

SUBJECT USE OF SOLID CO₂ (DRY ICE) AND
LIQUID AIR

SUPERSEDED DATE 9/17/46

Solid carbon dioxide - CO₂ (commonly called "dry ice") and liquid air are materials which have been found satisfactory for freezing moisture and condensing certain vapors, such as mercury, out of air,

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DANGER

MERCURY SAFETY PRECAUTIONS: See 33-2-10A

An application of these materials for such purposes is the freezing of moisture and condensing of mercury vapor from the air and gasses drawn by a mercury condensation pump from a radio tube during exhaust either by bench or machine. The freezing of moisture results in a higher vacuum and condensing the mercury vapor prevents it from working thru the line into the radio tubes.

Altho the temperature of "dry ice" is 200°F above that of liquid air, it has been found satisfactory for use in obtaining the normal vacuum required for radio tubes and costs but approx. one-fourth as much. Therefore, "dry ice" is standardized for use on exhaust machines or benches where mercury condensation pumps are used, and where but normal vacuum is required and liquid air is standardized where extremely high vacuum is required such as for cathode ray and power tubes. However, it may be more convenient to use liquid air exclusively, as c.g., in power tube work, in case the exhaust machine is not run regularly and therefore the quantity of dry ice required is small and not at regular times. Dry ice must also be used for traps thru which certain gasses pass, c.g., Xenon, since liquid air is so cold that it solidifies the gas. The gas is passed thru the trap to remove any stop cock grease which it may have picked up.

A description of the use of dry ice and liquid air in this application follows:

1. TRAP

A trap thru which the air is passed to be cooled and in which the impurities are collected is shown in Fig. 1. A trap may be made of 1/2" and 1", 3/4 and 1-1/2"; or 1" and 1-3/4" No. 7

(G702P) hard glass tubing with inlet and outlet tubes made to the length and shape required. The direction of flow of air and gasses is shown.

2. CONTAINER FOR HOLDING COOLING MATERIAL AROUND TRAP

The "dry ice" or liquid air should be held around a trap in a No. 606-F soft glass or a

No. 8645 Pyrex glass vacuum jar made by the American Thermos Bottle Co. The approx. sizes of the jars are O.D. 3-1/8", inside depth 10-3/4", and neck opening 2-3/8" dia. and O.D. 3-3/8", I.D. 2-3/4" and inside depth 11-3/4" respectively.

For safely holding the 606-F jar, a 1/16" thickness brass can 9" long x 3-3/8" I.D. may be used. The jar may be kept stationary by wrapping a rag around it at the top of the can. The can may be suspended by or set upon a support. The Pyrex jar is equipped with a short metal base.

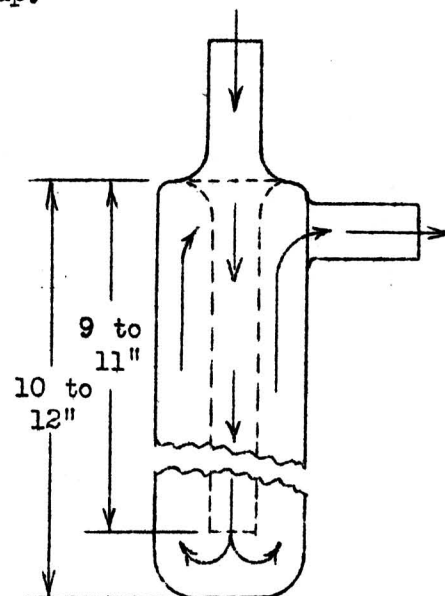


FIG. 1

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3. METHOD FOR USING DRY ICE

Dry ice has a temperature of -110°F . It is supplied at Harrison, N. J. by the Dry Ice Co. of Elizabeth, N. J., in approximately 10" cubic cakes containing about 45 lbs. which is the quantity required for 20 - 1" dia. traps. The ice may be stored in a small refrigerator altho a tightly covered metal container with vent, lined with waste has proven fairly satisfactory. Gloves should be worn when handling and working with it.

Dry ice may be used by either of the following methods, the latter being an addition and possibly more efficient to use.

METHOD No. 1 - Using a metal pestle and a wooden box, break up the ice until fine and soft. Place vacuum jar around trap centrally for its entire length to facilitate removal of jar if necessary before there is sufficient evaporation to relieve the close fit. Using a small scoop, fill the jar with ice and pack it down with a 1/4" dia. rod. Fill jar again and press ice down with thumbs. Wrap a cloth around trap and top of jar to cover the ice. It is usually not necessary to add ice during the day unless large volumes of hot gas and air are evacuated. However, the supply should be observed occasionally until its rate of depletion is learned for various sizes of bulbs and conditions. Upon refilling pack down the remaining ice and refill as described above.

METHOD No. 2 - Break up dry ice into small pieces about 1" cube or smaller depending upon size of trap. Place ice in vacuum jar until about 3/4 full. Pour acetone slowly over ice until level of liquid is about 3" from top of jar for 1" dia. trap.

CAUTION - Dry ice added to acetone at room temperature results in excessive bubbling and loss of acetone. Always add acetone to ice. Stir the mixture before the jar is placed around the trap. Usually it is not necessary to add any ice during the day. Pieces of ice may be added however while the solution is cold.

At end of day pour acetone back into container and save for future use. In no case should the solution be allowed to remain in vacuum jar over night. This solution is somewhat inflammable and should be kept away from open flames. It should be removed from the system if any glass work requiring an open flame is done on the system within 2 ft. of the jar.

4. METHOD OF USING LIQUID AIR

Liquid air has a temperature of -310°F . It should be obtained and stored in 5 liter pyrex liquid air containers. About .7 liter is required for a 1" dia. trap and a 606F- jar.

Gloves should not be worn when pouring liquid air. Pour it into the jar before putting it around the trap. Pouring should be done slowly and carefully so that the liquid touches sides of container as little as possible, but even with these precautions, soft glass jars may crack due to sudden change of temperature. Raise the jar up around the trap slowly so as to gradually cool it to prevent cracking which also may occur at times altho extreme care is used.

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4. METHOD OF USING LIQUID AIR (Cont'd)

Cover the opening between jar and trap by wrapping a rag around trap and top of jar. It is usually not necessary to add any liquid air during the day but this will depend upon the vacuum required and the temperature and volume of gas and air evacuated. When liquid air is added always remove the jar to prevent breaking the trap by pouring the liquid into it.

5. PRECAUTION

Gloves should always be used in handling dry ice since it will freeze the skin and flesh in a very short interval of time and cause a severe "burn", but should not be used with liquid air, so that the liquid air can immediately run off if it comes in contact with the skin.

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