

TABLE 1. USUAL TEMPERATURES REQUIRED IN GREENHOUSES

KIND OF VEGETATION	TEMPERATURE REQUIRED, DEG. FARE
Violets.....	40 to 45
Camelias.....	
Azaleas.....	
Lettuce.....	
Cool Palm Houses.....	50 to 55
Carnations.....	
General Purposes.....	55 to 60
Roses.....	
Mushrooms.....	
Forcing Houses.....	60 to 65
Conservatories.....	
Orchid Houses.....	
Fern Houses.....	
Peach House.....	65 to 70
Vinery.....	
Early Tomatoes and Cucumbers.....	
Tropical Palm House.....	

that with such plants there shall be vacuum pump returns, with thermostatic heater traps. It is important, whatever the type of system, that the heating surface or out-put be well subdivided, so that no matter how much or how little heat shall be needed, just enough and no more than enough can be delivered. The heat must be distributed just as evenly over the whole area of the greenhouse as though all of the output were being delivered. One recommendation is that the heating surface be subdivided and provided with valves in increments of not exceeding 10 per cent.

The openings in the roof of a greenhouse which serve for ventilation are arranged in a row along the ridge and are spaced uniformly. If pipe coils are arranged lengthwise of the house they must be heated evenly and proportionately to the cooling effect of the ventilation. However, in practice excess radiation must always be placed at the ends of the house to compensate for the extra heat losses at the gable ends. The result is that when the roof ventilation is open, the ends of the building tend to over-heat. Any small leakage of supply valves or return traps also tends to cause over-heating of the ends of the long coils. A curious observation is that the air in a greenhouse tends to move in a direction opposite to that of the wind outside. This causes over-heating of the windward end and under-heating of the leeward end. This reverse interior current also causes a lowered relative humidity at the leeward end and excess moisture at the windward end; since such leakage as there is tends to enter from the leeward end.

In one case when unit heaters with electric fans were installed in a rose greenhouse, observations with thermometers and humidity instruments indicated excellent results, but the roses would not grow until the air velocity from the unit heaters was reduced to a very gentle current.

The most recent testimony seems to indicate that in general, when steam is used, the electric unit heater is satisfactory, using low velocities of air and rather close spacing of the heaters.

All successful greenhouse operators testify that great manual effort and exceedingly detailed attention must be applied to the air conditioning. There is a demand for very reliable automatic temperature control. One State University reports most favorable results with unit heaters and electric automatic control.

There is no question but that forced circulation hot water heating finds an especial field in greenhouse work, since the heaters may be almost as small as those used with steam, and since the temperature of the heating surface may be controlled within such a wide range either by thermostats or by hand, without the constant adjusting of supply valves necessary when steam is used.

7. HEAT EXCHANGERS FOR WATER AND OIL

A valuable chapter on the subject of heat exchangers, giving the mathematics of this interesting thermal process, is included in THE GUIDE, 1929.

8. LAUNDRY, KITCHEN AND HOSPITAL SERVICE (PIPING AND EQUIPMENT FOR)

This subject is treated at length in THE GUIDES, 1929 and 1930, giving quantities and service sizes for various appliances used in these institutions, for hot water, cold water and steam.

Whenever, in connection with laundries, the question of hot water supply arises, it is recommended that the washing formula be checked. Formulae for various requirements are issued by *The American Institute of Laundering*.

9. LACQUER SPRAY BOOTHS (VENTILATION OF)

In general there must be an exhaust fan which will provide an air velocity of at least 150 lin. ft. per minute through the opening into the hood from the room. It is preferable in installations of this type to use a pressure fan with an inductor-jet or nozzle so that the carried-away lacquer does not enter the fan at all. It is proper to make the exhaust duct in the vicinity of the booth of such type that accumulations of paint may be removed when they begin to clog the air ways.

In many automobile body spray booths the ducts for exhausting from the spray hood will range from 30 to 48 in. in diameter. A 30 in. duct usually requires about 2 hp. for the fan, which maintains on the 5 in. nozzle pipe, pressure equal to a column of water about 7 in. high. For a 48 in. duct the fan requires about 5 hp. and the pressure is 10 in. of water on a 6½ in. nozzle pipe. There are proprietary systems of this type.

10. LIBRARIES (AIR CONDITIONING OF)¹

Temperature, per se, can be disregarded generally as having little effect upon the keeping qualities of books. There is an optimum temperature

¹Based on a paper by the Bureau of Standards.