

Lampiran 2 : Tabel A-1. Sifat-sifat cairan udara dan uap jenuh

**Tabel A-1 Air: Sifat-sifat cairan dan uap jenuh**

| $t, ^\circ\text{C}$ | Tekanan jenuh, kPa | Volume spesifik, $\text{m}^3/\text{kg}$ |       | Entalpi kJ/kg |        | Entropi, kJ/kg $\cdot$ K |        |
|---------------------|--------------------|-----------------------------------------|-------|---------------|--------|--------------------------|--------|
|                     |                    | Cairan                                  | Gas   | Cairan        | Gas    | Cairan                   | Gas    |
| 0                   | 0,6108             | 0,0010002                               | 206,3 | - 0,04        | 2501,6 | -0,0002                  | 9,1577 |
| 2                   | 0,7055             | 0,0010001                               | 179,9 | 8,39          | 2505,2 | 0,0306                   | 9,1047 |
| 4                   | 0,8129             | 0,0010000                               | 157,3 | 16,80         | 2508,9 | 0,0611                   | 9,0526 |
| 6                   | 0,9345             | 0,0010000                               | 137,8 | 25,21         | 2512,6 | 0,0913                   | 9,0015 |
| 8                   | 1,0720             | 0,0010001                               | 121,0 | 33,60         | 2516,2 | 0,1213                   | 8,9513 |
| 10                  | 1,2270             | 0,0010003                               | 106,4 | 41,99         | 2519,9 | 0,1510                   | 8,9020 |
| 12                  | 1,4014             | 0,0010004                               | 93,84 | 50,38         | 2523,6 | 0,1805                   | 8,8536 |
| 14                  | 1,5973             | 0,0010007                               | 82,90 | 58,75         | 2527,2 | 0,2098                   | 8,8060 |
| 16                  | 1,8168             | 0,0010010                               | 73,38 | 67,13         | 2530,9 | 0,2388                   | 8,7593 |
| 18                  | 2,062              | 0,0010013                               | 65,09 | 75,50         | 2534,5 | 0,2677                   | 8,7135 |
| 20                  | 2,337              | 0,0010017                               | 57,84 | 83,86         | 2538,2 | 0,2963                   | 8,6684 |
| 22                  | 2,642              | 0,0010022                               | 51,49 | 92,23         | 2541,8 | 0,3247                   | 8,6241 |
| 24                  | 2,982              | 0,0010026                               | 45,93 | 100,59        | 2545,5 | 0,3530                   | 8,5806 |
| 26                  | 3,360              | 0,0010032                               | 41,03 | 108,95        | 2549,1 | 0,3810                   | 8,5379 |
| 28                  | 3,778              | 0,0010037                               | 36,73 | 117,31        | 2552,7 | 0,4088                   | 8,4959 |
| 30                  | 4,241              | 0,0010043                               | 32,93 | 125,66        | 2556,4 | 0,4365                   | 8,4546 |
| 32                  | 4,753              | 0,0010049                               | 29,57 | 134,02        | 2560,0 | 0,4640                   | 8,4140 |
| 34                  | 5,318              | 0,0010056                               | 26,60 | 142,38        | 2563,6 | 0,4913                   | 8,3740 |
| 36                  | 5,940              | 0,0010063                               | 23,97 | 150,74        | 2567,2 | 0,5184                   | 8,3348 |
| 38                  | 6,624              | 0,0010070                               | 21,63 | 159,09        | 2570,8 | 0,5453                   | 8,2962 |
| 40                  | 7,375              | 0,0010078                               | 19,55 | 167,45        | 2574,4 | 0,5721                   | 8,2583 |
| 42                  | 8,198              | 0,0010086                               | 17,69 | 175,31        | 2577,9 | 0,5987                   | 8,2209 |
| 44                  | 9,100              | 0,0010094                               | 16,04 | 184,17        | 2581,5 | 0,6252                   | 8,1842 |
| 46                  | 10,086             | 0,0010103                               | 14,56 | 192,53        | 2585,1 | 0,6514                   | 8,1481 |
| 48                  | 11,162             | 0,0010112                               | 13,23 | 200,89        | 2588,6 | 0,6776                   | 8,1125 |
| 50                  | 12,335             | 0,0010121                               | 12,05 | 209,26        | 2592,2 | 0,7035                   | 8,0776 |
| 52                  | 13,613             | 0,0010131                               | 10,98 | 217,62        | 2595,7 | 0,7293                   | 8,0432 |
| 54                  | 15,002             | 0,0010140                               | 10,02 | 225,98        | 2599,2 | 0,7550                   | 8,0093 |
| 56                  | 16,511             | 0,0010150                               | 9,159 | 234,35        | 2602,7 | 0,7804                   | 7,9759 |
| 58                  | 18,147             | 0,0010161                               | 8,381 | 242,72        | 2606,2 | 0,8058                   | 7,9431 |
| 60                  | 19,920             | 0,0010171                               | 7,679 | 251,09        | 2609,7 | 0,8310                   | 7,9108 |
| 62                  | 21,84              | 0,0010182                               | 7,044 | 259,46        | 2613,2 | 0,8560                   | 7,8790 |
| 64                  | 23,91              | 0,0010193                               | 6,469 | 267,84        | 2616,6 | 0,8809                   | 7,8477 |
| 66                  | 26,15              | 0,0010205                               | 5,948 | 276,21        | 2620,1 | 0,9057                   | 7,8168 |
| 68                  | 28,56              | 0,0010217                               | 5,476 | 284,59        | 2623,5 | 0,9303                   | 7,7864 |
| 70                  | 31,16              | 0,0010228                               | 5,046 | 292,97        | 2626,9 | 0,9548                   | 7,7565 |

Sumber: Diringkaskan atas izin dari Referensi pertama.

Tabel A-1 (lanjutan)

| t, °C | Tekanan jenuh, kPa | Volume spesifik, m <sup>3</sup> /kg |        | Entalpi, kJ/kg |        | Entropi, kJ/kg · K |        |
|-------|--------------------|-------------------------------------|--------|----------------|--------|--------------------|--------|
|       |                    | Cairan                              | Gas    | Cairan         | Gas    | Cairan             | Gas    |
| 72    | 33,96              | 0,0010241                           | 4,646  | 301,35         | 2630,3 | 0,9792             | 7,7270 |
| 74    | 36,96              | 0,0010253                           | 4,300  | 309,74         | 2633,7 | 1,0034             | 7,6979 |
| 76    | 40,19              | 0,0010266                           | 3,976  | 318,13         | 2637,1 | 1,0275             | 7,6693 |
| 78    | 43,65              | 0,0010279                           | 3,680  | 326,52         | 2640,4 | 1,0514             | 7,6410 |
| 80    | 47,36              | 0,0010292                           | 3,409  | 334,92         | 2643,8 | 1,0753             | 7,6132 |
| 82    | 51,33              | 0,0010305                           | 3,162  | 343,31         | 2647,1 | 1,0990             | 7,5850 |
| 84    | 55,57              | 0,0010319                           | 2,935  | 351,71         | 2650,4 | 1,1225             | 7,5588 |
| 86    | 60,11              | 0,0010333                           | 2,727  | 360,12         | 2653,6 | 1,1460             | 7,5321 |
| 88    | 64,95              | 0,0010347                           | 2,536  | 368,53         | 2656,9 | 1,1693             | 7,5058 |
| 90    | 70,11              | 0,0010361                           | 2,361  | 376,94         | 2660,1 | 1,1925             | 7,4799 |
| 92    | 75,61              | 0,0010376                           | 2,200  | 385,36         | 2663,4 | 1,2156             | 7,4543 |
| 94    | 81,46              | 0,0010391                           | 2,052  | 393,78         | 2666,6 | 1,2386             | 7,4291 |
| 96    | 87,69              | 0,0010406                           | 1,915  | 402,20         | 2669,7 | 1,2615             | 7,4042 |
| 98    | 94,30              | 0,0010421                           | 1,789  | 410,63         | 2672,9 | 1,2842             | 7,3796 |
| 100   | 101,33             | 0,0010437                           | 1,673  | 419,06         | 2676,0 | 1,3069             | 7,3554 |
| 102   | 108,78             | 0,0010453                           | 1,566  | 427,50         | 2679,1 | 1,3294             | 7,3315 |
| 104   | 116,68             | 0,0010469                           | 1,466  | 435,95         | 2682,2 | 1,3518             | 7,3078 |
| 106   | 125,04             | 0,0010485                           | 1,374  | 444,40         | 2685,3 | 1,3742             | 7,2845 |
| 108   | 133,90             | 0,0010502                           | 1,289  | 452,85         | 2688,3 | 1,3964             | 7,2615 |
| 110   | 143,26             | 0,0010519                           | 1,210  | 461,32         | 2691,3 | 1,4185             | 7,2388 |
| 112   | 153,16             | 0,0010536                           | 1,137  | 469,78         | 2694,3 | 1,4405             | 7,2164 |
| 114   | 163,62             | 0,0010553                           | 1,069  | 478,26         | 2697,2 | 1,4624             | 7,1942 |
| 116   | 174,65             | 0,0010571                           | 1,005  | 486,74         | 2700,2 | 1,4842             | 7,1723 |
| 118   | 186,28             | 0,0010588                           | 0,9463 | 495,23         | 2703,1 | 1,5060             | 7,1507 |
| 120   | 198,54             | 0,0010606                           | 0,8915 | 503,72         | 2706,0 | 1,5276             | 7,1293 |

Sumber: Diringkaskan atas izin dari Referensi pertama.





Lampiran 3 : Tabel A-2. Lembab Udara: sifat-sifat termodinamik udara jenuh pada tekanan atmosfer 101,325 kPa

Tabel A-2 Lembab udara:<sup>2</sup> sifat-sifat termodinamik udara jenuh pada tekanan atmosfer 101,325 kPa.

| $t, ^\circ\text{C}$ | Tekanan gas, kPa | Perbandingan kelembaban, kg/kg | Volume spesifik, $\text{m}^3/\text{kg}$ | Entalpi, kJ/kg |
|---------------------|------------------|--------------------------------|-----------------------------------------|----------------|
| -40                 | 0,01283          | 0,000079                       | 0,6597                                  | -40,041        |
| -35                 | 0,02233          | 0,000138                       | 0,6740                                  | -34,868        |
| -30                 | 0,03798          | 0,000234                       | 0,6884                                  | -29,600        |
| -25                 | 0,06324          | 0,000390                       | 0,7028                                  | -24,187        |
| -20                 | 0,10318          | 0,000637                       | 0,7173                                  | -18,546        |
| -18                 | 0,12482          | 0,000771                       | 0,7231                                  | -16,203        |
| -16                 | 0,15056          | 0,000930                       | 0,7290                                  | -13,795        |
| -14                 | 0,18107          | 0,001119                       | 0,7349                                  | -11,314        |
| -12                 | 0,21716          | 0,001342                       | 0,7409                                  | -8,745         |
| -10                 | 0,25971          | 0,001606                       | 0,7469                                  | -6,073         |
| -8                  | 0,30975          | 0,001916                       | 0,7529                                  | -3,285         |
| -6                  | 0,36846          | 0,002280                       | 0,7591                                  | -0,360         |
| -4                  | 0,43716          | 0,002707                       | 0,7653                                  | 2,724          |
| -2                  | 0,51735          | 0,003206                       | 0,7716                                  | 5,991          |
| 0                   | 0,61072          | 0,003788                       | 0,7781                                  | 9,470          |
| 1                   | 0,6566           | 0,00407                        | 0,7813                                  | 11,200         |
| 2                   | 0,7055           | 0,00438                        | 0,7845                                  | 12,978         |
| 3                   | 0,7575           | 0,00471                        | 0,7878                                  | 14,807         |
| 4                   | 0,8130           | 0,00505                        | 0,7911                                  | 16,692         |
| 5                   | 0,8719           | 0,00542                        | 0,7944                                  | 18,634         |
| 6                   | 0,9347           | 0,00582                        | 0,7978                                  | 20,639         |
| 7                   | 1,0013           | 0,00624                        | 0,8012                                  | 22,708         |
| 8                   | 1,0722           | 0,00668                        | 0,8046                                  | 24,848         |
| 9                   | 1,1474           | 0,00716                        | 0,8081                                  | 27,059         |
| 10                  | 1,2272           | 0,00766                        | 0,8116                                  | 29,348         |
| 11                  | 1,3119           | 0,00820                        | 0,8152                                  | 31,716         |
| 12                  | 1,4017           | 0,00876                        | 0,8188                                  | 34,172         |
| 13                  | 1,4969           | 0,00937                        | 0,8225                                  | 36,719         |
| 14                  | 1,5977           | 0,01001                        | 0,8262                                  | 39,362         |
| 15                  | 1,7044           | 0,01069                        | 0,8300                                  | 42,105         |
| 16                  | 1,8173           | 0,01141                        | 0,8338                                  | 44,955         |
| 17                  | 1,9367           | 0,01218                        | 0,8377                                  | 47,918         |
| 18                  | 2,0630           | 0,01299                        | 0,8417                                  | 50,998         |
| 19                  | 2,1964           | 0,01384                        | 0,8457                                  | 54,205         |
| 20                  | 2,3373           | 0,01475                        | 0,8498                                  | 57,544         |
| 21                  | 2,4861           | 0,01572                        | 0,8540                                  | 61,021         |
| 22                  | 2,6431           | 0,01674                        | 0,8583                                  | 64,646         |
| 23                  | 2,8086           | 0,01781                        | 0,8626                                  | 68,425         |
| 24                  | 2,9832           | 0,01896                        | 0,8671                                  | 72,366         |
| 25                  | 3,1671           | 0,02016                        | 0,8716                                  | 76,481         |
| 26                  | 3,3609           | 0,02144                        | 0,8763                                  | 80,777         |
| 27                  | 3,5649           | 0,02279                        | 0,8811                                  | 85,263         |
| 28                  | 3,7797           | 0,02422                        | 0,8860                                  | 89,952         |
| 29                  | 4,0055           | 0,02572                        | 0,8910                                  | 94,851         |
| 30                  | 4,2431           | 0,02732                        | 0,8961                                  | 99,977         |
| 31                  | 4,4928           | 0,02900                        | 0,9014                                  | 105,337        |
| 32                  | 4,7552           | 0,03078                        | 0,9068                                  | 110,946        |
| 33                  | 5,0308           | 0,03266                        | 0,9124                                  | 116,819        |
| 34                  | 5,3201           | 0,03464                        | 0,9182                                  | 122,968        |
| 35                  | 5,6237           | 0,03674                        | 0,9241                                  | 129,411        |
| 36                  | 5,9423           | 0,03895                        | 0,9302                                  | 136,161        |
| 37                  | 6,2764           | 0,04129                        | 0,9365                                  | 143,239        |
| 38                  | 6,6265           | 0,04376                        | 0,9430                                  | 150,660        |
| 39                  | 6,9935           | 0,04636                        | 0,9497                                  | 158,445        |
| 40                  | 7,3778           | 0,04911                        | 0,9567                                  | 166,615        |

Tabel A-2 (lanjutan)

| $t, ^\circ\text{C}$ | Tekanan gas, kPa | Perbandingan kelembaban, kg/kg | Volume spesifik, $\text{m}^3/\text{kg}$ | Entalpi, kJ/kg |
|---------------------|------------------|--------------------------------|-----------------------------------------|----------------|
| 40                  | 7,3778           | 0,04911                        | 0,9567                                  | 166,615        |
| 41                  | 7,7803           | 0,05202                        | 0,9639                                  | 175,192        |
| 42                  | 8,2016           | 0,05509                        | 0,9713                                  | 184,200        |
| 43                  | 8,6424           | 0,05833                        | 0,9790                                  | 193,662        |
| 44                  | 9,1036           | 0,06176                        | 0,9871                                  | 203,610        |
| 45                  | 9,5856           | 0,06537                        | 0,9954                                  | 214,067        |
| 46                  | 10,0896          | 0,06920                        | 1,0040                                  | 225,068        |
| 47                  | 10,6161          | 0,07324                        | 1,0130                                  | 236,643        |
| 48                  | 11,1659          | 0,07751                        | 1,0224                                  | 248,828        |
| 49                  | 11,7402          | 0,08202                        | 1,0322                                  | 261,667        |
| 50                  | 12,3397          | 0,08680                        | 1,0424                                  | 275,198        |
| 52                  | 13,6176          | 0,09720                        | 1,0641                                  | 304,512        |
| 54                  | 15,0072          | 0,10887                        | 1,0879                                  | 337,182        |
| 56                  | 16,5163          | 0,12198                        | 1,1141                                  | 373,679        |
| 58                  | 18,1531          | 0,13674                        | 1,1429                                  | 414,572        |
| 60                  | 19,9263          | 0,15341                        | 1,1749                                  | 460,536        |
| 62                  | 21,8447          | 0,17228                        | 1,2105                                  | 512,391        |
| 64                  | 23,9184          | 0,19375                        | 1,2504                                  | 571,144        |
| 66                  | 26,1565          | 0,21825                        | 1,2953                                  | 638,003        |
| 68                  | 28,5701          | 0,24638                        | 1,3462                                  | 714,531        |
| 70                  | 31,1693          | 0,27884                        | 1,4043                                  | 802,643        |
| 75                  | 38,5562          | 0,38587                        | 1,5925                                  | 1092,010       |
| 80                  | 47,3670          | 0,55201                        | 1,8792                                  | 1539,414       |
| 85                  | 57,8096          | 0,83634                        | 2,3633                                  | 2302,878       |
| 90                  | 70,1140          | 1,41604                        | 3,3412                                  | 3856,547       |

