW400)

NOTE: Avoid storing R-410A where temperatures will exceed 120° F.
Charging

- Charge through the suction side of the system.

- Use a commercial-type metering device in manifold hose to allow liquid to vaporize.

- Follow your typical sub-cooling or superheat procedures to arrive at the correct charge.
R-410A Gauges With Sight Glass

R-410A Gauges

- Dedicated charge hoses
- Dedicated manifold
- R-410A hoses rated up to 550 to 800 PSIG

Hose Pressure 800 PSIG Rated
Manifold Gauge Set
Insta Charge
The chemistry of R-410A makes it incompatible with mineral based lubricants.

Mineral oils typically used with R-22 has relatively low Miscibility with R-410A.

Miscibility is the ability of an oil to dissolve uniformly in refrigerant in either the liquid or vapor state.
Lubrication

- The POE oils are more hygroscopic than mineral oils.
- This means that they absorb moisture very rapidly.
- Exposure to the atmosphere must be limited.
- The oil will break down into acid and alcohol.
- Keep the system closed.
PolyolEster Oil (POE)

- Alcohol & Organic Acid = Organic Ester & \( \text{H}_2\text{O} \)
- This is called **ESTERIFICATION**. This reaction is reversible
- Ester & \( \text{H}_2\text{O} \) = Alcohol & Acid
- This process is called **HYDROLYSIS**

- POE oil wants the water molecule back (Hygroscopic)
- Moisture will rapidly cause POE oil to sludge (Fatty Acid)
- Chemical change at 300 PPM
- **Driers will not remove moisture from POE oil**
- Driers remove moisture from the refrigerant in vapor form – very low concentrations
Lubrication

- Any moisture absorbed by into POE oils cannot be removed with a vacuum pump- Only a new drier will work!
- Break a recovery vacuum with Nitrogen!
- Keep all systems closed until any component replacements are ready for installation.
Filter, Sight Glass and Isolating Valves

- Liquid Line Filter
- Isolating Valve
- Quick Connect Flare Fittings
- Liquid Line Sight Glass With Moisture Indicator
Retrieval Machine with Oil Less Compressor

![Image of retrieval machine with oil less compressor](image-url)