TOTAL SYSTEM PROTECTION

The complete approach to the care and management of A/C & refrigeration systems

Nu-Calgon
Wholesaler, Inc.

Total System Protection

- ***Testing oil*** with the **Phase III®** Refrigeration Oil Acid Test Kit
- ***Flushing*** with OEM endorsed **R_x11-flush®**
- ***Acid removal*** with the innovative acid neutralizer, **R_x-Acid Scavenger**
- ***Sealing Leaks and removing moisture*** with **A/C EasySeal** and **EasyDry**

What are 2 of the most Common Words in Our Industry?

COMPRESSOR BURNOUT

- Why is it a big problem?
  - The compressor is the heart of the system
  - No compressor = No cooling
  - Expensive to repair
  - Difficult to repair – It's not just a compressor replacement in most cases

What Is a Burnout?

- Acid causes the motor winding insulation to break down, leading to…
- The compressor motor electrically shorting out & failing

Identifying a Burnout

- Strong pungent odor inside system is a good indicator, but…
- Testing the oil with an acid test kit and examining the oil color are very important
  - Routine maintenance on operating systems should include regular oil acid tests, and oil and dryer changes if tests show acid
  - Black oil – a possible indicator of bad oil as good refrigeration oil should be clear

Acid Testing

Phase III® Refrigeration Oil Acid Test Kit

Acid Testing

- **Universal** – works with all refrigeration oils
- **Extremely Precise** – Test is based upon neutralization of alkaline potassium hydroxide
- **Easy to Read** – phase separation eliminates all doubt

Acid Testing

Universal

- Works with mineral & alkylbenzene lubricants
- POE oils, including Mobil, Copeland and Emkarate
- Also, PVE oils like Idemitsu
- One acid test kit for all applications

Acid Testing

Acid Safe

Extremely Precise

- Color change occurs at industry accepted acid content of
- 0.05 mg in MO and AB oils
- 0.16 mg in POE oils

Acid Testing

Acid Safe

Easy to read

- Phase separation makes reading of results extremely easy
- Dyes & dirty oil remain in top layer. Reading of results is very clear on bottom layer
- Test results are distinct, no guess work

Acid Testing

Other Features

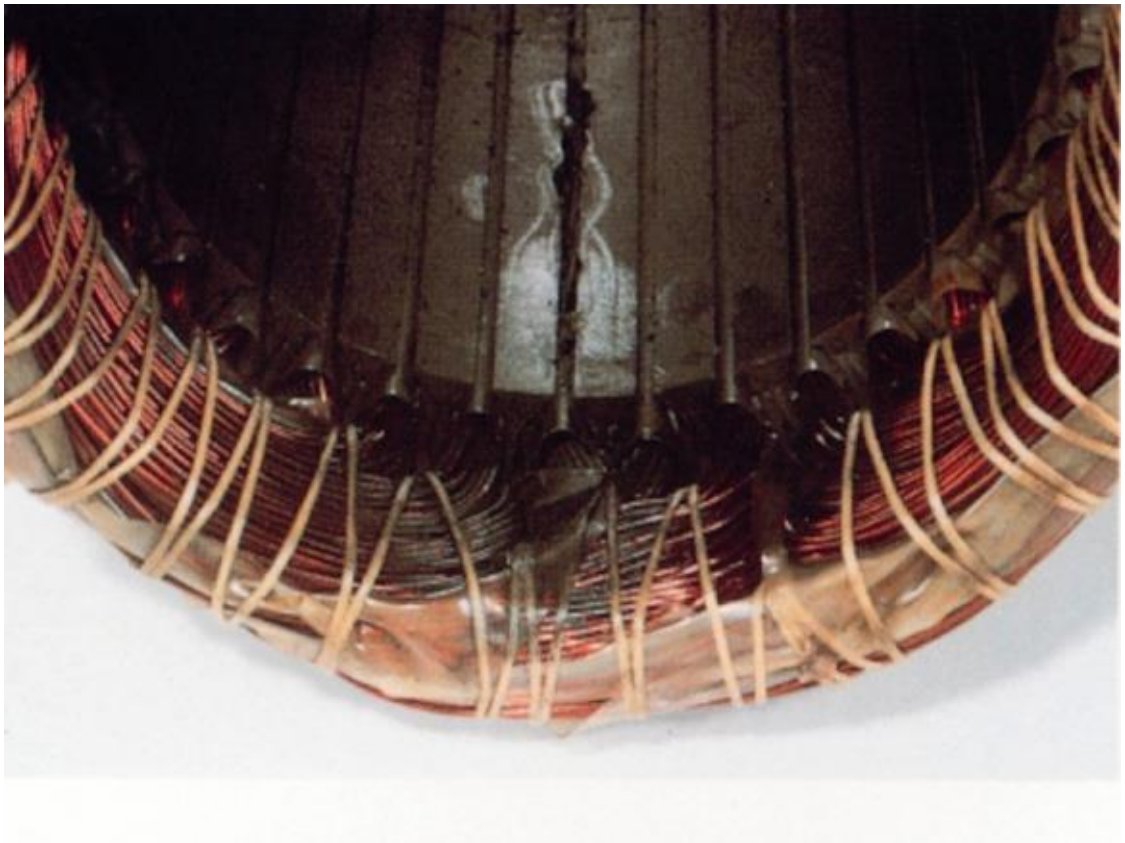
- Borosilicate glass and cap seals used for vials
- Two-year shelf life
- Convenient POP Display for the counter or shelf

Burnout Types

- Mild Burnout – Motor stops running before contaminants are pumped through the system.

- Severe burnout – occurs when burnout contaminants (acid, sludge, moisture and carbon) are pumped throughout the system before the motor stops running

Mild Burnout



Example of a Mild & Isolated Burnout

Severe Burnout

Windings from a severe burnout

Contamination

Moisture

Leads to additional problems…

- Acid
- Oil sludge
- Varnish
- Hard carbon
- Copper plating

Effects of HF and HCl Acids

Acid attack of terminal wires in compressor

Contaminants …. Oil Sludge

- Oil sludge
  - Reduces lubrication
  - Plugs passages and oil pump suction screens

Normal Screen

Plugged Screen

Next step is System Flushing with

R11-flush®

Contractors trust it
OEMs recommend it

R11-flush®

- **OEM Recommended** – 5 OEMs
- **Proven solvent** – Based on patented DuPont® Vertrel technology
- **Excellent degreaser** – quickly removes all contaminants
- **Easy to use** – Pressurized container allows flush to be injected and evacuated quickly and easily

System Flushing

Proven Solvent

- Part of the EPA's 'SNAP' program
- Based upon HFC technology making it ozone safe
- Non-toxic
- Non-flammable
- Leaves no residue
- Constant Boiling Mixture

System Flushing

Excellent Degreaser

- Cleans the system quickly and efficiently with no residue
- Removes all contamination including sludge, carbon deposits, moisture, acid & burnt oil residue
- Particularly effective vs. burnout residues and mineral oil in old line sets
- Gives the system the best chance for full recovery

System Flushing

Easy to use

- Pressurized canister means no special charging cylinder is needed
- Reusable injection valve and standard charging hoses are all that's required
- Outstanding for retrofits and components change-outs as well as burnouts

R11-flush®

It's very easy to use . . .

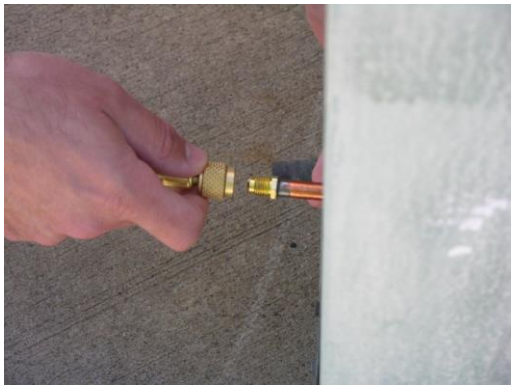
Attach valve to canister

Attach charging hose

R11-flush®

It's very easy to use . . .

Attach to Service Port

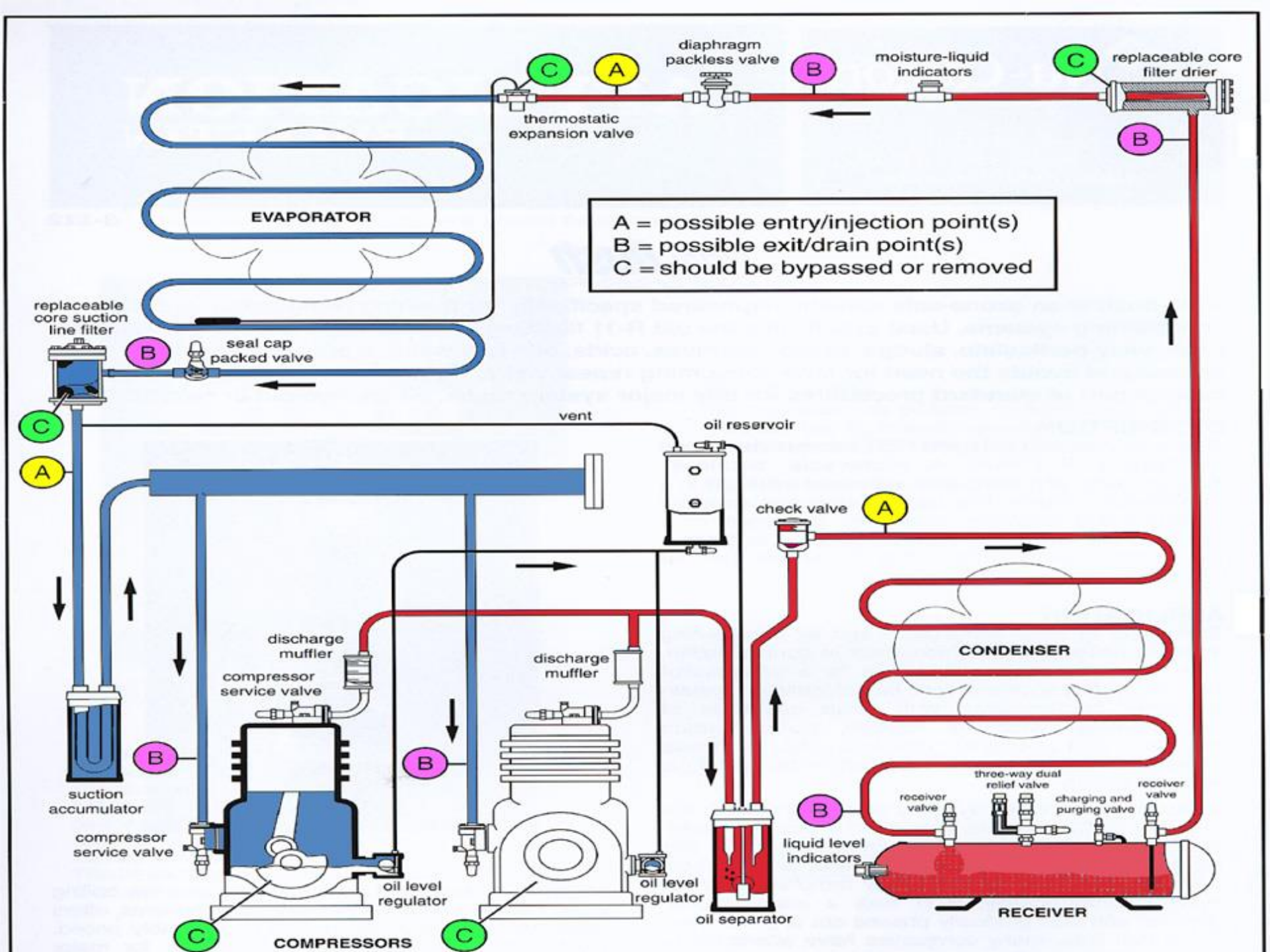


Or use Flushing Tool

System Flushing

Easy to use

- Inject into system as directed – just like the old R-11
- Use some restriction at the exit or drain point in order to increase mass flow
- Follow with 120 psi nitrogen purge
- And evacuate accordingly …product's low boiling point ensures complete removal
- Boiling point is 106°F at atmospheric pressure and -37°F under vacuum
- Two pounder will flush a 5-7 ton system, one pounder will flush a 3-4 ton system


diaphragm packless valve
moisture-liquid indicators
replaceable core filter drier
thermostatic expansion valve
EVAPORATOR
A = possible entry/injection point(s)
B = possible exit/drain point(s)
C = should be bypassed or removed
replaceable core suction line filter
seal cap packed valve
vent
oil reservoir
check valve
discharge muffler
compressor service valve
discharge muffler
CONDENSER
suction accumulator
compressor service valve
three-way dual relief valve
receiver valve
charging and purging valve
receiver valve
liquid level indicators
oil level regulator
oil level regulator
oil separator
COMPRESSORS
RECEIVER

Refrigerant Market

What's Going On?

- #1 Driving Issue is the market pressure on R-22
- Accelerated move away from R-22 and converting to R-410A

Systems Will Undergo Changes

- Existing systems . . . both residential and light commercial will be retrofitted or changed out and replaced with R-410A or other HFC's and the required POE lubricant

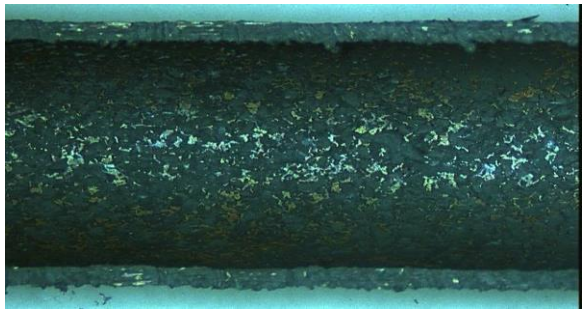
Why Flush Line Sets?

- When installing the new equipment, many line sets are buried in walls or underground and cannot be replaced . . . . to do so takes time and money.
- Also, the copper lines are most likely usable.
  - You must clean the mineral oil out of the old line sets before installing new POE oil and HFC gas
- The problem is mineral oil it is layered on the inside of the lines and it is not miscible with the new HFC refrigerant

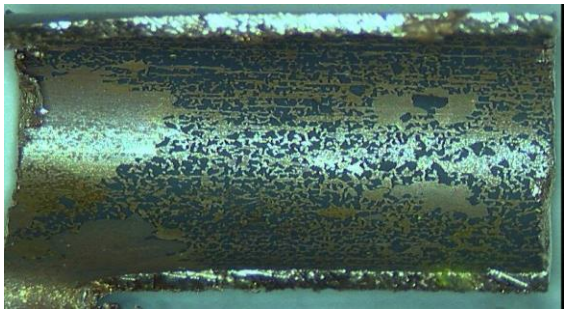
Line Sets

- Contaminants like copper oxide, sludge, varnish, acid, moisture, etc. are trapped in the residual oil.

  New R-410 systems use POE oil which scrubs the walls of the lines resulting in this debris being picked up and released to flow through the system and plug components like TXV's, RV's, filter-driers, etc…



Line set w/ MO Deposits



Line set after POE has been run through it

Pictures of line sets courtesy of Emerson

What about nitrogen?

- Unfortunately nitrogen isn't enough . . . . there is little to no mass flow and no degreasing

- What is needed is a flush that will provide the mass flow and cleaning . . . . and be easily removed

Why Flush Line Sets?

- There is a another very good reason . . . .
  - *Callbacks*
- Adequate flushing and proper removal of the waste and left-over flush is paramount to avoid callbacks

Flushing Line Sets

- Establish one end of the line set as the injection point, the other end of the line set will be the exit point.
- Provide for some restriction at the exit point as this will provide for longer contact time and better cleaning. Inject the Rx11-flush into the line set.

Flushing Line Sets

- Approximate amount of Rx11-flush required for flushing line sets . . .
  - Up to ½" tubing 20-30 Seconds per 50' of line
  - Up to 7/8" tubing 60-90 Seconds per 50' of line
- Using compressed nitrogen tank, connect the nitrogen tank to the system and inject it into the system behind the Rx11-flush. The nitrogen will increase the mass flow and maximize the cleaning power of the Rx11-flush.

R_x11-Flush Liquid

- Benefits of the original R_x11 in liquid non-pressurized version
  - Optimal boiling point
  - Leaves no residue
  - Non-flammable
  - Non-toxic
- Can be used with new flush tank supplied as a starter kit
- Starter kit includes tank, Rx11 liquid canister, hose, and flush gun. Part number 4300-38.

4300-30

4300-38

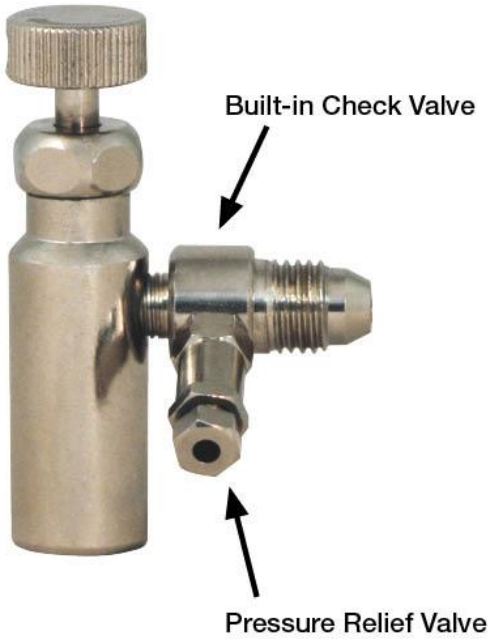
Rx11 Accessories

- Rx11-flush Gun
  - Great tool for flushing line sets
  - Rubber cone flushes lines up to 1 1/8”
  - Flushes lines as small as ¼”

- Rx11-flush Hose
  - 24” flushing hose
  - Open line designed for line set flushing
  - Allows contractor to have a dedicated flushing hose

Rx11 Accessories

- Injection Valve
- Features:
  - One-Way Flow
  - Pressure Relief Valve



4300-89

The Big Boys

13 lb. Cylinder (4300-15)

26 lb. Cylinder (4300-26)

R_x11-flush Product Line

2 lb.

1 lb.

Starter Kit

2+1 Display Pak

13 lb. Cylinder

Rx11 Liquid

Liquid Flush Kit

26 lb. Cylinder

Flush Gun

Flushing Valve

Flush Hose

Flushing Tool

Acid Scavenging

R_x-Acid Scavenger®

Rx–Acid Scavenger

Acid neutralizer for refrigeration oil

Advanced Technology

- Formulated as an advanced hydrolytic stabilizer for lubricants
- Neutralizes both inorganic and organic acids
- Eliminates acid build-up
- Prevents future acid contamination
- Prevents burnouts

Convenient Packaging

Liquid version in bottle

- Convenient 2 oz bottle can be added directly to oil in compressor
- Pointed spout allows for easy application
- 2 oz treats systems with 1/8 to 1 gallon of oil

Convenient Packaging

Pressurized Can

- Injects easily into a running system in less than 2 minutes
- Perfect for injecting into hermetically sealed systems
- All that is needed is the reusable Injection Valve (4300-89) and charging hose

Convenient Packaging

Pressurized Can

- Works with all refrigerant and oils (accept ammonia)
- Can be injected into the low side of a running R-22 system
- For systems with higher pressures like R-410A, pump the low side down to about 40-50 psi and inject

Rx-Acid Scavenger

Universal

- Works will all refrigeration oils
- Single product for
  - Mineral
  - Alkylbenzene
  - POE's
  - PVE
- Competitors have 2 products to service all refrigeration oils

Acid Scavenging

Low-Treat Feature

- Both packages contain 2 fl oz of Acid Scavenger which treats up to a gallon of system oil
- It is 50% less as compared to these other industry products
- This means less matter is added to the system

How does R_x-Acid Scavenger work?

- Neutralizes the acid by chemically converting it.
- The R_x-Acid Scavenger wants to accept the free H+ (hydrogen) in the acid
- The acid becomes tied up in the R_x-Acid Scavenger and forms a complex molecule that harmlessly goes into solution with the oil

How do other neutralizers work?

- "Neutralizes" the acid by adding a base

$$HCl + NaOH \rightarrow NaCl + H_2O$$

acid base salt water

- Water can be addressed with a drier but the salt is not soluble in the oil or refrigerant
- Too much base leaves the system basic, too little and the system is still acidic

Acid Neutralization . . . With Rx-Acid Scavenger

- Advanced Technology
- Convenient Packaging
- Universal – works with all industry refrigeration oils
- Low-Treat – use 2 fl. oz. charge per gallon of system oil

A/C EasySeal & A/C EasyDry

Problem Solving Technology

History of Leak Sealants

- Initial use of sealant technology dates to mid 90's
  - Military equipment
  - Aerospace industry
- Then evolved into use in automotive market
- Moved into stationary market in early 2000's
- A/C EasySeal enters market July 2009
- Overall sealant technology has an extensive history and industry use

A/C EasySeal

- A product for sealing refrigerant leaks in refrigeration and AC systems
  - Used to seal existing leaks in systems
  - Can also be used to prevent leaks in systems
- Utilizes a proven chemistry that works
- Because it is in a pressurized can, A/C EasySeal is easily injected into the suction side in less than 2 minutes
- This saves the contractor time and money over the more difficult to install vacuum packed sealants

Features & Benefits of Sealant

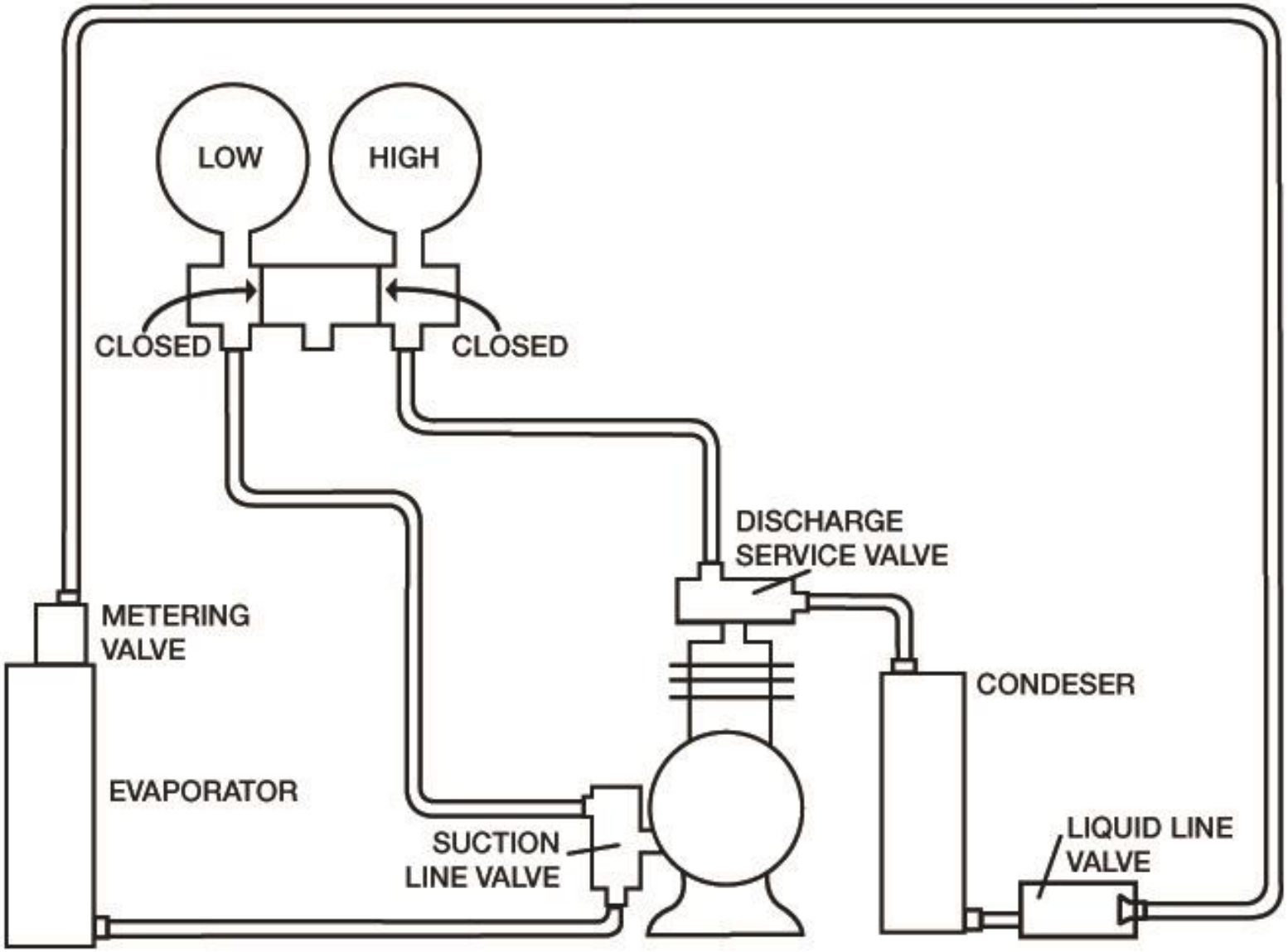
- Installation
  - Heavy duty reusable hose
  - Just attach to low side port while system is running, turn upside-down and inject
  - Takes 2 minutes or less
- Performance
  - A/C EasySeal travels with refrigerant to find leaks fast
  - Needs moisture or air (oxygen) to cure and setup
  - Curing time 20 minutes
- Compatible with all oils and refrigerants except ammonia

Method of travel

- A/C EasySeal travels with the refrigerant
  - 100% of the refrigerant circulates through the system while less than 5% of the oil migrates through the system
  - This means 100% of the EasySeal is circulating with the refrigerant while less than 5% of the vacuum packed sealants circulate with the oil
  - Requires less sealant in the system since it all circulates rather than setting in the compressor
  - When opening a system for maintenance the sealant will travel with gas during pump down or recovery rather than layering on the walls with the oil potentially setting up when contacting the outside atmosphere

What about installing in R410A?

- When installing EasySeal in a 410A system, the only additional step is to pump the system down so the low side pressure is about 40-50 psi
- This allows the pressure in the can to overcome the pressure in the low side of the system and be easily injected in less than 2 minutes


LOW
HIGH
CLOSED
CLOSED
DISCHARGE
SERVICE VALVE
METERING
VALVE
CONDESER
EVAPORATOR
SUCTION
LINE VALVE
LIQUID LINE
VALVE

A/C EasySeal Characteristics

- Once in the system it travels with the refrigerant, behaving much like a vapor or mist. This allows it to work quicker while traveling through the system

- Behaving similar to blood clotting to form a scab, EasySeal is activated by the oxygen in moisture or air, which exist at a leak. Once activated, it forms an epoxy-like seal at the site of the leak.

- A/C EasySeal can fix the leak as long as the system will not lose its entire charge in 7 days or less.

A/C EasySeal Packages

- Packaged in a 6x1 case (Part# 4050-06)
  - This can treats 1.5-5 ton systems but multiple cans can be used on larger systems.
- SS (small system) version in 6x1 case (Part# 4050-01)
  - This can treats up to 1.5 ton systems
  - Great for small refrigerated cases and PTAC units

Treats 1.5-5 ton systems

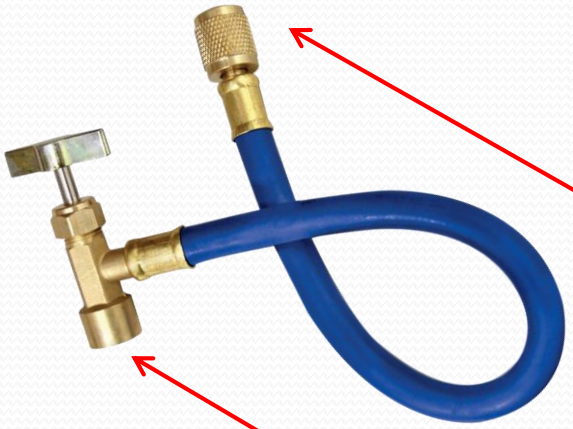
Treats up to 1.5 ton systems

A/C EasySeal Packages

- Packaged in “2+1” Display Pack (Part# 4050-02)
- Great for the first time user as they get the reusable hose and cans for 2 jobs.

A/C Piercing Valve & Hose

- Reusable A/C Piercing Valve & Hose (Part# 4051-99)
- Used for EasySeal and EasyDry
- It is included in the “2+1 Pack”



¼” Flare Fitting

R-134a Piercing Valve

Application Fills Critical Need

- Finding and repairing leaks
  - Can be time consuming
  - Many times difficult
  - Always expensive
- Availability and cost of refrigerant
  - Refrigerants like R-22 more regulated
  - **Cost is escalating** and topping off systems is becoming too expensive
- Ability to preventative these leaks is important

Opportunities

- Apartment complex
  - Talk to contractors that work on apartment complexes
  - There are many old A/C units that building managers want to extend the life of
- Hotels
  - Many PTAC units are replaced when they leak.
  - Difficult to repair those units so many see an early grave
- Schools
  - Also have many units that could have leaks and costly replacements may not fit in the budget

A/C EasySeal-XL

- For commercial AC and refrigeration equipment with refrigerant charge of 125 – 250 lbs.
- Same great EasySeal formula in a bigger more concentrated package
- Includes charging hose
- Multiple cans can be used on larger systems

A/C EasySeal-XL

- EPA requires owners and operators to monitor leaks on equipment holding over 50 lbs of refrigerant
- Once they reach the trigger leak rate for the equipment they much fix or retrofit the equipment.

Appliance Type	Trigger Leak Rate
Commercial refrigeration	35%
Industrial process refrigeration	35%
Comfort cooling	15%
All other appliances	15%

A/C EasyDry

- New technology for our industry
- Dehydrating agent that eliminates moisture
- Can be used in conjunction with or independent of A/C EasySeal

Features & Benefits of Dry product

- Installation
  - Just like A/C EasySeal
  - Utilizes reusable hose
  - Just attach to low side port while system is running, turn upside-down and inject
  - Takes 2 minutes or less
- Compatible with all oils and refrigerants except ammonia

Features & Benefits of Dry product

- Performance
  - Converts system moisture into a natural organic material that is compatible with and mixes with the lubricant
  - One can will convert 6 grams or 1,739 ppm of moisture in one gallon of oil
  - Because it eliminates moisture, it actually helps the drier work better and helps prevent acid formation
- Will prevent moisture levels from growing or eliminate moisture if it already exist in the system