

In some operations, time controllers are used which automatically alter the conditions according to a predetermined schedule and finally bring the drying operation to a close. With other dryers regulation is obtained in accordance with the loss in weight of samples of the material suspended on sensitized scales within the dryer, the drying being automatically terminated when the samples reach the desired degree of dryness. Generally, however, the only function of the control instruments is to maintain the desired temperature or humidity and any change in the conditions must be made by the operator by re-setting the instruments.

The higher the temperature, other things being equal, the faster will the moisture in the material transfuse to the surface and the faster will the drying proceed. Hot water passes through the material more rapidly than cold water because of its increased vapor pressure as well as its decreased viscosity. Increasing the rate of surface evaporation by greater circulation at low temperatures produces faster drying only when a corresponding increase in the rate of transfusion is obtained.

Provision must be made in every dryer to dispose of evaporated moisture as it comes from the material. In most dryers this is done by discharging part or all of the moisture laden air to the atmosphere, replacing it with an equal amount of outside air. In some types, particularly of the blower style, the surplus moisture is often removed by some form of condenser such as cold water coils or sprays. It is a mistake to attempt to obtain a practically saturated condition of the leaving air, as this is apt to slow down the speed of drying and cause an undesirable amount of condensation in the moist air ventilators or ducts returning to the blower. A saturation of from 50 to 75 per cent in the leaving air is usually as high as can be obtained without sacrificing speed.

Operating the Dryer

No matter how well the dryer may be designed, a considerable part of the success of a drying operation depends upon the operator. He must watch the material and study the results in a constant effort toward improvement. Good dryer operation includes regular sampling and testing of material, watching the conditions within the dryer, and keeping systematic and complete records of all essential data such as the movement of material, the length of the drying period, the temperatures and humidities at critical points in the dryer, and the extent to which the equipment is kept fully occupied. Standard schedules of drying time and drying conditions for material of different kinds are also useful in estimating production and regulating the operation of the dryer.

Moisture Content Calculations

Moisture content is usually expressed as a percentage of the original combined weight of the material and its contained water. Thus, if the moisture content were 20 per cent, the dry material would weigh 80 per cent of the total weight. In drying some types of material, notably lumber, it is customary to use the *bone-dry* or water-free weight of the material as the divisor, the weight of the water being calculated as a percentage of this dry weight. Regain, or absorption of hygroscopic moisture after drying, is almost always expressed by the latter method, as a percentage of the water-free weight of the material.

TABLE 1. DRYING TIME AND CONDITIONS FOR REPRESENTATIVE MATERIALS

KIND AND THICKNESS OF MATERIAL	TEMPERATURE DEG. FAHR.	DRYING TIME
Bedding.....	150-190	
Cereals.....	110-150	
Cocoanut.....	145-155	4-6 Hours
Coffee.....	160-180	24 "
Cores, Oil Sand, for molding..... $\frac{1}{2}$ in. - 1 in. thick	300	30 Minutes
Black sand with Goulac Binder { 3 in. " 480		2 $\frac{1}{2}$ Hours
about 6/10 of time for oil sand cores { 8 in. " 480		4 $\frac{1}{2}$ "
16 in. " 700		10 "
Feathers.....	150-180	
Films, Photographic.....	90	
Fruits and Vegetables.....	140	2-6 "
Furs.....	110	
Glue.....	70-90	2-4 "
Glue Size on Furniture.....	130	4 "
Gut.....	150	
Gypsum Wall Board..... { Start Wet	350	60 Minutes
Finish	190	
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 "
Lumber, Green Hardwood.....	100-180	3-180 Days
Lumber, Green Softwood.....	160-220	2-14 "
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. "	700	13 "
Nuts.....	75-140	24 "
Paper, Glued.....	130-300	
Paper, Treated.....	140-200	
Rubber.....	80-90	6-12 "
Sand, loose, 1 in. deep.....	300	10-15 Minutes
Shade Cloth.....	240	1-2 Hours
Soap.....	125	12 "
Starch.....	180-200	1-4 "
Stock Feed, Mixed.....	180-220	20-30 Minutes
Sugar.....	150-200	20-30 "
Tannin and other chemicals (Spray Dried).....	250-300	Instantaneous
Terra Cotta (air-drying in conditioning room).....	150-220	12-96 Hours
Wall Board.....	200-250	12-24 "