TRANE®

General Service Bulletin

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SUBJECT: System Clean Up after Compressor Failure, Using a Suction Line Filter-Drier and Oil Acid Test Kit.

INTRODUCTION: The purpose of this bulletin is to discuss the use of the acid test kit with the suction line filter method of system cleanup following a compressor failure. This procedure is recommended by The Trane Company as being the most effective and least costly means of decontaminating a refrigerant system.

This bulletin does not imply a warranty or authorization for labor or material.

DISCUSSION: Heat generated by a compressor failure causes some oil and refrigerant to break down and form acids and sludges which contaminate the system. These contaminants must be removed or they will attack the replacement compressor motor windings and another failure will result.

The suction line filter-drier method of clean up has been tested both in the laboratory and in the field, and it works very well. A filter-drier in the suction line not only filters out sludge but the desiccant removes acid and moisture.

The suction line filter-drier method is, in reality, a flush method. The agent used for flushing the system is the refrigerant in the system. The pump used for flushing the system is the compressor. All the suction line filter-drier does is collect the sludge and acid that has been flushed from the system.

It is interesting to note the kind of a flushing job that can be done on a 100 ton condensing unit. Consider that a 100-ton system circulates 350 lbs. of refrigerant per minute during its normal operation. This is 21,000 lbs. per hour. Also consider that the suction line filter-drier should be in the system for 48 hours of operation. Now, 48 hours times 21,000 lbs. of refrigerant per hour is over 1,000,000 lbs. of refrigerant which was actually circulated through the suction line filter to effect the clean up.

No wonder the filter-drier method does a good job. The only things to be concerned with is whether the suction line filter-drier actually catches and removes the acid and sludge and it is known that it does.

ACID TEST KITS

To understand how an acid test kit works, the following discussion concerns acids and how they are measured. There are two different types of acids formed in a refrigeration system: organic acids and inorganic acids.

Most organic acids also contain hydrogen, carbon, and oxygen. These are the acids formed due to oil breakdown. Oil is an organic compound of carbon, hydrogen and oxygen. If the molecules of oil are rearranged in certain ways, organic acids can be formed. The number of organic acids that are possible to form is countless since there are many combinations of carbon, oxygen, and hydrogen.

The organic acids also contain hydrogen, and, in addition, contain some minerals such as chlorine or fluorine. The inorganic acids formed in a refrigeration system using R-12 or R-22 are hydrochloric acid and hydrofluoric acid.

Both organic and inorganic acids ionize in water. This means that some of the hydrogen atoms in the acid separate out in the solution as positively charged hydrogen ions. At the same time, OH or hydroxyl ions separate out as negatively charged ions.

The number of the hydrogen ions in a given solution sample is a measure of the strength of the acid. Inorganic acids such as hydrochloric or hydrofluoric acid ionize to a high degree and these are called strong acids. The organic acids do no ionize so readily and so they are call weak acids. The strength of an acid may be measured by the number of hydrogen ions in the acid solution. This is called pH and the pH scale runs from 0 to 14.

A pH of 7 is neutral. This means that the number of positively charged hydrogen ions is exactly equal to the number of negatively charged OH or hydroxyl ions. pH less than 7 means that the number of hydrogen ions exceed the number of hydroxyl ions and thus the solution is on the acid side. If the pH is greater than 7, the number of hydrogen ions is less than the number of hydroxyl ions and the solution is basic or alkaline.

An oil may contain a large amount of weak organic acids and still have a high pH over 7 because the organic acids do not ionize readily. These weak organic acids can still cause problems in the refrigeration system and must be removed. Therefore, any acid test which is based on whether or not the pH is above or below 7 is not the best. The best test would be one which measures the amount or weight of acid present in the oil. This type of test is accomplished by adding a neutralizing agent to a given sample of oil until all of the acids in the oil have been neutralized. The amount of neutralizer agent added is measured which gives an indication of the weight of acid that was present in the sample and is expressed as an acid number.

It has been determined from laboratory experiments that when the pH of an oil sample is 11, the sample is essentially free of both organic and inorganic acids. Therefore, the acid number of an oil is the amount of neutralizing agent necessary to be added to the oil to bring the pH up to 11.

The neutralizing agent is either sodium hydroxide or potassium hydroxide. Sodium hydroxide is commonly known as household lye, and potassium hydroxide is very similar.

It has been determined that if a 1 gram sample of oil requires .05 milligrams of sodium hydroxide to bring its pH up to 11 (or neutralize it), the original oil sample is free enough of acid to be considered satisfactory for use in a refrigeration system. Consider that the acid number of this oil is .05. An oil with an acid number of less than .05 is even better. But, if the acid number is greater than .05, the oil contains too much acid and is unacceptable.

See Figure 1.

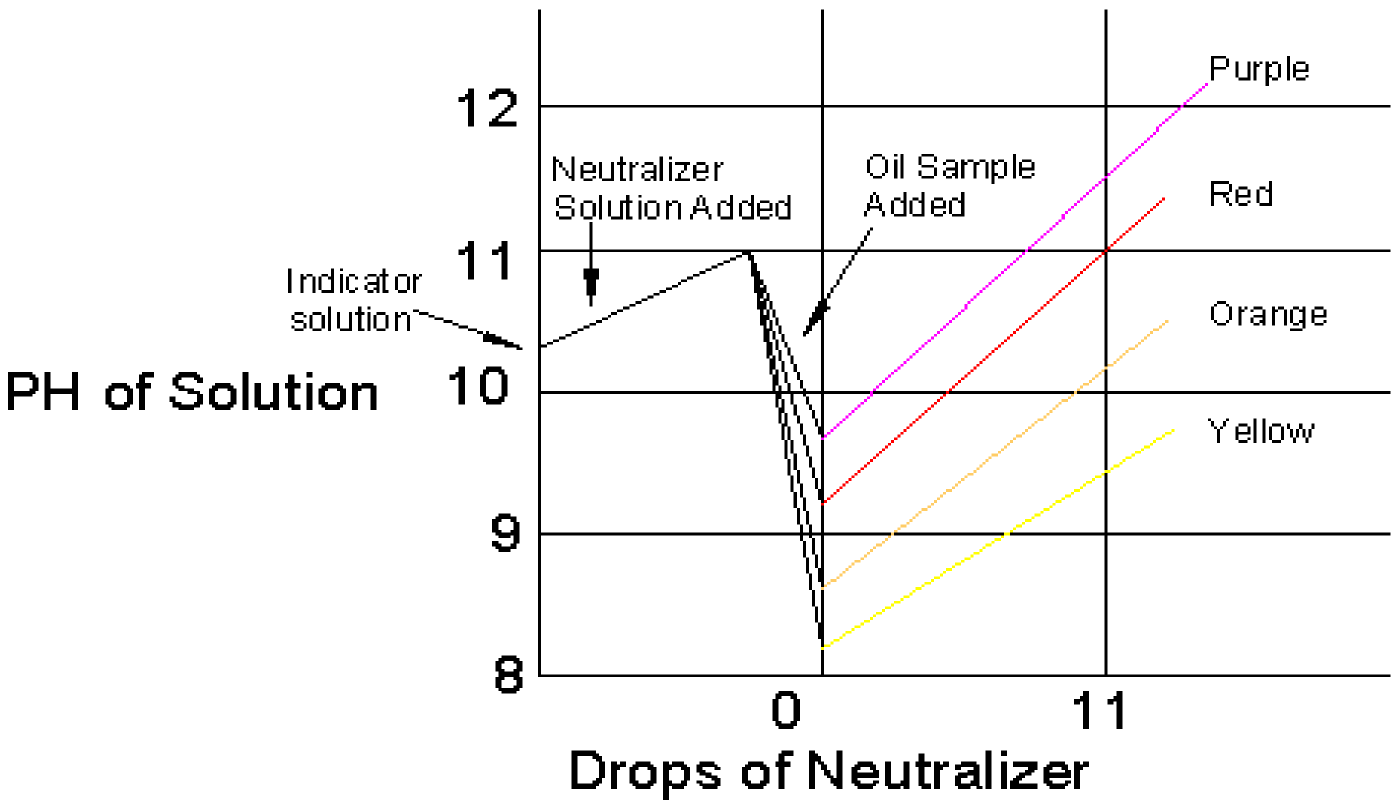


FIGURE 1 – Acid Test Kit Operating Range

SYSTEM CLEAN UP PROCEDURE

Following is the recommended procedure for servicing a refrigeration system which has had a compressor failure. The procedure will vary somewhat on manifolded scroll compressors.

- **REFRIGERANT REMOVAL**

Trane recommends that the refrigerant be reclaimed/recycled/recovered, **never discharge refrigerant to the atmosphere.**

Systems with service valves may not require all of the refrigerant to be removed. Some refrigerant in the low side of the system will have to be reclaimed in order to install the suction line filter-drier.

- **OIL TESTING**

The oil in a refrigeration system is a reflection of the condition of the system. If the oil is contaminated, the system is contaminated. Contamination other than acid will find its way into the oil. Test the oil in the failed compressor, this is the only accurate method of checking the condition of the system. A suction line filter core may be used to protect the compressor from other forms of contamination.

Service Tip
The oil suction screens on serviceable compressors can be damaged by acid; always check the screen for damage.

- **DRIER SELECTION**

Tables 4-1 through 12-2

It is important when cleaning up a system to install both liquid and suction line driers. On systems with hot-gas by-pass a liquid line drier will be by-passed when the hot-gas is active.

Suction line driers can be selected from unit parts list or tables. Typically there is no penalty associated with oversizing the suction line filter-driers, however the cores can log oil. Select the size based on tonnage. Select the core based on the application. Burn out and high acid cores should be used in both suction and liquid lines.

Liquid line driers should be selected from the unit parts list or based on application and tonnage.

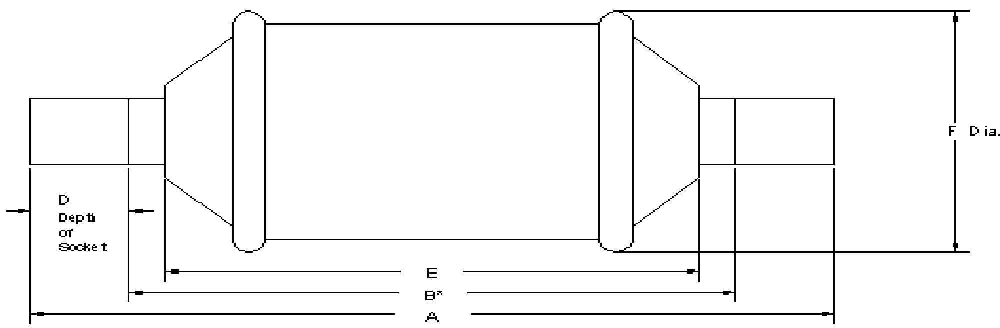
Packaged cooling units use the same size drier that is on the unit or the size indicated from parts list or the drier tables. Some packaged equipment is designed with a five to six lb. pressure drop across the liquid line drier, this is acceptable due to the amount of subcooling designed into the unit.

Split system driers should be selected based on tonnage and refrigerant type.

On heat pumps and units with critical refrigerant charges, caution should be used in oversizing liquid line driers. Use the drier recommended for that model from the parts list. If not available, select the proper one using the tables based on tonnage.

Service Tip
For 75 ton and 100 ton model “E” compressors, finding and piping the proper size suction line drier is difficult. Size the drier to one of the compressors unloaded capacities. Limit the loading during the clean up process. The cores and/or the shell will have to be removed after the system is clean.

Liquid Line Filter-Drier



* B Indicates Laying Length

Table 4-1 --- Liquid Line Hermetic Type Filter-Driers Dimensional Data

In³ Unit Size	Type .No	Connections Size & Type	Nominal System Tonnage[1] — Refrigeration: Low Temp. & Commercial Installations R-12	R-22	R-502	Air Conditioning: Field Replacement[2] and Field Installations R-12	R-22	R-502	OEM[3] Self-Contained Equipment R-12	R-22	R-502	Dimensions A	B	D	E	F	Ship Wt. Lbs.	Case Qty.	Trane Part No.
	032	1/4 SAE	1/4	1/4	1/4	1/2	1/2	1/2	3/4	1	3/4	4 3/8	--	--	2 9/16	1 5/8	1/2	25	DHY-0131
3	032S	1/4ODF - 3/8ODM										3 7/8	3 1/8	3/8					DHY-0132
	052	1/4 SAE				3/4	3/4	3/4	1	1	1	4 13/16	--	--					DHY-0137
5	052S	1/4 ODF	1/3	1/3	1/3							4 17/16	3 11/16	3/8	3	2 5/8	7/8	25	DHY-0138
	053	3/8 SAE				1 1/2	2	1	2	3	2	5 1/8	--	--					DHY-0139
	053S	3/8 ODF										4 1/2	3 5/8	7/12					DHY-0140
	083	3/8 SAE	1	1	1	2	2	2	3	4	3	5 15/16	---	---					DHY-0143
	083S	3/8 ODF										5 15/16	4 7/16	7/16	3 13/16	2 5/8	1 1/4	25	DHY-0144
8	084	1/2 SAE	1 1/2	1 1/2	1	3	3	2	4	5	4	6 3/16	--	--					DHY-0145
	084S	1/2 ODF										5 3/8	4 3/8	1/2					DHY-0146
	163	3/8 SAE	2	2 1/2	2	3	3	2	4	5	3	6 7/8	--	--					DHY-0149
	163S	3/8 ODF										6 1/4	5 3/8	7/16					DHY-0150
	164	1/2 SAE	2	3	2	3	5	3	5	7 1/2	5	7 1/16	--	---					DHY-0151
16	164S	1/2 ODF										6 5/16	5 5/16	1/2	4 3/4	2 5/8	1 1/2	25	DHY-0152
	165	5/8 SAE	2 1/2	3	2 1/2	5	5	4	7 1/2	10	7 1/2	7 1/2	--	--					DHY-0153
	165S	5/8 ODF										6 9/16	5 5/16	5/8					DHY-0154
	167S	7/8 ODF	3	4	3	5	7 1/2	5	10	12 1/2	10	7 3/16	5 5/8	3/4					DHY-0155
	303	3/8 SAE	3	3	2	3	4	3	4	5	4	9 5/8	--	--					DHY-0156
	303S	3/8ODF-1/2ODM									9	8 1/8	7/16						DHY-0157
	304	1/2 SAE	3	5	3	5	7 1/2	5	7 1/2	7 1/2	5	9 7/8	--	--	7 1/2	3 1/16	3 3/4	10	DHY-0158
30	304S	3/8ODF-5/8ODM										9 1/8	8 1/8	1/2					DHY-0159
	305	5/8 SAE	4	5	5	7 1/2	7 1/2	5	10	15	7 1/2	10 5/16	--	--					DHY-0160
	305S	5/8 ODF										9 5/16	8 1/16	5/8					DHY-0161
	414	1/2 SAE	5	5	5	5	7 1/2	5	7 1/2	7 1/2	5	10	--	--					DHY-0166
	414S	1/2ODF-5/8ODM										9 1/4	8 1/4	1/2					DHY-0167
41	415	5/8 SAE	7 1/2	7 1/2	7 1/2	7 1/2	7 1/2	5	10	15	7 1/2	10 7/16	--	---	7 5/8	3 9/16	4 3/4	10	DHY-0168
	415S	5/8 ODF										9 7/16	8 3/16	5/8					DHY-0169
	417S	7/8 ODF	10	10	7 1/2	10	10	7 1/2	15	20	12 1/2	10	8 1/2	3/4					DHY-0170
75	757S	7/8 ODF	15	15	10	15	20	10	20	25	15	15 7/16	13 15/16	3/4	13 1/16	13 9/16	7 1/2	6	DHY-0172

NOTES:

1. Suggested nominal tonnage selections. By type or application. 3. Ratings for OEM installed under controlled ambient conditions.
2. Suggested ratings for field installation on open equipment.

Table 4-2 – Refrigerant Liquid Contained in Liquid Line Filter-Driers

In³ Unit Size	Weight of Refrigerant –Ounces: R-12 Liquid Temperature 75F	R-12 125F	R-22 Liquid Temperature 75F	R-22 125F	R-502 Liquid Temperature 75F	R-502 125F
3	2.9	2.6	2.6	2.3	2.7	2.4
	6.5	5.9	5.9	5.3	6.1	5.4
8	8.3	7.6	7.5	6.8	7.8	7.0
16	10.2	9.4	9.3	8.4	9.7	8.6
30	28.7	26.1	26.1	23.5	27.1	24.0
41	40.0	36.4	36.4	32.5	37.8	33.4
75	72.4	65.8	65.8	59.2	68.4	60.5

Nonmenclature

16 4 S

Unit Size — 16

Conn. Size in 1/8" — 4

Conn. Style — S=ODF (Omit for SAE)

Liquid Line Burnout Cleaner Filter-Drier

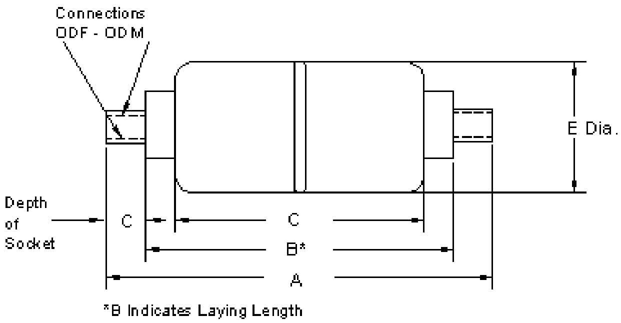


Table 5-1 --- Liquid Line Burnout Cleaner Filter-Drier Dimensional Data

Type Number	Connection Size & Style	A	B	C	D	E[1]	Wt. Lbs.	Qty.	Part No.
303	3/8 SAE	9 5/8	--	--	7½	3 1/16	3¾	10	DHY-0201
304	½ SAE	9 7/8	--	--	7½	3 1/16	3¾	10	DHY-0202
415	5/8 SAE	10 7/16	--	---	7 5/8	3 9/16	4¾	10	DHY-0207
417S	7/8 ODF	10	8½	¾	7 5/8	3 9/16	4¾	10	DHY-0208

[1] Dimension does not include weld bead.

Table5-2 --- Capacity Specifications

In³ Unit Size	Type Number	Connections Size & Style	Refrigeration: Low Temp./Commercial R-12	R-22	R-502	Air- Conditioning: Field Replacement R-12	R-22	R-502	O.E..M. Self-Contained R-12	R-22	R-502
30	303	3/8 SAE	3	3	2	3	4	3	4	5	4
	304	½ SAE	3	5	3	5	7½	5	7½	7½	5
41	415	5/8 SAE	7½	7½	7½	7½	10	5	10	15	7½
	417S	7/8 ODF	10	10	7½	10	10	7½	15	15	12½

(Nominal System Tons)

Table 5-3 – Refrigerant Liquid Contained In Filter-Drier

Weight of Refrigerant –Ounces

In³ Unit Size	R-12 Liquid Temperature 75F	R-12 125F	R-22 Liquid Temperature 75F	R-22 125F	R-502 Liquid Temperature 75F	R-502 125F
8	7.2	6.6	6.6	5.9	6.9	6.1
16	13.8	12.6	12.6	11.3	13.1	11.6
30	21.7	19.9	19.8	17.8	20.6	18.3
41	29.2	26.7	26.6	23.9	27.7	24.6

Nomenclature

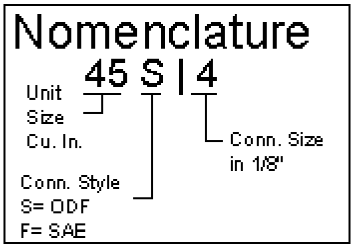
16 4 S

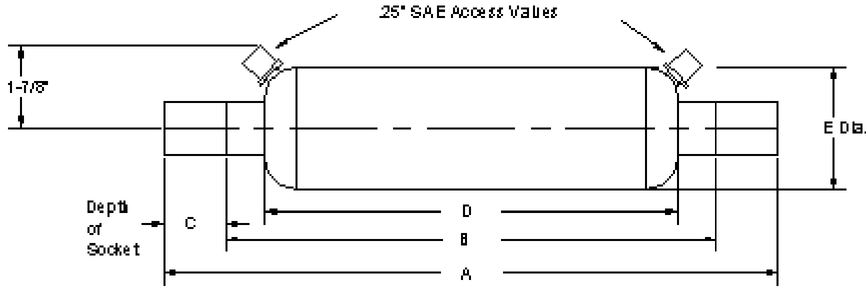
Unit Size — 16

Conn. Size in 1/8" — 4

Conn. Style — S
S=ODF
(Omit for SAE)

Suction Line Filter- Drier





Service Instructions

1 Upon installation and start-up, measure and record the pressure drop across the suction line filter-drier by means of the dual access valve.

2 Continue to periodically record pressure drop. Change the filter-drier if the pressure drop becomes excessive.

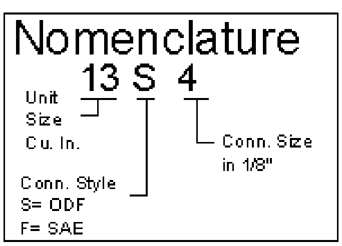
Table 6-1

Type No.	Connections Size & Type	A	B	C	D	E	Ship Wt. Lbs. Ea.	Case Qty.	Trane Part Number
28S4	½ ODF	$5^{5}/8$	$4^{5}/8$	$^{3}/8$	$4^{5}/32$	$3^{1}/16$	1 ½	10	DHY-0175
35F5	$^{5}/8$ SAE	$8^{7}/16$	----	----	$5^{5}/8$	$3^{1}/16$	2 ½	10	DHY-0176
35S5	$^{5}/8$ ODF	$7^{9}/16$	$6^{5}/32$	$5^{5}/8$	4 ¾			10	DHY-0177
45S6	¾ ODF	7 ¾	6 ½	$^{5}/8$	$5^{9}/16$	$3^{1}/16$	3	10	DHY-0178
45S7	$^{7}/8$ ODF	$7\ ^{15}/16$	$6\ ^{7}/16$	¾	$5^{9}/16$			10	DHY-0179
50S9	$1^{1}/8$ ODF	$8^{27}/32$	$7^{1}/32$	$^{29}/32$	$6\ ^{1}/8$		3 ½	10	DHY-0180
75S11	$1^{3}/8$ ODF	12 ¼	$10^{15}/16$	$^{31}/32$	8 ¼	$3^{11}/16$	5	6	DHY-0181
75S13	$1^{5}/8$ ODF	$12^{5}/32$	$9^{29}/32$	$1^{1}/8$	8 ¼		5 ½	6	DHY-0182

Table 6-2

Flow Capacity in Tons at Listed Conditions

	Refrigerant 12					Refrigerant 22							Refrigerant 502	
Evaporator Temperature F														
	40	20	0	-20	-40	20	0	-20	-40	40	20	0	-20	-40
Type	Pressure Drop PSI													
Number	2	1.5	1	0.5	3	2	1.5	1	0.5	3	2	1.5	1	0.5
28S4	1.9	1.2	.83	.63	3.8	2.1	1.4	1.0	.83	3.6	1.8	1.1	.74	.53
35F5	2.2	1.4	1.0	.75	4.4	2.5	1.7	1.2	1.0	4.1	2.1	1.3	.88	.64
35S5	2.9	1.9	1.3	1.0	5.8	3.2	2.2	1.6	1.3	5.4	2.8	1.7	1.1	.84
45S6	3.9	2.5	1.7	1.3	8.0	4.4	3.0	2.1	1.7	7.4	3.8	2.3	1.5	1.1
45S7	4.7	3.0	2.0	1.5	9.7	5.3	3.5	2.5	2.0	9.1	4.6	2.8	1.8	1.3
50S9	5.4	3.4	2.3	1.7	11.2	6.1	4.0	2.9	2.3	10.5	5.3	3.2	2.1	1.5
75S11	5.9	3.7	2.5	1.8	12.2	6.7	4.4	3.0	2.4	11.5	5.8	3.5	2.2	1.6
75S13	6.4	4.0	2.7	2.0	13.2	7.2	4.7	3.3	2.6	12.4	6.3	3.8	2.4	1.7



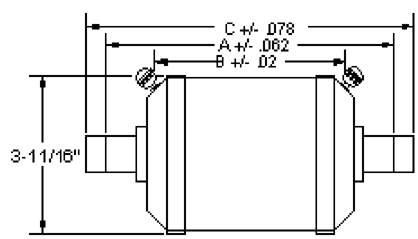


Table 7-1--- NominalSystemCapacity

Catalog Number	Horsepower* R-12	R-22	R-502	Trane Part Number
13S3	$^{1}/8$-$^{1}/3$	½-1	½-1	DHY-0235
13S4	¼-½	1-2	½ -1¾	DHY-0236
13S5	¾-1	2-2½	¾-2	DHY-0237
13S6	1-2	2½-3¼	3	DHY-0238
13S7	1½-2	1½-3	1½-3	DHY-0239
27S7	1½-3	1½-4	1½-4	DHY-0240
27S9	3-4	3-9	3-5	DHY-0241
54S11	5-7½	5-10	5-9	DHY-0242
54S13	7½-10	7½-15	6-10	DHY-0243

- Suggested nominal selection based on range of compressor motor horsepower and normal suction line size.

Table 7-2 – Dimensional Data

Filter-Drier	Connection	A	B	C	Shipping Wt. Lbs.
13S3	$^{3}/8$ ODF	$3^{21}/32$		$4^{27}/32$	
13S4	½ ODF	$3^{15}/16$	$3^{3}/8$	$4^{15}/16$	2
13S5	$^{5}/8$ ODF	$3^{29}/32$		$5^{5}/32$	
13S6	¾ ODF	4		5¼	
13S7	$^{7}/8$ ODF	4¼		5¾	
27S7	$^{7}/8$ ODF	6	$5^{1}/8$	7½	3
27S9	$1^{1}/8$ ODF	$5^{13}/16$		$7^{5}/8$	
54S11	$1^{3}/8$ ODF	$10^{5}/16$	8¼	12¼	4½
54S13	$1^{5}/8$ ODF	$9^{29}/32$		$12^{5}/32$	

Replaceable Core Shell

Table 8-1—Shell Flow Capacity Ratings –Suction Line Service

Catalog Number		Flow Capacity in Tons at Listed Conditions														
		Refrigerant 12				Refrigerant 22					Refrigerant 502					
		Evaporator Temperature F														
		40	20	0	-20	40	20	0	-20	-40	40	20	0	-20	-40	Trane
Take-Apart	Filter-Drier	Pressure Drop PSI														Part
Shell	Core	2	1.5	1	0.5	3	2	1.5	1	0.5	3	2	1.5	1	0.5	Number
37 SV	SC3	4.8	3.3	2.1	1.1	8.9	5.8	3.9	2.5	1.3	7.2	4.6	3.1	1.9	1.0	DHY-0244
39 SV	SC3	7.4	5.1	3.2	1.7	13.6	8.9	6.0	3.8	2.0	11.1	7.1	4.8	3.0	1.6	DHY-0245
311 SV	SC3	10.6	7.3	4.6	2.5	19.5	12.7	8.6	5.4	2.9	15.9	10.2	6.8	4.2	2.2	DHY-0246
413 SV	SC4	15.7	10.8	6.9	3.7	29.0	19.0	12.8	8.1	4.3	24.0	15.2	10.2	6.3	3.3	DHY-0247
417 SV	SC4	23.0	15.8	10.0	5.4	43.0	28.8	18.8	11.8	6.3	35.0	22.0	14.9	9.3	4.9	DHY-0248
521 SV	SC5	33.0	23.0	14.4	7.8	61.0	40.0	27.0	17.0	9.0	50.0	32.0	22.0	13.3	7.0	DHY-0249
525 SV	SC5	39.0	27.0	17.1	9.2	72.0	47.0	32.0	20.0	10.7	59.0	38.0	25.0	15.8	8.3	DHY-0250

All ratings in accordance with ARI Standard 730-86.

Table 8-2—Filter Drier Cores For Brass Replaceable Core Shells – Water Capacity Ratings

Filter Drier Cartridge	Water Capacity Rating — Drops of Water @ 65 F Suction Gas									Trane Part Number
	Refrigerant-12			Refrigerant-22			Refrigerant 502			
	Evaporator Temperature F									
	40	0	-20	40	0	-40	40	0	-40	
SC3	202	142	122	293	252	217	283	257	201	COR-0043
SC4	300	278	238	571	492	424	552	501	391	COR-0044
SC5	553	390	334	802	691	595	776	704	550	COR-0045

Nomenclature

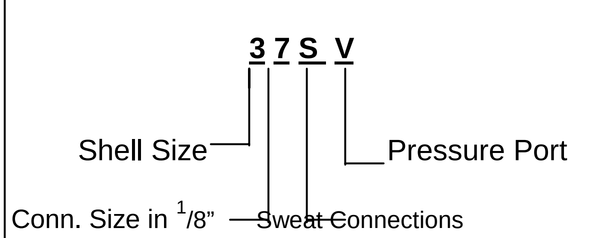


Table 9-1 – Dimensional Data

Filter-Drier Cartridge	For Shell Dia.	Cartridge O.D.	Cartridge Length	Desiccant Volume Cu. In.	Weight Lb.
SC3	3	2¾”	6 7/8”	13.3	7/8
SC4	4	3¾”	7½”	26.0	1½
SC5	5	4 5/16”	8½”	36.5	2

Dimensional Data Brass Shell

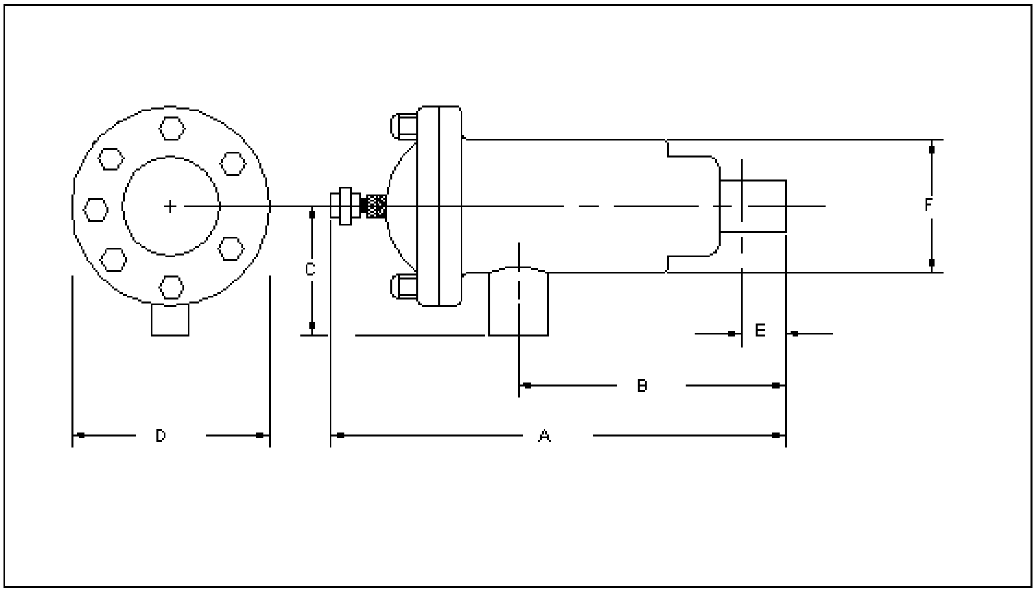


Table 9-2 – Dimensional Data

Catalog Number	Connection Size & Type	Nominal Shell Size	Dimensions A	B	C	D	E	F	Weight Lbs.
37 S-V	7/8 ODF		10 5/8	6½	3		.625		9¾
39 S-V	1 1/8 ODF	3”	10 5/16	6 13/16	3 5/16	4 5/8	.910	3 15/32	10¼
311S-V	1 3/8 ODF		11 1/16	6 15/16	3 7/16		.970		10½
413S-V	1 5/8 ODF	4”	12 1/32	7 13/16	4 1/8	5 ¾	1.090	4 15/32	16¾
417S-V	2 1/8 ODF		12 9/32	8 1/16	4 3/8		1.340		17½
521S-V	2 5/8 ODF	5”	13 9/16	8 15/32	4 15/16	7 3/32	1.470	5 9/16	29
525S-V	3 1/8 ODF		13¼	8 5/32	4 5/8		1.660		29¼

Replaceable Core Shell

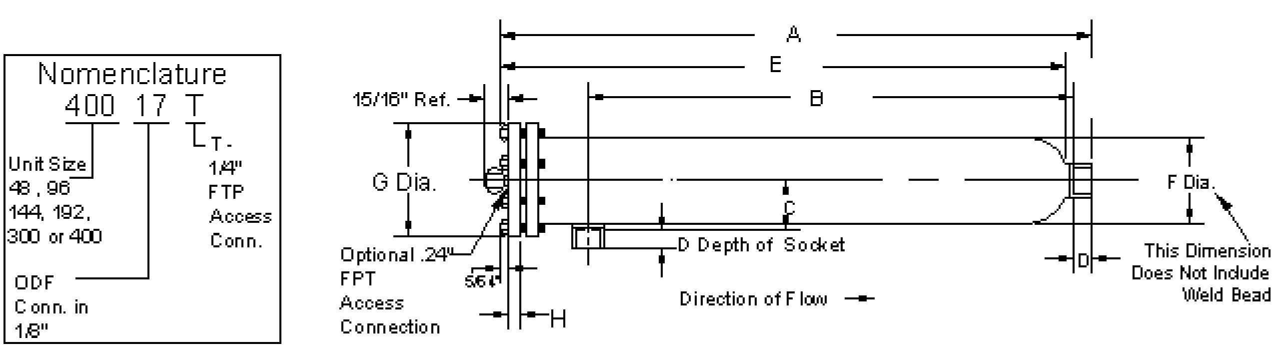


Table 10-1 Dimensional Data

Type Number	Connections Size & Type	A	B	C	D	E	F	G	H[1]	Ship Wt. Lbs. Ea.	Trane Part Number
485T	5/8 ODF	9 15/32	5 3/8	3 5/32	5/8						DHY-0110
487T	7/8 ODF	9 11/16	5 15/32	2 31/32	25/32						DHY-0111
489T	1 1/8ODF	9¾	5 3/8	2 29/32	15/16	8 15/32			7¾	13	DHY-0112
4811T	1 3/8ODF	9 27/32	5 13/32	2 15/16	1 1/32						DHY-0113
4813T	1 5/8ODF	9 7/8	5 3/8	2 29/32	1 1/8						DHY-0114
967T	7/8 ODF	15 3/16	10 15/16	2 31/32	25/32		5	6 3/16			DHY-0115
969T	1 1/8ODF	15 7/32	10 27/32	2 29/32	15/16	14 1/16			12¾	17	DHY-0116
9611T	1 3/8ODF	15 5/16	10 7/8	2 15/16	1 1/32						DHY-0117
9613T	1 5/8ODF	15 3/8	10 27/32	2 29/32	1 1/8						DHY-0118
1449T	1 1/8ODF	21¼	16 7/16	2 29/32	15/16	20 1/16			18¼	20	DHY-0120
19217T	2 1/8ODF	27 1/8	27 25/32	3 7/32	1 11/32	25 23/32			23¾	24	DHY-0126
30013T	1 5/8ODF	25½	19 15/32	4 3/16	1 1/8	23 3/16	6	7 9/16	22¼	39	DHY-0127
40017T	2 1/8ODF	32 3/32	25½	3 25/32	1 21/32	29 31/32			28 7/8	46	DHY-0129

Notes:
1. "H" Dimension is the clearance required to change the internal hardware assembly.
2. Replaceable core shells are individually boxed and shipped.

Table 11-1 --- Liquid Line Ratings for Take Apart Type Filter-Driers

			Flow Capacity Tons[1] 2PSI ΔP			Water Capacity[2] (Drops of Water)[3] Refrigerant / Liquid Line Temperature							
						R-12		R-22		R-502			
In^3 Unit Size	Type Number	Connections Size & Type	R-12	R-22	R-502	75F	125F	75F	125F	75F	125F	Filter Area Sq.In.	Number & Type of Drier Blocks Required
	485T	5/8 ODF	19	23	17								
	487T	7/8 ODF	25	31	22								
48	489T	1 1/8ODF	27	34	25	655	550	501	436	542	461	69	One-48
	811T	1 3/8ODF	30	38	29								
	4813T	1 5/8ODF	33	42	32								
	967T	7/8 ODF	43	54	38								
	969T	1 1/8ODF	52	65	46	1310	1100	1002	872	1084	922	138	Two-48
96	9611T	1 3/8ODF	58	72	50								
	9613T	1 5/8ODF	64	81	56								
144	1449T	1 1/8ODF	63	79	56	1965	1650	1503	1308	1626	1383	207	Three-48
192	19217T	2 1/8ODF	130	163	115	2620	2200	2004	1744	2168	1844	276	Four-48
300	30013T	1 5/8ODF	120	151	107	4037	3390	3078	2679	3337	2838	330	Three-100
400	40017T	2 1/8ODF	156	195	139	5383	4520	4105	3572	4450	3784	440	Four-100

Table 11-2 --- Suction Line Filter-Drier Ratings – Take Apart Models

			Flow Capacity in Tons at Listed Conditions																
			Refrigerant 12					Refrigerant 22					Refrigerant 502						Number & Type
			Evaporator Temperature F																
In^3			40	20	0	-20	-40	40	20	0	-20	-40	40	20	0	-20	–40	Filter Area	Of Blocks
Unit Size	Type Number	Connection Size & Type	Pressure Drop PSI 1	1.5	1	0.5	0.25	3	2	1.5	1	0.5	3	2	1.5	1	0.5	Sq. In.	Req'd
	485	5/8 ODF	3.0	2.1	1.4	.7	.4	5.3	3.5	2.4	1.5	.9	4.3	2.8	1.9	1.2	.6		
	487T	7/8 ODF	3.8	2.6	1.7	.9	.5	6.7	4.4	3.1	1.9	1.1	5.4	3.6	2.4	1.5	.8		
48	489T	1 1/ 8ODF	4.5	3.2	2.0	1.1	.5	8.1	5.3	3.7	2.3	1.3	6.6	4.3	2.9	1.8	1.0	69	One-48
	4811T	1 3/8ODF	5.2	3.7	2.4	1.3	.6	9.4	6.2	4.3	2.7	1.5	7.6	5.0	3.4	2.1	1.1		
	4813T	1 5/8ODF	5.9	4.1	2.7	1.5	.7	10.5	6.9	4.8	3.0	1.7	8.5	5.6	3.8	2.4	1.3		
	967T	7/8 ODF	4.9	3.4	2.2	1.2	.6	8.8	5.8	4.0	2.5	1.4	7.1	4.7	3.2	2.0	1.1		
	969T	1 1/8ODF	6.4	4.5	2.9	1.6	.8	11.5	7.6	5.2	3.3	1.8	9.3	6.1	4.2	2.6	1.4	138	Two-48
96	9611T	1 3/8ODF	7.8	5.4	3.5	1.9	.9	13.9	9.1	6.3	4.0	2.2	11.3	7.4	5.0	3.1	1.7		
	9613T	1 5/8ODF	9.2	6.4	4.1	2.3	1.1	16.4	10.8	7.5	4.7	2.6	13.3	8.7	5.9	3.7	2.0		
144	1449T	1 1/8ODF	6.7	4.7	3.0	1.7	.8	11.9	7.8	5.4	3.4	1.9	9.7	6.3	4.3	2.7	1.5	207	Three-48
192	19217T	2 1/8ODF	11.0	7.8	4.8	2.8	1.4	19.9	13.2	9.1	5.8	3.3	15.9	10.4	7.2	4.6	2.4	276	Four-48
300	30013T	1 5/8ODF	19.7	13.7	8.7	4.9	2.4	35.2	23.1	16.1	10.1	5.5	28.9	18.6	12.6	8.0	4.3	330	Three-100
400	40017T	2 1/8ODF	34.0	23.4	14.9	8.4	4.0	60.5	39.9	27.5	17.3	9.5	49.4	32.2	21.7	13.8	7.4	440	Four–100

Notes:
1. Flow rates are based on 86 degree F liquid refrigerant temperature, 5 degree F saturated temperature, 4.0 lbs./min./ton per R22 and 4.4 lbs./min./ton for R502.
2. Water capacities are based on an end point dryness of 15 ppm for R12, 60 ppm for R22 and 30 ppm for R502.
3. 20 drops of water = 1 gram = 1cc.

Filter-Drier Core

These cores for use with steel replaceable core shells in Table 10-1.

SC-48 Standard Capacity Block

This block provides system protection from water and acids in the majority of general purpose applications. It is used singly or in multiples in shells of 48 through 192 cubic inches.

HC-48 & 100 High Capacity Block

A filter-drier block similar to the SC-48 except with much greater water capacities for critical applications or where system conditions indicate the presence of an abnormal amount of water.

BB-48 & 100 Burnout Block

A filter-drier block possessing water capacities comparable to the high capacity block, and also featuring activated carbon to afford optimum contaminant cleanup following a motor burnout. This ingredient also provides wax and resin control on R-22 and R-502 low temperature applications.

* Water capacities to suit specific system conditions
* Exceptional acid capacities for normal system protection, or to effectively cleanup following a compressor burnout.
* Wax removal capabilities, if desired, for R-22 or R-502 low temperature applications, or for
* Physical dimensions and gasket sets that permit interchangeability with competitive products.

Filter-drier cores provide specific system protection from soluble contaminants – water, acids, waxes – according to the specific application requirements. In addition, they provide filtration capabilities of solid contaminants as small as 25 microns. These replaceable filter-drier blocks are designed for use in liquid line service or for installation in the suction line to obtain the ultimate in burnout cleanup performance.

Table 12-1 --- Capacities

Type Number	Description	Water Capacity --- Drops R-12 75F	R-12 125F	R-22 75F	R-22 125F	R-502 75F	R-502 125F	Case Qty.	Trane Part Number
SC-48	Standard Capacity	774	340	293	223	340	223	12	COR-0018
HC-48	High Capacity	964	558	524	436	558	436	12	COR-0019
BB-48	Burnout Block	775	515	480	400	515	430	12	COR-0020
HC-100	High Capacity	1870	1050	980	810	1050	810	4	COR-0021
BB-100	Burnout Block	1750	1120	1000	810	1110	875	4	COR-0022

NOTE: Water capacities are based on an equilibrium point dryness of 15 ppm for R12, 60 ppm for R22 and 30 ppm for R502 20 drops of water = 1 gram = 1cc.

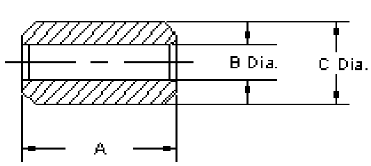
Table 12-2 – Replaceable Filter-Drier Blocks

Filter Drier Block Size	Effective Desiccant Filter Volume	Surface Filter Area	Liquid Refrigerant Capacity R12 75F	R12 125F	R22 75F	R22 125F	R502 75F	R502 125F
48	48 cu. in.	69 sq.in.	33 oz.	30 oz.	30 oz.	27 oz.	31 oz.	27 oz.
100	100 cu. in.	110 sq. in.	50 oz.	45 oz.	45 oz.	41 oz.	47 oz.	42 oz.

Table 12-3 – Replaceable Filter-Drier Block

Filter-Drier Block Size	Dimensions A	B	C	Filter Area	Shipping Weight Lbs. Ea.
48	5½	$1\frac{49}{64}$	$3\frac{23}{32}$	69 sq. in.	1½
100	6½	$2\frac{1}{16}$	$4\frac{13}{16}$	110 sq. in.	4

See installation instructions on page 16.



*** DRIER INSTALLATION**
Remove the failed compressor or motor and any driers before installing the suction line filter drier; any length of suction line between the drier and compressor must be cleaned.

Do not install replaceable core shells in a manner that they can become oil traps, suction line shells installed in the wrong location with the cores removed can trap a lot of oil!

On scroll compressors that are manifolded together there must be **18 inches** between the filter drier outlet and the oil separator tee in the suction line. It is recommended that the oil in the compressor that has not failed be changed. The reasons for this are: (1) the oil must be removed before the oil equalizer line can be connected and (2) the oil on the non-failed compressor is also contaminated if the oil in the failed compressor is contaminated. Scrolls use Trane OIL 15. Refer to IOM literature or HCOM-SB-4F for amount, or for more information on oils.

On unitary heat pumps, the discharge line from the compressor to the 4-way valve should be removed and cleaned. At the same time, the 4-way valve should be inspected for cleanliness. Severe burnouts will contaminate the 4-way valve so badly that it will have to be replaced. If the burn-out is not too severe, the 4-way valve may be acceptable or may be cleaned manually if necessary. The clean-up filter drier should be installed in the suction line between the 4-way valve and the compressor. This is necessary because this short length of line is always a suction line. If the drier is installed on the other side of the 4-way valve, it would be in the hot gas line when the unit is heating mode.

The liquid line drier should always be replaced or one should be installed if there is none to protect the metering device, and to remove moisture.

Consider installing isolation valves so that the refrigerant charge can be isolated from service filter driers on systems that are severely contaminated.

* **BRAZING**
Proper brazing techniques are essential when working on refrigeration systems. The following factors should be kept in mind when forming sweat connections.

When copper is heated in the presence of air, copper oxide forms. To prevent copper oxide from forming inside the tubing during brazing, sweep inert gas, such as dry nitrogen, through the tubing. Nitrogen displaces air in the tubing and prevents oxidation of the interior surfaces. A nitrogen flow of one to three cubic feet per minute is sufficient to displace the air. Use a pressure regulating valve and flow meter to control the flow.

Ensure that the tubing surfaces to be brazed are clean and that the ends of the tubes have been carefully reamed to remove any burrs.

Make sure the inner and outer tubes of the joint are symmetrical and have a close clearance, providing an easy slip fit. If the joint is too loose, the tensile strength of the connection will be significantly reduced. The overlap distance should be equal to the diameter of the inner tube.

Protect components from heat by wrapping with a damp cloth. Also move line insulation and grommets away from the joints since excessive heat can damage these components.

If flux is used, apply it sparingly to the joint. Excess flux will contaminate the refrigeration system.

Apply heat evenly over the length and circumference of the joint. The entire joint should become hot enough to melt the brazing material.

Use brazing materials approved for refrigeration systems. 40 to 45% silver brazing alloy should be used on dissimilar metals.

Begin brazing when the joint is hot enough to melt the brazing rod. The hot copper tubing, not the flame should melt the rod.

Continue to apply heat around the circumference of the joint until the brazing material is drawn into the joint by capillary action, making a mechanically sound and gas-tight connection. Remove the brazing rod as soon as a complete fillet is formed to avoid possible restriction on the inside of the tube.

Visually inspect the connection after brazing to locate any pin holes or crevices in the joint. The use of a mirror is advisable and can make locating leaks easier.

*** LEAK TESTING**

When leak testing the unit, the following safety precautions must be observed:

WARNING! DO NOT WORK IN A CLOSED AREA WHERE REFRIGERANT OR NITROGEN MAY BE LEAKING. A SUFFICIENT QUANTITY OF VAPORS MAY BE PRESENT TO CAUSE PERSONAL INJURY. PROVIDE ADEQUATE VENTILATION.

WARNING! DO NOT USE OXYGEN, ACETYLENE, OR AIR IN PLACE OF DRY NITROGEN FOR LEAK TESTING. A VIOLENT EXPLOSION WILL RESULT WHICH COULD CAUSE SERIOUS INJURY OR DEATH.

WARNING! ALWAYS USE A PRESSURE REGULATOR, VALVES, AND GAUGES TO CONTROL CYLINDER AND LINE PRESSURES WHEN PRESSURE TESTING THE SYSTEM. EXCESSIVE PRESSURES MAY CAUSE LINE RUPTURES, EQUIPMENT DAMAGE, OR AN EXPLOSION WHICH COULD RESULT IN PERSONAL INJURY OR DEATH.

Initial leak test should be performed using dry nitrogen and soap bubbles. Apply it to each joint then visually inspect the joint with a mirror. If a halide torch or electronic leak detector is used and the system is pressurized with refrigerant, reclaim the refrigerant prior to evacuation. If the system is left pressurized with refrigerant, the pressure in the system will change approximately 3 psig with each degree change in ambient temperature.

CAUTION: DO NOT EXCEED 200 PSIG WHEN LEAK TESTING THE SYSTEM.

*** EVACUATION**

For field evacuation, use a rotary-style vacuum pump capable of pulling a vacuum of 100 microns or less.

When hooking the vacuum pump to a refrigeration system, it is important to manifold the pump to both the high and low of the system (liquid line access valve and compressor suction access valve). Follow the pump manufacturer's directions for the proper methods of using the vacuum pump.

CAUTION: DO NOT UNDER ANY CIRCUMSTANCES, USE A MEGOHM METER OR APPLY POWER TO THE WINDINGS OF THE COMPRESSOR WHILE IT IS UNDER A DEEP VACUUM. IN THE RARIFIED ATMOSPHERE OF A VACUUM, THE MOTOR WINDINGS CAN BE DAMAGED.

The lines used to connect the pump to the system should be copper and the largest diameter that can practically be used. Using larger line sizes within minimum flow resistance can significantly reduce evacuation time. Rubber or synthetic hoses are not recommended for system evacuation because they have moisture absorbing characteristics which result in excessive rates of out gassing and pressure rise during standard vacuum test. This makes it impossible to determine if the unit has a leak, excessive residual moisture, or continual or high rate of pressure increase due to the hoses.

An electric micron vacuum gauge should be installed in the common line ahead of the vacuum pump shut off valve, as shown in figure 2. Close valves B and C, and open valve A. After several minutes, the gauge reading will indicate the minimum blank off pressure which the pump is capable of pulling. Rotary pumps should produce vacuums of less than 100 microns.

Open valves B and C, evacuate the systems to a pressure of 500 microns or less. Once 500 microns or less is obtained with valve A closed, a time verses pressure rise should be performed. The maximum allowable rise over a 15 minute period is 200 microns.

If the pressure rise is greater than 200 microns but levels off to a constant value, excessive moisture is present. If the pressure steadily continues to rise, a leak is indicated. Figure 3 illustrates three possible results of time verses temperature rise checks.

Figure 2
Typical Vacuum Pump
Hook-up

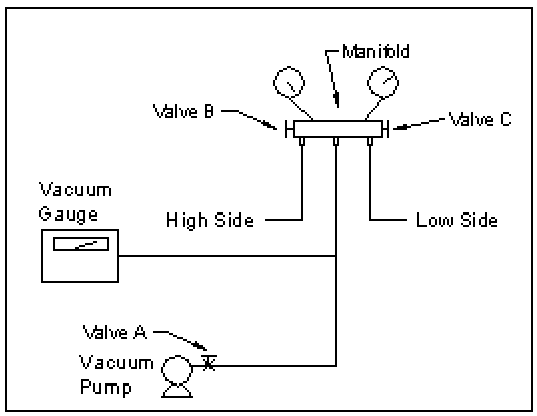
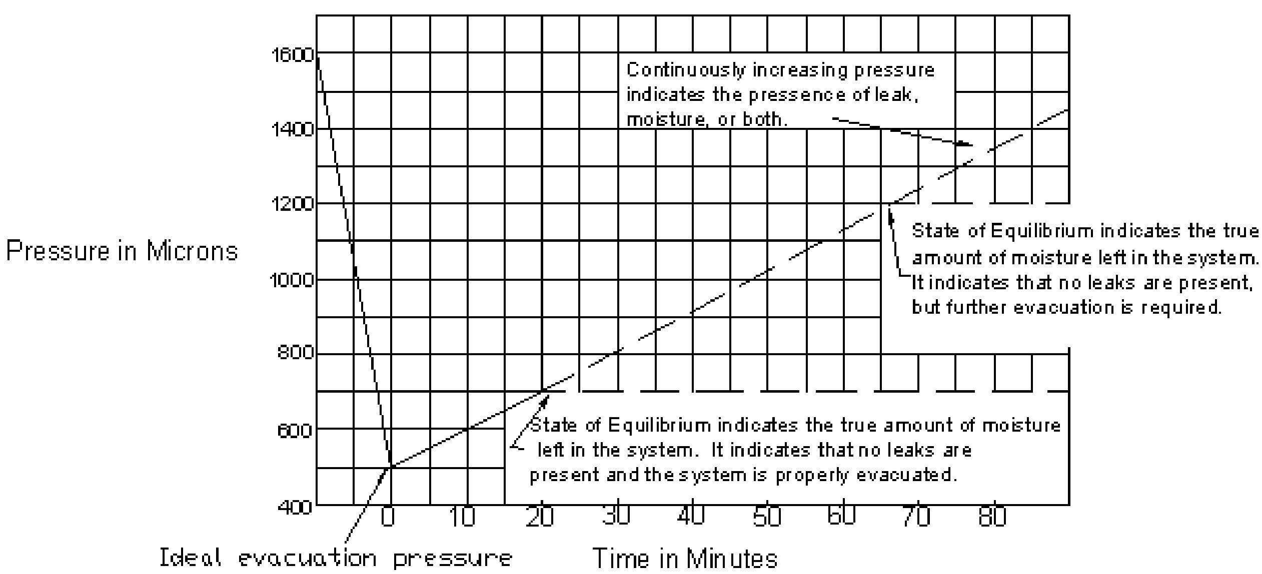


Figure 3
Time-vs-Pressure Rise
After Evacuation



* OBTAINING OIL SAMPLES

Take an oil sample after the first four hours of operation and test it to determine the condition of the system. Oil samples can be taken directly from the oil serviced valves on systems so equipped. On systems without such valves, an oil sample may be obtained by one of the methods shown in figures 4, 5, and 6, only about an ounce of oil is required for the acid test. Figure 4 can be used if the suction line filter drier is installed in a vertical position with a pressure tap installed at the outlet, a sufficient amount of oil may be obtained for acid testing. Be sure to purge the remaining oil from the trap, in order not to contaminate the next sample. Figure 5 illustrates the use of oil sample tube that can be installed on the bottom of the suction line, again be sure to purge the remaining oil from the tube in order not to contaminate the next sample. Figure 6 uses items readily available in the field, and can be connected to the suction and discharge lines with a service manifold. When the oil level is visible in the sight glass, isolate the trap and drain off the oil sample.

Figure 4

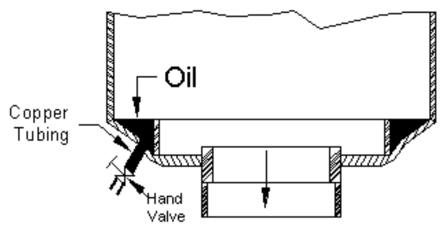


Figure 5

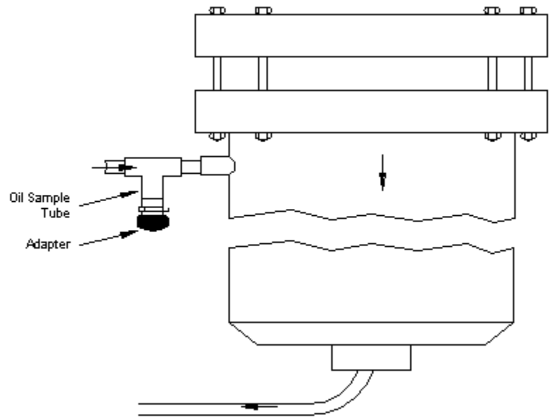
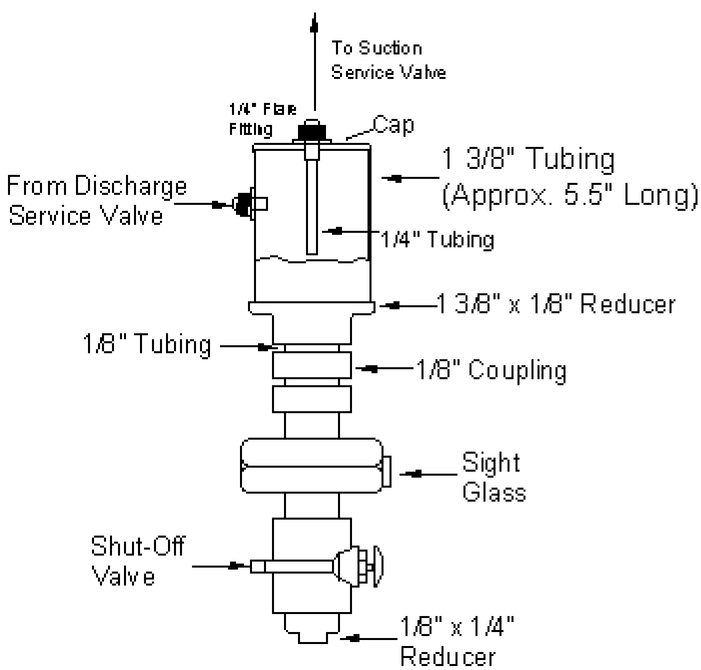


Figure 6



* SYSTEM CLEANUP

Once the system is operational it must be monitored to determine when it is clean. In all of the tests conducted, the systems were cleaned within 24 hours of operation. Some were cleaned within the first two or three hours, consequently, it is conservative to say that the drier has completed its job after 48 hours of operation.

On an extremely severe system burn-out, where there is considerable sludge in the system, the drier cores may become plugged. Pressure drop readings across the cores will be an indication of plugging. If the pressure drop exceeds 16 to 20 pounds during clean up, the drier core is plugged enough to warrant replacement.

Severely contaminated systems should be checked after four hours of operation. Change the drier cores and the oil at this time; this will speed up the cleaning process. Check the system next after 8 hours of operation and test the oil for acid at this time. Continue to check the system, doubling the run time each interval, until the system is clean. When the system is clean, replaceable suction line cores and/or shells should be removed.

Many systems use permanent suction and liquid line driers that may be left in the system if the pressure drop is not excessive. Packaged units typically can stand higher pressure drops than split systems the internal piping has so little pressure drop. In any case, if the drier pressure drop is effecting system operation, it should be changed or removed.

For systems that do not have oil service valves and use permanent filters, the oil samples can be obtained and tested. Changing the oil and driers on these systems is difficult. Testing the oil to see if the system is clean is practical. If the initial drier did not clean up the system, change the driers until it is clean.

Repeat Compressor Failure Clean Up

Special attention must be given to systems that have had repeat compressor failures. Acids and moisture attack all the materials in the system, motor insulation, drier cores, and metal. The broken compressor parts that may be loose in the system generate filings. The contamination in the system is like a fine powder. Changing oil and drier cores repeatedly is the only way to clean up the system. Many times the cause of the failure has been eliminated but a repeat failure is the result of improper clean up.

* MOISTURE INDICATORS

Moisture in the system should be removed during the evacuation process. Moisture indicators take a minimum of 12 hours after installation to determine system moisture content. Systems that are severely contaminated can damage the moisture indicator; if this is the case, the indicator should be replaced or removed.