

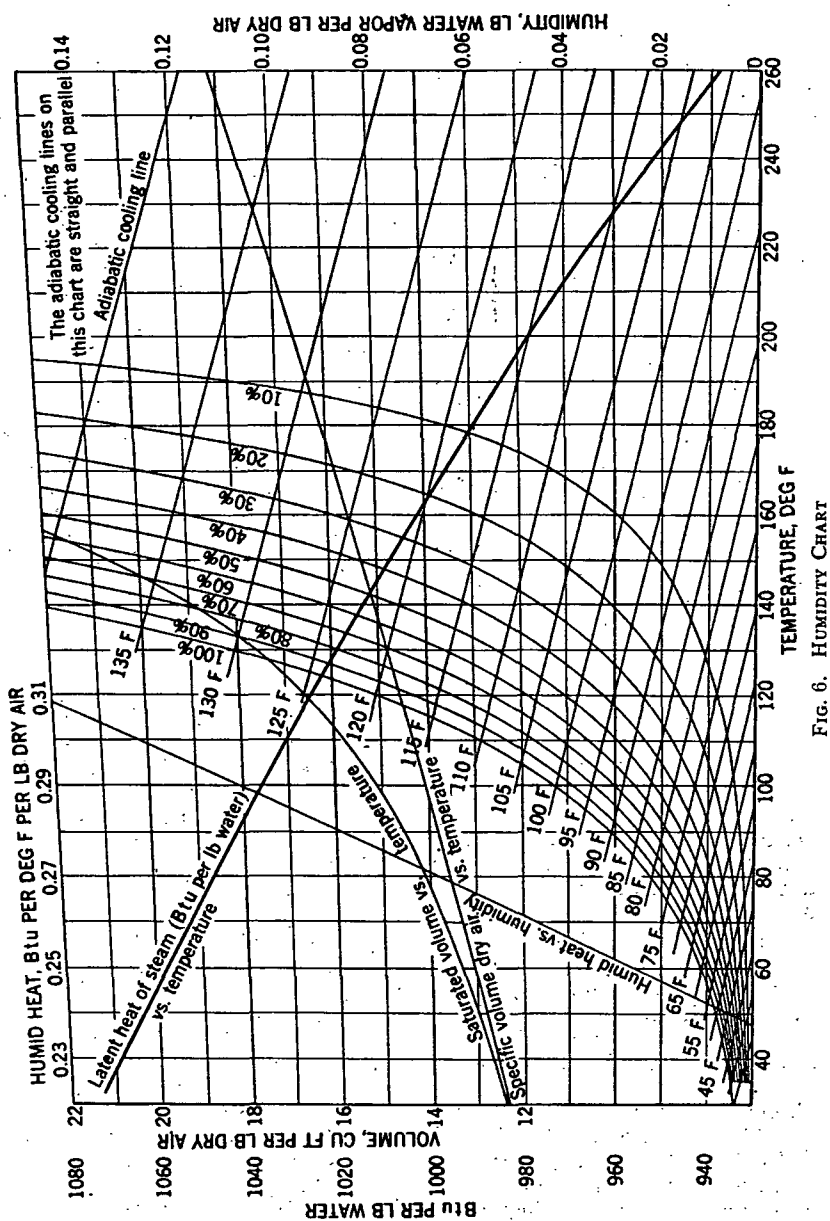


FIG. 6. HUMIDITY CHART

for this reason after-cooling is not required, and reheating is reduced to a minimum. Complete descriptions of such dehumidifying systems are given in Chapter 24 on cooling and dehumidification methods.

Air Circulation

As noted under Mechanism of Drying, air velocity is more important in the first two stages of drying than in the last, and for this reason zone drying in continuous dryers is frequently considered. It permits accurate regulation of temperature, humidity, and velocity in the different zones. High velocity results in more rapid drying, more even distribution of temperature and consequently more even drying in the first period. Too high a velocity may be detrimental because of excessive power needed for creating it, or because the material may blow away if it is light and fluffy. In the drying of paints, varnishes, and enamels, high velocity or improper distribution of the air even with the use of filters, may cause dust already in the dryer to be blown against the material, ruining the finish.

DRYER CALCULATIONS

The fundamental calculations for the design and performance of dryers are based on the thermodynamics of air and water mixtures treated in Chapter 1, and the fundamentals of heat transfer treated in Chapter 3. For the humidity calculations a high-temperature psychrometric chart is given in Fig. 6. In addition to the fundamental heat transfer calculations of radiation, conduction and convection, the heat losses through the walls of the dryer will be computed by the methods illustrated in Chapter 4 and Chapter 43. Additional data on radiation calculations are given in Chapter 45.

Where products of combustion are used directly in a dryer, a knowledge of the properties of fuels and combustion products is important. Data on fuels and combustion are given in Chapter 8. For determining the heat available in products of combustion, a specific heat of 0.25 Btu per pound per degree Fahrenheit may be used.

The calculations for drying during the constant-rate period are different from those applying to the falling-rate period.

Constant-Rate Period

The rate of drying by air passing over a wet surface is directly proportional to the vapor pressure difference, and also proportional to the

TABLE 3. CRITICAL MOISTURE CONTENT FOR VARIOUS MATERIALS^a

MATERIAL	CRITICAL MOISTURE CONTENT, PER CENT
Sand.....	3 to 20
Clay; soil; pigments.....	5 to 40
Paper, book or coated.....	30 to 40
Paper, newsprint.....	60 to 70
Paper pulp and pulp-boards (wallboard).....	75 to 150
Leather (heavy).....	90 to 120

^aThe critical moisture content is expressed as weight of water in per cent of weight of dry material.