INSTRUCTION MANUAL

FREEZE DRYER 8

MODEL 75040, 75040-01

S/N 167389

Cat H

RCD March 87 on Special Allocation Funds

LABCONCO CORPORATION, 8811 PROSPECT, KANSAS CITY, MO. 64132, 816—333-8811

Dear Customer:

This letter is to insure that you get the best performance from your new Labconco product. We want to be sure you are satisfied. If damage has occurred in shipping, the customer must file a claim with the carrier IMMEDIATELY! DO NOT return any items to Labconco Corporation without written authorization from the factory. Your local laboratory apparatus dealer can assist you, and should be contacted if problems occur. If satisfaction is not obtained, contact Labconco Corporation.

A great deal of care has gone into the engineering, production and ultimate quality control of your Labconco product. That is why we affix this badge to our products. Your satisfaction is of great concern to us.

We know that even the best products require service from time to time. So if this is ever true of your Labconco product, call the service department of the dealer from whom you purchased the unit. He is trained to make whatever might be wrong with the unit right. If you need additional help, call us at (816) 333-8811 and ask for our Service Manager. We will make sure that you get all the help you need.

We suggest you keep all of this material together. It's nice to know you are protected, even though you may never need it.

Sincerely,

LABCONCO CORPORATION

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INTRODUCTION TO FREEZE DRYING

The Freeze Drying Process

Dehydration is an important process for the preservation and storage of biologicals, pharmaceuticals, and foods. Of the various methods of dehydration, freeze drying (lyophilization) is especially suited for substances that are heat sensitive. Other than food processing (e.g., coffee, whole dinners), freeze drying has been used extensively in the area of pharmaceuticals (e.g., antibiotics) and biologicals (e.g., proteins, plasma, viruses, and microorganisms). The nondestructive nature of this process has been demonstrated by the retention of viability of freeze dried viruses and microorganisms.

Freeze Drying is a process whereby water is removed from frozen materials by converting the frozen water directly into its vapor without the intermediate formation of liquid water. The basis for this sublimation process involves (1) the absorption of heat by the frozen sample in order to vaporize the water, (2) the use of a vacuum pump to enhance the removal of water vapor from the surface of the sample, (3) the transfer and deposit of the water vapor onto a condenser, (4) the removal of heat, due to ice formation, from the condenser by means of a refrigeration compressor or a dry ice solvent bath. In essence the freeze drying process depends upon a balance between the heat absorbed by the sample to vaporize the water and the heat removed from the condensor to convert the vapor into ice.

Freeze Drying Rates

The efficiency of the freeze drying process is depended upon (1) the surface area and thickness of the sample, (2) the condensor temperature and vacuum obtained, and (3) the melting temperature and solute concentration of the sample. These factors will be helpful in the efficient utilization of your freeze dryer unit. A listing of selected materials and their drying times are shown below for your reference.

SAFE TEMPERATURE AND DRYING TIMES
FOR SELECTED MATERIALS

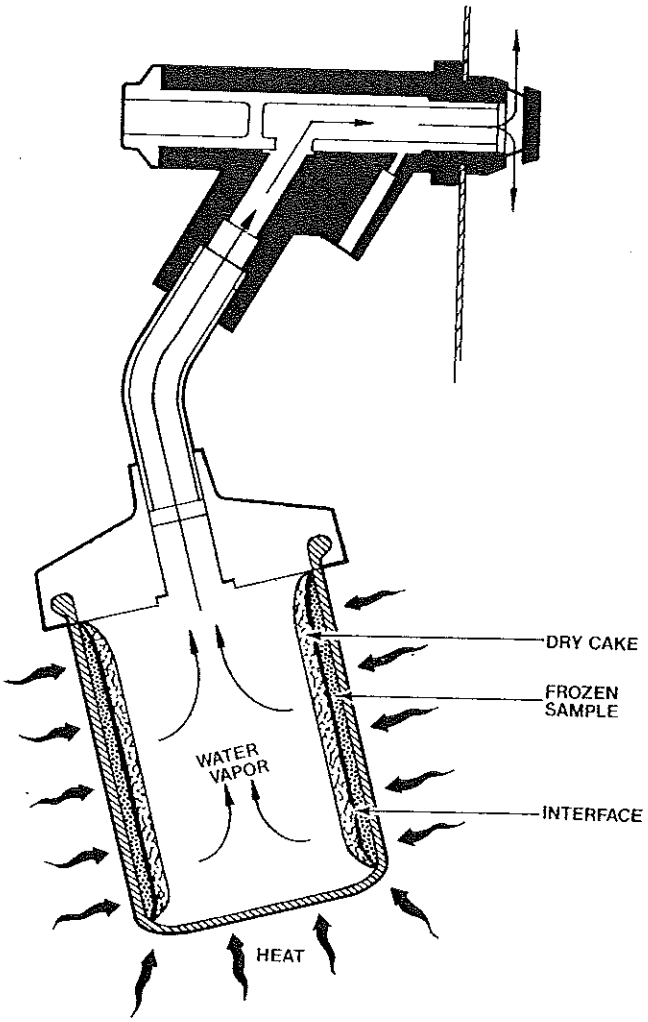
MATERIAL 10MM THICK	SAFE TEMPERATURE °C	CONDENSER TEMPERATURE °C	HOURS (APPROX)*
Milk	−5	−40	10
Urea	−7	−40	10
Blood Plasma	−10 to −25	−40	16
Serum	−25	−40	18
Vaccinia	−30 to −40	−50	22
Influenza Vaccine	−30	−50	24
Human Tissue	−30 to −40	−50	48
Vegetable Tissue	−50	−80	60

*Total sample quantities are contingent on various freeze dryer capacities.

Surface Area and Thickness Of the Sample

Up to the point of overloading the system, the greater the surface area of the sample, the greater the rate of freeze drying. By contrast for a given surface area, the thicker the sample the slower the rate of lyophilization. This is based upon the fact that the heat of sublimation is usually absorbed on one side of the frozen sample and must travel through the frozen layer to vaporize water at the other surface. In addition, if the sample is lyophilized the water vapor must travel through the layer of dried material. The thicker the sample, the greater the chance that the dried layer can collapse which would cause an additional decrease in the rate of freeze drying.

The surface area and thickness of the sample can usually be ignored when each sample only contains a few milliliters. However, for larger volumes, the samples should be shell frozen to maximize the surface area and minimize the thickness of the sample. Sample volume of the lyophilizer flask should be two times the volume of the sample.



Condenser Temperature and Vacuum Attained

In order for lyophilization to occur, the water vapr at the surface of the frozen sample must be removed. This is accomplished by a condenser and the vacuum pump. The condenser which should be at least 10 to 15 degrees C. colder that the eutectic temperature (melting temperature) of the sample, serves to trap the water vapor as ice. Since the vapor pressure at the condenser is less than that of the sample, the net flow of water vapor is from the sample to the condenser. While this vapor diffusional process could occur very slowly in air, a good vacuum is essential to maintain a sufficient diffusional rate. In most applications the maintenance of a vacuum of 100 microns or less is required for freeze drying to occur; in general, a vacuum of 20-30 microns will be obtained.

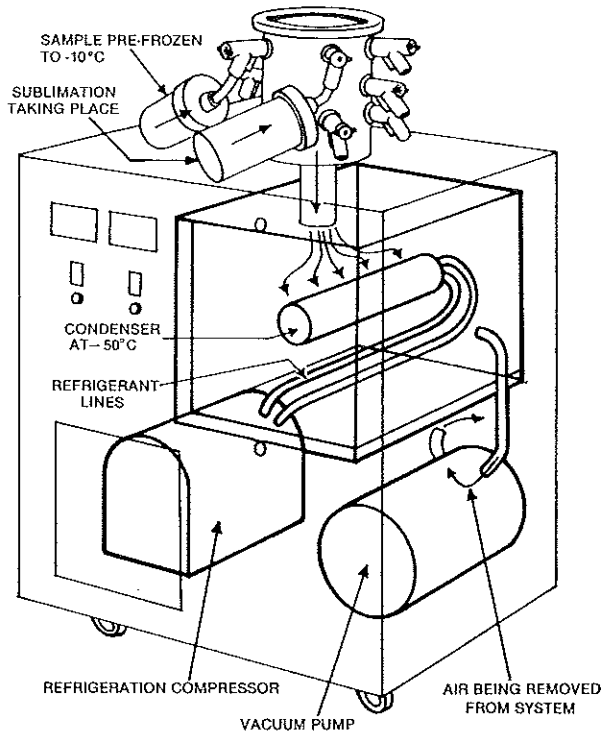
CAUTION: Since most but not all of the vapors will be trapped by the condenser, the vacuum pump ballast must always be open a small amount in order to allow the vapors to be removed from the pump oil.

Melting Temperature and Solute Concentration of the Sample

The rate of lyophilization is directly proportional to the vapor pressure and the vapor pressure is dependent upon both the eutectic temperature and solute concentration of the sample. For example, a solution of sodium chloride would lyophilize at a slower rate than pure water. The eutectic temperature of a sodium chloride solution is about -21°C. and at this temperature the vapor pressure of pure water is about 1/16 that at 0°C. Although the eutectic temperature is not dependent upon the concentration of sodium chloride, the vapor pressure of the water would decrease as the concentration of sodium chloride increased. This is due to the fact that as the solute concentration increases, less of the surface area of the frozen sample is occupied by water. In general most solutions or biological samples will have a eutectic temperature of -10 to -25 degrees C. However, if there is a simple sugar such as glucose or if the sample is animal or plant tissue, the eutectic temperature may be as low as -30 to -50°C.

Capacity of Freeze Dryers

The volume of a sample (capacity) that can be freeze dried at one time is related to the factors discussed previously and the size and design of the freeze dryer. With any given instrument, the capacity is based upon (1) the surface area of the frozen sample, (2) the eutectic temperature of the sample, (3) the concentration of the sample, and (4) the rate and amount of heat transferred to the frozen sample. Of these factors, the eutectic temperature is the most important in determining the amount of sample that can be lyophilized at one time, particularly when flasks are used. This is because, as the eutectic temperature decreases, the vapor pressure decreases whereas the rate of the heat absorption by the sample does not decrease. This tends to promote melting of the sample which leads to a marked increase in vapor pressure and ultimately overloads the condenser and vacuum pump. Samples that have eutectic temperatures of -20° C. or lower should be placed on the freeze dryer one flask at a time so as to allow the vacuum of the system to recover before placing another sample on the machine. If the vacuum does not recover to less than 100 microns, the capacity of the freeze dryer has been exceeded and the sample should be removed. If there is a problem with a particular type of sample melting when placed on the freeze dryer, dilution of the sample with more water or providing some insulation around the flask to decrease the rate of heat absorption by the flask may help. If the eutectic temperature of the sample is -40 to -60° C., the freeze dryer must be equipped with a cascade type of refrigeration system so that the condenser temperature can be cooled to below -80° C.



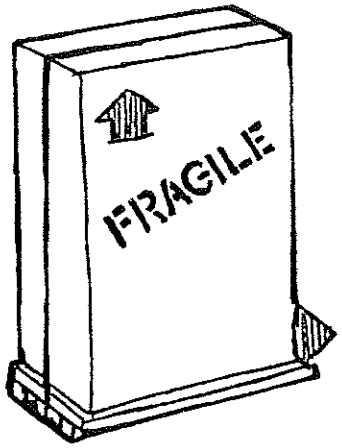
Samples Contain Additional Volatile Substances

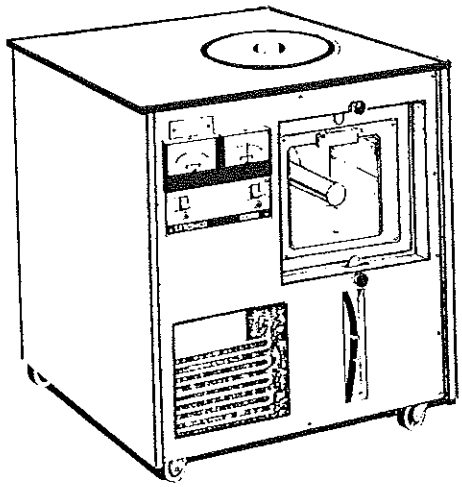
In certain cases the solvent used for freeze drying a sample, in addition to water, may contain another volatile component; (e.g., acidic acid, formic acid or pyridine). In addition to these substances having an effect on the eutectic temperature, they may enhance the vapor pressure at the surface of the sample. Also, compared to water, they will all require the absorption of less heat for sublimation to occur. Hence, freeze drying samples that involve the sublimation of an additional substance will have a greater tendency to melt, particularly when placed in flasks or exposed to room temperature. If a sample containing an additional volatile substance tends to melt when placed on a freeze dryer, dilution of the sample with more water may help keep a sample frozen; for example, a 0.2 M solution of acidic acid is much easier to lyophilize than a 0.5 M solution.

Installation

Your laboratory freeze dryer unit has been shipped to you in one carton (optional equipment has been packaged separately).

Be sure to inspect the freeze dryer thoroughly prior to installation. Report any damage that may have occurred in transit.





Installation Factors

Once you have completed the unpackaging of your Labconco Freeze Dryer unit, check for any internal freight damage that may have occurred during transit. Once this is completed, you should also check the refrigeration components prior to installation and operation.

Check the refrigeration components as follows:

1. Inspect all refrigeration components for visible damage and check the condenser fan to insure unobstructed operation. Observe pre-rotation on the fan blade when the refrigeration side is switched on.

WARNING: Disconnect the freeze dryer unit from the main power supply connection before inspection and maintenance procedures are performed on the unit.

2. Locate the freeze dryer unit in an area that provides an unobstructed flow of air around the cabinet. This air acts as cooling air to the refrigeration system. The refrigeration system draws the air through the grill on the front panel and exhausts it out through the back. A minimum of 3" must be allowed between the freeze dryer unit and the wall surface, of the openings on the cabinet while the unit is in operation, as the performance will be adversely affected. Periodically remove any dust from the front grill and condenser to maintain optimum performance.

3. A vacuum pump with a rated capacity of at least 100 liters per minute is required to operate your freeze dryer unit properly. The unit itself is provided with a ¾" I.D. heavy wall vacuum hose for connection between your vacuum pump and the freeze dryer unit refrigeration system. Place the vacuum pump itself on the movable shelf internal to the freeze dry cabinet and secure to the vacuum hose with the enclosed hose clamp.

WARNING: Do not allow the vacuum hose to kink when it is installed. If the hose is too long for the vacuum pump that you have selected, cut the hose down to a suitable length prior to installation.

Start Up An Initial Check-Out

Before nominal everyday usage of your freeze dry unit begins, a functional check of the refrigeration system should be performed to insure proper operation of the machine.

The check list of steps required for this procedure are as follows:

1. Clean the rubber gasket on the clear, acrylic condenser chamber closure to remove dirt and other contaminants that could be a source of vacuum leakage. As a rule, vacuum grease is NOT required to obtain a vacuum. If vacuum grease is used, the procedure should be as follows:
   A. Clean both surfaces with a soft cloth or paper towel to remove old vacuum

grease and/or dirt that may have accumulated.

B. Apply a very thin film to one surface only.

C. Use a soft cloth or paper towel to wipe off all excess grease.

1. Wipe the interior of the condenser chamber with a soft cloth or paper towel to remove any moisture that may have accumulated during transit. Reposition the acrylic cover on the unit, when this is complete.

2. Check the drain line of the condenser chamber to insure that the line has its plug in place and is free of moisture.

3. Install accessories, (ie. manifold and/or chamber), to the base unit as required.

4. Connect your freeze dryer to a power supply. Locate the control switch marked REF, on the front of the cabinet. Turn the switch to the on position. Allow the condenser unit to reach a temperature of -40° C. or lower.

5. Locate the control switch marked VAC on the front of the cabinet. Turn the switch to the on position and wait until the vacuum pump pulls a system pressure of 25 microns or lower to assertain that there are no vacuum leaks in your system.

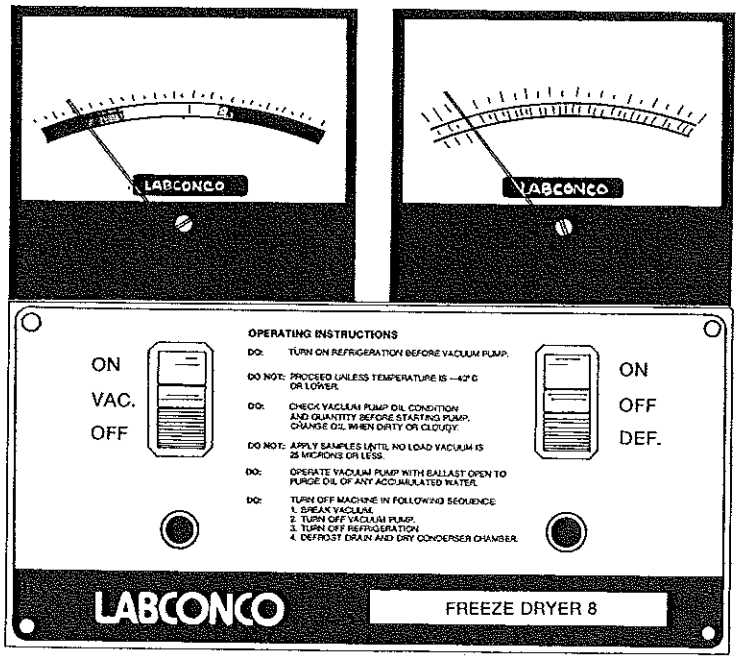
NOTE: All performance ratings represented in this manual are given for an ambient condition of 21° C/70° F at the rated voltage and 60 Hz electrical service.

Normal Operation

Once you have gone through the initial installation and check list for your freeze dry unit and have ascertained that it is in proper working condition, you are now ready to proceed with the actual operation of the equipment.

The operating instructions for the unit are printed on the freeze dryer switch plate located on the front panel of the cabinet and also here for your review.

Follow the steps as listed on the switch plate each time you use the unit for overall optimum performance.



Freeze Drying - Manifold Drying Procedures

1. Pre-freeze samples. Appropriate containers for freeze drying include ampules, serum bottles, and wide-mouth freeze drying flasks. Proper sample container size should always be no more than two times the sample size. Examples: 150 ml samples should be prepared in a 300 ml container, a one liter sample should be prepared in a two liter container, etc. Shell-freezing of samples is recommended. Shell-freezing is accomplished by rotating or swelling the liquid sample during the pre-freezing process. Rotating or swelling action distributes the frozen sample into a thin shell over the internal surface of the container.

2. Connect the pre-frozen samples one at a time to a vacuum valve on your manifold assembly. Although samples can be connected to any size valve, a small (½") vacuum valve is generally used for samples less than 150 ml. The large (¾") valve can be used for either small or large samples. After connecting pre-frozen samples to a vacuum valve, turn the plastic valve knob to the "VAC" position to open the valve (Figure B), shown on page 15.

3. Allow the system pressure to return to a vacuum of approximately 100 microns or less before adding additional samples to the unit. Any combination of valves and sample sizes may be used at one time. Provided the system vacuum remains sufficiently low to prevent meltback and the condenser temperature remains below -40° C.

4. Ambient temperature plus water vapor in the room condensing on the outer surface of a sample container will usually supply sufficient heat for rapid sublimation of your material.

   Samples containing salts and/or sugars with depressed freezing points may tend to meltback, and require insulation from room heat.

5. When all the frost has disappeared from the outer surface of the sample container and no cold spots can be detected by handling the container, the sample is nearly dry. To be certain of low final moisture content, dry the sample for several more hours past this point.

6. To remove a flask after drying is complete, turn the plastic knob on the vacuum valve, to the closed position ("VENT"). Should you desire to backfill with nitrogen gas or other types of material, this can now be accomplished at this time by connecting through the vent port on the valve as shown in Figure B.

7. Ampules may be flame sealed while connected to a vacuum valve by using a sealing torch. The oxygen/natural gas torch is recommended for the borosilicate glass ampules.

   For ampules with short stems, it will be necessary to place an insulation material between the vacuum valve and the torch flame to prevent any damage to the rubber valve structure.

Freeze Drying - Bulk Drying Procedures

The inside area of the combination, bulk, and/or other drying chambers (see Labconco catalog) may be used to bulk freeze dry large pre-frozen volumes of material in trays, or for processing samples in containers such as serum bottles, Petri dishes and/or beakers.

Defrosting

Frequent defrosting of the condenser on your freeze dry unit is recommended to keep the defrost times short and your unit's efficiency at its peak. The following steps should be used in defrosting your freeze dry unit.

WARNING: If acid has been used as part of the sample, flush out condenser with cold water before defrosting. This will keep acid(s) from attacking the materials used in the condenser chamber.

1. Release the vacuum inside the condensor chamber by using either a valve or the drain line connection.

2. Turn off refrigerator system and the vacuum pump.

3. Place the condenser drain hose in a suitable container for the accumaultion fo the moisture that will be removed from the condenser.

4. For rapid defrost, turn the REF./OFF/DEF. switch to the defrost position. Allow the condenser to defrost a minimum of 30 minutes. After the bond between the ice and the condenser is broken, remove the ice intact and turn the switch to the "OFF" position.

WARNING: Do not attempt to chip ice off the condenser, as serious damage to the refrigeration system may result.

5. If the rapid ice removal is not desired, the frozen condensate may be allowed to melt and drain out through the drain line at room temperature.

6. The condenser chamber should be flushed with water after each defrosting. This flushing cleans out any material that may have collected on the walls of the condenser chamber and should be wiped dry prior to going back into normal operation again.

7. Replace the drain line plug when the draining of the condenser chamber has been completed.

Routine Maintenance

Cabinet Maintenance

1. Moisture in the vacuum pump and insufficient pump oil are major causes of poor performance of freeze drying equipment. Frequently check the pump oil for signs of water or low oil level. To expel small amounts of water which may accumulate in the pump oil, it is advisable to occasionally operate the pump against a dry, tight system with the gas ballast open.

WARNING: Evidence of mercury or other contaminants in the vacuum pump will void warranty.

1. If the oil in your vacuum pump contains excessive moisture, it will be necessary to change the oil. For further information in regard to exact procedures of changing the vacuum pump oil, refer to the vacuum pump manufacturer's instructions.

2. All rubber parts on your freeze dryer unit will eventually deteriorate and will require replacement. The effective life of rubber parts will depend upon both their usage and the surrounding environment. It is recommended that all rubber hoses and gaskets be checked frequently and replaced when signs of hardness, permanent set, or deterioration occur.

3. To clean the acrylic cover, wash with a non-abrasive soap or detergent and water, using the bare hand to feel and dislodge any dirt. A soft grit-free cloth, sponge, or chamois may be used. The cloth or chamois may be kept free of grit by rinsing frequently in clean water. Dry with a clean, damp chamois prior to reinstallation. Hard, rough cloths will scratch. Where water cannot be used freely, dust very lightly with a soft cloth or feather duster.

4. To clean the exterior of your freese dryer cabinet, wash with a non-abrasive soap or detergent and water. Liquid spray cleaners and polishes may be used. Do not use solvents to remove the stains from the cabinet finish as the finish may be damaged.

Vacuum System Leak Detection

The Labconco Freeze Dryer can achieve an ultimate vacuum of 25 microns of mercury (10 x 10^{-3} Torr.) or lower under a no-load condition. In order to achieve sufficent vacuum, it is necessary that all joints and connections be tight, that the vacuum pump is operating properly and that the condenser refrigeration temperature is -40° C or lower. If the Freeze Dryer does not obtain a satisfactory vacuum, the following procedure should be used to locate and correct vacuum system problems:

1. General Connections

   A. Make sure vacuum gauge is working properly, that there are no leaks in the connecting line, and that the system is dry.

   B. Check vacuum pump oil sight gauge for oil condition. Replace the oil if it is dirty or cloudy. Add oil to the pump if the level is low. Close the pump gas ballast valve. (See vacuum pump manufacturer's instructions for additional information.)

   C. Remove or isolate the drying chamber from the vacuum connection. Where applicable, plug or stopper the 3" vacuum connection using a rubber gasket with a back-up plate of metal or plastic. (A convenient acrylic plug is available for this purpose--Labconco Part No. 76426.)

   D. Turn on vacuum pump. If the vacuum pump is less than 25 microns, the leak was in the drying chamber. Clean and lightly grease gasket of drying chamber and check all valves and make sure they are clean, and fully closed. Reconnect the

chamber to the Freeze Dryer and turn on the vacuum pump. If unable to achieve sufficient vacuum, contact your dealer representative or if satisfaction is not obtained there, contact Labconco Corp. directly. If vacuum leak was not in the drying chamber, proceed to the next step.

E. Plug the vacuum line that connects the vacuum pump to the condenser chamber. The plug isolates the vacuum pump and connecting hose from the condenser chamber.

F. Turn on the vacuum pump and observe the vacuum gauge. The pressure should drop to approximately 5 microns immediately. If the vacuum is sufficient, the vacuum pump and hose connection is not the source of the leak, the leak is therefore located in the condenser chamber, and you should proceed to Step W. If the vacuum is not sufficient, the leak is in the vacuum pump or connecting hoses and you should proceed to Step 2.

2. Vacuum Pump Connection

A. Turn off the vacuum pump and vent the vacuum.

B. Disconnect the vacuum hose connection at the pump and connect the vacuum gauge directly to the pump inlet. A gauge-to-pump connection can be made by boring a small rubber stopper to accept a gauge connection (usually ⅜" or ¼" metal or glass tubing), and inserting the stopper in the pump inlet. Grease lightly all connections with silicone vacuum grease at this time.

C. Turn on the vacuum pump. The pressure should drop to approximately 5 microns or lower immediately. If not, the pump is defective. If the vacuum is sufficient then the leak is not in the pump itself, but is in the hose connections between the pump and the condenser chamber.

D. Disconnect the vacuum hose and vacuum gauge connections inside the cabinet and lightly regrease the joints with silicone vacuum grease. Reconnect the joints themselves using the hose clamps and retest.

3. Condenser Chamber

A. Check the seal on the condenser chamber closure gasket. Wipe seal clean with a soft cloth and inspect the gasket for cracks, tears, or indentations. If the gasket is found to be in good condition, regrease seal with a very thin, silicone vacuum grease and reinsert on the closure lid itself. Inspect the vacuum lines for cracks and tighten all clamps. Check tightness of all nuts and screws on the condenser chamber area and check all welded connections for cracks or leaks.

B. Turn the refrigeration system on and allow the unit to reach temperature (-40°) C. Turn on the vacuum pump. The vacuum should drop to 25 microns or lower within 20 minutes if the leak has been corrected. For additional assistance, contact your dealer service representative or if satisfaction is not obtained, contact Labconco Corp. directly.

Refrigeration System Leak Detection

Should repair of any refrigeration component be required, contact a laboratory supply dealer immediately. If satisfaction is not obtained through the dealer service network, please contact Labconco Corp. directly. Repairs should only be undertaken by a competent refrigeration technician or through an authorized Labconco service agency.

1. Performance
   Under a no-load condition (dry, water vapor condenser without ice and a vacuum of 25 microns or lower) the water vapor condenser temperature will reach -40° C or lower depending upon ambient temperature and humidity. If the temperature does not reach --40° C. within 20 minutes, the system is not functioning properly.
   Should you detect that your system is not functioning properly, refer to the trouble shooting chart, refrigeration system and electrical schematic for problem solving and construction details on your specific Freeze Dry unit.

Instrumentation

The instrumentation on your Freeze Dry unit consists of a thermocouple temperature indicator

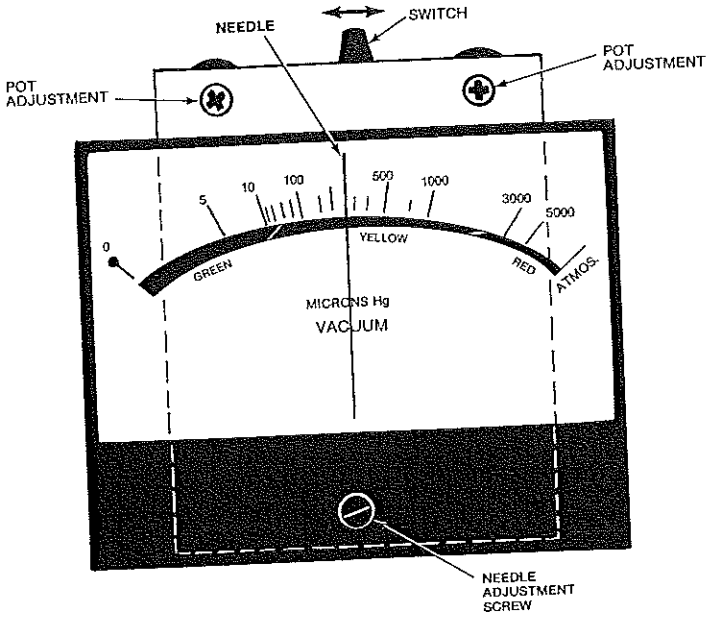
for the water vapor condenser and a vacuum gauge for vacuum indication on the total system. Repair and maintenance suggestions on both of these two indicators are as follows:

1. Thermocouple Temperature Gauge
   The thermocouple is iron constantan and is located on the water vapor condenser coils. The gauge is a dual-scale (°F and °C) indicating meter. Erratic temperature indication, high temperature indication, or fluctuation of the indicating needle is possibly due to a loose connection in the thermocouple circuit.

CAUTION: Prior to checking loose connections on your thermocouple gauge, disconnect the main power to the Freeze Dryer unit. Check to see that the lead connections on the back of the meter are clean and tight. Also check to see if the thermocouple is making positive contact on the refrigeration coil. Failure of the meter to show any change in temperature is an indication of a damaged meter.
Repair of a damaged meter is not feasible and the meter must be replaced. Continuous indication of a temperature at or near room temperature is an indication of either an open or short circuit in the thermocouple wire.

2. Electronic Vacuum Gauge
   The electronic vacuum gauge Figure A does not require mercury for operation. This vacuum gauge operates on a thermal principle and because of this, it is effected differently by different gases, therefore any particular reading will depend upon the gas components being measured. The gauge itself will measure condensables as well as non-condensable gases. The principle advantage of the electronic vacuum gauge is its ability to give a continuous indication of the relative vacuum conditions. The gauge is not as absolute as the mercury McLeod gauge, and therefore a difference in indication between those two measuring devices is to be expected and should not be construed as an inaccuracy on the part of either, but merely a normal difference between two types of measuring systems.

   Although the electronic vacuum gauge requires no routine maintenance, should adjustment for calibration become necessary, please consult Figure A for instructions.



Electronic Gauge
Figure A

Method Of Adjustment Is As Follows

1. With power OFF and unit under atmospheric conditions, turn the needle adjustment screw so needle is on line with atmosphere mark.
2. Turn power to gauge "ON."
3. The switch is a TWO position switch. Positioning the switch will cause the needle to be in either the "zero" or the "atmos" side of the meter.
4. Adjust the pot on the side TOWARD which the switch is positioned to achieve "zero" or "atmos" reading.
5. Place switch in alternate position and adjust the other pot for "atmos" or "zero" reading.
6. Repeat steps 4 and 5 for fine adjustment.
7. If last adjustment was for "atmos" reading, unit is ready to use. If adjustment was for "zero" reading, place switch #1 in alternate position to obtain "atmos" reading. Unit is now ready to use.

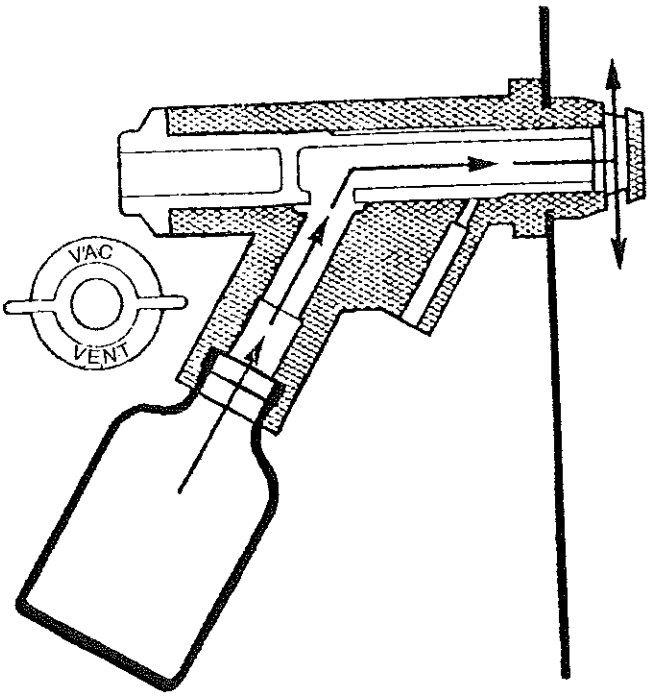
NOTE: Switch must be in "atmos" adjustment position for normal operation.

Vacuum System Trouble Shooting

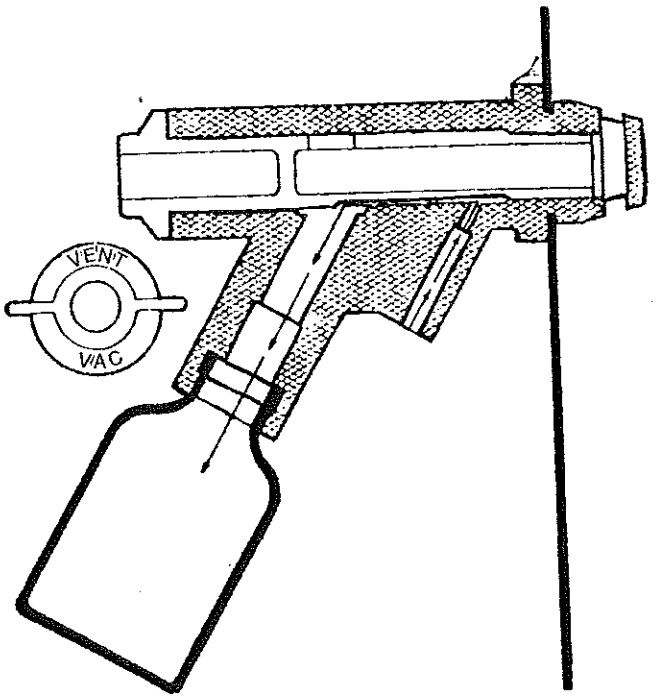
PROBLEM	CAUSE	CORRECTIVE ACTION
1. No Vacuum	a. Pump not on	a. Turn on pump
	b. Pump not connected to vacuum system	b. Connect vacuum connection to pump outlet.
	c. Water vapor condenser drain open	c. Install plug in open end of drain line
	d. Break or opening in vacuum lines	d. Locate and correct
	e. Vacuum valve open	e. Close all valves ("vent" up position)
2. Very poor vacuum (pressure of 200 microns .2 Torr or higher)	a. Vacuum pump oil level low	a. Add vacuum pump oil to proper level
	b. Excessive moisture in vacuum pump oil	b. Replace pump oil
	c. Vacuum leaks in line	c. Locate and repair leaks. Apply silicone vacuum grease to connections and secure with hose clamps.
	d. Vacuum leaks in condenser and drying chamber gaskets	d. Locate and repair leaks. Apply silicone vacuum grease to gaskets.

Refrigeration System Touble Shooting

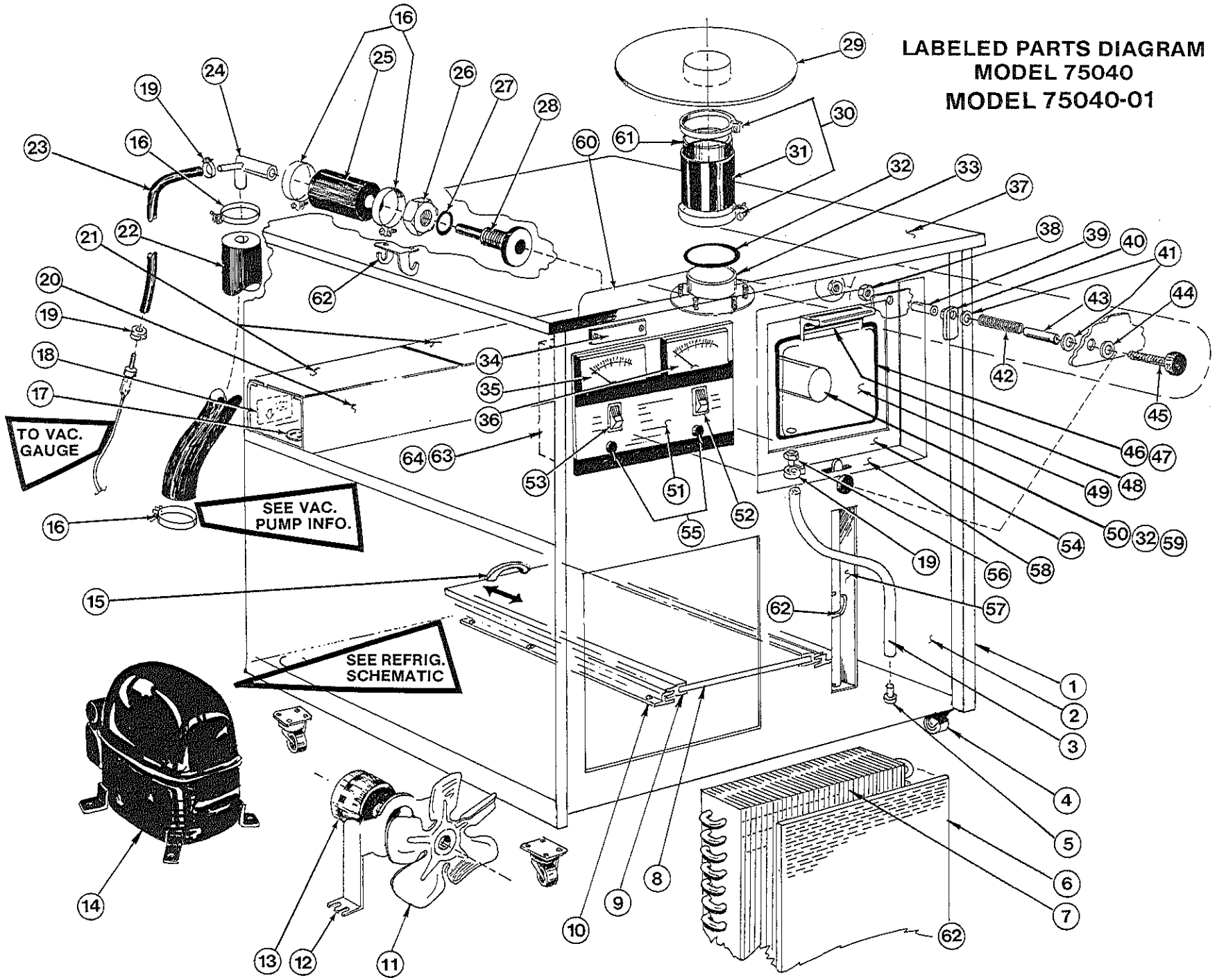
PROBLEM	CAUSE	CORRECTIVE ACTION
1. Refrigeration system does not start.	a. Unit not plugged in.	a. Plug into 115 V, 60 Hz, 20 amp service, or 220 V, 50 Hz, 15 amp service, depending on specific model.
	b. Fuse blown.	b. Replace defective fuse.
	c. Defective off/on switch.	c. Replace switch.
	d. Defective internal wiring.	d. Locate and replace defective wire.
2. Refrigeration system starts but shuts off.	a. Low voltage to unit.	a. Determine reason and correct.
	b. Defective voltage to unit.	b. Replace protector.
	c. Excessive suction.	c. Determine reason and correct.
3. Shelf temperature too high.	a. System low in refrigerant.	a. Locate and repair leak, evacuate, recharge.
	b. Excessive load.	b. Reduce load.
	c. Restrictions in cooling air.	c. Locate and remove obstruction, clean refrigerant condenser.
	d. Excessive ambient temperature.	d. Reduce ambient temperature.



With valve in VAC position, freeze dry containers are directly connected to the vacuum system.



Turn to VENT position and your container is disconnected from the vacuum system and automatically connected to the vent port which gently bleeds air to release the vacuum in the container. The vent port may also be used in conjunction with glass or polypropylene drying tubes to introduce sterile air or dry nitrogen.


LABELED PARTS DIAGRAM
MODEL 75040
MODEL 75040-01
TO VAC. GAUGE
SEE VAC. PUMP INFO.
SEE REFRIG. SCHEMATIC

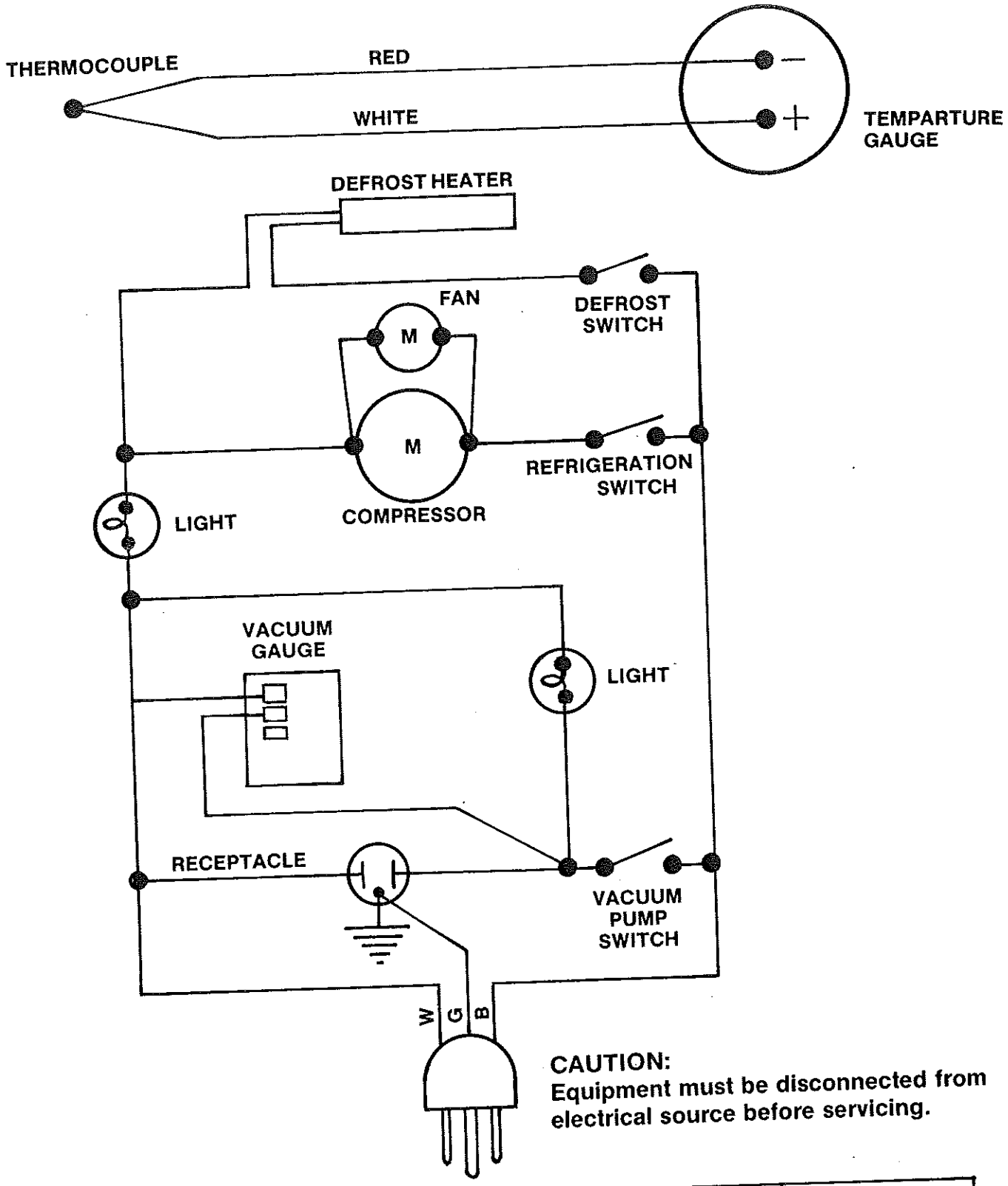
REPLACEMENT PARTS

PART NO. 75040 8 LITER

PART NO. 75040-01 8 LITER

ITEM NO.	DESCRIPTION	MODEL NO. 75040 PART NO.	75040-01 PART NO.
1	Cabinet Frame	77123	
2	Front Panel	77122	
3	Drain Tube	76241	
4	Caster	19414	
5	Drain Plug	14283	
6	Front Grille	76860	
7	Condenser Coil	14710	
8	Shelf	76864	
9	Track-Shelf	76854	
10	Track-Base	76853	
11	Fan Blade	14528	14530
12	Bracket-Fan Motor	13439	
13	Fan Motor	12058	12061
14	Compressor	14685	14696
15	Handle	18712	
16	Hose Clamp	19676	
17	Receptacle	12811	12812
18	Label-Outlet	77107	
19	Hose Clamp	14884	
20	Wire Channel	77102-01	
21	Channel Cover	77103-01	
22	Tube-Rubber	76244	
23	Tube-Rubber	76242	
24	Tee	77111	
25	Tube-Rubber	76324	
26	Nut	19094-36	
27	"O" Ring	16432	
28	Vacuum Fitting	76858	
29	Adaptor Plate	75110	
30	Hose Clamp	19669	
31	Tube-Rubber	76352	
32	"O" Ring	16440	
33	Deflector Assembly	77152	
34	Control Cover	77105	
35	Vacuum Gauge	76815	
36	Temperature Gauge	19509	
37	Top	76929	
38	Nut	19069-21	
39	Tube Spacer-Short	77101-01	
40	Door Clamp	77148	
41	Washer-Metal	19110-16	
42	Spring	19957	
43	Tube Spacer-Long	77101	
44	Washer-Nylon	19958	
45	Knob	76835	
46	Door Gasket	16434	
47	Adhesive-Door Gasket	15763	
48	Handle	76841	
49	Door	76843	
50	Evaporator	77124	
51	Instruction Plate	77106-01	77106-05
52	Switch-Refrigeration	13239	
53	Switch-Vacuum	13240	
54	Filler Panel-Shroud	76928	
55	Pilot Light	12726	12793
56	Connector	14269	
57	Drain Panel	77120	
58	Shroud	76818	
59	Heater Assembly	77121	
60	Vacuum Chamber	76926	
61	Tube Coupling	76933	
62	Clip-Crain Tube	19165	
63	Cover-Electrical Panel	76859	
64	Bushing-Wire Protector	13471	

NOTE: All component parts for Model 75040-01 are the same as shown for Model 7504C, except where noted.



CAUTION:
Equipment must be disconnected from electrical source before servicing.

115V - 60 Hz - 1 Phase

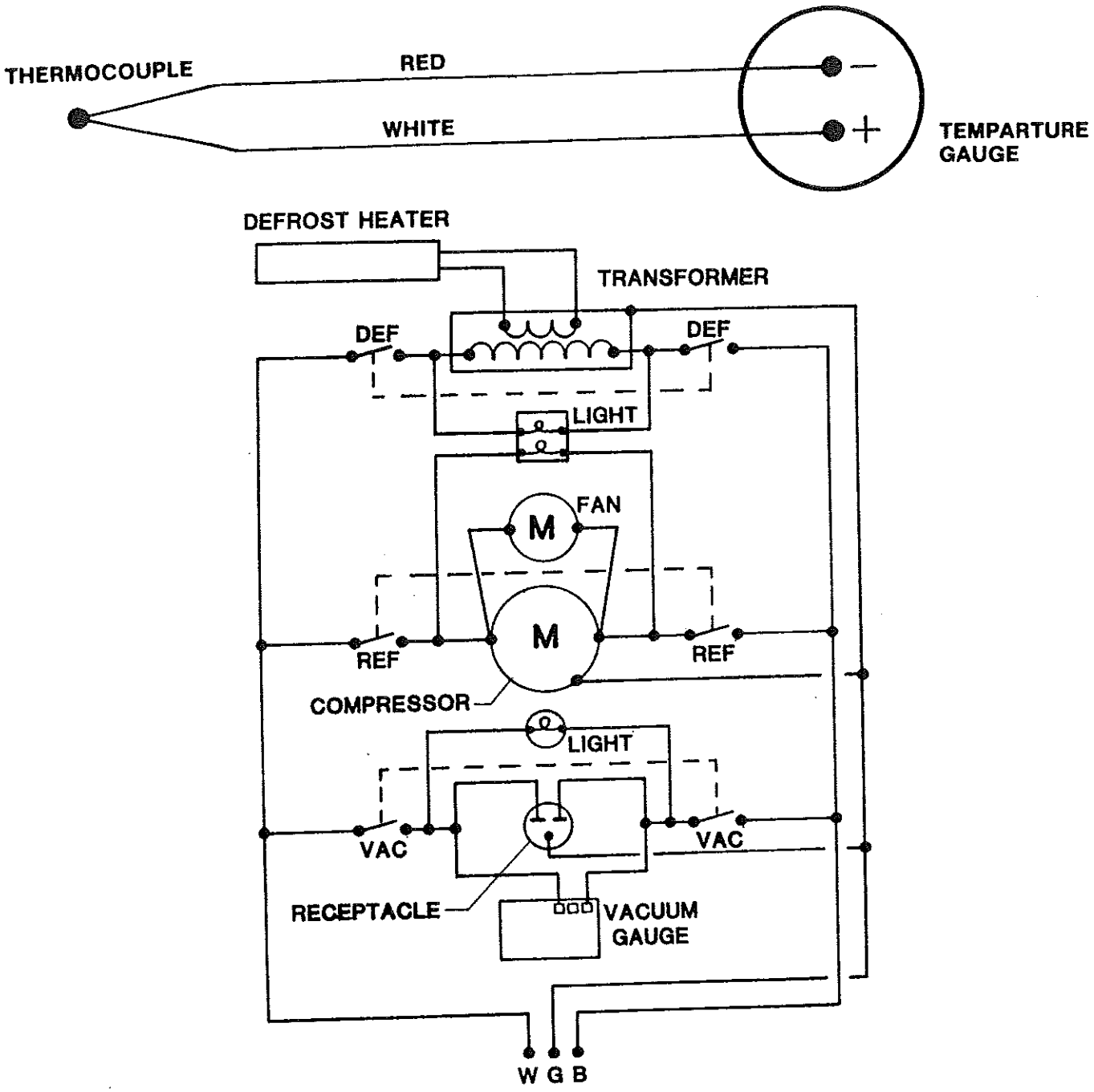
(3 CONDUCTOR GROUNDED)

NOTE: ANY REPLACEMENT WIRING MUST BE SAME SIZE AND TYPE AS ORIGINAL.

M=MOTOR

Volts	115
Ref. Amps	9
Max. Amps Recept	9
Total Max. Amps	18

ELECTRICAL SCHEMATIC - FREEZE DRYER - 8

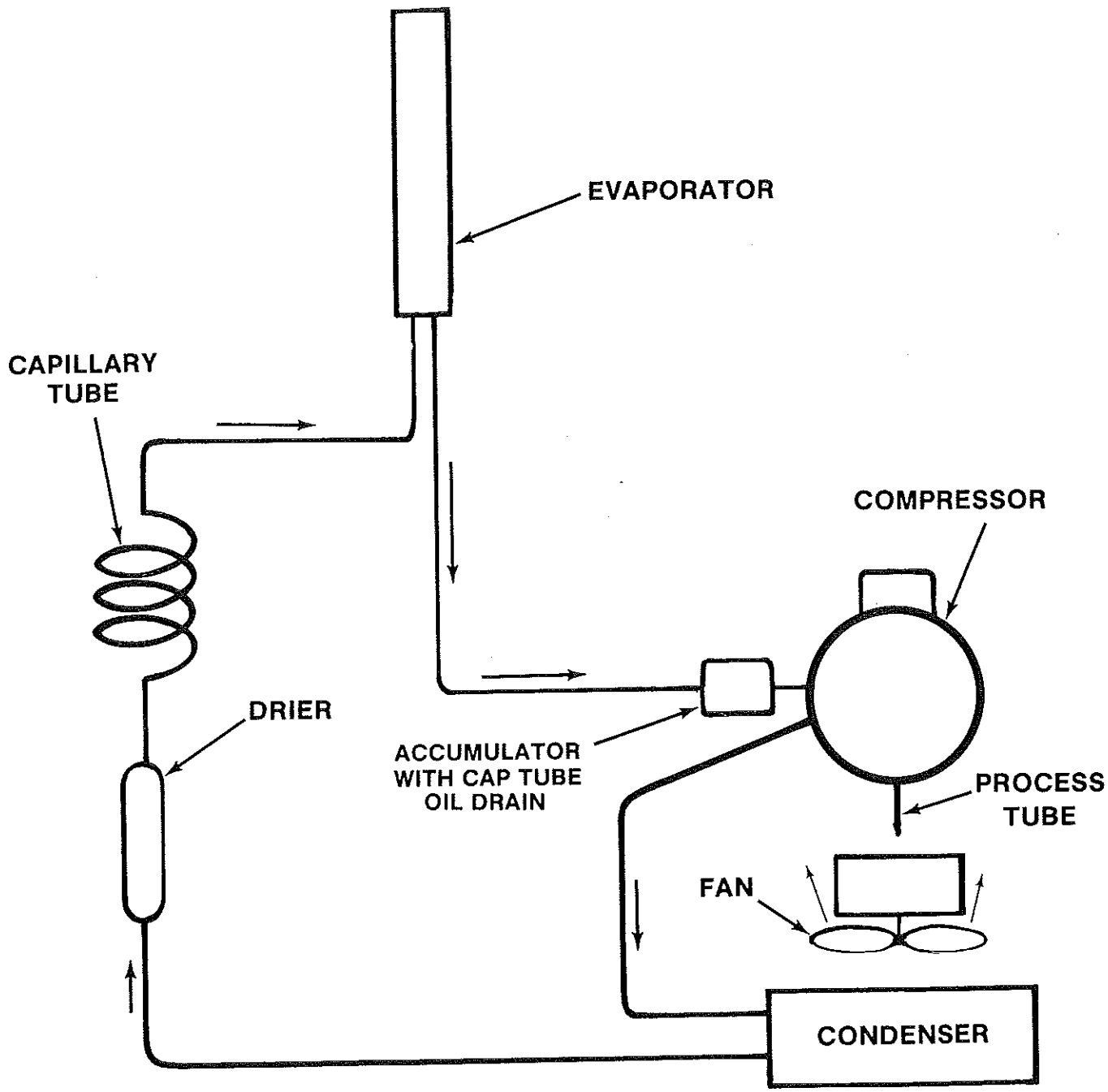


NOTE: ANY REPLACEMENT WIRING MUST BE SAME SIZE AND TYPE AS ORIGINAL.

CAUTION:
Equipment must be disconnected from electrical source before servicing.

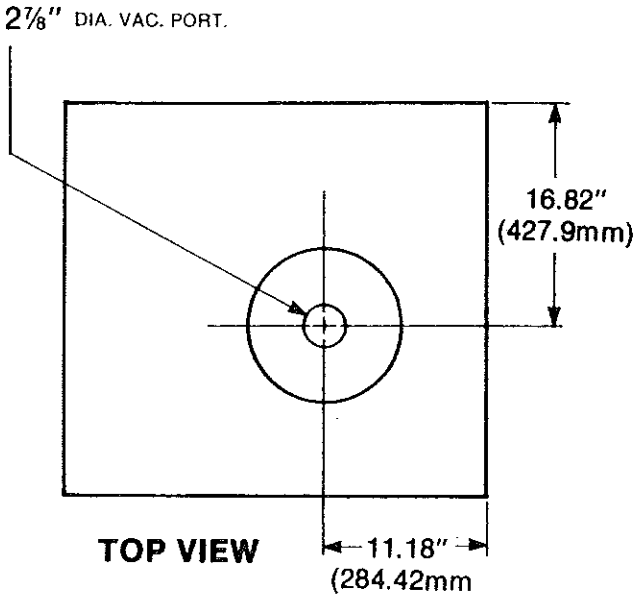
Volts	220
Ref. Amps	4.5
Max. Amps Recept	9
Total Max. Amps	13.5

ELECTRICAL SCHEMATIC - FREEZE DRYER - 8 - 220 V/50 HZ



REFRIGERATION SCHEMATIC — FREEZE DRYER - 8

FOR REFRIGERATION SYSTEM CHARGING INSTRUCTIONS, SEE LABEL ON CABINET BACK



Freeze Dryer 8 (Model 75040)
(Model 75040-01)

Cabinet: 30-¾" wide, 28" deep, 36⅛" high

Casters: (Four) 3" diameter, hard rubber

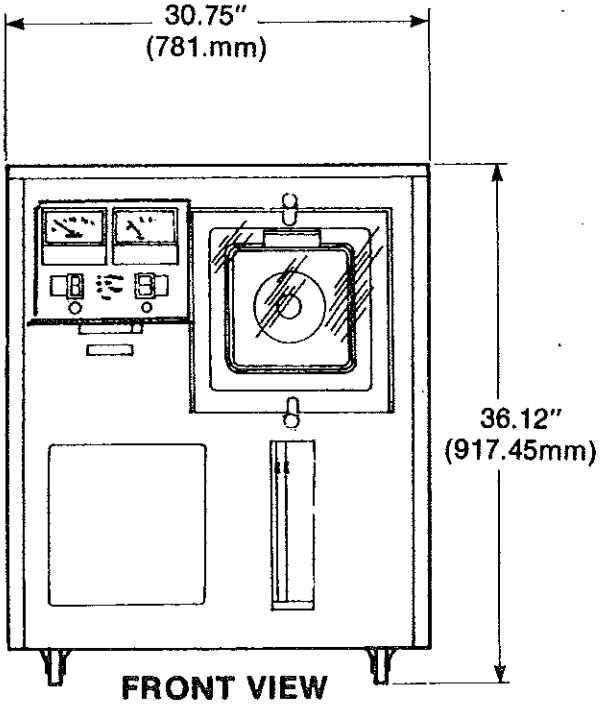
Work Surface: Chemical resistant with 2⅞" dia. vacuum connection in the top for connection of drying chambers or accessories.

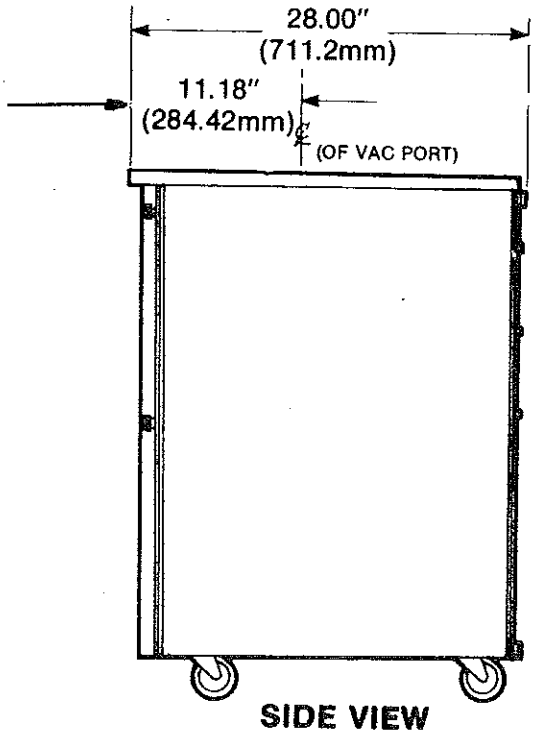
Cabinet Panels: Front and side panels are epoxy coated steel. The front panel also features an expanded metal grill for cooling air.

Condenser: Capacity, up to 8 liters of ice before defrosting. Condensing coil itself, fabricated out of stainless steel.

Instrument Controls: Condenser temperature continuously indicated on thermocouple gauge in both degrees F and degrees C. Electronic vacuum gauge monitors on a range from 5 microns to 5mm (TOR).

Electrical Requirements: Model 75040
115 volt, single phase, 20 amp., 60 Hz.
Model 75040-01
220 volt, single phase, 15 amp., 50 Hz.



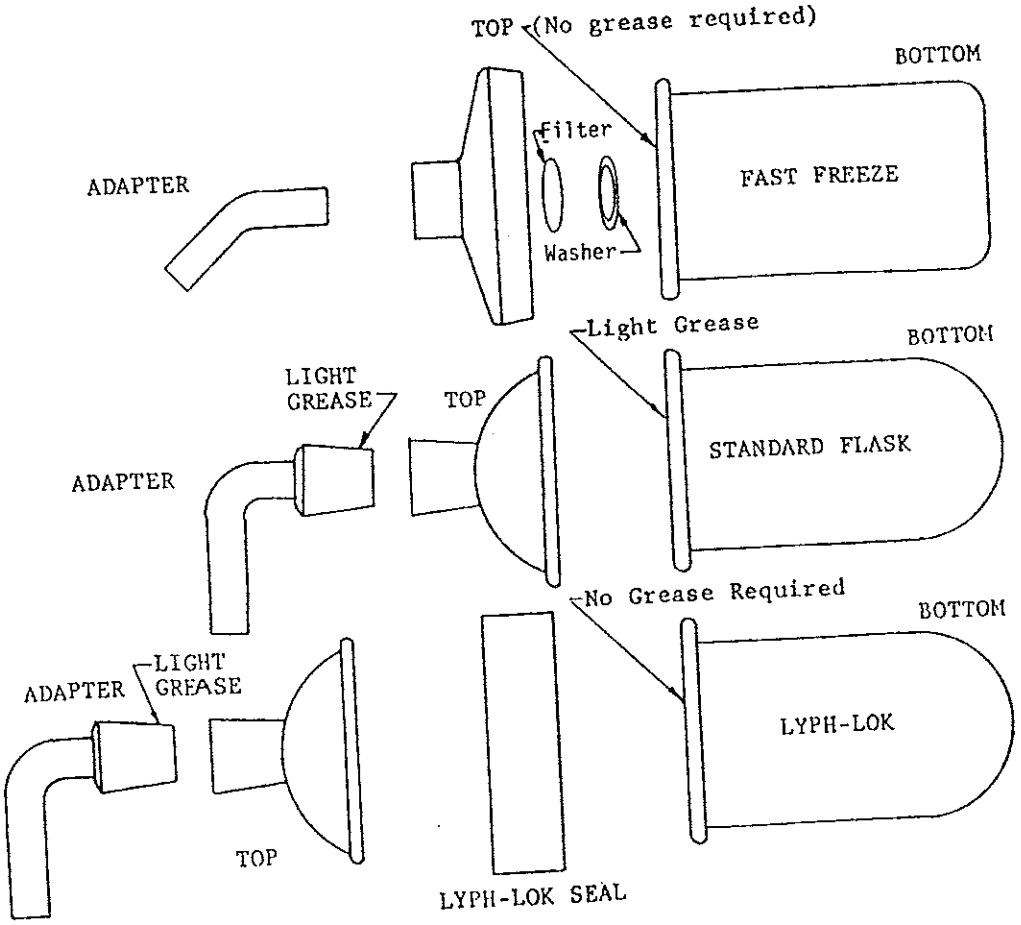


INSTRUCTION SHEET

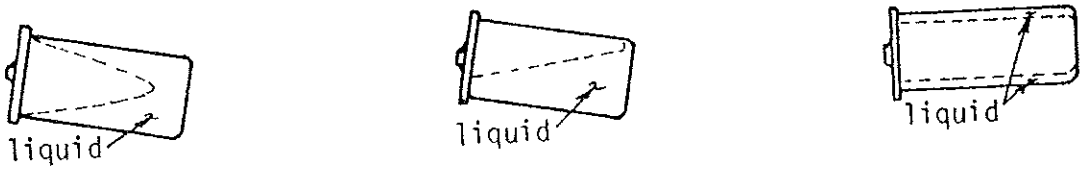
LABCONCO FREEZE DRY FLASK

CAUTION: Glassware is subject to breakage. Care should be exercised during use. Avoid rough handling and shock.

Safety glasses should be worn when glassware is under vacuum.



Either Shell Freeze or angle the flask as shown to avoid breakage due to expansion of liquid. Do not freeze in vertical position.



LABCONCO

INSTRUCTION SHEET

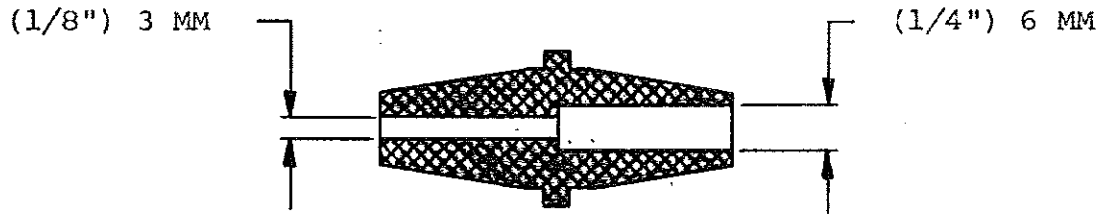
LABCONCO CORPORATION
8811 Prospect
Kansas City, Mo. 64132
816-333-8811

LABCONCO VALVES 1/2" AND 3/4"

LABCONCO valves are new and different. Their unique snap-fit design places the valves all the way into the drying chamber through precision-cut manifold openings for a direct compression seal. So leaks due to defective welds or corrosion are eliminated. Just snap it in for a leak-proof high vacuum seal. You can even rotate the valve a full 360° during operation with no loss of vacuum.

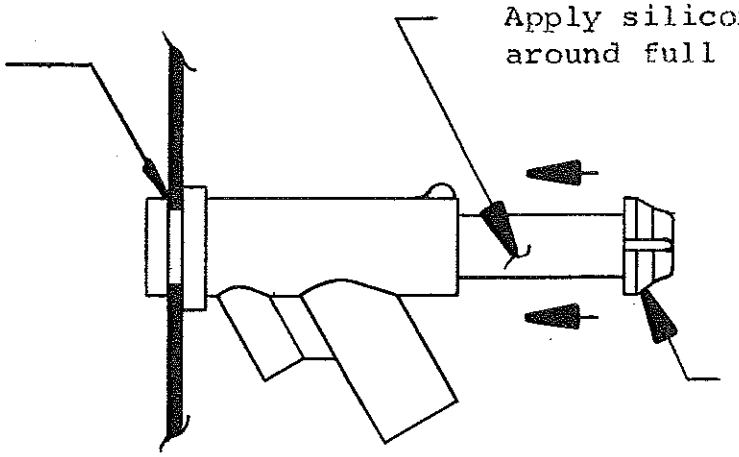
A vent port provides a convenient connection for glass or polypropylene drying tubes, so you can release the vacuum with dry sterile air or dry nitrogen. For combination bulk and manifold drying chambers, one or more valves may be removed to provide access ports for electronic product temperature indicators, controllers, or recorders.

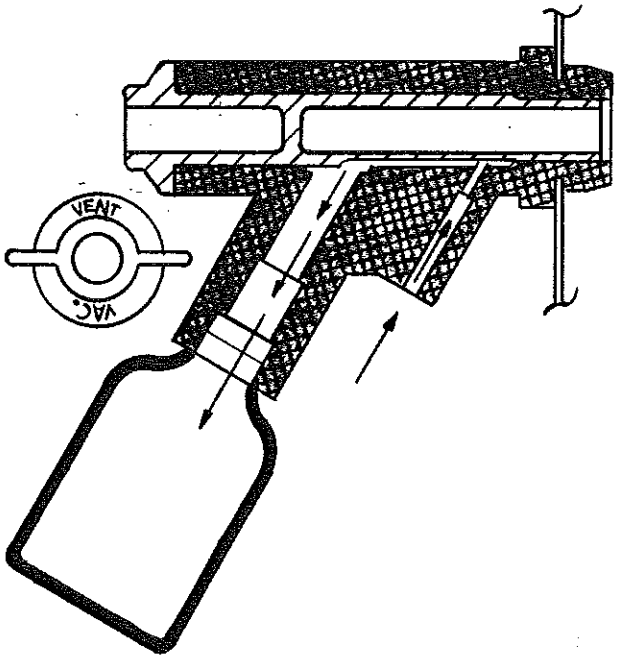
LABCONCO valves accommodate flasks, ampules and serum bottles. The LABCONCO Adapter #75934 increases the capacity of the 1/2" valves by reducing the inlet diameter of the valve to accommodate the complete line of ampules.



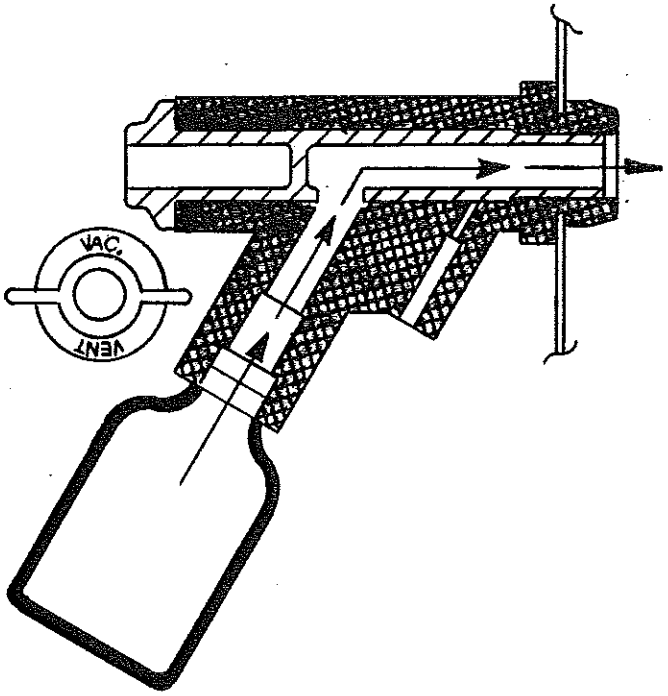
To install the valve, coat the stem lightly with vacuum grease. In addition, coat the end of the valve body and the port hole into which the valve will fit. Insert the valve body with a twisting rotating movement until it is seated in the groove as shown. Next install the lubricated stem into the valve body with a rotating motion until it is seated as shown. The valve is now ready for use. To remove valve reverse installation procedure.

Apply silicone grease all around as indicated.





Turn to "vent" position and your container is disconnected from the vacuum system and automatically connected to the vent port which gently bleeds air to release the vacuum in the container. The vent port may also be used in conjunction with glass or polypropylene drying tubes to introduce sterile air or dry nitrogen.



With valve in "vac" position, freeze dry containers are directly connected to the vacuum system.

PARTS LIST

Valve Size	Complete Valve	Polypropylene Stem Only	Buna-N Body Only
1/2"	75900	76000	76001
3/4"	75910	76002	76003

LABCONCO

INSTRUCTION SHEET

LABCONCO CORPORATION
8811 Prospect
Kansas City, Mo. 64132
816-333-8811

LABCONCO DRYING CHAMBERS & HEAT RACKS

Part Number	Ports
75100	16 Chamber
75102	12 Chamber
75104	18 Chamber
75106	39 Chamber
75210	Bulk Chamber
75130	10" Diameter Heat Rack
75132	6" Diameter Heat Rack

The LABCONCO drying chambers are used to facilitate visibility during lyophyilization even when bulk drying. The chambers are fabricated of 304 stainless steel and have a clear acrylic top. The ported chambers come complete with the unique LABCONCO valve that provides a leak-proof vacuum seal. The 75132 heat rack may be used with all of the drying chambers while the 75130 heat rack is primarily for the 75210 bulk chamber and the 75104 and 75106 chambers. The heat racks come with a built-in high limit thermostat (110°F), a 24 volt power transformer and a power feed through cord. The 75210 chamber includes the 75130 rack and transformer. The three-shelf product heaters are black anodized for more efficient heat transfer.

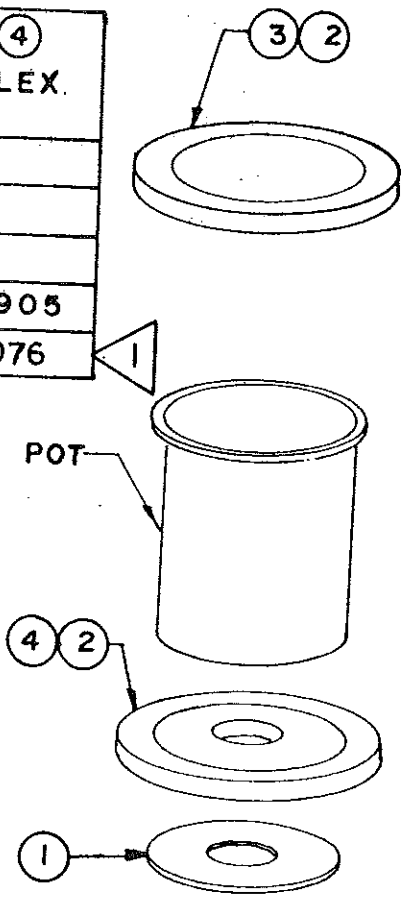
The LABCONCO valves used in the drying chambers are of a unique snap-fit design that places the valve into the drying chamber through a precision-cut manifold opening which compresses the valve body for a seal. The valve may be rotated 360° during operation with no loss of vacuum.

A vent port provides a convenient connection for glass or polypropylene drying tubes to backfill with dry sterile air or nitrogen.

LABCONCO DRYING CHAMBERS & HEAT RACKS

PARTS LIST
FOR POT ASSY. ONLY

ASSEMBLY NO.	POT	① BOTTOM GASKET	② TOP GASKET	③ PLEX. TOP	④ PLEX.
75100	16 PORT	76054	76908	76898	
75102	12 PORT	76139	76885	76884	
75104	18 PORT	76054	76908	76898	
75106	39 PORT	76961	76908	76907	76905
75210	BULK	76139	76885	76885	77076

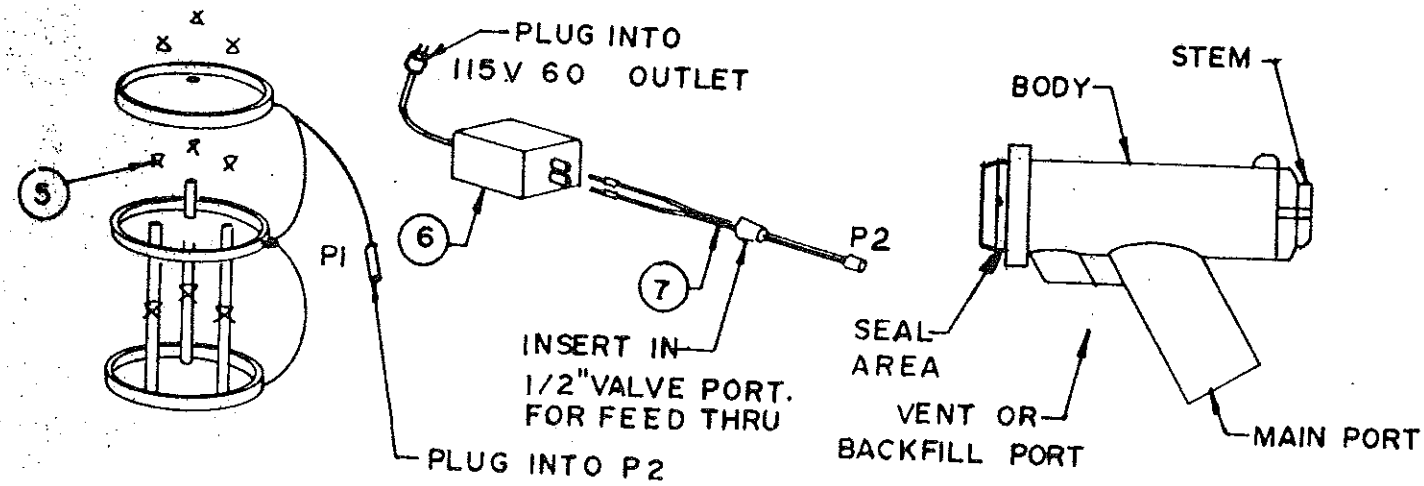


PARTS LIST
FOR HEAT RACK ASSY. ONLY

ASSEMBLY NO,	HEAT RACK	⑤ SUPPORT CLIPS	⑥ XFMR	⑦ POWER CORD, 24V
75130	10"	19158	76554	76542
75132	6"	19158	76554	76542

PARTS LIST
FOR VALVE ASSY. ONLY

ASSEMBLY NO.	VALVE	STEM ONLY	BODY ONLY
75900	1/2"	76000	76001
75910	3/4"	76002	76003



1 FOR 3 LITER UNITS USE GASKET ON EXISTING LID ON PART NO. 77076.

ECO 4822