

TABLE 1. DRYING TIME AND CONDITIONS FOR REPRESENTATIVE MATERIALS

KIND AND THICKNESS OF MATERIAL	TEMPERATURE DEG F	DRYING TIME
Bedding.....	150-190	
Cereals.....	110-150	
Cocoonut.....	145-155	4-6 Hours
Coffee.....	160-180	24 Hours
Cores, Oil Sand, for molding..... $\frac{1}{2}$ in.—1 in. thick	300	30 Minutes
Black sand with Goulac Binder about $\frac{3}{8}$ in. thick	480	2½ Hours
6/10 of time for oil sand cores..... $\frac{8}{16}$ in. thick	480	4½ Hours
	700	10 Hours
Feathers.....	150-180	
Films, Photographic.....	90	
Fruits and Vegetables.....	140	2-6 Hours
Furs.....	110	
Glue.....	70-90	2-4 Hours
Glue Size on Furniture.....	130	4 Hours
Gut.....	150	
Gypsum Wall Board— $\frac{3}{8}$ in. thick..... { Start Wet	350	60 Minutes
	275	
Gypsum Blocks.....	350-190	8-16 Hours
Hair Goods.....	150-190	1 Hour
Hats, Felt.....	140-180	
Hops.....	120-180	
Hides, Thin Leather.....	90	2-4 Hours
Ink, Printing.....	70-300	
Knitted Fabrics.....	140-180	
Leather, Thick Sole.....	90	4-6 Hours
Lumber, Green Hardwood.....	100-180	3-180 Days
Lumber, Green Softwood.....	160-220	2-14 Days
Macaroni.....	90-110	
Matches.....	140-180	
Milk and other Liquid Foods (Spray Dried).....	250-300	Instantaneous
Molds, Green Sand, C. I. Flasks (one surface only exposed)		
8 in. thick.....	600	6 Hours
13 in. thick.....	700	13 Hours
Nuts.....	75-140	24 Hours
Paper, Machine Dried.....	180	
Paper, Air Dried.....	90-200	
Rubber.....	80-90	6-12 Hours
Sand, loose, 1 in. deep.....	300	10-15 Minutes
Shade Cloth.....	240	1-2 Hours
Soap.....	125	12 Hours
Starch.....	180-200	1-4 Hours
Stock Feed, Mixed.....	180-220	20-30 Minutes
Sugar.....	150-200	20-30 Minutes
Tannin and other chemical (Spray Dried).....	250-300	Instantaneous
Terra Cotta (air-drying in conditioning room).....	150-220	12-96 Hours
Wall Board, pasted ply board.....	300	15-20 Minutes
Wall Board, fiber-insulating, Roller Type Dryer.....	300-385	2½-3 Hours
Wall Board, fiber insulating, Truck Type Dryer.....	300-385	24-48 Hours

which can be used without injuring the material. In this case, theoretical analysis, according to Lewis, shows that in the early stages the time of drying is proportional to the square of the thickness and to the square of the total moisture lost, and the time moisture curve is a parabola. In the later stages, after all free water has been evaporated, the curve becomes logarithmic. The form of this drying curve will, in general, resemble that shown in Fig. 2. On the other hand, in drying material in which free water can flow by capillary action at a sufficient rate to keep pace with surface evaporation, the time is proportional to the first power of the thickness and the rate will be governed by the drying conditions of the air and the area of surface exposed.

DRYER DESIGN

Methods of Calculations

A psychrometric chart applying to atmospheric pressure and plotted in units convenient for use in dryer calculations, is given in Fig. 3. The amount of moisture in the air, H is given in pounds of water per pound of dry air. With this choice of units, changes in H represent directly the moisture picked up by the air from the material being dried. The inclined

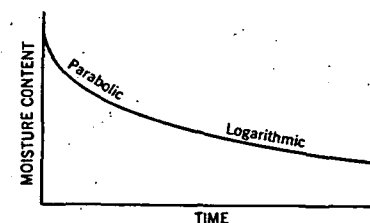


FIG. 2. TYPICAL TIME-MOISTURE CURVE FOR MATERIALS IN WHICH NO CAPILLARY FLOW OF FREE MOISTURE OCCURS

straight lines are adiabatic cooling lines for air in contact with water at its wet-bulb temperature, and also represent the cooling of air in the adiabatic drying of any stock, the sensible heat of which is negligible in comparison with the heat of vaporization of the water in it.

The following nomenclature and explanation of terms will be used in the discussion of drying calculations:

- H = humidity of air, pounds of water vapor per pound of dry air.
- G = pounds of dry air supplied to the dryer per unit of time.
- S = pounds of stock dried per unit of time in a continuous dryer.
- S' = pounds of stock charged per batch to a discontinuous dryer.
- θ = time.
- Q = total heat supplied to the dryer.
- t = air temperature.
- t' = stock temperature.
- t'' = average stock temperature over short time interval, in a batch dryer.
- t_w = wet-bulb temperature.
- s' = specific heat of the stock.