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CHAPTER 64

MEDICAL APPLICATIONS

Refrigeration in Laboratory Medicine, Laboratory Instruments Using Refrigeration, Refrigerated Centrifuge, Freezing Microtome, Electron Microscope, Liquid Scintillation Counter, Warburg Apparatus, Freeze-Dry Apparatus, Principles and Systems, Tissue Banks, Virus Preservation and Storage, Blood Banks, Pathology and Anatomy Laboratories, Refrigeration in Clinical Medicine

IN outlining refrigerating applications in laboratory and clinical medicine, it is evident that the majority of the equipment used does not vary in any spectacular fashion from that used in any other field. The great emphasis lies in greater stringency of control and closer scrutiny of the permissible temperature variation, since much of the material entrusted to refrigeration preservation or action in the medical area either has an acute bearing on human life, or has its origin from human or animal sources that make it irreplaceable or highly expensive.

By far the most common piece of refrigerating equipment in any medical area is the standard household refrigerator, varying in size within the limits of such equipment and with the same special features of shelving or freezing compartment that make the instrument attractive to any buyer. Specially designed refrigerators for laboratories do exist and are listed in catalogs of laboratory and hospital equipment, but the difference in cost above the standard household appliance precludes their use in the average medical facility.

Following closely in standard medical refrigerating equipment is the walk-in unit, which may vary in size from the 500 cu ft range to much larger construction. These areas for preservation of either larger objects such as anatomic cadavers, or many smaller objects such as units of banked blood, are fitted with exactly the same type of cooling equipment necessary to meet specifications of any such areas outside the medical scope. Walls, floors, and ceilings involve the same general principles of construction and insulation familiar to everyone interested in this field. These principles are equally applicable, and indeed the desired equipment is not unlike other cold storage units used industrially in preservation and handling of many perishables.

Lastly, there are specially constructed instruments involving refrigerating principles such as the cold centrifuge, freezing microtome and tissue freeze-dry apparatus which are more closely and specifically related to medicine and its allies in the scientific realm, but the cooling principle is the same and construction peculiar to the instrument is but a variation on a general theme that enables a specific temperature to be produced and maintained in a specific area.

The important variant that distinguishes the major uses of commercially designed refrigeration in the medical field is the wide application of recording thermometers and alarms. In certain medical areas as many as three or four control and recording devices may be integrated in one piece of refrigerating equipment and a margin of variation of perhaps only one or two C deg will be the crux of the whole application. Thus in a blood storage refrigerator, systems of recorders both without and within the cooled area, an alarm system of lights or bells or both, and fans to insure air circulation and a constant temperature throughout a shelved space may be added to an insulated walk-in or large commercial refrigerator.

Consequently, a medical refrigerating application calls for concern in exact specifications and a knowledge of ancillary equipment that informs the user at all times that his specifications are met and are continuing to be maintained. Equipment failure is probably no more common or less common in medical facilities than in any other area of refrigeration use, but the responsibility resting on this refrigeration may be somewhat greater than the tangible considerations of cost.

A recent article[1] by Gage describes the overall refrigeration and air-conditioning facilities of one major medical institution, emphasizing the applications of refrigeration to the building itself. The above commentary on medical applications is well supported by Gage both from the standpoint of the equipment described and the emphasis on controls, alarms, and automatic sequence-changing devices which supply a comfortable reserve in areas where equipment failure would prove most critical.

REFRIGERATION IN LABORATORY MEDICINE

General Refrigeration Applications

Surveys of clinical laboratories, whether private, in hospitals, physicians' offices or research areas such as large medical centers, will reveal wide use of standard household refrigerators and freezers, from the small apartment size up to the double-door 17 cu ft box. The majority of this equipment will be used for three main reasons: to preserve and store by simple cooling or freezing for bacteriostatic action, various sera and biological products, either liquid or dried, and common specimens of blood, urine, etc., until proper studies may be made or confirmed; to preserve by cooling or freezing, for reduction of chemical reaction, various reagents used in the laboratory testing of specimens mentioned; and the manufacture of ice for use in procedures demanding ice cooling-baths. This last is generally a function of biochemical laboratories, and the common refrigerator ice cube facilities may be replaced by an ice-making machine if the demand warrants. As indicated, these refrigeration needs are adequately met by common household units, so that materials of one sort or another are both cool and readily accessible.

If the maintenance of sharply critical temperature is also expected of these refrigerators, the most dependable device is a simple spring wound seven-day recording thermometer, which can be placed on a shelf in a convenient location within the unit and is easy to maintain and service. The chart is replaced weekly, and forms a permanent record of the operation of the cooling unit. This is of great value if there are power or mechanical failures which may be corrected without the knowledge of those using the refrigerator. While the insulation will prevent sudden temperature rises, variations beyond critical limits, both high and low, may have made the material dependent on this critical refrigeration an immediate total loss. Since the recording thermometer is moderately high priced, the purchase and use of such instruments is tempered by the value of the refrigerator contents or by the necessity