

(a) the heat to be removed from the lithium chloride solution to maintain these conditions, and (b) the temperature rise of the solution in passing through the absorber.

Solution. (a) The enthalpy of the entering air at 100 F dry-bulb and 39 per cent relative humidity = $h_a + \mu h_{as} = 24.00 + (0.39 \times 47.40) = 42.49$ Btu per pound (Table 6, Chapter 1).

The relative humidity of the air leaving at 85 F dry-bulb and 35 F dew-point is 16.7 per cent (psychrometric chart). Enthalpy of leaving air = $20.39 + (0.167 \times 28.85) = 25.21$ Btu per pound (Table 6, Chapter 1).

Heat to be extracted from air = $1000 (42.49 - 25.21) = 17,280$ Btu per minute. Heat of mixing = $145 - (0.186 \times 80) = 130$ Btu per pound of moisture removed. From Table 6, Chapter 1, the moisture removal per pound of air = $0.01574 - 0.00426 = 0.01148$ lb. Heat of mixing for 1000 lb of air = $1000 \times 0.01148 \times 130 = 1492$ Btu. Total heat extraction = $17,280 + 1492 = 18,772$ Btu per minute.

(b) The weight of solution circulated is 200×1.27 (Table 1) $\times 8.33 = 2116$ lb per minute. Its heat capacity = 2116×0.631 (Table 1) = 1335 Btu per minute per degree Fahrenheit. The temperature rise = $18,772 \div 1335 = 14.1$ F.

TABLE 3. DENSITY OF LITHIUM CHLORIDE SOLUTIONS

CONCENTRATION POUND MOLES (42.4 LB) LiCl PER 1000 LB WATER	TEMPERATURE DEG F						
	0	50	100	150	200	250	300
0							
2		1.045	1.037	1.026	1.012		
4	1.090	1.085	1.076	1.064	1.052		
6	1.124	1.119	1.111	1.100	1.087		
8	1.156	1.150	1.143	1.132	1.122		
10	1.188	1.181	1.172	1.162	1.152	1.142	
12	1.217	1.209	1.199	1.188	1.178	1.168	
14	1.242	1.235	1.225	1.214	1.203	1.192	
16		1.257	1.248	1.236	1.226	1.215	
18		1.279	1.270	1.259	1.248	1.237	
20			1.291	1.280	1.279	1.268	
22				1.310	1.289	1.278	1.267
24				1.317	1.307	1.296	1.286
26					1.313	1.312	1.302
28					1.338	1.327	1.318
30						1.34	1.33
32							1.35

SOLID DEHYDRATION METHODS

One type of equipment suitable for producing dehydration with solid drying agents utilizes an apparatus with continuous operating rotating beds or dampers as illustrated in Fig. 4. The apparatus consists essentially of a cylinder or drum filled with dehydrating material. Air flow through the drum is directed by baffles which permit three independent air streams to flow through the adsorbing material. One air stream consists of the wet air which is to be dehydrated. The second is heated activation air used for drying that part of the dehydrating material which has become saturated. The third air stream purges away the products of combustion left in the bed from the activation cycle (when direct fired) and cools the bed to a temperature low enough to permit pickup of moisture when that part of the bed returns to the dehydration cycle.

In the rotating bed apparatus, the baffle sheets are stationary and the screened bed rotates at a definite speed to permit the proper time of

contact in the activation, purge and dehydration cycles. In the rotating damper apparatus, the bed remains stationary and a sectionalized damper rotates. This rotating damper produces the same effect as if the stationary baffles previously mentioned rotated.

Clean heated air for activation is supplied at temperatures normally ranging from 300 to 450 F. Any source of heat such as high pressure steam coils, electric heaters or oil or coal-fired air heat interchangers can, therefore, be used for heating the air. Direct-fired heaters are limited to gas since there must be no combustion products to contaminate the adsorbent.

Another type of solid dehydrating equipment uses two complete sets of stationary adsorbing beds, arranged so that one set is dehydrating the air while the other set is being activated. With the dampers in the position shown in Fig. 5, air to be dried flows through one set of beds and is dehydrated, while activation air is heated and circulated through the

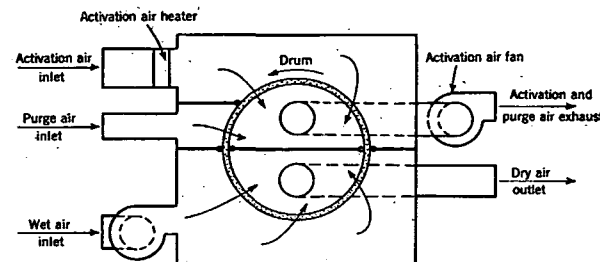


FIG. 4. SOLID ADSORBENT DEHYDRATOR—ROTATING BED TYPE

other set. After activation is complete, the beds are purged by shutting off the activation air heaters and allowing unheated air to circulate through them.

After the beds which are dehydrating have adsorbed moisture to a degree which begins to impair performance, a timer-controller causes the dampers to rotate to the opposite side. Thus the beds which on the previous cycle were adsorbing have activation air circulated through them, and vice versa. Activation air is heated in the same manner as with continuous equipment.

LIQUID DEHYDRATING METHODS

One type of system utilizing liquid dehydrating agents includes an external interchanger having essential parts consisting of a dehydration contactor, a solution concentrator, a solution heater and a solution cooler, all as shown in Fig. 6. The dehydrator contactor is located in the wet air stream. The air to be conditioned is brought into contact with an aqueous brine solution having a vapor pressure below that of the entering air, resulting in a transfer of moisture (latent heat). As previously described, this results in a conversion of latent to sensible heat, raising both air and solution temperatures. This temperature rise is kept down