

known as *saturated steam*. If it contains no actual water in the form of mist or priming, it is called *dry saturated steam*. If this be heated and the pressure maintained the same as when it was vaporized, its temperature will increase and it will become *superheated*, that is, its temperature will be higher than that of saturated steam at the same pressure. The relation between pressure and specific volume for dry saturated steam is given by the experimental equation (Goodenough) as:

$$pv^{1.6631} = 484.2 \quad (1)$$

where

p = the pressure in pounds per square inch.
 v = the specific volume.

The *total heat* of a dry saturated vapor for any pressure and temperature is the sum of the heat required to raise the temperature of one pound of the liquid from the freezing point to the given temperature and corresponding pressure plus the heat required entirely to vaporize it at this pressure.

Steam which is in contact with the water from which it was generated is called *wet saturated steam* if it contains more or less actual water in the form of mist or priming. The percentage of dry steam in a mixture of steam and water is known as the *quality* (x) of the steam. The total heat of wet vapor at any pressure and temperature is the sum of the heat required to raise the temperature of one pound of the liquid from the

TABLE 5. VELOCITIES OF DRY AIR IN FEET PER MINUTE (AT VARIOUS TEMPERATURES) CORRESPONDING TO VARIOUS VELOCITY PRESSURES IN OUNCES PER SQUARE INCH^a
 Barometric Pressure 29.921 In.

PRESSURE		TEMPERATURE, DEG. FAHR.									
Ounces	Inches	50°	60°	70°	80°	100°	150°	200°	300°	500°	550°
0.1	0.1734	1635	1653	1667	1683	1714	1788	1860	1996	2244	2410
0.2	0.3468	2313	2338	2358	2380	2424	2530	2632	2824	3174	3405
0.3	0.5202	2833	2864	2888	2915	2969	3098	3223	3458	3887	4175
0.4	0.6936	3272	3307	3335	3367	3428	3578	3722	3994	4489	4850
0.5	0.8670	3658	3698	3729	3765	3833	4000	4162	4466	5019	5395
0.6	1.0400	4007	4051	4085	4124	4199	4382	4559	4892	5498	5900
0.7	1.2140	4329	4375	4412	4454	4535	4733	4924	5283	5938	6380
0.8	1.3870	4626	4677	4716	4761	4848	5059	5263	5647	6347	6820
0.9	1.5605	4907	4960	5002	5050	5142	5366	5582	5990	6733	7250
1.0	1.7340	5172	5229	5273	5323	5420	5656	5884	6314	7098	7625
1.1	1.9073	5426	5485	5531	5584	5685	5933	6172	6623	7444	8000
1.2	2.0808	5664	5725	5774	5828	5935	6194	6443	6914	7772	8350
1.3	2.2540	5896	5960	6011	6068	6179	6448	6708	7198	8090	8700
1.4	2.4275	6120	6186	6238	6297	6412	6692	6962	7470	8396	9020
1.5	2.6010	6335	6404	6457	6520	6638	6928	7207	7733	8692	9345
1.6	2.7742	6543	6614	6670	6734	6856	7155	7444	7987	8977	9650
1.8	3.1210	6942	7017	7076	7143	7274	7591	7897	8473	9524	10220
2.0	3.4680	7315	7395	7457	7528	7665	8000	8322	8930	10037	10780
2.2	3.8145	7672	7755	7820	7894	8038	8462	8727	9364	10525	11300
2.4	4.1615	8012	8099	8168	8245	8396	8762	9115	9781	10995	11800
2.6	4.5080	8338	8429	8500	8581	8737	9118	9486	10179	11440	12280
2.8	4.8550	8654	8748	8822	8906	9068	9464	9845	10564	11873	12750
3.0	5.2020	8960	9057	9134	9220	9388	9798	10193	10938	12293	13200

^aFrom Fan Engineering.

freezing point to the given temperature and corresponding pressure plus the heat required to vaporize the part x at this pressure.

AIR

Composition. Air is a mechanical mixture made up, by volume, of 20.91 per cent of oxygen and 79.09 per cent of nitrogen, or by weight, of 23.15 per cent of oxygen and 76.85 per cent of nitrogen. Air as found in nature always contains other constituents in varying amounts, such as carbon dioxide, ozone, water vapor, dust, bacteria, etc.

The *specific density* or weight per cubic foot of dry air decreases with an increase in temperature; and the specific volume, or volume per pound, increases with such increase. The *specific heat* of air at constant pressure, or the Btu required to raise the temperature of one pound one degree Fahrenheit, varies from 0.2375 to 0.2430 as determined by various investigators. The value 0.24 is recommended for engineering calculations. It has been found that a given volume of air expands when heated under constant pressure, and again that if the temperature of a given volume of air be kept constant and the pressure increased, contraction takes place. These changes follow definite laws, which apply to other gases as well as air, known as the *laws of perfect gases*. These laws do not generally apply to steam, since it is not a perfect gas, but superheated steam at high temperatures follows the laws approximately. (See Tables 5, 6, 7 and 8).

Boyle's Law refers to the relation between the pressure and volume of a

TABLE 6. VELOCITIES OF DRY AIR IN FEET PER MINUTE (AT VARIOUS TEMPERATURES) CORRESPONDING TO VARIOUS VELOCITY PRESSURES IN INCHES OF WATER^a
 Barometric Pressure 29.921 In.

PRESSURE		TEMPERATURE, DEG. FAHR.									
Inches	Ounces	50°	60°	70°	80°	100°	150°	200°	300°	500°	550°
0.1	0.0577	1242	1255	1266	1278	1300	1358	1413	1516	1704	1830
0.2	0.1154	1757	1776	1791	1808	1841	1921	2000	2145	2411	2590
0.25	0.1443	1965	1986	2003	2022	2059	2149	2235	2399	2696	2895
0.3	0.1730	2151	2175	2193	2214	2254	2352	2447	2626	2952	3175
0.4	0.2308	2485	2512	2533	2557	2603	2717	2827	3033	3409	3660
0.5	0.2884	2778	2808	2832	2859	2911	3038	3160	3391	3812	4095
0.6	0.3460	3043	3076	3102	3131	3188	3327	3462	3715	4175	4490
0.7	0.4037	3287	3323	3351	3383	3445	3595	3740	4013	4510	4850
0.75	0.4326	3402	3439	3468	3501	3565	3720	3870	4153	4668	5020
0.8	0.4614	3524	3552	3582	3616	3682	3843	3997	4290	4821	5185
0.9	0.5190	3728	3768	3800	3836	3906	4076	4241	4550	5114	5500
1.0	0.5768	3929	3971	4005	4043	4117	4296	4470	4796	5390	5795
1.25	0.7209	4393	4440	4478	4520	4602	4804	4997	5362	6027	6470
1.50	0.8650	4812	4864	4905	4952	5042	5262	5474	5874	6602	7100
1.75	1.0092	5197	5254	5298	5348	5446	5683	5912	6344	7131	7655
2.00	1.1535	5556	5616	5664	5718	5822	6076	6320	6783	7624	8195
2.25	1.2975	5892	5956	6007	6064	6174	6443	6704	7193	8085	8690
2.50	1.4418	6211	6278	6332	6392	6508	6792	7066	7582	8523	9150
2.75	1.5860	6514	6585	6641	6704	6827	7124	7412	7952	8938	9600
3.00	1.7300	6807	6879	6937	7003	7130	7440	7742	8307	9336	10000
4.00	2.3070	7857	7942	8010	8086	8233	8592	8940	9581	10780	11580
5.00	2.8840	8772	8867	8943	9027	9192	9593	9980	10710	12037	12900
6.00	3.4600	9623	9728	9810	9903	10083	10523	10950	11750	13203	14180

^aFrom Fan Engineering.