

## Datos de referencia

### Propiedades del aire

#### Calor específico, viscosidad y densidad (peso) del aire a diferentes temperaturas y presiones

| Temp del Aire (°F) | Calor específico (Btu/Lbs/°F) | Viscosidad absoluta (Lbs/Ft/Hr) | Presión indicada en lbs/plg <sup>2</sup> (basado en presión atmosférica absoluta de 14.7 lbs/plg <sup>2</sup> al nivel del mar) |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|--------------------|-------------------------------|---------------------------------|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                    |                               |                                 | 0   | 10    | 20    | 30    | 40    | 50    | 60    | 70    | 80    | 100   | 120   | 150   | 200   | 250   | 300   |       |
|                    |                               |                                 | Densidad (peso) en lbs/plg <sup>3</sup>   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| -20                | 0.239                         | 0.039                           | 0.0900  | 0.152 | 0.213 | 0.274 | 0.336 | 0.397 | 0.458 | 0.519 | 0.580 | 0.641 | 0.702 | 0.825 | 1.010 | 1.318 | 1.625 | 1.934 |
| -10                | 0.239                         | 0.039                           | 0.0882  | 0.149 | 0.209 | 0.268 | 0.328 | 0.388 | 0.448 | 0.508 | 0.567 | 0.627 | 0.687 | 0.807 | 0.989 | 1.288 | 1.588 | 1.890 |
| 0                  | 0.239                         | 0.040                           | 0.0864  | 0.146 | 0.204 | 0.263 | 0.322 | 0.380 | 0.438 | 0.497 | 0.556 | 0.615 | 0.674 | 0.790 | 0.968 | 1.260 | 1.553 | 1.850 |
| 10                 | 0.239                         | 0.040                           | 0.0846  | 0.143 | 0.199 | 0.257 | 0.315 | 0.372 | 0.429 | 0.486 | 0.543 | 0.600 | 0.658 | 0.774 | 0.947 | 1.233 | 1.520 | 1.810 |
| 20                 | 0.239                         | 0.041                           | 0.0828  | 0.140 | 0.196 | 0.252 | 0.307 | 0.365 | 0.421 | 0.477 | 0.533 | 0.590 | 0.645 | 0.757 | 0.927 | 1.208 | 1.489 | 1.770 |
| 30                 | 0.240                         | 0.041                           | 0.0811  | 0.137 | 0.192 | 0.247 | 0.302 | 0.357 | 0.412 | 0.467 | 0.522 | 0.577 | 0.632 | 0.742 | 0.908 | 1.184 | 1.460 | 1.730 |
| 40                 | 0.240                         | 0.042                           | 0.0795  | 0.134 | 0.188 | 0.242 | 0.295 | 0.350 | 0.404 | 0.458 | 0.511 | 0.565 | 0.619 | 0.727 | 0.890 | 1.161 | 1.431 | 1.705 |
| 50                 | 0.240                         | 0.042                           | 0.0780  | 0.131 | 0.184 | 0.237 | 0.291 | 0.343 | 0.396 | 0.449 | 0.501 | 0.554 | 0.607 | 0.713 | 0.873 | 1.139 | 1.403 | 1.661 |
| 60                 | 0.240                         | 0.043                           | 0.0764  | 0.128 | 0.180 | 0.232 | 0.284 | 0.336 | 0.388 | 0.440 | 0.493 | 0.546 | 0.596 | 0.700 | 0.856 | 1.116 | 1.376 | 1.638 |
| 70                 | 0.240                         | 0.044                           | 0.0750  | 0.126 | 0.177 | 0.228 | 0.279 | 0.330 | 0.381 | 0.432 | 0.482 | 0.534 | 0.584 | 0.686 | 0.839 | 1.095 | 1.350 | 1.604 |
| 80                 | 0.240                         | 0.045                           | 0.0736  | 0.124 | 0.174 | 0.224 | 0.274 | 0.324 | 0.374 | 0.423 | 0.473 | 0.522 | 0.572 | 0.673 | 0.824 | 1.074 | 1.325 | 1.573 |
| 90                 | 0.240                         | 0.045                           | 0.0723  | 0.122 | 0.171 | 0.220 | 0.269 | 0.318 | 0.367 | 0.415 | 0.464 | 0.513 | 0.561 | 0.660 | 0.809 | 1.054 | 1.300 | 1.546 |
| 100                | 0.240                         | 0.046                           | 0.0710  | 0.120 | 0.168 | 0.215 | 0.264 | 0.312 | 0.360 | 0.408 | 0.455 | 0.503 | 0.551 | 0.648 | 0.794 | 1.035 | 1.276 | 1.517 |
| 120                | 0.240                         | 0.047                           | 0.0686  | 0.116 | 0.162 | 0.208 | 0.255 | 0.302 | 0.348 | 0.394 | 0.440 | 0.533 | 0.626 | 0.767 | 0.901 | 1.141 | 1.382 | 1.465 |
| 150                | 0.241                         | 0.049                           | 0.0652  | 0.110 | 0.154 | 0.199 | 0.243 | 0.287 | 0.331 | 0.375 | 0.419 | 0.508 | 0.596 | 0.730 | 0.863 | 1.103 | 1.344 | 1.392 |
| 175                | 0.241                         | 0.051                           | 0.0626  | 0.105 | 0.148 | 0.191 | 0.234 | 0.275 | 0.318 | 0.361 | 0.403 | 0.488 | 0.573 | 0.701 | 0.831 | 1.071 | 1.312 | 1.337 |
| 200                | 0.241                         | 0.052                           | 0.0603  | 0.101 | 0.143 | 0.184 | 0.225 | 0.266 | 0.305 | 0.347 | 0.388 | 0.470 | 0.552 | 0.674 | 0.804 | 1.044 | 1.285 | 1.287 |
| 250                | 0.242                         | 0.055                           | 0.0560  | 0.094 | 0.132 | 0.171 | 0.208 | 0.247 | 0.285 | 0.322 | 0.360 | 0.436 | 0.513 | 0.627 | 0.757 | 0.997 | 1.238 | 1.197 |
| 300                | 0.243                         | 0.058                           | 0.0523  | 0.088 | 0.124 | 0.159 | 0.195 | 0.230 | 0.265 | 0.301 | 0.336 | 0.407 | 0.478 | 0.585 | 0.715 | 0.955 | 1.196 | 1.118 |
| 350                | 0.244                         | 0.060                           | 0.0491  | 0.083 | 0.116 | 0.150 | 0.184 | 0.216 | 0.249 | 0.282 | 0.316 | 0.382 | 0.449 | 0.549 | 0.679 | 0.919 | 1.160 | 1.048 |
| 400                | 0.245                         | 0.063                           | 0.0463  | 0.078 | 0.109 | 0.140 | 0.172 | 0.203 | 0.235 | 0.266 | 0.298 | 0.360 | 0.423 | 0.517 | 0.647 | 0.887 | 1.128 | 0.987 |
| 500                | 0.248                         | 0.067                           | 0.0414  | 0.067 | 0.098 | 0.126 | 0.154 | 0.182 | 0.210 | 0.238 | 0.266 | 0.322 | 0.379 | 0.463 | 0.604 | 0.844 | 1.084 | 0.885 |
| 600                | 0.25                          | 0.072                           | 0.0376  | 0.063 | 0.089 | 0.114 | 0.140 | 0.165 | 0.190 | 0.216 | 0.241 | 0.292 | 0.343 | 0.419 | 0.547 | 0.757 | 0.957 | 0.801 |
| 700                | 0.254                         | 0.076                           | 0.0341  | 0.058 | 0.081 | 0.104 | 0.127 | 0.151 | 0.174 | 0.198 | 0.221 | 0.267 | 0.328 | 0.383 | 0.500 | 0.670 | 0.830 | 0.733 |
| 800                | 0.257                         | 0.080                           | 0.0314  | 0.053 | 0.071 | 0.096 | 0.117 | 0.139 | 0.160 | 0.181 | 0.203 | 0.246 | 0.314 | 0.353 | 0.460 | 0.590 | 0.710 | 0.675 |
| 900                | 0.259                         | 0.085                           | 0.0295  | 0.049 | 0.069 | 0.089 | 0.109 | 0.129 | 0.148 | 0.168 | 0.188 | 0.228 | 0.289 | 0.327 | 0.427 | 0.526 | 0.625 | 0.625 |
| 1000               | 0.262                         | 0.089                           | 0.0275  | 0.046 | 0.064 | 0.083 | 0.101 | 0.120 | 0.138 | 0.157 | 0.175 | 0.212 | 0.268 | 0.304 | 0.397 | 0.490 | 0.582 | 0.582 |

#### Cálculo de la densidad a otras temperaturas y presiones

La densidad a presión y temperatura específicas puede convertirse en otra densidad a otra presión y temperatura usando la siguiente ecuación:

$$D_2 = D_1 \frac{T_1}{T_2} \times \frac{P_2}{P_1}$$

Donde:

T<sub>1</sub> = Temperatura en condición inicial (°F + 460°)

T<sub>2</sub> = Temperatura en condición nueva (°F + 460°)

D<sub>1</sub> = Densidad en lbs/plg<sup>3</sup> en condición inicial

D<sub>2</sub> = Densidad en lbs/plg<sup>3</sup> en condición nueva

P<sub>1</sub> = Presión absoluta (psia) en condición inicial

P<sub>2</sub> = Presión absoluta (psia) en condición nueva

#### Cálculo de flujo o volumen

La misma fórmula puede usarse para convertir el flujo de aire o volumen a la presión indicada (psig) en condiciones estándares (presión atmosférica a 21 °C [70 °F]) sustituyendo pies cúbicos (pies<sup>3</sup>) o pies cúbicos por minuto (CFM) por densidad (D):

$$\text{CFM estándar} = \text{CFM real} \frac{(70 + 460)}{(T_2 + 460)} \times \frac{(\text{psig} + 14.7)}{14.7 \text{ psia}}$$

#### Contenido de vapor de agua del aire en libras de agua/100 pies<sup>3</sup> a diferentes temperaturas y humedad relativa

| Aire (°F) | lbs/100 pies <sup>3</sup> a la humedad relativa especificada |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|-----------|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|           | 20%  | 25%  | 30%  | 35%  | 40%  | 45%  | 50%  | 55%  | 60%  | 65%  | 70%  | 75%  | 80%  | 85%  | 90%  | 95%  | 100% |
| -20       | .001   | .001 | .001 | .001 | .001 | .002 | .002 | .002 | .002 | .002 | .002 | .002 | .003 | .003 | .003 | .003 | .003 |
| -10       | .001   | .001 | .001 | .001 | .002 | .002 | .002 | .002 | .003 | .003 | .003 | .003 | .003 | .004 | .004 | .004 | .004 |
| 0         | .001   | .002 | .002 | .002 | .003 | .003 | .004 | .004 | .004 | .005 | .005 | .005 | .006 | .006 | .006 | .007 | .007 |
| 10        | .002   | .003 | .003 | .004 | .004 | .005 | .006 | .006 | .007 | .007 | .008 | .008 | .009 | .009 | .010 | .010 | .011 |
| 20        | .004   | .005 | .005 | .006 | .007 | .008 | .009 | .010 | .011 | .011 | .012 | .013 | .014 | .014 | .015 | .016 | .017 |
| 30        | .006   | .007 | .008 | .010 | .011 | .013 | .014 | .015 | .017 | .018 | .020 | .021 | .022 | .024 | .025 | .027 | .028 |
| 40        | .008   | .010 | .012 | .014 | .016 | .018 | .021 | .023 | .025 | .027 | .029 | .031 | .033 | .035 | .037 | .039 | .041 |
| 50        | .012   | .015 | .018 | .021 | .024 | .027 | .030 | .032 | .035 | .038 | .041 | .044 | .047 | .050 | .053 | .056 | .059 |
| 60        | .017   | .021 | .025 | .029 | .033 | .037 | .042 | .046 | .050 | .054 | .058 | .062 | .066 | .071 | .075 | .079 | .083 |
| 65        | .020   | .025 | .029 | .034 | .039 | .044 | .049 | .054 | .059 | .064 | .069 | .074 | .078 | .083 | .088 | .093 | .098 |
| 68        | .022   | .027 | .032 | .038 | .043 | .049 | .054 | .059 | .065 | .070 | .076 | .081 | .086 | .092 | .097 | .103 | .108 |
| 70        | .023   | .029 | .035 | .040 | .046 | .052 | .058 | .063 | .069 | .075 | .081 | .086 | .092 | .098 | .104 | .109 | .115 |
| 71        | .024   | .030 | .036 | .042 | .048 | .054 | .060 | .065 | .071 | .077 | .083 | .089 | .095 | .101 | .107 | .113 | .119 |
| 72        | .025   | .031 | .037 | .043 | .049 | .055 | .062 | .068 | .074 | .080 | .086 | .092 | .098 | .105 | .111 | .117 | .123 |
| 73        | .025   | .032 | .038 | .044 | .051 | .057 | .064 | .070 | .076 | .083 | .089 | .095 | .102 | .108 | .114 | .121 | .127 |
| 74        | .026   | .033 | .039 | .046 | .052 | .059 | .066 | .072 | .079 | .085 | .092 | .098 | .105 | .111 | .118 | .124 | .131 |
| 75        | .027   | .034 | .041 | .047 | .054 | .061 | .068 | .074 | .081 | .088 | .094 | .101 | .108 | .115 | .122 | .128 | .135 |
| 78        | .030   | .037 | .044 | .052 | .059 | .067 | .074 | .081 | .089 | .096 | .104 | .111 | .118 | .126 | .133 | .141 | .148 |
| 80        | .032   | .040 | .047 | .055 | .063 | .071 | .079 | .087 | .095 | .103 | .111 | .119 | .126 | .134 | .142 | .150 | .158 |
| 85        | .037   | .046 | .055 | .064 | .074 | .083 | .092 | .101 | .110 | .120 | .129 | .138 | .147 | .156 | .166 | .175 | .184 |
| 90        | .043   | .053 | .064 | .075 | .085 | .096 | .107 | .117 | .128 | .138 | .149 | .160 | .170 | .181 | .192 | .202 | .213 |
| 95        | .049   | .062 | .074 | .086 | .099 | .111 | .124 | .136 | .148 | .161 | .173 | .185 | .198 | .210 | .222 | .235 | .247 |
| 100       | .057   | .071 | .086 | .100 | .114 | .128 | .143 | .157 | .171 | .185 | .200 | .214 | .228 | .242 | .257 | .271 | .285 |

**Nota:** Para convertir los "granos de humedad" a libras, multiplique los granos por 0.0001428.