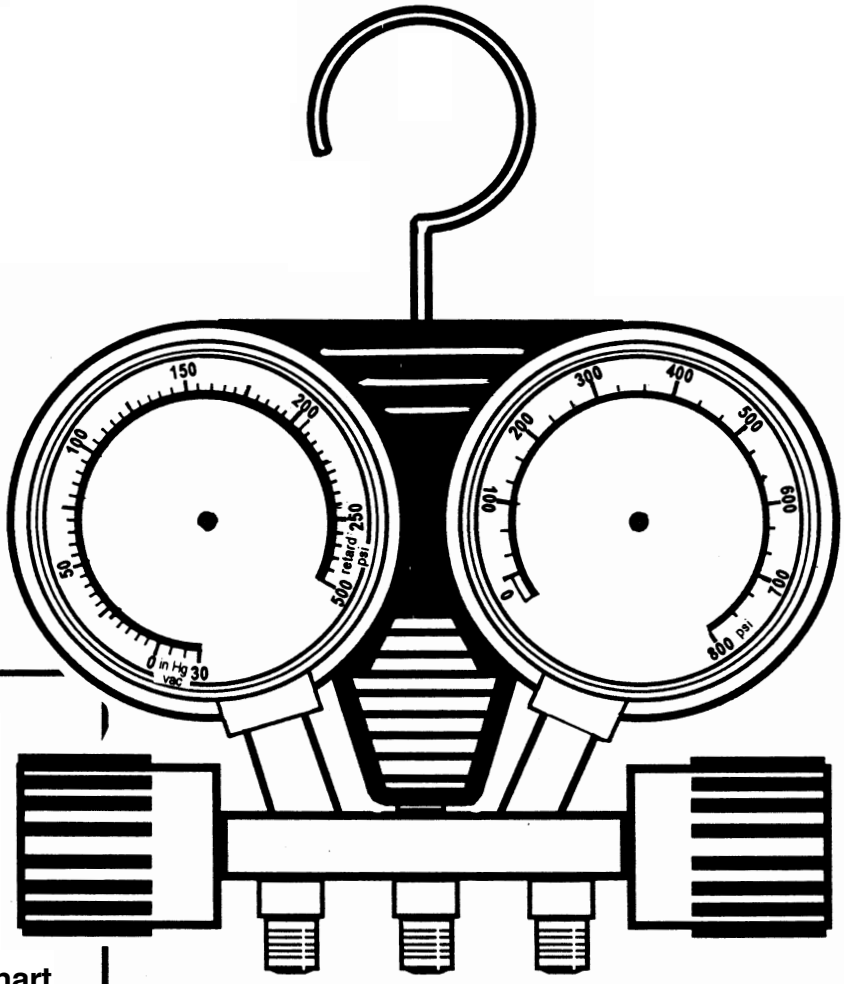
REFRIGERANT 410A

An Alternative to R-22



Background
Refrigerant Characteristics
Refrigerant Safety
System Charging Using R-410A
Refrigerant 410A Data
R-410A Temperature & Pressure Chart
Required Liquid Line Temperature
Application Notes

A Manual For Instructors

PUB. # 34-4066-04

REFRIGERANT 410A

Background

The traditional refrigerants, which have been used in central air conditioning systems for the past fifty years, have been declared to be a threat to the environment. This is due to the presence of Chlorine in their chemical make-up. As a consequence, the air conditioning industry has been required to search for a suitable replacement for the most popular of the current refrigerants, Refrigerant 22.

Since there are concerns of efficiency and service use, as well as the environmental issues, the job has not been easy. To locate a replacement and qualify it for use in the products we manufacture has taken years of work. The refrigerant chosen at this time is Refrigerant 410A. Continuing study will be conducted into other alternates.

Refrigerant Characteristics

The refrigerants developed in the nineteen twenties, using chlorine, such as Refrigerant 22, were uniform in their chemical make-up. Such refrigerants are called compounds. Each molecule of the refrigerant is like every other molecule. There is no way in the field to separate the elements of a compound once it has been made. Only the most sophisticated laboratory equipment can break the building blocks of the refrigerant apart. They contained Hydrogen, Chlorine, Fluorine, and Carbon. These refrigerants were called HCFC's.

The alternative refrigerants are different in the materials used to make them. They are also different in the manner in which they are made. Refrigerants like Refrigerant 410A are mixtures of chemicals. This means its components are not as tightly bonded together and may separate when released from pressure. It is said to be near AZEOTROPIC in its construction. This word means that it is a mixture, not a compound. It is manufactured by combining Refrigerant 32 and Refrigerant 125. Both of these refrigerants are made of Hydrogen, Fluorine, and Carbon and are referred to as HFC's.

The most important reason for using an alternate refrigerant is that it does not contain any Chlorine.

Under Federal law, no release of refrigerant is allowed beyond the minimum required to do service to the products. This "DE MINIMUS" or "least possible" loss must be closely observed during service to avoid being subject to possible fines and worse. Even the alternative refrigerants cannot be released to atmosphere. The EPA (Environmental Protection Agency) requires they must be collected and handled as the existing refrigerants are handled. The issue here is not Ozone Depletion but the contribution to Global Warming and the waste of a valuable resource.

The alternative refrigerant R-410A is not a "drop-in" replacement for R-22. Since they use different oils, different drier construction materials and different expansion devices, they require the greatest caution in replacement situations. At this time, R-410A is intended for use in new equipment.

The service tools that are used for the alternative refrigerant are not the same as the tools used for the current refrigerants and this will be explained in this manual. Please read and heed the warnings included in the material in this manual and the manufacturers' literature included with the products containing this alternative refrigerant.

REFRIGERANT SAFETY

The alternative refrigerant, R-410A, like R-22 is a safe product. The same precautions must be observed when using either one. However, the technician must be aware of several differences in the handling of R-410A.

When the cylinders containing Refrigerant 410A are sitting upright, the valve will release liquid refrigerant. As you can see in Figure 1, there is a dip tube in the tank reaching to near the bottom of the cylinder. To charge with vapor, turn the cylinder upside down as shown in Figure 2. For cylinders made after 2/99, turn the cylinder upside down as shown in Figure 1A for liquid and upright for vapor as shown in Figure 2A.

Refrigerant cylinders containing Refrigerant 410A are ROSE colored for identification.

Refrigerant cylinders should never be stored at 125°F or higher temperatures.

Never charge any refrigerant cylinder to greater than 80% of its capacity. This was true for Refrigerant 22 and is also true for Refrigerant 410A.

Refrigerant 410A boils at -62.9°F. when released to atmosphere. This is twenty degrees colder than Refrigerant 22. The danger of frostbite is much greater on exposed skin. Wear gloves and protect your eyes with safety glasses at all times.

This refrigerant, like Refrigerant 22, is low in toxicity but it can still be harmful to humans as it displaces oxygen. Since it is heavier than air, it will form puddles in low places. Use adequate ventilation near equipment that is leaking.

Refrigerant 410A is classified as non-flammable. Like Refrigerant 22, when mixed with air under pressure it can ignite. Make sure the system is without pressure before using a torch for a repair.

SAFETY AND HANDLING

DOT Refrigerant Cylinder Information

Storage and handling limitations are set by the chemical manufacturers to meet Department of Transportation regulations.

R-22 and R-410A refrigerant cylinders will have different pressure rating requirements. These ratings establish the safe pressure ranges that cylinders may be exposed to.

The BA400 cylinder is rated for R-410A. This cylinder has a service pressure rating of 400 PSIG. A BA300 cylinder is rated for R-22. This cylinder has a service pressure rating of 300 PSIG. A DOT 39 cylinder is also rated for R-22 and has a service pressure rating of 260 PSIG.

The Test Pressure of cylinders is defined as 2 times the rated service pressure. Example, a BA400 is rated at 2 times 400 or 800 PSIG. A BA300 is 2 times 300 or 600 Test Pressure. A DOT 39 is 260 times 2 or 520 PSIG Test Pressure.

The Department of Transportation requires these cylinders to have a safety device which will relieve containers contents between 75% and 100% of the test pressure. Minimum relief pressure settings for BA400 cylinders is 600 PSIG up to a maximum of 800 PSIG. Minimum relief pressure settings for a BA300 cylinder is 450 PSIG up to a maximum of 600 PSIG. Minimum relief pressure settings for a DOT 39 is 420 PSIG up to a maximum of 560 PSIG.

The Department of Transportation specifies that no product with a saturated pressure at 130°F be placed into a cylinder where the refrigerant pressure is greater than 5/4 of the service pressure. For example, a BA400 cylinder has a service pressure rating of 400 PSIG divided by 4 times 5 has a pressure rating of 500 PSIG. R-410A at 130 degrees has a pressure of 473 PSIG. This pressure is below the 500 PSIG DOT requirement.

The BA300 cylinder has service pressure rating of 300 PSIG. 300 PSIG divided by 4 times five gives us a pressure rating of 375. R-22 has a pressure of 296 PSIG at 130°F making it safe for a BA300 cylinder to contain R-22.

The DOT 39 cylinder has a service pressure rating of 260 PSIG. 260 divided by 4 times five equals 325 PSIG. This pressure is still above the R-22 pressure of 296 PSIG at 130 degrees. Therefore, R-22 can be stored in a DOT 39 cylinder.

OK, so what does all of this mean? Follow the manufacturers recommended storage and handling information for refrigerants. These requirements include:

- Never expose refrigerants to temperatures in excess of 125°F.
- Keep refrigerant cylinders out of direct sunlight.
- Do not ever overfill your recovery cylinders or try to refill disposable refrigerant cylinders.
- Always properly secure refrigerant bottles when transporting.
- And most importantly, stay informed by always referring to the latest Material Safety and Handling information as provided by the chemical manufacturers.

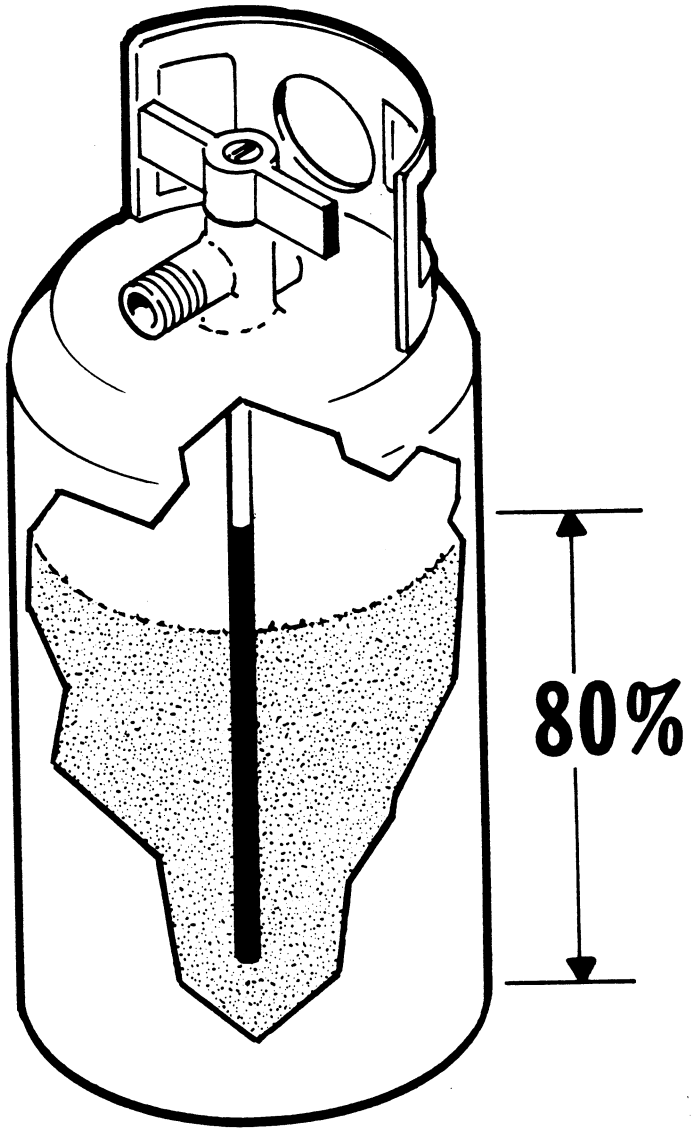


FIGURE 1

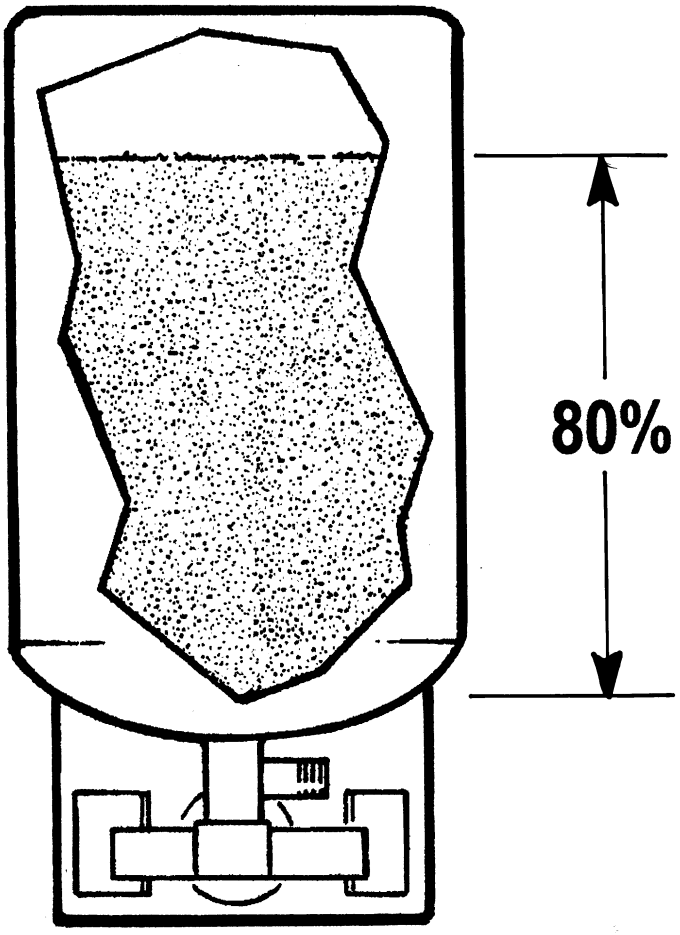


FIGURE 1A

Invert cylinder if it has NO Dip Tube for charging.
NO Dip Tube on cylinders manufactured after Feb. 1999.

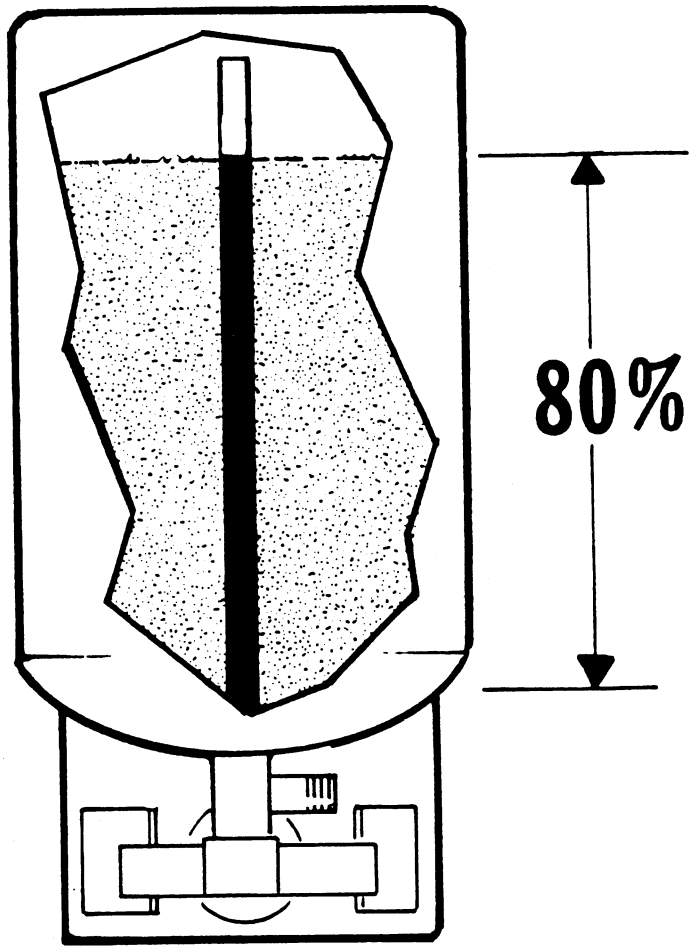


FIGURE 2

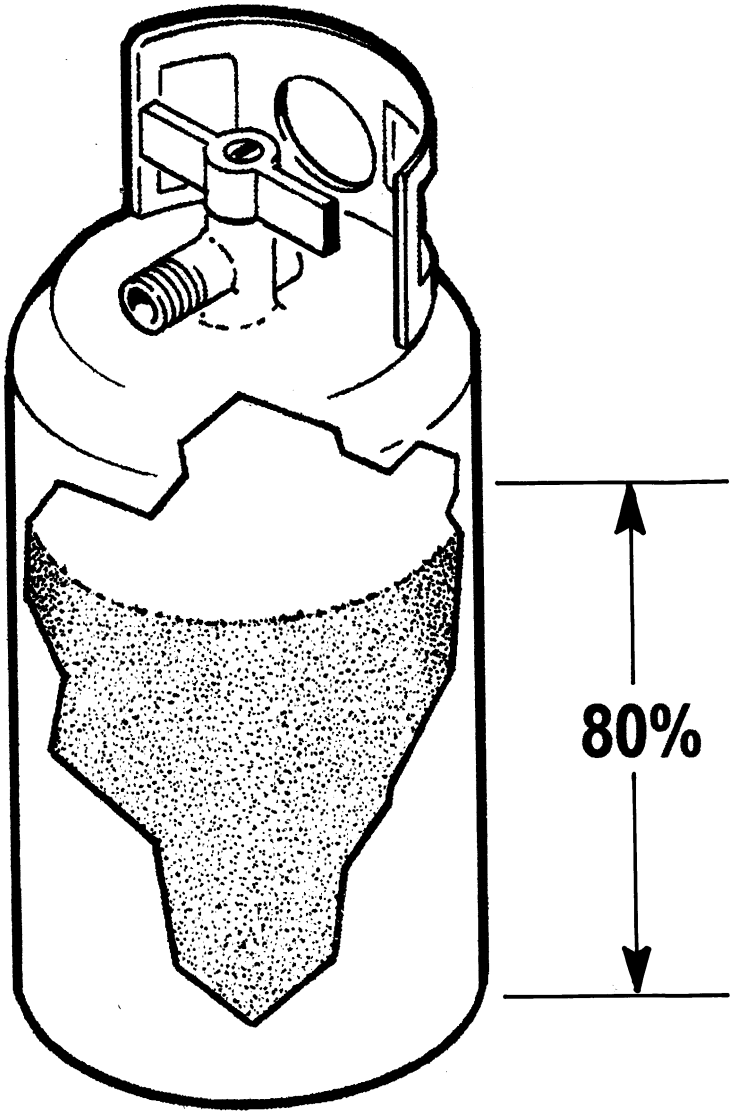


FIGURE 2A

No Dip Tube After 2-1999

Recovery cylinders used with Refrigerant 410A are not the same cylinders used for Refrigerant 22. Refrigerant 410A recovery cylinders are constructed and tested to higher pressures, 400 PSIG (Pounds to the Square Inch Gauge).

Since the vapor pressure of Refrigerant 410A is from 50% to 70% higher than Refrigerant 22 at the same temperature, service hoses, manifolds and gauges are all constructed to withstand higher pressures. See Figure 3 for the gauge faces.

The oils used with the alternative refrigerant are also different. The oil used with the HCFC refrigerants such as 22 was mineral oil based. The oil used with Refrigerant 410A is a synthetic oil called POLYOLESTER, abbreviated POE. This oil requires special handling. Since it is hygroscopic in nature, (it picks up moisture from the air), it must be kept sealed until used. Liquid line driers must be changed whenever the system is opened for service. A good vacuum cannot adequately remove the moisture from the synthetic oil as it did from a mineral oil based lubricant.

The only system additive that may be used is AcidAway. This additive has **ONLY** been approved for **Refrigerant 22**, when used in accordance with the manufacturers' instructions. All other additives are discouraged and are not recommended.

The last caution will seem unusual to the technician. Synthetic oil will attack many materials used in roofing. When service is required on equipment mounted on a roof, the surrounding roof must be protected from oil spray or spills. A plastic covering or tarp must be spread around the work area. This caution must be taken seriously! Wiping up spilled oil will not stop it from causing long term damage to roofing materials.

SYSTEM CHARGING USING R-410A

Charging systems with refrigerants which are classified as AZEOTROPIC, such as R-410A, require special technique. The blended refrigerants may tend to separate when charging is done with only the vapor. This may lead to FRACTIONATION, when the refrigerants in the blend do not boil off at the exact same temperature. Fortunately, R-410A has a well-matched pair of refrigerants. The difference in boiling points is less than a degree. This means that for our purposes the refrigerant does not require you to calculate the temperature difference known as GLIDE. - For all our work, the refrigerant will have a single boiling point for each pressure.

The use of liquid in charging is not new. We have charged the high side of the system with liquid for many years. Charging the low side with liquid will require the use of a special charging metering device. A Chargefaster (CH200) by Watsco or

its equivalent must be used. This device allows the refrigerant to be taken from the cylinder as liquid but puts it into the system as a vapor. Remember, the refrigerant cylinder will dispense liquid when it is upright because of the cylinder dip tube on cylinders manufactured before Feb. 1999. The cylinder must be inverted, if manufactured after Feb. 1999, to obtain liquid for charging. To dispense vapor directly, you must turn the cylinder on its top.

The subcooling method will be used when an expansion valve (TXV) is installed in the system.

In this method of charge adjustment, an accurate reading of the temperature of one of the refrigerant lines is required. The standard service thermometer is not accurate or fast enough to properly react. An electronic temperature tester, such as an Annie A-8 or equivalent, should be used. The sensing element must be tightly connected to the tubing and insulated from the ambient air. The charts for charge adjustment will be found in the equipment and the service literature for the product.

While charging the system, allow sufficient time for the system to react to the adjustment before adding or removing charge.

REFRIGERANT 410A DATA

The charts to be used with Refrigerant 410A, (Figure 4), will show the dramatic difference in pressure from the Refrigerant 22 pressures.

- The typical pressure for 41°F with R-22 is 70 PSIG (Pounds per Square Inch Gauge). With R-410A, it is 120 PSIG. This would be representative of the temperature in the evaporator of a properly functioning air conditioner.

- The pressure for 130°F of R-22 is 300 PSIG. For R-410A, it is 475.6 PSIG. This temperature would be representative of the conditions in the condenser of an air conditioner on a hot day.

If you bring your refrigerant cylinder into the house overnight to check your gauges, with a temperature of 74°F, you will read 130 PSIG for R-22 but 216 PSIG for R-410A.

At the same temperatures, the pressures for R-410A are 50% to 70% higher than the R-22 pressures.

The Subcooling chart shown in Figure 5 will help you to make the decisions when charging units equipped with thermostatic expansion valves (TXV). Since the valve controls the superheat, subcooling must be used to determine the correct charge level.

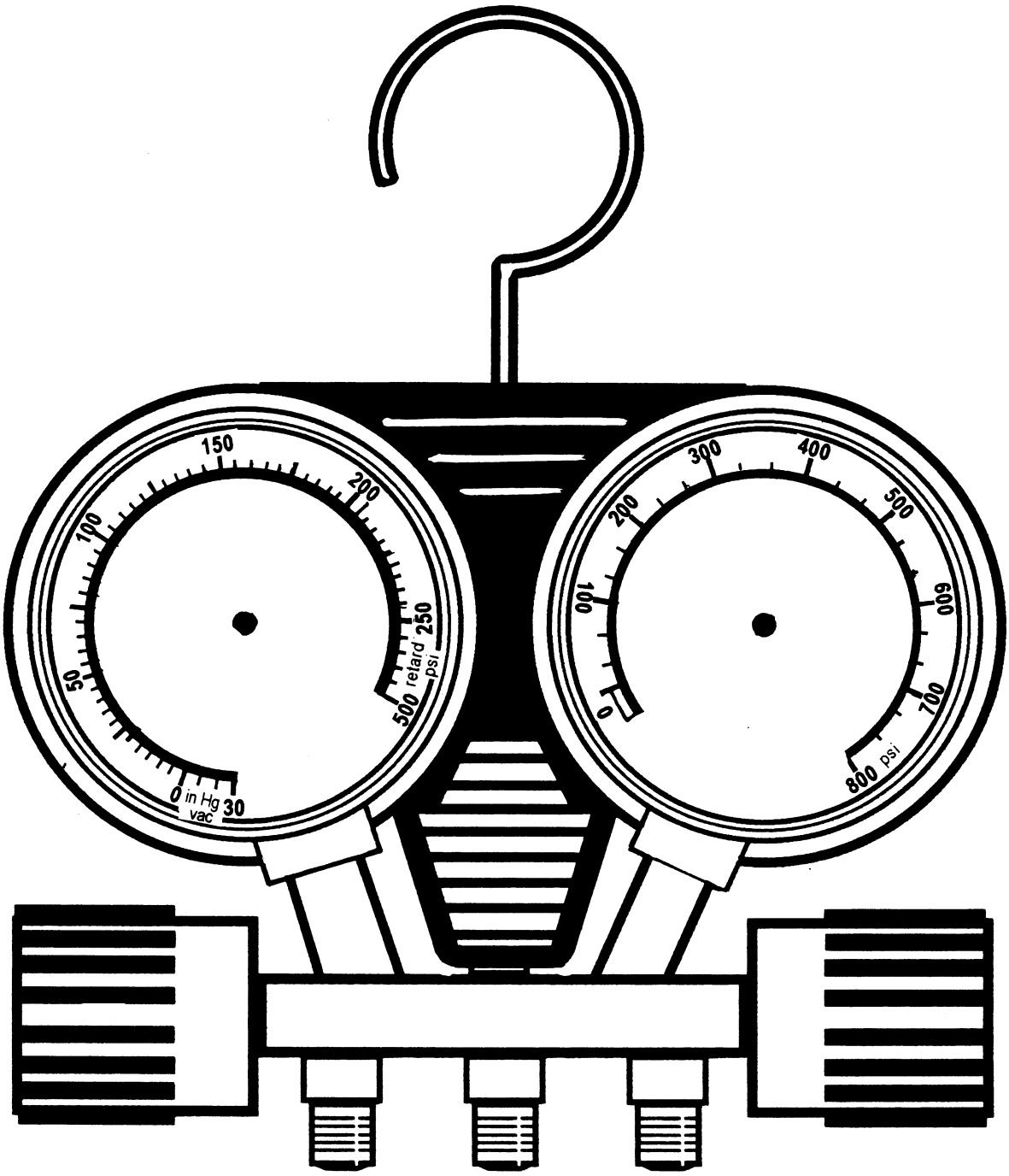

150
200
100
50
0 in Hg vac 30
retard psi
250
500
300
400
500
200
100
600
0
700
800 psi

FIGURE 3

R-410A Temperature & Pressure Chart

TEMP	R410	TEMP	R410	TEMP	R410
-60	1.2	16	71.7	44	127.3
-55	3.4	17	73.3	45	129.7
-50	5.8	18	75.0	46	132.2
-45	8.6	19	76.6	47	134.6
-40	11.6	20	78.3	48	137.1
-35	14.9	21	80.1	49	139.6
-30	18.5	22	81.8	50	142.2
-25	22.5	23	83.6	55	155.5
-20	26.9	24	85.4	60	169.6
-15	31.7	25	87.3	65	184.6
-10	36.8	26	89.1	70	200.6
-5	42.5	27	91.0	75	217.4
0	48.6	28	92.9	80	235.3
1	49.9	29	94.9	85	254.1
2	51.2	30	96.8	90	274.1
3	52.5	31	98.8	95	295.1
4	53.8	32	100.8	100	317.2
5	55.2	33	102.9	105	340.5
6	56.6	34	105.0	110	365.0
7	58.0	35	107.1	115	390.7
8	59.4	36	109.2	120	417.7
9	60.9	37	111.4	125	445.9
10	62.3	38	113.6	130	475.6
11	63.8	39	115.8	135	506.5
12	65.4	40	118.0	140	539.0
13	66.9	41	120.3	145	572.8
14	68.5	42	122.6	150	608.1
15	70.0	43	125.0	155	645.0

Pub No. 34-3400-01

FIGURE 4

REQUIRED LIQUID LINE TEMPERATURE						
LIQUID PRESSURE AT SERVICE VALVE (PSIG)	REQUIRED SUBCOOLING TEMPERATURE (°F)					
	8	10	12	14	16	18
189	58	56	54	52	50	48
195	60	58	56	54	52	50
202	62	60	58	56	54	52
208	64	62	60	58	56	54
215	66	64	62	60	58	56
222	68	66	64	62	60	58
229	70	68	66	64	62	60
236	72	70	68	66	64	62
243	74	72	70	68	66	64
251	76	74	72	70	68	66
259	78	76	74	72	70	68
266	80	78	76	74	72	70
274	82	80	78	76	74	72
283	84	82	80	78	76	74
291	86	84	82	80	78	76
299	88	86	84	82	80	78
308	90	88	86	84	82	80
317	92	90	88	86	84	82
326	94	92	90	88	86	84
335	96	94	92	90	88	86
345	98	96	94	92	90	88
354	100	98	96	94	92	90
364	102	100	98	96	94	92
374	104	102	100	98	96	94
384	106	104	102	100	98	96
395	108	106	104	102	100	98
406	110	108	106	104	102	100
416	112	110	108	106	104	102
427	114	112	110	108	106	104
439	116	114	112	110	108	106
450	118	116	114	112	110	108
462	120	118	116	114	112	110
474	122	120	118	116	114	112
486	124	122	120	118	116	114
499	126	124	122	120	118	116
511	128	126	124	122	120	118

Subcooling Charging Table

FIGURE 5

R-410A Refrigerant

It is recommended that charging be done in the liquid phase. When adding liquid refrigerant into the low side of the system, a charge-metering device is recommended (WATSCO CH200, or equivalent). Allow ample time when adding refrigerant for the system to balance out, to avoid having to recover refrigerant.

Existing Halide leak detectors do not work with R-410A. Existing acid test kits do not work with R-410A. (New kits are being developed.) Existing driers do not work with R-410A. Note that although R-410A does not deplete the ozone layer, all refrigerants must be recovered.

R-410A systems use POE oil, which is not compatible with the oils used in R-22 systems. If existing refrigerant lines are to be used with a R-410A system (assuming that the line sizes are acceptable), they must be thoroughly blown out with dry nitrogen to remove the old oil. Blow vertical sections from top to bottom.

POE oils absorb moisture very quickly. Keep container tightly closed, whenever possible, and expose the system to the atmosphere as little as possible. POE oils can also damage a roof, if spilled.

Vacuum pumps cannot remove all of the moisture from POE oils. **Change the liquid line drier anytime the system is opened to the atmosphere.**

Suction line driers are to be left in the system for no more than 72 hours. Use only liquid and suction line driers approved for R-410A.

Since all current R-410A systems are expansion valve systems, the refrigerant charge is to be checked by the subcooling method.

Maximum liquid line pressure drop with R-410A systems is 50 PSI (10° subcooling). Recommended suction line pressure drop (2°F) is 4.8 PSI (Round up to 5.0).

At this time, only matched systems are permitted with R-410A. Both indoor and outdoor units must be changed in a unit replacement.

R-410A boils at -62.9° at atmospheric pressure, so beware of frostbite!

Line set lengths and lift restrictions will be similar to those found in R-22 systems, as long as the rise is limited to 60 feet and the length is 200 feet or less. Tables on the following pages show the line sizes.

Retrofitting R-22 to R-410A Indoor Coil

Retrofitting Existing R-22 Systems to R-410A

We have always recommended installing complete HVAC systems regardless of refrigerant type. The benefits of installing new approved indoor and outdoor split system combinations are: maximum efficiency, optimum performance, and the best overall system reliability.

If you sell a retrofit job and the indoor section (air handler and coil) cannot be changed, some of the previously installed indoor section components may be modified to be compatible with R-410A. Refer to Tables 1 and 2 for approved air handlers and coils. Refer to Table 3 for TXV kits.

When replacing any HVAC system, the existing refrigerant lines must be evaluated to determine if they are properly sized for the new system.

Line set lengths and lift restrictions will be similar to those found in R-22 systems. This table is shown for training only, and must be used only for that purpose. For line sizing, use Pub # 32-3009 latest edition. Part of this publication is in the Application Guide section of this publication.

	5 Ton	4 Ton	3.5 Ton	3 Ton	2.5 Ton	2 Ton	1.5 Ton	1 Ton
R-22	1 1/8, 7/8	1 1/8, 7/8	7/8	7/8	3/4	3/4	5/8	5/8
R-410A	7/8	7/8	3/4	3/4	3/4	5/8	1/2	1/2
Liquid Line	3/8	3/8	3/8	3/8	5/16	5/16	1/4	1/4

NOTES:

This chart illustrates the difference in required size of lines between R-22 and R-410A. You will note the liquid line is unchanged, but the suction line size may change.

Evacuation

Proper evacuation to 500 microns will remove moisture from an R-22/mineral oils system. However, evacuation to 500 microns will not sufficiently remove moisture from a system using POE oils such as used with R-410A. To facilitate moisture removal with an R-410A systems utilizing POE oil, the liquid filter drier must be replaced any time the refrigeration system is opened for service.

Liquid Line Drier

All R-410A units require a liquid line filter drier. The driers used with R-22 and R-410A systems are different from one another. Specifically, R-410A systems use liquid line driers rated for minimum working pressures of 60OPSIG. Desiccant material must be compatible with POE oils and R-410A. Use of the wrong filter drier in R-410A systems may result in higher than acceptable moisture levels.

Leak Detection

Warning! Never leak test a system with air and R-410A under pressure! At pressures above 1 atmosphere, just like R-22, mixtures of R-410A and air can be combustible. R-410A and air should never be mixed in tanks or supply lines, or be allowed to accumulate in storage tanks. Leak checking can be performed safely with nitrogen or a mixture of R-410A and nitrogen. Use a leak detector capable of detecting an HFC gas. Halide leak detectors will not work with R-410A systems.

Commercially Available Solders and Brazing Materials

Designation	Composition	Temperature	
		Melting	Flow
TIN-LEAD SOLDERS			
Fifty-Fifty	50% lead, 50% tin	360° F	415° F
Sixty-Forty	60% lead, 40% tin	360° F	459° F
Eutectic	37% lead, 63% tin	360° F	360° F
Stay-Brite	—		400° F
Stay-Brite No.8	—	430° F	535° F
TIN-ANTIMONY SOLDERS			
Ninety-five-Five	—	450° F	465° F
Materials above having melting points below 700° F should not be used for refrigerant connections.			
Easy-Flo (45)	45% silver	1120° F	1145° F
Mueller (122)	—		
Safety Silv No. 1200	75% silver		1145° F
Stay-Silv No. 45	45% silver		1160° F
Easy-Flow (Original)	50% silver	1160° F	1175° F
Sil-Fos	15% silver, 80% copper, 5% phosphorous	1185° F	1300° F
Phos-Copper	93% copper, 7% phosphorous	1317° F	1470° F
Sil-Fos and Easy-Flo are tradenames of Handy and Harman. Phos-Copper is a tradename of Westinghouse Electric Company.			

NOTES:

Copper to Copper:
Sil-Fos is probably the best material to use copper to copper as it requires no flux. It should not be used for any joints that involve iron or steel as the phosphorous reacts with the iron to form iron phosphate which is extremely brittle.

Copper to Steel:
Copper to steel requires the use of Easy-Flo 35 or 45 and a flux. The joint after brazing should be wire brushed and tapped to break away any slag or scale that may form that has only temporary bonding strength.

Retrofitting R-22 to R-410A Indoor Coil

1. Run an acid test using the appropriate test kit for R-22/Mineral oil systems.

2. If the acid test shows good, then proceed with installing the new outdoor unit and retrofitting the indoor coil. (Go to cleaning mineral oil section below)

3. If the acid test indicates acid, then treat this system as a burnout. (The indoor coil in this case must be replaced in order to reduce opportunities for contaminants. If possible replace line set and there will be no need for a suction line dryer).

4. A suction line drier must be temporarily placed in the system if the old refrigerant line set is used.

5. Leave it in the system for no more than 72 hours.

6. If the system is a heat pump, lock the system into the cooling mode. If this cannot be done, the suction line drier must be placed between the switchover valve and the compressor.

7. After 72 hours perform another acid test using an R-410A/ POE test kit. If the acid test is OK, remove the drier, and replace the liquid line drier.

8. If acid is still present, repeat the process until the acid test checks out OK.

When no acid is present, perform the following steps:

CAUTION: For this step the service person must wear safety goggles and rubber gloves to eliminate the risk of getting oil and debris in eyes and on skin.

After the line set, the indoor unit/indoor coil, and the refrigerant flow device are verified to be properly sized and matched, the existing line set and coil must be cleared of as much mineral oil as possible.

The procedure for clearing unwanted mineral oil:

1. With the outdoor unit uncoupled, blow the existing line set and coil out with dry nitrogen.

2. The indoor coil may require removal in order to purge all existing oil from the coil.

3. All oil must be captured! Special care must be provided in order to protect the building owner's property from oil spray.

4. Recovered oil must be sent to a certified recycling center.

Retrofitting R-22 to R-410A Indoor Coil

Air handlers*

Air handlers that can be converted for use with R-410A are similar in construction to today's production units that use R-22 refrigerant. To retrofit one of these air handlers to R-410A, the only change that will be necessary is a change in metering devices. (FCCV OR TXV) Table 1 lists the air handlers that are approved for retrofit from R-22 to R-410A. This table also tells you what must be done to retrofit the air handler's coil.

TABLE 1

APPROVED AIR HANDLERS FOR USE WITH R-410A	
TWE-C14	FCCV Shipped with outdoor unit or 4AYTXV kit
TWE-C15	Requires TXV Replacement
TWE-P13	Requires TXV Replacement
TWE-E13	Requires TXV Replacement
TVF	FCCV Shipped with outdoor unit or 4AYTXV kit
TWG-A14	FCCV Shipped with outdoor unit or 4AYTXV kit
TWG-A15	Requires TXV Replacement
TWV-B	FCCV Shipped with outdoor unit or 4AYTXV kit
TWH-B	FCCV Shipped with outdoor unit or 4AYTXV kit

Capillary Tube Models have a "2" in the 9th digit. Air handlers and coils using capillary tubes may not be used with R-410A condensing units/heat pumps.

Any unit model number not listed is not approved for use with R-410A

TXV PART NUMBER MATRIX			
Model Number	**R410A TXV Part Number**	**Model Number**	**R410A TXV Part Number**
TWE018P13	VAL07350	TWE048P13	VAL07351
TWE024P13		TWE040E13	
TWE030P13		TWE049E13	
TWE031E13			
TWE036P13	VAL06726	TWE060P13	VAL06727
TWE042P13		TWE063P13	
TWE037E13		TWE065E13	

A retrofitted system will function, however, may not be rated in accordance with ARI Standard 210/270

Coils*

Table 2 lists the evaporator coils that have been approved for retrofit from R-22 to R-410A. The table also tells you what metering device changes are required.

TABLE 2

APPROVED AIR HANDLERS FOR USE WITH R-410A	
Coil	**Required Retrofit**
TXA-C4	FCCV Shipped with outdoor unit or 4AYTXV kit
TXA-C5	Requires TXV Replacement
TXC-C4	FCCV Shipped with outdoor unit or 4AYTXV kit
TXC-C5	Requires TXV Replacement
TXC-D4	FCCV Shipped with outdoor unit or 4AYTXV kit
TXC-E5	Requires TXV Replacement
TXC-S3	Requires TXV Replacement
TXH-A4	FCCV Shipped with outdoor unit or 4AYTXV kit
TXH-P3	FCCV Shipped with outdoor unit or 4AYTXV kit

Table 3 lists the R-410A TXV Kit requirements for split system air conditioners.

TABLE 3

R-410A TXV MATRIX	
TONNAGE	**R-410A TXV KIT**
1-2.5 TON	4AYTXVH3A1830AA
3-4 TON	4AYTXVH3A3654AA
5 TONS	4AYTXVH3A6060AA

TXV MATRIX	
Model Number	**R410A TXV Part Number**
TXC031E/S	VAL07360
TXC036E/S	VAL06929
TXC037E/S	
TXC054E/S	
TXC/TXA060CS	VAL06930
TXC/TXA061CS	
TXC065E/S	

A retrofitted system will function, however, may not be rated in accordance with ARI Standard 210/270

*** CHECK WITH YOUR DISTRIBUTOR FOR THE LATEST REVISED LISTING OF APPROVED R-410A RETROFIT MATCHES.**

SERVICE BULLETIN

A service bulletin explaining the company's position on the future phase-out of Refrigerant 22 has been included for your information.

GENERAL SERVICE BULLETIN:	MISC-TYR-SB-10
LIBRARY:	SERVICE LITERATURE
PRODUCT SECTION:	UNITARY
PRODUCT:	ALL EQUIPMENT USING R-22
MODEL:	ALL EQUIPMENT USING R-22
LITERATURE TYPE:	GENERAL SERVICE BULLETIN
SEQUENCE:	1
DATE:	May 18, 1998
FILE NO.	SV-UN-S/S-MISC-TYR-SB-10 05/98
SUPERSEDES:	NEW

SUBJECT: The Facts About Air Conditioning Equipment Containing Refrigerant 22

DISCUSSION:

Recent trade and consumer advertising would lead you to believe that the tried and tested refrigerant used by nearly all manufacturers will be obsolete in the very near future. The truth about the very reliable Refrigerant 22 according to the Air Conditioning and Refrigeration Institute (ARI) is as follows:

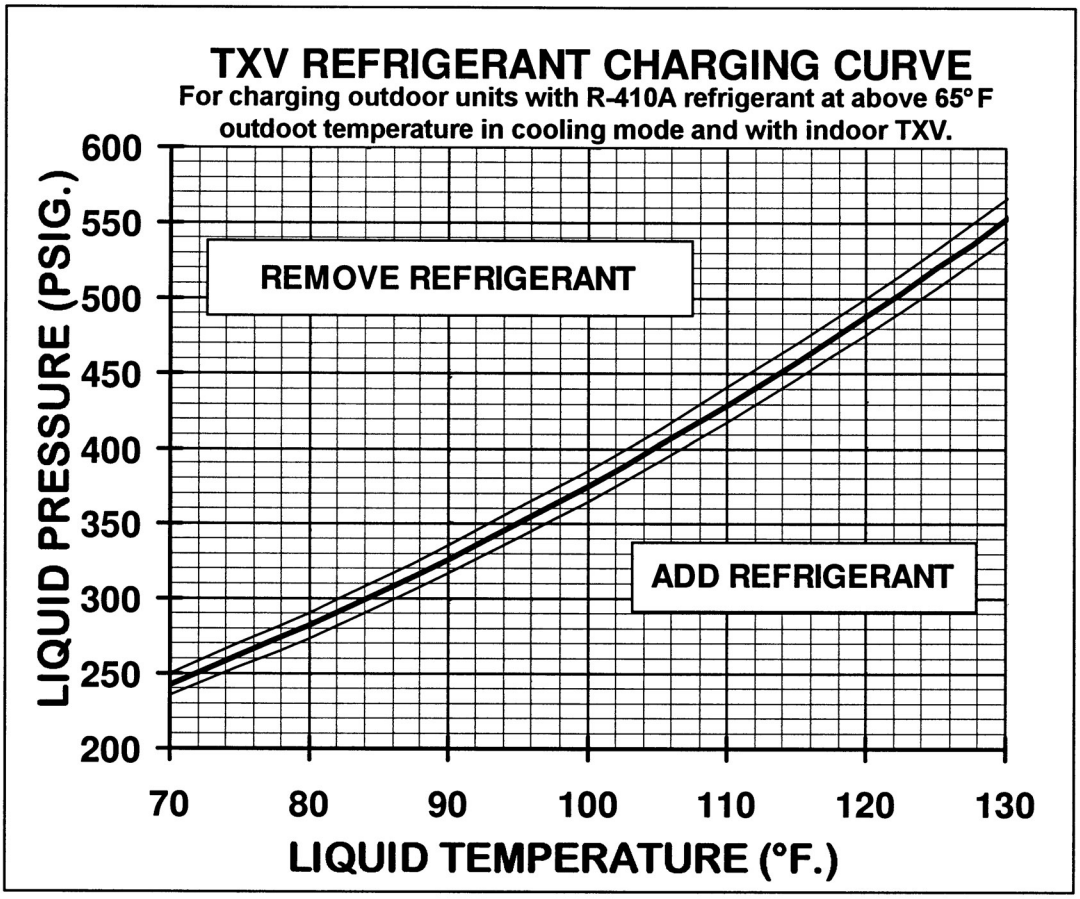
"Refrigerant 22 is regulated by international controls under the Montreal Protocol and in the United States by the Environmental Protection Agency. It has a long life ahead of it as it is scheduled to be in production until the year 2020. It is used in approximately 95% of the equipment produced in the United States today."

The production of R-22 for new equipment will continue for more than ten years. In anticipation of the long range phase-out, the industry, under the auspices of the Air Conditioning & Refrigeration Institute, has examined and characterized a number of possible candidates for future replacement of R-22. With this cooperative characterization substantially complete, equipment manufacturers are undertaking field tests and some limited marketing tests with one or more of the possible R-22 successor refrigerants. R-22 still commands over 99.5% of the market, and is expected to command the overwhelming majority of the market for some years to come.

The Trane Company, with a tradition of thoroughly proving new products and refrigerants before product introduction, believes that alternative refrigerant unitary products are still in the reliability demonstration stage and that any large-scale conversion from R-22 to alternatives for air conditioning is premature. In the interest of continued excellence in product reliability and performance, Trane will convert to alternate refrigerants only after long-term test programs prove their suitability as R-22 replacements. In considering the acceptance of R-22 replacements, we urge the trade and the consumer to exercise caution and to assure that products using these alternate refrigerants offer the reliability, performance and value that they have come to expect of products using R-22.

ISSUED BY: TYLER PRODUCT SERVICE

R-410A SPLIT COOLING UNITS ONLY



1. Measure Liquid Line Temperature and Refrigerant Pressure at service valves.

2. Determine total refrigerant pipe length and height (lift) if indoor section is above the condenser. Plot the intersection of the two points on the Curve Selection Chart to determine which curve to use.

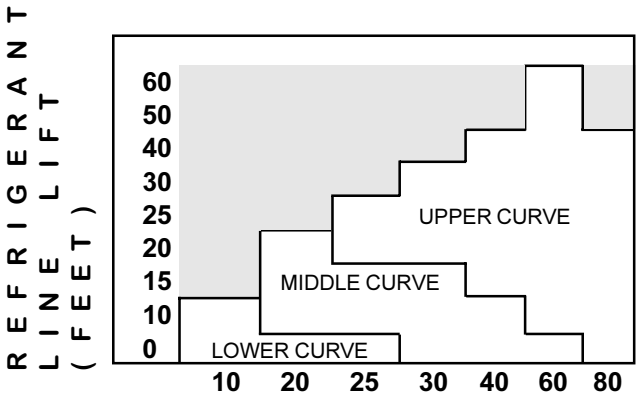
3. Plot the pressure and temperature on the TXV Charging Curve.

4. If the lines cross above the curve remove refrigerant, if below curve add refrigerant.

5. Whenever charge is removed or added, the system must be operated for a minimum 20 minutes to stabilize before additional measurements can be made.

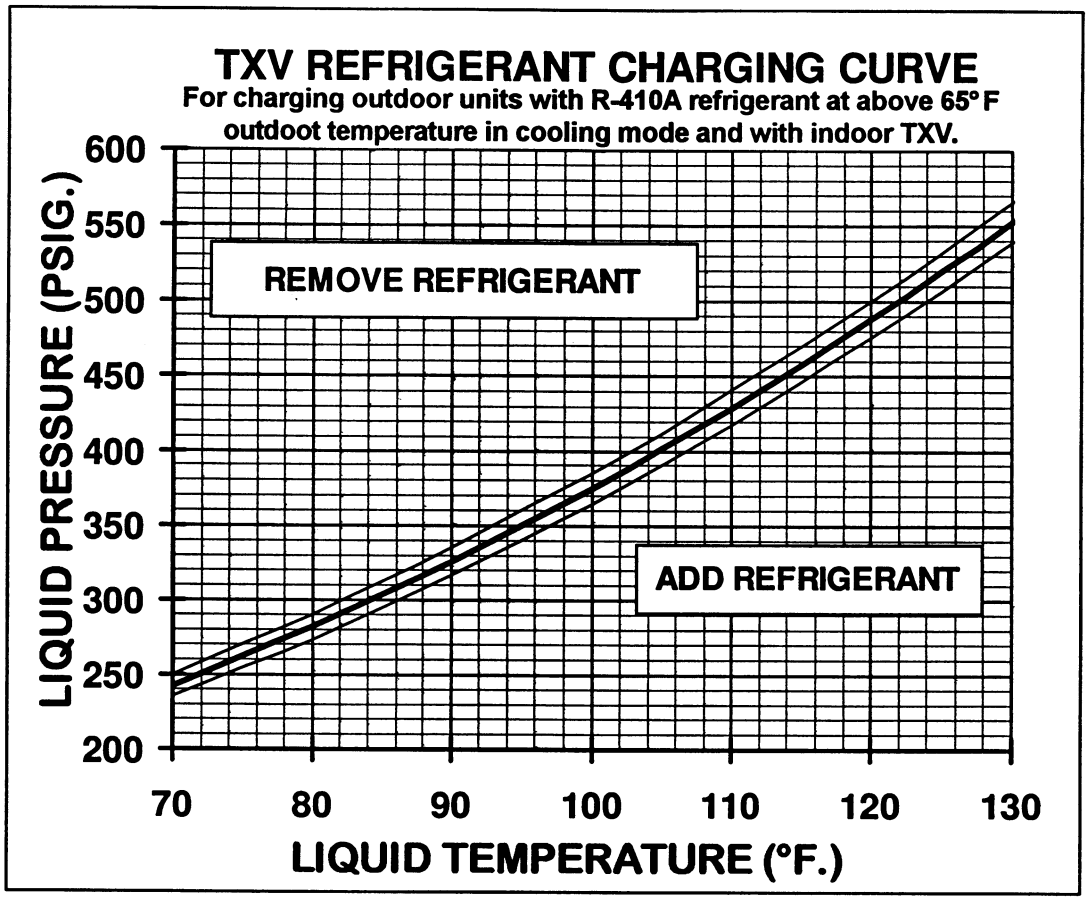
6. When system is correctly charged refer to System Performance Curves to verify charge and performance.

CHARGING CURVE SELECTION CHART



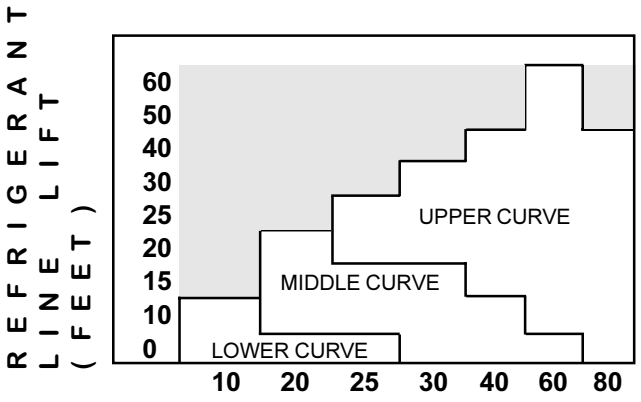
ERPD 4292A
DISTR T-1
A150999P05 REV.0

R-410A SPLIT HEAT PUMP UNITS ONLY



1. Measure Liquid Line Temperature and Refrigerant Pressure at service valves.
2. Determine total refrigerant pipe length and height (lift) if indoor section is above the condenser. Plot the intersection of the two points on the Curve Selection Chart to determine which curve to use.
3. Plot the pressure and temperature on the TXV Charging Curve.
4. If the lines cross above the curve remove refrigerant, if below curve add refrigerant.
5. Whenever charge is removed or added, the system must be operated for a minimum 20 minutes to stabilize before additional measurements can be made.
6. When system is correctly charged refer to System Performance Curves to verify charge and performance.

CHARGING CURVE SELECTION CHART



ERPD 4309B
DISTR T-1
A150999P06 REV.0

Application Guide

Table "A-R (R-410A)"

Liquid Line Selection Table For R-410A Systems

Maximum Allowable Liquid Line Pressure Drop ..... = 50 PSI

Subtract .43 PSI for each foot of Liquid Lift (if any) .....

Do Not Exceed this value when selecting Liquid Line. .....

Tube O.D.	Rated BTUH	Pressure Drop (PSI) For Total Equivalent Length											
		20'	40'	60'	80'	100'	120'	140'	160'	180'	200'	220'	240'
1/4"	15000	4.5	9.0	13.6	18.1	22.6	27.1	31.6	36.2	40.7	45.2	49.7	—
	18000	6.3	12.6	18.8	25.1	31.4	37.7	44.0	—	—	—	—	—
5/16"	15000	1.2	2.4	3.5	4.7	5.9	7.1	8.3	9.4	10.6	11.8	13.0	14.2
	18000	1.6	3.3	4.9	6.6	8.2	9.8	11.5	13.1	14.8	16.4	18.0	19.7
	24000	2.8	5.5	8.3	11.0	13.8	16.6	19.3	22.1	24.8	27.6	30.4	33.1
	30000	4.1	8.3	12.4	16.6	20.7	24.8	29.0	33.1	37.3	41.4	45.5	49.7
	36000	5.8	11.6	17.3	23.1	28.9	34.7	40.5	46.2	—	—	—	—
	42000	7.7	15.4	23.0	30.7	38.4	46.1	—	—	—	—	—	—
3/8"	24000	1.0	1.9	2.9	3.8	4.8	5.8	6.7	7.7	8.6	9.6	10.6	11.5
	30000	1.4	2.9	4.3	5.8	7.2	8.6	10.1	11.5	13.0	14.4	15.8	17.3
	36000	2.0	4.0	6.1	8.1	10.1	12.1	14.1	16.2	18.2	20.2	22.2	24.2
	42000	2.7	5.3	8.0	10.6	13.3	16.0	18.6	21.3	23.9	26.6	29.3	31.9
	48000	3.4	6.8	10.2	13.6	17.0	20.4	23.8	27.2	30.6	34.0	37.4	40.8
	60000	5.1	10.3	15.4	20.6	25.7	30.8	36.0	41.1	46.3	—	—	—
1/2"	42000	.5	1.1	1.6	2.2	2.7	3.2	3.8	4.3	4.9	5.4	5.9	6.5
	48000	.7	1.4	2.0	2.7	3.4	4.1	4.8	5.4	6.1	6.8	7.5	8.2
	60000	1.0	2.1	3.1	4.2	5.2	6.2	7.3	8.3	9.4	10.4	11.4	12.5
	72000	1.4	2.9	4.3	5.8	7.2	8.6	10.1	11.5	13.0	14.4	15.8	17.3
	90000	2.2	4.3	6.5	8.6	10.8	13.0	15.1	17.3	19.4	21.6	23.8	25.9
	120000	3.7	7.4	11.0	14.7	18.4	22.1	25.8	29.4	33.1	36.8	40.5	44.2
5/8"	72000	.4	.9	1.3	1.8	2.2	2.6	3.1	3.5	4.0	4.4	4.8	5.3
	90000	.7	1.3	2.0	2.6	3.3	4.0	4.6	5.3	5.9	6.6	7.3	7.9
	120000	1.1	2.2	3.3	4.4	5.5	6.6	7.7	8.8	9.9	11.0	12.1	13.2

Note 1: A blank space indicates a pressure drop of over 50 PSI.
Note 2: Other existing sources of pressure drop, (solenoid valves, etc.) must be considered.
Note 3: A vertical run with a heat pump system always results in a liquid lift (heating or cooling).
Note 4: The smallest liquid line diameter that results in a total liquid line pressure drop of 50 PSI or less results in the most reliable system (fewer pounds of R-410A).

Example

Given: Rated system capacity = 42000 BTUH, 68 linear ft., 4 long radius elbows (no solenoid valve or other source of pressure drop): 20 ft. liquid lift.

Step #1 20 x .43 = 8.6 PSI pressure drop due to liquid lift. 50 minus 8.6 = 41.4 PSI available for friction loss.

Step #2 68 + (4 x 3.2) = 80.8 eq. ft. (See Table "C," page 10, for equivalent lengths.)

Step #3 Referring to Table A-R, we find that 80 ft. of 5/16" liquid line, (42,000 BTUH) = 30.7 PSI pressure drop. (Well within our 41.4 PSI limit.)

Application Guide

R-410A Refrigerant

R-410A is a near-azeotropic mixture of R-32 and R-125 refrigerants. Some separation of the two components can occur in the vapor phase (not enough to cause a significant change in the composition of the refrigerant with a refrigerant leak). However, it is recommended that charging be done in the liquid phase. When adding liquid refrigerant into the low side of the system, a charge metering device is recommended (WATSCO CH200, or equivalent). Allow ample time when adding refrigerant, for the system to balance out, to avoid having to recover refrigerant.

R-410A cylinders are pink in color and dispense liquid when in the upright position. (This may change.)

Gauges, hoses, recovery cylinders, and recovery machines must handle the higher pressures associated with R-410A. (See pressure/temperature chart.) Note that 45° corresponds to 129.7 PSIG, and 115° corresponds to 390.7 PSIG (compared to 76.0 PSIG and 242.7 PSIG for R-22).

R-410A has practically no temperature "Glide." (The temperature remains practically constant when going from 100% liquid to a saturated vapor at a given pressure.)

Existing Halide leak detectors do not work with R-410A. Existing acid test kits do not work with R-410A. (New kits are being developed.) Note that although R-410A does not deplete the ozone layer, all refrigerants must be recovered.

Do not expose R-410A cylinders to temperatures over 125°F.

R-410A systems use a POE oil, which is not compatible with the oils used in R-22 systems. If existing refrigerant lines are to be used with and R-410A system (assuming that the line sizes are acceptable), they must be thoroughly blown out with dry nitrogen to remove the old oil. Blow vertical sections from top to bottom.

POE oils absorb moisture very quickly. Keep container tightly closed, whenever possible, and expose the system to the atmosphere as little as possible. POE oils can also damage a roof, if spilled.

Vacuum pumps can not remove all of the moisture from POE oils. Change the liquid line drier anytime the system is opened to the atmosphere.

Suction line dryers are to be left in the system for no more than 72 hours. Use only liquid and suction line dryers approved for R-410A.

Since all current R-410A systems are expansion valve systems, the refrigerant charge is to be checked by the subcooling method.

Maximum liquid line pressure drop with R-410A systems is 50 PSI (10° subcooling). Recommended suction line pressure drop (2°F) is 4.8 PSI (Round up to 5.0).

At this time, only matched systems are permitted with R-410A.

R-410A boils at -62.9° at atmospheric pressure, so be wary of frostbite!

Figure 6

R-410A Temperature and Pressure Chart

TEMP.	R-410A	TEMP.	R-410A	TEMP.	R-410A
-60	1.2	16	71.7	44	127.3
-55	3.4	17	73.3	45	129.7
-50	5.8	18	75.0	46	132.2
-45	8.6	19	76.6	47	134.6
-40	11.6	20	78.3	48	137.1
-35	14.9	21	80.2	49	139.6
-30	18.5	22	81.8	50	142.2
-25	22.5	23	83.6	55	155.5
-20	26.9	24	85.4	60	169.6
-15	31.7	25	87.3	65	184.6
-10	36.8	26	89.1	70	200.6
-5	42.5	27	91.0	75	217.4
0	48.6	28	92.9	80	235.3
1	49.9	29	94.9	85	254.1
2	51.2	30	96.8	90	274.1
3	52.5	31	98.8	95	295.1
4	53.8	32	100.8	100	317.2
5	55.2	33	102.9	105	340.5
6	56.6	34	105.0	110	365.0
7	58.0	35	107.1	115	390.7
8	59.4	36	109.2	120	417.7
9	60.9	37	111.4	125	445.9
10	62.3	38	113.6	130	475.6
11	63.8	39	115.8	135	506.5
12	65.4	40	118.0	140	539.0
13	66.9	41	120.3	145	572.8
14	68.5	42	122.6	150	608.1
15	70.0	43	125.0	155	645.0

Table "G"

Pounds of R-410A Required for Line Sets

TUBING SIZES	Linear Length								
	40	60	80	100	120	140	160	180	200
1/4" - 5/8"	.4	.7	1.0	1.4	1.7	2.0	2.3	2.6	3.0
5/16" - 3/4"	.7	1.2	1.8	2.3	2.8	3.4	3.9	4.5	5.0
5/16" - 7/8"	.7	1.3	1.9	2.5	3.0	3.6	4.2	4.8	5.4
5/16" - 1-1/8"	.9	1.5	2.2	2.9	3.6	4.3	4.9	5.6	6.3
3/8" - 3/4"	1.0	1.7	2.5	3.2	4.0	4.8	5.5	6.3	7.0
3/8" - 7/8"	1.0	1.8	2.6	3.4	4.2	5.0	5.8	6.6	7.4
3/8" - 1-1/8"	1.1	2.0	2.9	3.8	4.7	5.6	6.5	7.4	8.3
3/8" - 1-3/8"	1.3	2.3	3.4	4.4	5.5	6.5	7.5	8.6	9.6
1/2" - 7/8"	1.7	3.1	4.4	5.8	7.1	8.5	9.9	11.2	12.6
1/2" - 1-1/8"	1.8	3.3	4.7	6.2	7.7	9.1	10.6	12.0	13.5
1/2" - 1-3/8"	2.0	3.6	5.2	6.8	8.4	10.0	11.6	13.2	14.8
1/2" - 1-5/8"	2.2	4.0	5.7	7.5	9.2	11.0	12.8	14.5	16.3
5/8" - 1-3/8"	3.0	5.4	7.7	10.1	12.5	14.9	17.3	19.6	22.0
5/8" - 1-5/8"	3.2	5.7	8.3	10.8	13.3	15.9	18.4	21.0	23.5

Note: The 15 ft. of tubing included in the nameplate charge has been accounted for, use actual linear length with the above table.

Application Guide

Table "B-R (R-410A Refrigerant)"

Allowable Suction Line Diameters and BTUH Loss (R-410A)

Nominal Tons	Tube O.D. (Inches)	Press. Drop PSI/100 Ft.	BTUH Loss For Equivalent Length										
			40'	60'	80'	100'	120'	140'	160'	180'	200'	220'	240'
1.0	1/2*	5.0	70	160	250	340	430	520	610	700	790	880	970
	5/8	1.5	20	50	73	100	130	155	180	210	235	265	290
1.5	1/2*	10.8	173	410	640	875	1110	1340	1575	1810	2040	2275	2510
	5/8	3.1	50	120	185	250	320	385	450	520	585	655	720
	3/4	1.2	20	45	70	95	125	150	175	200	225	255	280
2.0	5/8*	5.4	115	270	430	585	740	895	1050	1205	1360	1515	1670
	3/4	2.0	45	100	160	215	275	330	390	445	505	560	620
	7/8	.9	20	45	70	95	125	150	175	200	225	255	280
2.5	5/8*	8.2	220	515	810	1110	1400	1695	1990	2290	2585	2880	3175
	3/4	3.0	80	190	295	405	515	620	730	840	945	1055	1160
	7/8	1.3	35	80	130	175	220	270	315	365	410	455	505
3.0	5/8	11.7	380	885	1390	1895	2400	2905	3410	3915	4425	4930	—
	3/4*	4.3	140	325	510	700	880	1070	1255	1440	1625	1810	2000
	7/8	1.9	60	145	225	310	390	470	555	635	720	800	880
3.5	3/4*	5.8	220	510	805	1095	1390	1680	1975	2265	2560	2850	3140
	7/8	2.5	95	220	345	475	600	725	850	975	1105	1230	1355
4.0	3/4	7.4	320	745	1170	1600	2025	2450	2875	3305	3730	4155	4580
	7/8*	3.2	140	325	510	690	875	1060	1245	1430	1615	1795	1980
	1-1/8	.9	40	90	145	195	245	300	350	400	455	505	555
5.0	3/4	11.5	620	1450	2280	3105	3935	4760	5590	6415	7245	8073	8900
	7/8*	4.9	265	615	970	1325	1675	2030	2380	2735	3080	3440	3795
	1-1/8	1.3	70	165	255	350	445	540	630	725	820	915	1005
6.0	3/4	16.5	1070	2495	3920	5345	6770	8195	9625	—	—	—	—
	7/8	7.0	455	1060	1665	2270	2875	3480	4080	4685	5290	5895	6500
	1-1/8	1.8	115	270	430	585	740	895	1050	1205	1360	1515	1670
7.5	7/8	10.8	875	2040	3210	4375	5540	6705	7875	9040	10203	11370	12540
	1-1/8	2.8	225	530	830	1135	1435	1740	2040	2345	2645	2950	3250
	1-3/8	1.0	80	190	300	405	515	620	730	835	945	1055	1160
10.0	7/8	19.3	2085	4865	7645	10420	13200	15980	—	—	—	—	—
	1-1/8	4.9	530	1235	1940	2645	3350	4255	4765	5470	6175	6880	7585
	1-3/8	1.7	185	430	675	920	1165	1410	1650	1895	2140	2385	2630

Note: *Rated tube size.
Note 1: Shaded value indicates more than 10% capacity loss.
Note 2: Blank space indicates more than 15% capacity loss.

Suction Line Selection Example (R-410A)

Given: 4 ton system
132 linear ft.
8 long radius elbows

The equivalent length of the rated, (7/8" O.D.) suction line size = 132 + (8 x 5.3) or 174.4 ft. Table B-R indicates a capacity loss of 1430 BTUH for 180 equivalent feet (approx. 3%). If this loss is acceptable, 7/8" O.D. is the correct size. If capacity is critical, the 1-1/8" O.D. suction line loss is less than 400 BTUH.

Table "C"

Equivalent Length (Ft.) of Non-Ferrous Valves and Fittings (Brazed)

O.D. Tube Size (Inches)	Globe Valve	Angle Valve	Short Radius Ell	Long Radius Ell	Tee Line Flow	Tee Branch Flow
1/2*	70	24	4.7	3.2	1.7	6.6
5/8	72	25	5.7	3.9	2.3	8.2
3/4	75	25	6.5	4.5	2.9	9.7
7/8	78	28	7.8	5.3	3.7	12.0
1-1/8	87	29	2.7	1.9	2.5	8.0
1-3/8	102	33	3.2	2.2	2.7	10.0
1-5/8	115	34	3.8	2.6	3.0	12.0

Information for this chart extracted by permission from A.R.I. Refrigerant Piping Data, page 28.
* For smaller sizes, use 1/2" values.

Question

Would a 3/4" O.D. suction line be adequate for a 4 ton system with a piping run of 60 equivalent feet?

Answer

Obviously, oil return would not be a problem with the smaller diameter tube, (higher velocity). So, if the capacity loss of 745 BTUH, (approx. 1.5%) is not a problem, the 3/4" suction line is O.K. for the 60 equivalent feet.