

国家市场监督管理总局

发 布

202×-××-××实施

202×-××-××发布

**蒸汽热能计量技术规范**

**Metrological Specification for the Heat Measurement of Steam**

（征求意见稿）

**JJF**XXXX—202X

中华人民共和国国家计量技术规范

**蒸汽热能计量技术规范**

JJFXXXX-202X

**Metrological Specification for the Heat**

**Measurement of Steam**

**归口单位：**全国能源资源计量技术委员会

能源计量分技术委员会

**主要起草单位：**

**参加起草单位：**

本规范由全国能源资源计量技术委员会能源计量分技术委员会负责解释

目 录

[引言](#_Toc15891) Ⅱ

[1 范围 1](#_Toc27484)

[2 引用文件 1](#_Toc13306)

[3 术语和计量单位 1](#_Toc13283)

[3.1 术语 1](#_Toc1353)

[3.2 计量单位 2](#_Toc16995)

[4 计量特性 2](#_Toc18723)

[5 计量条件 2](#_Toc17645)

[6 计量方法 3](#_Toc738)

[6.1 蒸汽流量 3](#_Toc20665)

[6.2 蒸汽比焓 4](#_Toc15616)

[6.3 蒸汽热能 6](#_Toc28661)

[7 计量结果的表达 7](#_Toc17449)

[附录 A 蒸汽性质表 8](#_Toc17162)

[附录 B 不确定度评估示例](#_Toc19422) 59

**引 言**

为规范蒸汽热能计量，在充分考虑我国蒸汽生产、销售、使用的实际状况和蒸汽计量仪表的技术特点基础上，按照JJF1071-2010《国家计量校准规范编写规则》，依据IAPWS-IF97《国际水和水蒸气性质学会工业用计算公式1997》及GB/T34060-2017《蒸汽热量计算方法》相关内容，制定本规范。

本规范为首次发布，无国际标准和国际建议参考。

蒸汽热能计量技术规范

**1 范围**

本规范规定了蒸汽热能计量系统的评价、蒸汽热能计量结果的核验及其等级的评定方法。

本规范适用于温度范围273.16K≤*T*≤623.15K、压力范围0MPa＜*p*≤*p*s(*T*)（*T*对应的饱和蒸汽压力）的干饱和蒸汽和过热蒸汽，以及当温度范围623.15K＜*T*≤1073.15K、压力范围0MPa＜*p*≤16.5292MPa的过热蒸汽流经封闭管道某一截面的蒸汽热能的计量。其他蒸汽流经封闭管道某一截面的蒸汽热能的计量也可参考执行。

**2 引用文件**

本规范引用了下列文件：

JJG 229 工业铂、铜热电阻

JJG 640 差压式流量计

JJG 882 压力变送器

JJG 1003 流量积算仪

JJG 1029 涡街流量计

JJG 1030 超声流量计

JJG 1038 科里奥利质量流量计

JJG 1121 旋进旋涡流量计

JJF 1183 温度变送器

GB/T 34060蒸汽热量计算方法

T/CMA NY050-2020 工业蒸汽流量计量技术要求

凡是注日期的引用文件，仅注日期的版本适用于本规范；凡是不注日期的引用文件，其最新版本（包括所有的修改单）适用于本规范。

**3 术语和计量单位**

**3.1 术语**

下列术语适用于本文件。

3.1.1 蒸汽steam

液态水汽化或固态水升华而成的气态水。

3.1.2 饱和蒸汽 saturated steam

密闭空间内气、液两相处于动态平衡状态即饱和状态的蒸汽。

3.1.3 饱和蒸汽压力saturated steam pressure

处于饱和状态的蒸汽压力。

3.1.4 饱和蒸汽温度 saturated steam temperature

处于饱和状态的蒸汽温度。

3.1.5 干饱和蒸汽 dry saturated steam

全部液态水都汽化成蒸汽，不含液态水的饱和蒸汽。

3.1.6 过热蒸汽 hyperthermia steam

在一定压力下对干饱和蒸汽再加热使其温度超过该压力下的饱和蒸汽温度的蒸汽。

3.1.7 蒸汽比焓steam specific enthalphy

某一温度和压力下单位质量的蒸汽所含有的能量，即单位质量蒸汽的内能与压力势能之和。

3.1.8 蒸汽质量流量 steam mass flow

单位时间流过某一截面的蒸汽质量。

3.1.9蒸汽热功率 steam thermal power

单位时间内蒸汽可释放的能量或做的功。

3.1.10 蒸汽热能 steam heating value

在某一时间段流经封闭管道某一截面的蒸汽能量。

**3.2计量单位**

体积流量单位：立方米每小时，符号m3/h。

质量流量单位：千克每秒，符号kg/s；千克每小时，符号kg/h；或吨每小时，符号t/h。

压力单位：帕[斯卡]，符号Pa；或千帕，符号kPa；或兆帕，符号MPa。

温度单位：摄氏度，符号℃；或热力学温度：开尔文，符号K。

热能单位：兆焦，符号MJ；或吉焦，符号GJ；或千瓦时，符号kWh。

**4 计量特性**

本规范使用蒸汽热能的最大允许误差（MPE）表征蒸汽热能计量系统（以下简称：热能系统）的计量特性，并按最大允许误差划分准确度等级，如表1所示。

表1 准确度等级与最大允许误差

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 准确度等级 | 1.0级 | 1.5级 | 2.0级 | 2.5级 |
| 最大允许误差 | ±1.0% | ±1.5% | ±2.0% | ±2.5% |

**5 计量条件**

**5.1 系统构成**

热能系统通常由流量测量仪表、温度测量仪表、压力测量仪表、热能计算机（或热能积算仪）组成，按结构类型一般可分为一体式和组合式，如图1所示。



图1 蒸汽热能计量系统示意图

**5.2 计量器具配备**

构成热能系统的各计量器具应符合相应计量检定规程或校准规范的技术要求，并具有有效的检定或校准证书。不同热能系统准确度等级的温度、压力和流量计等计量器具的准确度等级应满足表2的要求。

表2 蒸汽热能计量系统的配备要求

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| MPE  计量参数 | 准确度等级 | | | |
| 1.0级 | 1.5级 | 2.0级 | 2.5级 |
| 流量 | ±0.5% | ±1.0% | ±1.5% | ±1.5% |
| 温度 | ±0.3% | ±0.5% | ±0.5% | ±0.5% |
| 压力 | ±0.2%FS | ±0.2%FS | ±0.5%FS | ±1.0%FS |
| 热能积算仪 | ±0.2% | ±0.5% | ±0.5% | ±0.5% |

注：一体式热能系统各计量参数分量技术指标应满足表2要求。

**6计量方法**

**6.1 蒸汽质量流量**

将流量测量仪表、温度测量仪表、压力测量仪表安装在蒸汽管道上，热能积算仪采集蒸汽的流量、压力和/或温度信号后，依据相关标准计算蒸汽质量流量。

6.1.1 流量测量

可使用速度式、差压式和质量式等不同原理的流量计测量得到体积流量或质量流量。流量计的上、下游直管段长度、内径和内壁粗糙度，温度套管插入长度和位置，取压位置，流动调整器类型和位置，以及数据采集和处理方法等应符合流量计相应规范或标准要求。

流量计在管道上的安装应避免对管道产生附加的安装应力，必要时设置支架（座）。流量计安装应易于拆卸更换。压力调节阀应安装在蒸汽热能计量系统的上游，压力调节阀与流量测量仪表之间应有满足流量计上游直管段要求的直管段。

计量特性应符合JJG640、JJG1029、JJG1030、JJG1038、JJG1121等流量计相应检定规程或校准规范的相关要求。

6.1.2 温度测量

温度测量使用温度传感器（变送器），温度传感器插孔宜设置于流量计下游规定的位置上，以避免对流量计入口流场分布造成干扰。温度传感器套管应伸入管道至公称内径的约三分之一处，对于大于300mm口径的管道，设计插入深度应在75mm~150mm。安装温度传感器插孔时应考虑预留一个备用温度传感器插孔，用来进行比对，备用插孔应与主插孔成同一角度。为保证温度传感器插入处测得的温度与流过流量计的蒸汽真实温度相一致，必要时将温度传感器插孔的外部和流量计的上下游适当管段进行隔热处理。

计量特性应符合JJG 229和 JJF 1183等检定规程或校准规范的相关要求。

6.1.3 压力测量

压力测量使用压力变送器，压力测量位置一般应在蒸汽热能计量系统流量传感器上游，对取压有特殊要求的流量计按其说明书要求设置取压位置。压力测量系统应方便进行维护、检查和校准。在检查和校准时，要求压力传感器能与导压管隔开，具备为其提供标准压力的条件。导压对压力测量的影响应做到可忽略不计。

计量特性应符合JJG 882检定规程的相关要求。

**6.2 蒸汽比焓**

已知蒸汽的温度*T*与压力*p*，按式（1）计算流经管道截面的蒸汽的比焓。

**** （1）

式中：

 ——反对比温度，无量纲，，=540K；

——无量纲形式的比吉布斯能理想气体部分对反对比温度的偏导数，按式（2）计算；

——无量纲形式的比吉布斯能过余部分对反对比温度的偏导数，按式（3）计算。

 （2）

式中：

——第*i*个系数，见表3；

——第*i*个系数与指数，见表3。

表 3 无量纲吉布斯能理想气体部分方程（2区）的系数与指数

|  |  |  |
| --- | --- | --- |
|  |  |  |
| 1 | 0 | -9.69 276 865 002 17×100 |
| 2 | 1 | 1.00 866 559 680 18×101 |
| 3 | -5 | -5.60 879 112 830 20×10-3 |
| 4 | -4 | 7.14 527 380 814 55×10-2 |
| 5 | -3 | -4.07 104 982 239 28×10-1 |
| 6 | -2 | 1.42 408 191 714 44×100 |
| 7 | -1 | -4.38 395 113 194 50×100 |
| 8 | 2 | -2.84 086 324 607 72×10-1 |
| 9 | 3 | 2.12 684 637 533 07×10-2 |

 （3）

式中：

——第*i*个*n*系数，见表4 ；

*——*对比压力，无量纲，，*p\**=1MPa ；

—— 第*i*个*I*系数与*I*指数，见表4 ；

——第*i*个*J*系数与*J*指数，见表4 ；

 ——反对比温度，无量纲，，*T\**=540K。

表 4 无量纲吉布斯能过余部分方程（2区）的系数与指数

|  |  |  |  |
| --- | --- | --- | --- |
| *I* | *Ii* | *Ji* | *ni* |
| 1 | 1 | 0 | -1.77 317 424 732 13×10-3 |
| 2 | 1 | 1 | -1.78 348 622 923 58×10-2 |
| 3 | 1 | 2 | -4.59 960 136 963 65×10-2 |
| 4 | 1 | 3 | -5.75 812 590 834 32×10-2 |
| 5 | 1 | 6 | -5.03 252 787 279 30×10-2 |
| 6 | 2 | 1 | -3.30 326 416 702 03×10-5 |
| 7 | 2 | 2 | -1.89 489 875 163 15×10-4 |
| 8 | 2 | 4 | -3.93 927 772 433 55×10-3 |
| 9 | 2 | 7 | -4.37 972 956 505 73×10-2 |
| 10 | 2 | 36 | -2.66 745 479 140 87×10-5 |
| 11 | 3 | 0 | 2.04 817 376 923 09×10-8 |
| 12 | 3 | 1 | 4.38 706 672 844 35×10-7 |
| 13 | 3 | 3 | -3.22 776 772 385 70×10-5 |
| 14 | 3 | 6 | -1.50 339 245 421 48×10-3 |
| 15 | 3 | 35 | -4.06 682 535 626 49×10-2 |
| 16 | 4 | 1 | -7.88 473 095 593 67×10-10 |
| 17 | 4 | 2 | 1.27 907 178 522 85×10-8 |
| 18 | 4 | 3 | 4.82 253 727 185 07×10-7 |
| 19 | 5 | 7 | 2.29 220 763 376 61×10-6 |
| 20 | 6 | 3 | -1.67 147 664 510 61×10-11 |
| 21 | 6 | 16 | -2.11 714 723 213 55×10-3 |
| 22 | 6 | 35 | -2.38 957 419 341 04×101 |
| 23 | 7 | 0 | -5.90 595 643 242 70×10-18 |
| 24 | 7 | 11 | -1.26 218 088 991 01×10-6 |
| 25 | 7 | 25 | -3.89 468 424 357 39×10-2 |
| 26 | 8 | 8 | 1.12 562 113 604 59×10-11 |
| 27 | 8 | 36 | -8.23 113 408 979 98×100 |
| 28 | 9 | 13 | 1.98 097 128 020 88×10-8 |
| 29 | 10 | 4 | 1.04 069 652 101 74×10-19 |
| 30 | 10 | 10 | -1.02 347 470 959 29×10-13 |
| 31 | 10 | 14 | -1.00 181 793 795 11×10-9 |
| 32 | 16 | 29 | -8.08 829 086 469 85×10-11 |
| 33 | 16 | 50 | 1.06 930 318 794 09×10-1 |
| 34 | 18 | 57 | -3.36 622 505 741 71×10-1 |
| 35 | 20 | 20 | 8.91 858 453 554 21×10-25 |
| 36 | 20 | 35 | 3.06 293 168 762 32×10-13 |
| 37 | 20 | 48 | -4.20 024 676 982 08×10-6 |
| 38 | 21 | 21 | -5.90 560 296 856 39×10-26 |
| 39 | 22 | 53 | 3.78 269 476 134 57×10-6 |
| 40 | 23 | 39 | -1.27 686 089 346 81×10-15 |
| 41 | 24 | 26 | 7.30 876 105 950 61×10-29 |
| 42 | 24 | 40 | 5.54 147 153 507 78×10-17 |
| 43 | 24 | 58 | -9.43 697 072 412 10×10-7 |

**6.3 蒸汽热能**

采用热能积算仪计算蒸汽质量流量后，用蒸汽质量流量乘以蒸汽比焓得到流经测量截面的蒸汽热功率，经过累积计算得到系统的蒸汽热能。

热能积算仪的计量特性应符合JJG 1003检定规程的相关要求。

蒸汽热功率按式（4）计算：

 （4）

蒸汽热能按式（5）计算：

 （5）

式中：

*Q*——蒸汽热功率，kW；

*q*m——蒸汽的质量流量，kg/s；

——蒸汽在测量温度和压力条件下的比焓，kJ/kg；

——计量时间周期内通过截面的蒸汽热能，kJ；

*tn*——计量的结束时间，s；

*t*0——计量的开始时间，s；

若蒸汽流量计为由节流式差压件和配套仪表组成的差压式流量计，蒸汽热功率按式（6）计算。

 （6）

*d*——工作条件下，节流件孔径（或喉部直径），m；

*C*——工作条件下的流出系数；

*β*——工作条件下的直径比或等效直径比；

——工作条件下蒸汽的可膨胀系数；

——差压，Pa；

——工作条件下，节流件上游流体的密度，kg/m3；

注：其他类型的差压式流量计可参照JJG640检定规程要求执行。

若蒸汽流量计为频率输出型涡街流量计，蒸汽热功率按式（7）计算。

 （7）

*f*——涡街流量计的输出频率，Hz；

*K*——涡街流量计的仪表系数，1/m3；

——工作条件下蒸汽的密度，kg/m3；

注：电流输出型涡街流量计按照JJG1029检定规程要求计算体积流量。

其他测量原理的蒸汽流量计参照流量计相关标准和技术规范要求执行。

**7计量结果的表达**

蒸汽热能计量结果为蒸汽热能值及其相对扩展不确定度*U*r和最大允许误差MPE，详见附录 B。

**附录 A**

蒸汽性质表

以下表中数据引自GB/T 34060-2017。

A.1 以温度为基础的饱和状态蒸汽物性值

以温度为基础的饱和状态蒸汽物性值包括了温度 0℃至临界温度 *θ*s =373.946℃以下的饱和蒸汽的热物理性质值，包含：

·饱和蒸汽压力 *p*s；

·饱和蒸汽比容 *v* ''；

·饱和蒸汽声速 *w*''；

·饱和蒸汽比焓 *h*''；

·饱和蒸汽等熵指数*к*''；

·饱和蒸汽动力粘度*η*''；

·饱和蒸汽比熵 *s*''。

表A.1 以温度为基础的饱和状态蒸汽物性值

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *θ* | *T* | *p*s | *v''* | *h''* | *s''* | *w''* | *к''* | *η''* |
| [℃] | [K] | [MPa] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| 0 | 273.15 | 0.0006112127 | 206.140 | 2500.89 | 9.1558 | 408.88 | 1.3269 | 8.945 |
| 0.01a | 273.16 | 0.0006116570 | 205.997 | 2500.91 | 9.1555 | 408.89 | 1.3269 | 8.946 |
| 1 | 274.15 | 0.000657088 | 192.445 | 2502.73 | 9.1291 | 409.61 | 1.3268 | 8.974 |
| 2 | 275.15 | 0.000705988 | 179.764 | 2504.57 | 9.1027 | 410.34 | 1.3268 | 9.003 |
| 3 | 276.15 | 0.000758082 | 168.014 | 2506.40 | 9.0765 | 411.07 | 1.3267 | 9.032 |
| 4 | 277.15 | 0.000813549 | 157.121 | 2508.24 | 9.0506 | 411.80 | 1.3266 | 9.061 |
|  |  |  |  |  |  |  |  |  |
| 5 | 278.15 | 0.000872575 | 147.017 | 2510.07 | 9.0249 | 412.53 | 1.3266 | 9.090 |
| 6 | 279.15 | 0.000935353 | 137.638 | 2511.91 | 8.9994 | 413.25 | 1.3265 | 9.120 |
| 7 | 280.15 | 0.00100209 | 128.928 | 2513.74 | 8.9742 | 413.97 | 1.3264 | 9.149 |
| 8 | 281.15 | 0.00107299 | 120.834 | 2515.57 | 8.9492 | 414.69 | 1.3264 | 9.179 |
| 9 | 282.15 | 0.00114828 | 113.309 | 2517.40 | 8.9244 | 415.41 | 1.3263 | 9.209 |
|  |  |  |  |  |  |  |  |  |
| 10 | 283.15 | 0.00122818 | 106.309 | 2519.23 | 8.8998 | 416.13 | 1.3262 | 9.238 |
| 11 | 284.15 | 0.00131295 | 99.7927 | 2521.06 | 8.8755 | 416.84 | 1.3262 | 9.268 |
| 12 | 285.15 | 0.00140282 | 93.7243 | 2522.89 | 8.8514 | 417.55 | 1.3261 | 9.299 |
| 13 | 286.15 | 0.00149806 | 88.0698 | 2524.71 | 8.8275 | 418.26 | 1.3260 | 9.329 |
| 14 | 287.15 | 0.00159894 | 82.7981 | 2526.54 | 8.8038 | 418.97 | 1.3259 | 9.359 |
|  |  |  |  |  |  |  |  |  |
| 15 | 288.15 | 0.00170574 | 77.8807 | 2528.36 | 8.7804 | 419.68 | 1.3258 | 9.390 |
| 16 | 289.15 | 0.00181876 | 73.2915 | 2530.19 | 8.7571 | 420.38 | 1.3257 | 9.420 |
| 17 | 290.15 | 0.00193829 | 69.0063 | 2532.01 | 8.7341 | 421.08 | 1.3257 | 9.451 |
| 18 | 291.15 | 0.00206466 | 65.0029 | 2533.83 | 8.7112 | 421.79 | 1.3256 | 9.482 |
| 19 | 292.15 | 0.00219818 | 61.2609 | 2535.65 | 8.6886 | 422.48 | 1.3255 | 9.513 |
|  |  |  |  |  |  |  |  |  |
| 20 | 293.15 | 0.00233921 | 57.7615 | 2537.47 | 8.6661 | 423.18 | 1.3254 | 9.544 |
| 21 | 294.15 | 0.00248810 | 54.4873 | 2539.29 | 8.6439 | 423.88 | 1.3253 | 9.575 |
| 22 | 295.15 | 0.00264521 | 51.4225 | 2541.10 | 8.6218 | 424.57 | 1.3252 | 9.607 |
| 23 | 296.15 | 0.00281092 | 48.5521 | 2542.92 | 8.6000 | 425.26 | 1.3251 | 9.638 |
| 24 | 297.15 | 0.00298563 | 45.8626 | 2544.73 | 8.5783 | 425.95 | 1.3250 | 9.669 |
|  |  |  |  |  |  |  |  |  |
| 25 | 298.15 | 0.00316975 | 43.3414 | 2546.54 | 8.5568 | 426.63 | 1.3249 | 9.701 |
| 26 | 299.15 | 0.00336369 | 40.9768 | 2548.35 | 8.5355 | 427.32 | 1.3248 | 9.733 |
| 27 | 300.15 | 0.00356789 | 38.7582 | 2550.16 | 8.5144 | 428.00 | 1.3247 | 9.764 |
| 28 | 301.15 | 0.00378281 | 36.6754 | 2551.97 | 8.4934 | 428.68 | 1.3246 | 9.796 |
| 29 | 302.15 | 0.00400892 | 34.7194 | 2553.78 | 8.4727 | 429.36 | 1.3245 | 9.828 |
|  |  |  |  |  |  |  |  |  |
| 30 | 303.15 | 0.00424669 | 32.8816 | 2555.58 | 8.4521 | 430.04 | 1.3244 | 9.860 |
| 31 | 304.15 | 0.00449663 | 31.1540 | 2557.39 | 8.4317 | 430.72 | 1.3243 | 9.892 |
| 32 | 305.15 | 0.00475925 | 29.5295 | 2559.19 | 8.4115 | 431.39 | 1.3242 | 9.924 |
| 33 | 306.15 | 0.00503508 | 28.0010 | 2560.99 | 8.3914 | 432.06 | 1.3241 | 9.957 |
| 34 | 307.15 | 0.00532469 | 26.5624 | 2562.79 | 8.3715 | 432.73 | 1.3240 | 9.989 |
|  |  |  |  |  |  |  |  |  |
| 35 | 308.15 | 0.00562862 | 25.2078 | 2564.58 | 8.3518 | 433.40 | 1.3239 | 10.02 |
| 36 | 309.15 | 0.00594747 | 23.9318 | 2566.38 | 8.3323 | 434.07 | 1.3238 | 10.05 |
| 37 | 310.15 | 0.00628185 | 22.7292 | 2568.17 | 8.3129 | 434.73 | 1.3237 | 10.09 |
| 38 | 311.15 | 0.00663237 | 21.5954 | 2569.96 | 8.2936 | 435.40 | 1.3235 | 10.12 |
| 39 | 312.15 | 0.00699968 | 20.5261 | 2571.75 | 8.2746 | 436.06 | 1.3234 | 10.15 |
|  |  |  |  |  |  |  |  |  |
| 40 | 313.15 | 0.00738443 | 19.5170 | 2573.54 | 8.2557 | 436.72 | 1.3233 | 10.18 |
| 41 | 314.15 | 0.00778731 | 18.5646 | 2575.33 | 8.2369 | 437.37 | 1.3232 | 10.22 |
| 42 | 315.15 | 0.00820901 | 17.6652 | 2577.11 | 8.2183 | 438.03 | 1.3231 | 10.25 |
| 43 | 316.15 | 0.00865026 | 16.8155 | 2578.89 | 8.1999 | 438.68 | 1.3230 | 10.28 |
| 44 | 317.15 | 0.00911180 | 16.0126 | 2580.67 | 8.1816 | 439.33 | 1.3229 | 10.32 |

表A.1 以温度为基础的饱和状态蒸汽物性值（续）

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *θ* | *T* | *p*s | *v''* | *h''* | *s''* | *w''* | *к''* | *η''* |
| [℃] | [K] | [MPa] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| 45 | 318.15 | 0.00959439 | 15.2534 | 2582.45 | 8.1634 | 439.98 | 1.3228 | 10.35 |
| 46 | 319.15 | 0.0100988 | 14.5355 | 2584.23 | 8.1454 | 440.63 | 1.3227 | 10.38 |
| 47 | 320.15 | 0.0106259 | 13.8562 | 2586.00 | 8.1276 | 441.28 | 1.3226 | 10.42 |
| 48 | 321.15 | 0.0111764 | 13.2132 | 2587.77 | 8.1099 | 441.92 | 1.3224 | 10.45 |
| 49 | 322.15 | 0.0117512 | 12.6045 | 2589.54 | 8.0923 | 442.56 | 1.3223 | 10.48 |
|  |  |  |  |  |  |  |  |  |
| 50 | 323.15 | 0.0123513 | 12.0279 | 2591.31 | 8.0749 | 443.20 | 1.3222 | 10.52 |
| 51 | 324.15 | 0.0129774 | 11.4815 | 2593.08 | 8.0576 | 443.84 | 1.3221 | 10.55 |
| 52 | 325.15 | 0.0136305 | 10.9637 | 2594.84 | 8.0405 | 444.48 | 1.3220 | 10.58 |
| 53 | 326.15 | 0.0143116 | 10.4726 | 2596.60 | 8.0235 | 445.11 | 1.3219 | 10.62 |
| 54 | 327.15 | 0.0150215 | 10.0069 | 2598.35 | 8.0066 | 445.74 | 1.3218 | 10.65 |
|  |  |  |  |  |  |  |  |  |
| 55 | 328.15 | 0.0157614 | 9.56492 | 2600.11 | 7.9899 | 446.37 | 1.3217 | 10.68 |
| 56 | 329.15 | 0.0165322 | 9.14543 | 2601.86 | 7.9733 | 447.00 | 1.3216 | 10.72 |
| 57 | 330.15 | 0.0173350 | 8.74712 | 2603.61 | 7.9568 | 447.63 | 1.3214 | 10.75 |
| 58 | 331.15 | 0.0181708 | 8.36879 | 2605.36 | 7.9405 | 448.25 | 1.3213 | 10.79 |
| 59 | 332.15 | 0.0190407 | 8.00932 | 2607.10 | 7.9243 | 448.88 | 1.3212 | 10.82 |
|  |  |  |  |  |  |  |  |  |
| 60 | 333.15 | 0.0199458 | 7.66766 | 2608.85 | 7.9082 | 449.50 | 1.3211 | 10.85 |
| 61 | 334.15 | 0.0208873 | 7.34281 | 2610.58 | 7.8922 | 450.11 | 1.3210 | 10.89 |
| 62 | 335.15 | 0.0218664 | 7.03384 | 2612.32 | 7.8764 | 450.73 | 1.3209 | 10.92 |
| 63 | 336.15 | 0.0228842 | 6.73990 | 2614.05 | 7.8607 | 451.34 | 1.3208 | 10.96 |
| 64 | 337.15 | 0.0239421 | 6.46015 | 2615.78 | 7.8451 | 451.95 | 1.3206 | 10.99 |
|  |  |  |  |  |  |  |  |  |
| 65 | 338.15 | 0.0250411 | 6.19383 | 2617.51 | 7.8296 | 452.56 | 1.3205 | 11.02 |
| 66 | 339.15 | 0.0261827 | 5.94021 | 2619.23 | 7.8142 | 453.17 | 1.3204 | 11.06 |
| 67 | 340.15 | 0.0273680 | 5.69861 | 2620.96 | 7.7990 | 453.77 | 1.3203 | 11.09 |
| 68 | 341.15 | 0.0285986 | 5.46840 | 2622.67 | 7.7839 | 454.38 | 1.3202 | 11.13 |
| 69 | 342.15 | 0.0298756 | 5.24896 | 2624.39 | 7.7689 | 454.98 | 1.3200 | 11.16 |
|  |  |  |  |  |  |  |  |  |
| 70 | 343.15 | 0.0312006 | 5.03973 | 2626.10 | 7.7540 | 455.57 | 1.3199 | 11.19 |
| 71 | 344.15 | 0.0325750 | 4.84018 | 2627.81 | 7.7392 | 456.17 | 1.3198 | 11.23 |
| 72 | 345.15 | 0.0340001 | 4.64980 | 2629.51 | 7.7245 | 456.76 | 1.3197 | 11.26 |
| 73 | 346.15 | 0.0354775 | 4.46812 | 2631.21 | 7.7100 | 457.35 | 1.3195 | 11.30 |
| 74 | 347.15 | 0.0370088 | 4.29469 | 2632.91 | 7.6955 | 457.94 | 1.3194 | 11.33 |
|  |  |  |  |  |  |  |  |  |
| 75 | 348.15 | 0.0385954 | 4.12908 | 2634.60 | 7.6812 | 458.52 | 1.3193 | 11.37 |
| 76 | 349.15 | 0.0402389 | 3.97090 | 2636.29 | 7.6669 | 459.11 | 1.3191 | 11.40 |
| 77 | 350.15 | 0.0419409 | 3.81978 | 2637.98 | 7.6528 | 459.69 | 1.3190 | 11.44 |
| 78 | 351.15 | 0.0437031 | 3.67535 | 2639.66 | 7.6388 | 460.26 | 1.3189 | 11.47 |
| 79 | 352.15 | 0.0455271 | 3.53729 | 2641.34 | 7.6248 | 460.84 | 1.3187 | 11.50 |
|  |  |  |  |  |  |  |  |  |
| 80 | 353.15 | 0.0474147 | 3.40527 | 2643.01 | 7.6110 | 461.41 | 1.3186 | 11.54 |
| 81 | 354.15 | 0.0493676 | 3.27899 | 2644.68 | 7.5973 | 461.98 | 1.3185 | 11.57 |
| 82 | 355.15 | 0.0513875 | 3.15818 | 2646.35 | 7.5837 | 462.55 | 1.3183 | 11.61 |
| 83 | 356.15 | 0.0534762 | 3.04257 | 2648.01 | 7.5701 | 463.11 | 1.3182 | 11.64 |
| 84 | 357.15 | 0.0556355 | 2.93190 | 2649.67 | 7.5567 | 463.67 | 1.3180 | 11.68 |
|  |  |  |  |  |  |  |  |  |
| 85 | 358.15 | 0.0578675 | 2.82593 | 2651.33 | 7.5434 | 464.23 | 1.3179 | 11.71 |
| 86 | 359.15 | 0.0601738 | 2.72445 | 2652.98 | 7.5301 | 464.79 | 1.3177 | 11.75 |
| 87 | 360.15 | 0.0625565 | 2.62722 | 2654.62 | 7.5170 | 465.34 | 1.3176 | 11.78 |
| 88 | 361.15 | 0.0650174 | 2.53406 | 2656.26 | 7.5039 | 465.89 | 1.3174 | 11.82 |
| 89 | 362.15 | 0.0675587 | 2.44476 | 2657.90 | 7.4909 | 466.44 | 1.3173 | 11.85 |

表A.1 以温度为基础的饱和状态蒸汽物性值（续）

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *θ* | *T* | *p*s | *v''* | *h''* | *s''* | *w''* | *к''* | *η''* |
| [℃] | [K] | [MPa] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| 90 | 363.15 | 0.0701824 | 2.35915 | 2659.53 | 7.4781 | 466.98 | 1.3171 | 11.89 |
| 91 | 364.15 | 0.0728904 | 2.27705 | 2661.16 | 7.4653 | 467.52 | 1.3169 | 11.92 |
| 92 | 365.15 | 0.0756849 | 2.19830 | 2662.78 | 7.4526 | 468.06 | 1.3168 | 11.95 |
| 93 | 366.15 | 0.0785681 | 2.12275 | 2664.39 | 7.4400 | 468.60 | 1.3166 | 11.99 |
| 94 | 367.15 | 0.0815420 | 2.05025 | 2666.01 | 7.4275 | 469.13 | 1.3164 | 12.02 |
|  |  |  |  |  |  |  |  |  |
| 95 | 368.15 | 0.0846089 | 1.98065 | 2667.61 | 7.4150 | 469.66 | 1.3163 | 12.06 |
| 96 | 369.15 | 0.0877711 | 1.91383 | 2669.22 | 7.4027 | 470.18 | 1.3161 | 12.09 |
| 97 | 370.15 | 0.0910308 | 1.84965 | 2670.81 | 7.3904 | 470.71 | 1.3159 | 12.13 |
| 98 | 371.15 | 0.0943902 | 1.78801 | 2672.40 | 7.3782 | 471.23 | 1.3157 | 12.16 |
| 99 | 372.15 | 0.0978518 | 1.72878 | 2673.99 | 7.3661 | 471.74 | 1.3155 | 12.20 |
|  |  |  |  |  |  |  |  |  |
| 100 | 373.15 | 0.101418 | 1.67186 | 2675.57 | 7.3541 | 472.26 | 1.3153 | 12.23 |
| 102 | 375.15 | 0.108873 | 1.56454 | 2678.72 | 7.3303 | 473.27 | 1.3150 | 12.30 |
| 104 | 377.15 | 0.116776 | 1.46529 | 2681.84 | 7.3068 | 474.28 | 1.3146 | 12.37 |
| 106 | 379.15 | 0.125147 | 1.37342 | 2684.94 | 7.2836 | 475.26 | 1.3142 | 12.44 |
| 108 | 381.15 | 0.134007 | 1.28831 | 2688.02 | 7.2607 | 476.24 | 1.3137 | 12.51 |
|  |  |  |  |  |  |  |  |  |
| 110 | 383.15 | 0.143376 | 1.20939 | 2691.07 | 7.2380 | 477.20 | 1.3133 | 12.58 |
| 112 | 385.15 | 0.153277 | 1.13615 | 2694.09 | 7.2157 | 478.15 | 1.3128 | 12.65 |
| 114 | 387.15 | 0.163734 | 1.06813 | 2697.09 | 7.1937 | 479.08 | 1.3124 | 12.72 |
| 116 | 389.15 | 0.174768 | 1.00489 | 2700.07 | 7.1719 | 480.00 | 1.3119 | 12.79 |
| 118 | 391.15 | 0.186404 | 0.946070 | 2703.02 | 7.1504 | 480.90 | 1.3114 | 12.86 |
|  |  |  |  |  |  |  |  |  |
| 120 | 393.15 | 0.198665 | 0.891304 | 2705.93 | 7.1291 | 481.79 | 1.3109 | 12.93 |
| 122 | 395.15 | 0.211578 | 0.840276 | 2708.82 | 7.1081 | 482.66 | 1.3104 | 13.00 |
| 124 | 397.15 | 0.225168 | 0.792695 | 2711.69 | 7.0873 | 483.52 | 1.3098 | 13.07 |
| 126 | 399.15 | 0.239460 | 0.748294 | 2714.52 | 7.0668 | 484.36 | 1.3093 | 13.13 |
| 128 | 401.15 | 0.254481 | 0.706832 | 2717.32 | 7.0465 | 485.19 | 1.3087 | 13.20 |
|  |  |  |  |  |  |  |  |  |
| 130 | 403.15 | 0.270260 | 0.668084 | 2720.09 | 7.0264 | 486.00 | 1.3082 | 13.27 |
| 132 | 405.15 | 0.286823 | 0.631849 | 2722.83 | 7.0066 | 486.79 | 1.3076 | 13.34 |
| 134 | 407.15 | 0.304199 | 0.597939 | 2725.53 | 6.9869 | 487.57 | 1.3070 | 13.41 |
| 136 | 409.15 | 0.322417 | 0.566183 | 2728.20 | 6.9675 | 488.34 | 1.3064 | 13.48 |
| 138 | 411.15 | 0.341508 | 0.536425 | 2730.84 | 6.9483 | 489.08 | 1.3057 | 13.55 |
|  |  |  |  |  |  |  |  |  |
| 140 | 413.15 | 0.361501 | 0.508519 | 2733.44 | 6.9293 | 489.81 | 1.3051 | 13.62 |
| 142 | 415.15 | 0.382427 | 0.482334 | 2736.01 | 6.9105 | 490.53 | 1.3044 | 13.69 |
| 144 | 417.15 | 0.404318 | 0.457748 | 2738.54 | 6.8918 | 491.22 | 1.3038 | 13.76 |
| 146 | 419.15 | 0.427205 | 0.434648 | 2741.04 | 6.8734 | 491.90 | 1.3031 | 13.82 |
| 148 | 421.15 | 0.451122 | 0.412931 | 2743.50 | 6.8551 | 492.57 | 1.3024 | 13.89 |
|  |  |  |  |  |  |  |  |  |
| 150 | 423.15 | 0.476101 | 0.392502 | 2745.92 | 6.8370 | 493.22 | 1.3018 | 13.96 |
| 152 | 425.15 | 0.502177 | 0.373273 | 2748.30 | 6.8191 | 493.85 | 1.3011 | 14.03 |
| 154 | 427.15 | 0.529383 | 0.355162 | 2750.64 | 6.8014 | 494.46 | 1.3004 | 14.10 |
| 156 | 429.15 | 0.557755 | 0.338095 | 2752.95 | 6.7838 | 495.06 | 1.2997 | 14.17 |
| 158 | 431.15 | 0.587329 | 0.322002 | 2755.21 | 6.7664 | 495.64 | 1.2990 | 14.24 |
|  |  |  |  |  |  |  |  |  |
| 160 | 433.15 | 0.618139 | 0.306818 | 2757.43 | 6.7491 | 496.21 | 1.2982 | 14.30 |
| 162 | 435.15 | 0.650224 | 0.292486 | 2759.61 | 6.7320 | 496.75 | 1.2975 | 14.37 |
| 164 | 437.15 | 0.683619 | 0.278948 | 2761.75 | 6.7150 | 497.28 | 1.2968 | 14.44 |
| 166 | 439.15 | 0.718364 | 0.266155 | 2763.84 | 6.6982 | 497.80 | 1.2961 | 14.51 |
| 168 | 441.15 | 0.754495 | 0.254059 | 2765.89 | 6.6815 | 498.30 | 1.2953 | 14.58 |

表A.1 以温度为基础的饱和状态蒸汽物性值（续）

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *θ* | *T* | *p*s | *v''* | *h''* | | *s''* | *w''* | *к''* | *η''* |
| [℃] | [K] | [MPa] | [m3/kg] | [kJ/kg] | | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| 170 | 443.15 | 0.792053 | 0.242616 | | 2767.89 | 6.6649 | 498.78 | 1.2946 | 14.64 |
| 172 | 445.15 | 0.831077 | 0.231785 | | 2769.85 | 6.6485 | 499.24 | 1.2939 | 14.71 |
| 174 | 447.15 | 0.871606 | 0.221528 | | 2771.77 | 6.6322 | 499.68 | 1.2931 | 14.78 |
| 176 | 449.15 | 0.913681 | 0.211810 | | 2773.63 | 6.6161 | 500.11 | 1.2924 | 14.85 |
| 178 | 451.15 | 0.957343 | 0.202598 | | 2775.45 | 6.6000 | 500.52 | 1.2916 | 14.92 |
|  |  |  |  | |  |  |  |  |  |
| 180 | 453.15 | 1.00263 | 0.193862 | | 2777.22 | 6.5841 | 500.92 | 1.2909 | 14.99 |
| 182 | 455.15 | 1.04960 | 0.185572 | | 2778.94 | 6.5682 | 501.29 | 1.2902 | 15.05 |
| 184 | 457.15 | 1.09827 | 0.177703 | | 2780.61 | 6.5525 | 501.65 | 1.2894 | 15.12 |
| 186 | 459.15 | 1.14871 | 0.170229 | | 2782.23 | 6.5369 | 501.99 | 1.2887 | 15.19 |
| 188 | 461.15 | 1.20094 | 0.163127 | | 2783.80 | 6.5214 | 502.31 | 1.2879 | 15.26 |
|  |  |  |  | |  |  |  |  |  |
| 190 | 463.15 | 1.25502 | 0.156377 | | 2785.31 | 6.5060 | 502.61 | 1.2872 | 15.33 |
| 192 | 465.15 | 1.31099 | 0.149957 | | 2786.77 | 6.4907 | 502.90 | 1.2864 | 15.39 |
| 194 | 467.15 | 1.36889 | 0.143848 | | 2788.18 | 6.4755 | 503.16 | 1.2857 | 15.46 |
| 196 | 469.15 | 1.42877 | 0.138034 | | 2789.53 | 6.4603 | 503.41 | 1.2850 | 15.53 |
| 198 | 471.15 | 1.49069 | 0.132497 | | 2790.82 | 6.4453 | 503.63 | 1.2842 | 15.60 |
|  |  |  |  | |  |  |  |  |  |
| 200 | 473.15 | 1.55467 | 0.127222 | | 2792.06 | 6.4303 | 503.84 | 1.2835 | 15.67 |
| 202 | 475.15 | 1.62078 | 0.122195 | | 2793.24 | 6.4154 | 504.03 | 1.2827 | 15.73 |
| 204 | 477.15 | 1.68906 | 0.117402 | | 2794.36 | 6.4006 | 504.19 | 1.2820 | 15.80 |
| 206 | 479.15 | 1.75955 | 0.112830 | | 2795.42 | 6.3858 | 504.34 | 1.2812 | 15.87 |
| 208 | 481.15 | 1.83231 | 0.108467 | | 2796.42 | 6.3711 | 504.46 | 1.2804 | 15.94 |
|  |  |  |  | |  |  |  |  |  |
| 210 | 483.15 | 1.90739 | 0.104302 | | 2797.35 | 6.3565 | 504.57 | 1.2797 | 16.01 |
| 212 | 485.15 | 1.98483 | 0.100325 | | 2798.22 | 6.3420 | 504.65 | 1.2789 | 16.08 |
| 214 | 487.15 | 2.06470 | 0.0965249 | | 2799.03 | 6.3275 | 504.71 | 1.2782 | 16.15 |
| 216 | 489.15 | 2.14702 | 0.0928934 | | 2799.77 | 6.3130 | 504.75 | 1.2774 | 16.22 |
| 218 | 491.15 | 2.23187 | 0.0894214 | | 2800.45 | 6.2986 | 504.76 | 1.2766 | 16.29 |
|  |  |  |  | |  |  |  |  |  |
| 220 | 493.15 | 2.31929 | 0.0861007 | | 2801.05 | 6.2842 | 504.76 | 1.2759 | 16.35 |
| 222 | 495.15 | 2.40933 | 0.0829236 | | 2801.59 | 6.2699 | 504.73 | 1.2751 | 16.42 |
| 224 | 497.15 | 2.50205 | 0.0798826 | | 2802.05 | 6.2557 | 504.68 | 1.2743 | 16.49 |
| 226 | 499.15 | 2.59749 | 0.0769710 | | 2802.45 | 6.2414 | 504.60 | 1.2735 | 16.56 |
| 228 | 501.15 | 2.69572 | 0.0741823 | | 2802.76 | 6.2272 | 504.50 | 1.2728 | 16.63 |
|  |  |  |  | |  |  |  |  |  |
| 230 | 503.15 | 2.79679 | 0.0715102 | | 2803.01 | 6.2131 | 504.38 | 1.2720 | 16.70 |
| 232 | 505.15 | 2.90075 | 0.0689492 | | 2803.18 | 6.1989 | 504.23 | 1.2712 | 16.78 |
| 234 | 507.15 | 3.00767 | 0.0664936 | | 2803.27 | 6.1848 | 504.05 | 1.2704 | 16.85 |
| 236 | 509.15 | 3.11758 | 0.0641385 | | 2803.28 | 6.1707 | 503.85 | 1.2696 | 16.92 |
| 238 | 511.15 | 3.23056 | 0.0618788 | | 2803.21 | 6.1566 | 503.63 | 1.2688 | 16.99 |
|  |  |  |  | |  |  |  |  |  |
| 240 | 513.15 | 3.34665 | 0.0597101 | | 2803.06 | 6.1425 | 503.38 | 1.2680 | 17.06 |
| 242 | 515.15 | 3.46592 | 0.0576280 | | 2802.82 | 6.1285 | 503.10 | 1.2672 | 17.13 |
| 244 | 517.15 | 3.58843 | 0.0556284 | | 2802.50 | 6.1144 | 502.79 | 1.2664 | 17.21 |
| 246 | 519.15 | 3.71423 | 0.0537073 | | 2802.10 | 6.1003 | 502.46 | 1.2656 | 17.28 |
| 248 | 521.15 | 3.84338 | 0.0518612 | | 2801.60 | 6.0863 | 502.10 | 1.2648 | 17.35 |
|  |  |  |  | |  |  |  |  |  |
| 250 | 523.15 | 3.97594 | 0.0500866 | | 2801.01 | 6.0722 | 501.71 | 1.2640 | 17.43 |
| 252 | 525.15 | 4.11197 | 0.0483801 | | 2800.33 | 6.0582 | 501.30 | 1.2632 | 17.50 |
| 254 | 527.15 | 4.25154 | 0.0467386 | | 2799.56 | 6.0441 | 500.85 | 1.2624 | 17.58 |
| 256 | 529.15 | 4.39471 | 0.0451592 | | 2798.69 | 6.0300 | 500.38 | 1.2616 | 17.66 |
| 258 | 531.15 | 4.54153 | 0.0436390 | | 2797.71 | 6.0158 | 499.87 | 1.2608 | 17.73 |

表A.1 以温度为基础的饱和状态蒸汽物性值（续）

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *θ* | *T* | *p*s | *v''* | *h''* | *s''* | *w''* | *к''* | *η''* |
| [℃] | [K] | [MPa] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| 260 | 533.15 | 4.69207 | 0.0421755 | 2796.64 | 6.0017 | 499.33 | 1.2600 | 17.81 |
| 262 | 535.15 | 4.84640 | 0.0407660 | 2795.47 | 5.9875 | 498.77 | 1.2592 | 17.89 |
| 264 | 537.15 | 5.00457 | 0.0394082 | 2794.19 | 5.9733 | 498.17 | 1.2583 | 17.97 |
| 266 | 539.15 | 5.16666 | 0.0380997 | 2792.80 | 5.9590 | 497.53 | 1.2575 | 18.05 |
| 268 | 541.15 | 5.33273 | 0.0368385 | 2791.30 | 5.9448 | 496.87 | 1.2567 | 18.13 |
|  |  |  |  |  |  |  |  |  |
| 270 | 543.15 | 5.50284 | 0.0356224 | 2789.69 | 5.9304 | 496.16 | 1.2559 | 18.21 |
| 272 | 545.15 | 5.67706 | 0.0344496 | 2787.96 | 5.9160 | 495.43 | 1.2550 | 18.29 |
| 274 | 547.15 | 5.85547 | 0.0333180 | 2786.11 | 5.9016 | 494.65 | 1.2542 | 18.37 |
| 276 | 549.15 | 6.03812 | 0.0322260 | 2784.14 | 5.8871 | 493.84 | 1.2533 | 18.46 |
| 278 | 551.15 | 6.22510 | 0.0311719 | 2782.05 | 5.8725 | 493.00 | 1.2525 | 18.54 |
|  |  |  |  |  |  |  |  |  |
| 280 | 553.15 | 6.41646 | 0.0301540 | 2779.82 | 5.8578 | 492.11 | 1.2516 | 18.63 |
| 282 | 555.15 | 6.61228 | 0.0291708 | 2777.47 | 5.8431 | 491.18 | 1.2508 | 18.72 |
| 284 | 557.15 | 6.81264 | 0.0282208 | 2774.97 | 5.8283 | 490.21 | 1.2499 | 18.81 |
| 286 | 559.15 | 7.01760 | 0.0273027 | 2772.34 | 5.8134 | 489.20 | 1.2490 | 18.90 |
| 288 | 561.15 | 7.22724 | 0.0264152 | 2769.56 | 5.7984 | 488.14 | 1.2481 | 18.99 |
|  |  |  |  |  |  |  |  |  |
| 290 | 563.15 | 7.44164 | 0.0255568 | 2766.63 | 5.7832 | 487.04 | 1.2472 | 19.08 |
| 292 | 565.15 | 7.66087 | 0.0247265 | 2763.55 | 5.7680 | 485.89 | 1.2463 | 19.18 |
| 294 | 567.15 | 7.88502 | 0.0239231 | 2760.31 | 5.7526 | 484.69 | 1.2454 | 19.28 |
| 296 | 569.15 | 8.11415 | 0.0231454 | 2756.90 | 5.7372 | 483.45 | 1.2445 | 19.38 |
| 298 | 571.15 | 8.34835 | 0.0223924 | 2753.33 | 5.7215 | 482.16 | 1.2436 | 19.48 |
|  |  |  |  |  |  |  |  |  |
| 300 | 573.15 | 8.58771 | 0.0216631 | 2749.57 | 5.7058 | 480.81 | 1.2427 | 19.58 |
| 305 | 578.15 | 9.20919 | 0.0199370 | 2739.38 | 5.6656 | 477.21 | 1.2404 | 19.85 |
| 310 | 583.15 | 9.86475 | 0.0183389 | 2727.92 | 5.6243 | 473.27 | 1.2381 | 20.13 |
| 315 | 588.15 | 10.5558 | 0.0168557 | 2715.08 | 5.5816 | 468.96 | 1.2360 | 20.44 |
| 320 | 593.15 | 11.2839 | 0.0154759 | 2700.67 | 5.5373 | 464.25 | 1.2342 | 20.77 |
|  |  |  |  |  |  |  |  |  |
| 325 | 598.15 | 12.0505 | 0.0141887 | 2684.48 | 5.4911 | 459.12 | 1.2328 | 21.13 |
| 330 | 603.15 | 12.8575 | 0.0129840 | 2666.25 | 5.4425 | 453.52 | 1.2320 | 21.53 |
| 335 | 608.15 | 13.7067 | 0.0118522 | 2645.60 | 5.3910 | 447.37 | 1.2320 | 21.97 |
| 340 | 613.15 | 14.6002 | 0.0107838 | 2622.07 | 5.3359 | 440.59 | 1.2329 | 22.48 |
| 345 | 618.15 | 15.5401 | 0.0097698 | 2595.01 | 5.2763 | 433.05 | 1.2352 | 23.06 |
|  |  |  |  |  |  |  |  |  |
| 350 | 623.15 | 16.5292 | 0.0088009 | 2563.59 | 5.2109 | 424.63 | 1.2395 | 23.74 |
| 355 | 628.15 | 17.5701 | 0.0078660 | 2526.45 | 5.1377 | 414.79 | 1.2449 | 24.57 |
| 360 | 633.15 | 18.6664 | 0.0069449 | 2480.99 | 5.0527 | 402.76 | 1.2513 | 25.64 |
| 365 | 638.15 | 19.8222 | 0.0060044 | 2422.00 | 4.9482 | 387.25 | 1.2600 | 27.12 |
| 370 | 643.15 | 21.0434 | 0.0049462 | 2333.50 | 4.7996 | 364.77 | 1.2784 | 29.60 |
|  |  |  |  |  |  |  |  |  |
| 371 | 644.15 | 21.2964 | 0.0046914 | 2307.45 | 4.7573 | 358.38 | 1.2855 | 30.40 |
| 372 | 645.15 | 21.5528 | 0.0043985 | 2274.69 | 4.7046 | 350.51 | 1.2959 | 31.46 |
| 373 | 646.15 | 21.8132 | 0.0040212 | 2227.55 | 4.6299 | 339.58 | 1.3146 | 33.11 |
| 373.946a | 647.096 | 22.0640 | 0.00310559 | 2087.55 | 4.4120 | -b | -b | 39.33c |

a临界温度。

b在临界点，IAPWS-IF97不能计算精确的*cp*、*w*和*к*值。

C工业方程（3.1）和（3.4）对于*η*和*λ*不能表现临界点附近范围增量。如果需要更准确地*η*和*λ*量值应使用科学计算方程[31]和[ 35]。

# A.2以压力为基础的饱和状态蒸汽物性值表

以压力为基础的饱和状态蒸汽物性值包括了压力自0.0006112127MPa至临界压力*pc*=22.064MPa以下的饱和蒸汽热物理性质值，包含：

·饱和蒸汽温度 *θs*；

·饱和蒸汽比容 *v''*；

·饱和蒸汽比熵 *s''*；

·饱和蒸汽比焓 *h''*。

表A.2 以压力为基础的饱和状态蒸汽物性值表

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *p* | *θs* | *v''* | *h''* | *s''* |
| [MPa] | [℃] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] |
| 0.0006112127 | 0 | 206.140 | 2500.89 | 9.1558 |
| 0.0006116570a | 0.01 | 205.997 | 2500.91 | 9.1555 |
| 0.0007 | 1.88090 | 181.223 | 2504.35 | 9.1058 |
| 0.0008 | 3.76142 | 159.646 | 2507.80 | 9.0567 |
| 0.0009 | 5.44443 | 142.763 | 2510.89 | 9.0135 |
|  |  |  |  |  |
| 0.001 | 6.96963 | 129.183 | 2513.68 | 8.9749 |
| 0.002 | 17.4953 | 66.9896 | 2532.91 | 8.7227 |
| 0.003 | 24.0799 | 45.6550 | 2544.88 | 8.5766 |
| 0.004 | 28.9615 | 34.7925 | 2553.71 | 8.4735 |
|  |  |  |  |  |
| 0.005 | 32.8755 | 28.1863 | 2560.77 | 8.3939 |
| 0.006 | 36.1603 | 23.7342 | 2566.67 | 8.3291 |
| 0.007 | 39.0009 | 20.5252 | 2571.76 | 8.2746 |
| 0.008 | 41.5101 | 18.0994 | 2576.24 | 8.2274 |
| 0.009 | 43.7618 | 16.1997 | 2580.25 | 8.1859 |
|  |  |  |  |  |
| 0.01 | 45.8075 | 14.6706 | 2583.89 | 8.1489 |
| 0.02 | 60.0586 | 7.64815 | 2608.95 | 7.9072 |
| 0.03 | 69.0954 | 5.22856 | 2624.55 | 7.7675 |
| 0.04 | 75.8568 | 3.99311 | 2636.05 | 7.6690 |
|  |  |  |  |  |
| 0.05 | 81.3167 | 3.24015 | 2645.21 | 7.5930 |
| 0.06 | 85.9258 | 2.73183 | 2652.85 | 7.5311 |
| 0.07 | 89.9315 | 2.36490 | 2659.42 | 7.4790 |
| 0.08 | 93.4854 | 2.08719 | 2665.18 | 7.4339 |
| 0.09 | 96.6870 | 1.86946 | 2670.31 | 7.3942 |
|  |  |  |  |  |
| 0.10 | 99.6059 | 1.69402 | 2674.95 | 7.3588 |
| 0.101325b | 99.9743 | 1.67330 | 2675.53 | 7.3544 |
| 0.11 | 102.292 | 1.54955 | 2679.18 | 7.3268 |
| 0.12 | 104.784 | 1.42845 | 2683.06 | 7.2976 |
| 0.13 | 107.109 | 1.32541 | 2686.65 | 7.2708 |
| 0.14 | 109.292 | 1.23665 | 2689.99 | 7.2460 |
|  |  |  |  |  |
| 0.15 | 111.350 | 1.15936 | 2693.11 | 7.2229 |
| 0.16 | 113.298 | 1.09143 | 2696.04 | 7.2014 |
| 0.17 | 115.149 | 1.03124 | 2698.81 | 7.1811 |
| 0.18 | 116.912 | 0.977534 | 2701.42 | 7.1620 |
| 0.19 | 118.597 | 0.929299 | 2703.89 | 7.1440 |
|  |  |  |  |  |
| 0.20 | 120.212 | 0.885735 | 2706.24 | 7.1269 |
| 0.21 | 121.761 | 0.846187 | 2708.48 | 7.1106 |
| 0.22 | 123.251 | 0.810119 | 2710.62 | 7.0951 |
| 0.23 | 124.688 | 0.777086 | 2712.66 | 7.0802 |
| 0.24 | 126.074 | 0.746716 | 2714.62 | 7.0660 |
|  |  |  |  |  |
| 0.25 | 127.414 | 0.718697 | 2716.50 | 7.0524 |
| 0.26 | 128.711 | 0.692763 | 2718.31 | 7.0393 |
| 0.27 | 129.968 | 0.668687 | 2720.04 | 7.0267 |
| 0.28 | 131.188 | 0.646274 | 2721.72 | 7.0146 |
| 0.29 | 132.373 | 0.625355 | 2723.33 | 7.0029 |
|  |  |  |  |  |
| 0.30 | 133.525 | 0.605785 | 2724.89 | 6.9916 |
| 0.31 | 134.647 | 0.587436 | 2726.40 | 6.9806 |
| 0.32 | 135.740 | 0.570196 | 2727.86 | 6.9700 |
| 0.33 | 136.806 | 0.553966 | 2729.27 | 6.9597 |
| 0.34 | 137.845 | 0.538658 | 2730.64 | 6.9498 |

a三相点压力 b标准大气压

表A.2 以压力为基础的饱和状态蒸汽物性值表（续）

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *P* | *θs* | *v''* | *h''* | *s''* |
| [MPa] | [℃] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] |
| 0.35 | 138.861 | 0.524196 | 2731.97 | 6.9401 |
| 0.36 | 139.853 | 0.510510 | 2733.25 | 6.9307 |
| 0.37 | 140.823 | 0.497539 | 2734.51 | 6.9215 |
| 0.38 | 141.773 | 0.485228 | 2735.72 | 6.9126 |
| 0.39 | 142.702 | 0.473527 | 2736.91 | 6.9039 |
|  |  |  |  |  |
| 0.40 | 143.613 | 0.462392 | 2738.06 | 6.8954 |
| 0.41 | 144.505 | 0.451781 | 2739.18 | 6.8872 |
| 0.42 | 145.380 | 0.441658 | 2740.27 | 6.8791 |
| 0.43 | 146.238 | 0.431990 | 2741.33 | 6.8712 |
| 0.44 | 147.081 | 0.422747 | 2742.37 | 6.8635 |
|  |  |  |  |  |
| 0.45 | 147.908 | 0.413900 | 2743.39 | 6.8560 |
| 0.46 | 148.721 | 0.405425 | 2744.38 | 6.8486 |
| 0.47 | 149.519 | 0.397299 | 2745.34 | 6.8414 |
| 0.48 | 150.305 | 0.389499 | 2746.28 | 6.8343 |
| 0.49 | 151.077 | 0.382007 | 2747.21 | 6.8274 |
|  |  |  |  |  |
| 0.50 | 151.836 | 0.374804 | 2748.11 | 6.8206 |
| 0.55 | 155.462 | 0.342592 | 2752.33 | 6.7885 |
| 0.60 | 158.832 | 0.315575 | 2756.14 | 6.7592 |
| 0.65 | 161.986 | 0.292581 | 2759.60 | 6.7321 |
| 0.70 | 164.953 | 0.272764 | 2762.75 | 6.7070 |
|  |  |  |  |  |
| 0.75 | 167.755 | 0.255503 | 2765.64 | 6.6835 |
| 0.80 | 170.414 | 0.240328 | 2768.30 | 6.6615 |
| 0.85 | 172.943 | 0.226878 | 2770.76 | 6.6408 |
| 0.90 | 175.358 | 0.214874 | 2773.04 | 6.6212 |
| 0.95 | 177.669 | 0.204090 | 2775.15 | 6.6027 |
|  |  |  |  |  |
| 1.00 | 179.886 | 0.194349 | 2777.12 | 6.5850 |
| 1.05 | 182.017 | 0.185504 | 2778.95 | 6.5681 |
| 1.10 | 184.070 | 0.177436 | 2780.67 | 6.5520 |
| 1.15 | 186.050 | 0.170045 | 2782.27 | 6.5365 |
| 1.20 | I87.965 | 0.163250 | 2783.77 | 6.5217 |
|  |  |  |  |  |
| 1.25 | 189.817 | 0.156979 | 2785.17 | 6.5074 |
| 1.30 | 191.613 | 0.151175 | 2786.49 | 6.4936 |
| 1.35 | 193.355 | 0.145786 | 2787.73 | 6.4804 |
| 1.40 | 195.047 | 0.140768 | 2788.89 | 6.4675 |
| 1.45 | 196.693 | 0.136084 | 2789.98 | 6.4551 |
|  |  |  |  |  |
| 1.50 | 198.295 | 0.131702 | 2791.01 | 6.4431 |
| 1.55 | 199.856 | 0.127593 | 2791.97 | 6.4314 |
| 1.60 | 201.378 | 0.123732 | 2792.88 | 6.4200 |
| 1.65 | 202.864 | 0.120097 | 2793.73 | 6.4090 |
| 1.70 | 204.315 | 0.116668 | 2794.53 | 6.3983 |
|  |  |  |  |  |
| 1.75 | 205.733 | 0.113428 | 2795.28 | 6.3878 |
| 1.80 | 207.120 | 0.110362 | 2795.99 | 6.3776 |
| 1.85 | 208.477 | 0.107456 | 2796.65 | 6.3676 |
| 1.90 | 209.806 | 0.104698 | 2797.26 | 6.3579 |
| 1.95 | 211.108 | 0.102076 | 2797.84 | 6.3484 |

表A.2 以压力为基础的饱和状态蒸汽物性值表（续）

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *p* | *θs* | *v''* | *h''* | *s''* |
| [MPa] | [℃] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] |
| 2.00 | 212.385 | 0.0995805 | 2798.38 | 6.3392 |
| 2.05 | 213.637 | 0.0972026 | 2798.89 | 6.3301 |
| 2.10 | 214.865 | 0.0949339 | 2799.36 | 6.3212 |
| 2.15 | 216.071 | 0.0927671 | 2799.80 | 6.3125 |
| 2.20 | 217.256 | 0.0906953 | 2800.20 | 6.3040 |
|  |  |  |  |  |
| 2.25 | 218.420 | 0.0887123 | 2800.58 | 6.2956 |
| 2.30 | 219.564 | 0.0868125 | 2800.92 | 6.2874 |
| 2.35 | 220.689 | 0.0849906 | 2801.24 | 6.2793 |
| 2.40 | 221.795 | 0.0832421 | 2801.54 | 6.2714 |
| 2.45 | 222.885 | 0.0815623 | 2801.80 | 6.2636 |
|  |  |  |  |  |
| 2.50 | 223.956 | 0.0799474 | 2802.04 | 6.2560 |
| 2.55 | 225.012 | 0.0783935 | 2802.26 | 6.2485 |
| 2.60 | 226.052 | 0.0768973 | 2802.45 | 6.2411 |
| 2.65 | 227.076 | 0.0754556 | 2802.63 | 6.2338 |
| 2.70 | 228.086 | 0.0740653 | 2802.78 | 6.2266 |
|  |  |  |  |  |
| 2.75 | 229.081 | 0.0727238 | 2802.91 | 6.2196 |
| 2.80 | 230.063 | 0.0714285 | 2803.02 | 6.2126 |
| 2.85 | 231.031 | 0.0701770 | 2803.11 | 6.2058 |
| 2.90 | 231.986 | 0.0689671 | 2803.18 | 6.1990 |
| 2.95 | 232.928 | 0.0677968 | 2803.23 | 6.1924 |
|  |  |  |  |  |
| 3.00 | 233.858 | 0.0666641 | 2803.26 | 6.1858 |
| 3.05 | 234.777 | 0.0655672 | 2803.28 | 6.1793 |
| 3.10 | 235.684 | 0.0645044 | 2803.28 | 6.1729 |
| 3.15 | 236.580 | 0.0634741 | 2803.27 | 6.1666 |
| 3.20 | 237.464 | 0.0624748 | 2803.24 | 6.1604 |
|  |  |  |  |  |
| 3.25 | 238.339 | 0.0615052 | 2803.19 | 6.1542 |
| 3.30 | 239.203 | 0.0605639 | 2803.13 | 6.1481 |
| 3.35 | 240.057 | 0.0596497 | 2803.05 | 6.1421 |
| 3.40 | 240.901 | 0.0587614 | 2802.96 | 6.1362 |
| 3.45 | 241.736 | 0.0578979 | 2802.86 | 6.1303 |
|  |  |  |  |  |
| 3.50 | 242.562 | 0.0570582 | 2802.74 | 6.1245 |
| 3.55 | 243.378 | 0.0562413 | 2802.61 | 6.1188 |
| 3.60 | 244.186 | 0.0554463 | 2802.47 | 6.1131 |
| 3.65 | 244.986 | 0.0546722 | 2802.31 | 6.1075 |
| 3.70 | 245.776 | 0.0539183 | 2802.15 | 6.1019 |
|  |  |  |  |  |
| 3.75 | 246.559 | 0.0531837 | 2801.97 | 6.0964 |
| 3.80 | 247.334 | 0.0524678 | 2801.78 | 6.0910 |
| 3.85 | 248.101 | 0.0517698 | 2801.57 | 6.0856 |
| 3.90 | 248.861 | 0.0510890 | 2801.36 | 6.0802 |
| 3.95 | 249.613 | 0.0504248 | 2801.13 | 6.0749 |
|  |  |  |  |  |
| 4.00 | 250.358 | 0.0497766 | 2800.90 | 6.0697 |
| 4.05 | 251.095 | 0.0491438 | 2800.65 | 6.0645 |
| 4.10 | 251.826 | 0.0485259 | 2800.39 | 6.0594 |
| 4.15 | 252.550 | 0.0479223 | 2800.13 | 6.0543 |
| 4.20 | 253.267 | 0.0473326 | 2799.85 | 6.0492 |

表A.2 以压力为基础的饱和状态蒸汽物性值表（续）

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *P* | *θs* | *v''* | *h''* | *s''* | |
| [MPa] | [℃] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | |
| 4.25 | 253.978 | 0.0467562 | 2799.57 | 6.0442 |
| 4.30 | 254.683 | 0.0461927 | 2799.27 | 6.0393 |
| 4.35 | 255.381 | 0.0456417 | 2798.97 | 6.0343 |
| 4.40 | 256.073 | 0.0451027 | 2798.65 | 6.0294 |
| 4.45 | 256.759 | 0.0445754 | 2798.33 | 6.0246 |
|  |  |  |  |  |
| 4.50 | 257.439 | 0.0440593 | 2798.00 | 6.0198 |
| 4.55 | 258.114 | 0.0435542 | 2797.66 | 6.0150 |
| 4.60 | 258.783 | 0.0430596 | 2797.31 | 6.0103 |
| 4.65 | 259.446 | 0.0425753 | 2796.95 | 6.0056 |
| 4.70 | 260.104 | 0.0421009 | 2796.59 | 6.0010 |
|  |  |  |  |  |
| 4.75 | 260.757 | 0.0416361 | 2796.21 | 5.9963 |
| 4.80 | 261.404 | 0.0411806 | 2795.83 | 5.9917 |
| 4.85 | 262.046 | 0.0407341 | 2795.44 | 5.9872 |
| 4.90 | 262.683 | 0.0402964 | 2795.04 | 5.9827 |
| 4.95 | 263.316 | 0.0398672 | 2794.64 | 5.9782 |
|  |  |  |  |  |
| 5.0 | 263.943 | 0.0394463 | 2794.23 | 5.9737 |
| 5.1 | 265.183 | 0.0386282 | 2793.38 | 5.9649 |
| 5.2 | 266.405 | 0.0378403 | 2792.51 | 5.9562 |
| 5.3 | 267.610 | 0.0370811 | 2791.60 | 5.9475 |
| 5.4 | 268.797 | 0.0363488 | 2790.67 | 5.9390 |
|  |  |  |  |  |
| 5.5 | 269.967 | 0.0356422 | 2789.72 | 5.9307 |
| 5.6 | 271.121 | 0.0349597 | 2788.74 | 5.9224 |
| 5.7 | 272.260 | 0.0343003 | 2787.73 | 5.9141 |
| 5.8 | 273.383 | 0.0336627 | 2786.70 | 5.9060 |
| 5.9 | 274.492 | 0.0330458 | 2785.64 | 5.8980 |
|  |  |  |  |  |
| 6.0 | 275.586 | 0.0324487 | 2784.56 | 5.8901 |
| 6.1 | 276.667 | 0.0318703 | 2783.46 | 5.8822 |
| 6.2 | 277.734 | 0.0313098 | 2782.33 | 5.8744 |
| 6.3 | 278.788 | 0.0307664 | 2781.19 | 5.8667 |
| 6.4 | 279.830 | 0.0302392 | 2780.02 | 5.8591 |
|  |  |  |  |  |
| 6.5 | 280.859 | 0.0297276 | 2778.83 | 5.8515 |
| 6.6 | 281.876 | 0.0292308 | 2777.62 | 5.8440 |
| 6.7 | 282.881 | 0.0287482 | 2776.39 | 5.8366 |
| 6.8 | 283.875 | 0.0282792 | 2775.13 | 5.8292 |
| 6.9 | 284.858 | 0.0278231 | 2773.86 | 5.8219 |
|  |  |  |  |  |
| 7.0 | 285.830 | 0.0273796 | 2772.57 | 5.8146 |
| 7.1 | 286.791 | 0.0269479 | 2771.26 | 5.8074 |
| 7.2 | 287.743 | 0.0265277 | 2769.93 | 5.8003 |
| 7.3 | 288.684 | 0.0261185 | 2768.58 | 5.7932 |
| 7.4 | 289.615 | 0.0257198 | 2767.21 | 5.7862 |
|  |  |  |  |  |
| 7.5 | 290.537 | 0.0253313 | 2765.82 | 5.7792 |
| 7.6 | 291.449 | 0.0249525 | 2764.41 | 5.7722 |
| 7.7 | 292.352 | 0.0245831 | 2762.99 | 5.7653 |
| 7.8 | 293.247 | 0.0242227 | 2761.55 | 5.7584 |
| 7.9 | 294.132 | 0.0238709 | 2760.09 | 5.7516 |

表A.2 以压力为基础的饱和状态蒸汽物性值表（续）

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *p* | *θs* | *v''* | | *h''* | *s''* |
| [bar] | [℃] | [m3/kg] | | [kJ/kg] | [kJ/(kg·K)] |
| 8.0 | 295.009 | 0.0235275 | 2758.61 | | 5.7448 |
| 8.1 | 295.878 | 0.0231922 | 2757.12 | | 5.7381 |
| 8.2 | 296.738 | 0.0228646 | 2755.60 | | 5.7314 |
| 8.3 | 297.591 | 0.0225446 | 2754.07 | | 5.7247 |
| 8.4 | 298.435 | 0.0222317 | 2752.52 | | 5.7181 |
|  |  |  |  | |  |
| 8.5 | 299.272 | 0.0219258 | 2750.96 | | 5.7115 |
| 8.6 | 300.102 | 00216266 | 2749.38 | | 5.7050 |
| 8.7 | 300.924 | 0.0213340 | 2747.78 | | 5.6984 |
| 8.8 | 301.738 | 0.0210476 | 2746.16 | | 5.6919 |
| 8.9 | 302.546 | 0.0207673 | 2744.53 | | 5.6855 |
|  |  |  |  | |  |
| 9.0 | 303.347 | 0.0204929 | 2742.88 | | 5.6790 |
| 9.1 | 304.141 | 0.0202242 | 2741.22 | | 5.6726 |
| 9.2 | 304.928 | 0.0199610 | 2739.53 | | 5.6662 |
| 9.3 | 305.709 | 0.0197031 | 2737.83 | | 5.6598 |
| 9.4 | 306.483 | 0.0194503 | 2736.12 | | 5.6535 |
|  |  |  |  | |  |
| 9.5 | 307.251 | 0.0192026 | 2734.38 | | 5.6472 |
| 9.6 | 308.013 | 0.0189597 | 2732.64 | | 5.6409 |
| 9.7 | 308.768 | 0.0187214 | 2730.87 | | 5.6346 |
| 9.8 | 309.518 | 0.0184878 | 2729.09 | | 5.6283 |
| 9.9 | 310.262 | 0.0182585 | 2727.29 | | 5.6221 |
|  |  |  |  | |  |
| 10.0 | 310.999 | 0.0180336 | 2725.47 | | 5.6159 |
| 10.5 | 314.606 | 0.0169687 | 2716.14 | | 5.5850 |
| 11.0 | 318.081 | 0.0159939 | 2706.39 | | 5.5545 |
| 11.5 | 321.436 | 0.0150972 | 2696.21 | | 5.5243 |
| 12.0 | 324.678 | 0.0142689 | 2685.58 | | 5.4941 |
|  |  |  |  | |  |
| 12.5 | 327.816 | 0.0135006 | 2674.49 | | 5.4640 |
| 13.0 | 330.857 | 0.0127851 | 2662.89 | | 5.4339 |
| 13.5 | 333.806 | 0.0121163 | 2650.77 | | 5.4036 |
| 14.0 | 336.669 | 0.0114889 | 2638.09 | | 5.3730 |
| 14.5 | 339.452 | 0.0108981 | 2624.81 | | 5.3422 |
|  |  |  |  | |  |
| 15.0 | 342.158 | 0.0103401 | 2610.86 | | 5.3108 |
| 15.5 | 344.792 | 0.00981114 | 2596.22 | | 5.2789 |
| 16.0 | 347.357 | 0.00930813 | 2580.80 | | 5.2463 |
| 16.5 | 349.856 | 0.00882826 | 2564.57 | | 5.2129 |
| 17.0 | 352.293 | 0.00836934 | 2547.41 | | 5.1785 |
|  |  |  |  | |  |
| 17.5 | 354.671 | 0.00792681 | 2529.11 | | 5.1428 |
| 18.0 | 356.992 | 0.00749867 | 2509.53 | | 5.1055 |
| 18.5 | 359.258 | 0.00708178 | 2488.41 | | 5.0663 |
| 19.0 | 361.471 | 0.00667261 | 2465.41 | | 5.0246 |
| 19.5 | 363.633 | 0.00626677 | 2440.00 | | 4.9795 |
|  |  |  |  | |  |
| 20.0 | 365.746 | 0.00585828 | 2411.39 | | 4.9299 |
| 20.5 | 367.811 | 0.00543778 | 2378.16 | | 4.8736 |
| 21.0 | 369.827 | 0.00498768 | 2337.54 | | 4.8062 |
| 21.5 | 371.795 | 0.00446300 | 2282.18 | | 4.7166 |
| 22.0 | 373.707 | 0.00357662 | 2164.18 | | 4.5308 |
| 22.0640a | 373.946 | 0.00310559 | 2087.55 | | 4.4120 |

a临界点压力。

# A.3单相区的物性值表

单相区的物性值表包括了温度自饱和蒸汽温度至800℃而压力自0.0006112127MPa至16MPa以下的单相水和蒸汽热物理性质值：

·比容*ν*；

·声速*w*；

·比焓*h*；

·等墒指数*к*；

·比熵*s*；

·动力粘度*η*。

表A.3单相区的物性值表（饱和蒸汽温度至800℃）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.0006112127MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs*=0°C 饱和状态 | | | | | | |
| 液 | 0.00100021 | -0.041586 | -0.000154542 | 1402.3 | 3216538 | 1792.0 |
| 汽 | 206.140 | 2500.89 | 9.1558 | 408.88 | 1.3269 | 8.945 |
| 2 | 207.657 | 2504.66 | 9.1695 | 410.50 | 1.3277 | 9.003 |
| 4 | 209.173 | 2508.42 | 9.1831 | 412.08 | 1.3282 | 9.062 |
| 6 | 210.688 | 2512.18 | 9.1966 | 413.63 | 1.3286 | 9.121 |
| 8 | 212.203 | 2515.92 | 9.2100 | 415.15 | 1.3288 | 9.180 |
| 10 | 213.717 | 2519.67 | 9.2233 | 416.65 | 1.3289 | 9.240 |
|  |  |  |  |  |  |  |
| 12 | 215.231 | 2523.41 | 9.2364 | 418.13 | 1.3290 | 9.301 |
| 14 | 216.744 | 2527.15 | 9.2495 | 419.60 | 1.3290 | 9.362 |
| 16 | 218.258 | 2530.89 | 9.2625 | 421.06 | 1.3290 | 9.424 |
| 18 | 219.771 | 2534.63 | 9.2754 | 422.51 | 1.3290 | 9.486 |
| 20 | 221.284 | 2538.37 | 9.2882 | 423.95 | 1.3289 | 9.549 |
|  |  |  |  |  |  |  |
| 25 | 225.065 | 2547.71 | 9.3198 | 427.53 | 1.3287 | 9.707 |
| 30 | 228.846 | 2557.06 | 9.3509 | 431.07 | 1.3285 | 9.869 |
| 35 | 232.626 | 2566.42 | 9.3815 | 434.57 | 1.3282 | 10.03 |
| 40 | 236.406 | 2575.77 | 9.4116 | 438.03 | 1.3279 | 10.20 |
| 45 | 240.185 | 2585.13 | 9.4413 | 441.47 | 1.3276 | 10.37 |
|  |  |  |  |  |  |  |
| 50 | 243.964 | 2594.50 | 9.4705 | 444.87 | 1.3272 | 10.54 |
| 55 | 247.743 | 2603.87 | 9.4993 | 448.25 | 1.3269 | 10.71 |
| 60 | 251.521 | 2613.25 | 9.5276 | 451.59 | 1.3265 | 10.89 |
| 65 | 255.299 | 2622.64 | 9.5556 | 454.90 | 1.3262 | 11.06 |
| 70 | 259.077 | 2632.03 | 9.5832 | 458.19 | 1.3258 | 11.24 |
|  |  |  |  |  |  |  |
| 75 | 262.855 | 2641.44 | 9.6104 | 461.44 | 1.3254 | 11.42 |
| 80 | 266.632 | 2650.85 | 9.6372 | 464.67 | 1.3249 | 11.60 |
| 85 | 270.409 | 2660.27 | 9.6637 | 467.88 | 1.3245 | 11.78 |
| 90 | 274.186 | 2669.70 | 9.6898 | 471.05 | 1.3240 | 11.97 |
| 95 | 277.963 | 2679.14 | 9.7157 | 474.20 | 1.3236 | 12.15 |
|  |  |  |  |  |  |  |
| 100 | 281.740 | 2688.58 | 9.7411 | 477.33 | 1.3231 | 12.34 |
| 110 | 289.294 | 2707.51 | 9.7912 | 483.51 | 1.3221 | 12.71 |
| 120 | 296.847 | 2726.48 | 9.8401 | 489.59 | 1.3211 | 13.09 |
| 130 | 304.399 | 2745.50 | 9.8878 | 495.58 | 1.3201 | 13.48 |
| 140 | 311.952 | 2764.56 | 9.9346 | 501.49 | 1.3190 | 13.86 |
|  |  |  |  |  |  |  |
| 150 | 319.504 | 2783.67 | 9.9803 | 507.31 | 1.3179 | 14.25 |
| 160 | 327.056 | 2802.84 | 10.025 | 513.05 | 1.3168 | 14.65 |
| 170 | 334.608 | 2822.05 | 10.069 | 518.72 | 1.3156 | 15.04 |
| 180 | 342.160 | 2841.32 | 10.112 | 524.31 | 1.3145 | 15.44 |
| 190 | 349.712 | 2860.64 | 10.154 | 529.83 | 1.3133 | 15.84 |
|  |  |  |  |  |  |  |
| 200 | 357.264 | 2880.01 | 10.195 | 535.28 | 1.3121 | 16.24 |
| 210 | 364.816 | 2899.45 | 10.236 | 540.66 | 1.3109 | 16.64 |
| 220 | 372.367 | 2918.93 | 10.276 | 545.98 | 1.3097 | 17.05 |
| 230 | 379.919 | 2938.48 | 10.315 | 551.23 | 1.3085 | 17.45 |
| 240 | 387.470 | 2958.08 | 10.354 | 556.43 | 1.3073 | 17.86 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.0006112127MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| 250 | 395.022 | 2977.75 | 10.392 | 561.56 | 1.3061 | 18.27 |
| 260 | 402.573 | 2997.47 | 10.429 | 566.64 | 1.3049 | 18.68 |
| 270 | 410.125 | 3017.25 | 10.466 | 571.67 | 1.3037 | 19.09 |
| 280 | 417.676 | 3037.09 | 10.502 | 576.64 | I.3025 | 19.50 |
| 290 | 425.227 | 3057.00 | 10.538 | 581.56 | 1.3013 | 19.91 |
|  |  |  |  |  |  |  |
| 300 | 432.779 | 3076.96 | 10.573 | 586.43 | 1.3001 | 20.32 |
| 310 | 440.330 | 3096.99 | 10.608 | 591.25 | 1.2989 | 20.74 |
| 320 | 447.881 | 3117.08 | 10.642 | 596.02 | 1.2977 | 21.15 |
| 330 | 455.432 | 3137.23 | 10.675 | 600.74 | 1.2965 | 21.56 |
| 340 | 462.984 | 3157.44 | 10.709 | 605.42 | 1.2953 | 21.98 |
|  |  |  |  |  |  |  |
| 350 | 470.535 | 3177.72 | 10.741 | 610.06 | 1.2941 | 22.39 |
| 360 | 478.086 | 3198.07 | 10.774 | 614.65 | 1.2929 | 22.80 |
| 370 | 485.637 | 3218.47 | 10.806 | 619.20 | 1.2917 | 23.22 |
| 380 | 493.188 | 3238.94 | 10.837 | 623.70 | 1.2905 | 23.63 |
| 390 | 500.740 | 3259.48 | 10.869 | 628.17 | 1.2893 | 24.04 |
|  |  |  |  |  |  |  |
| 400 | 508.291 | 3280.08 | 10.899 | 632.60 | 1.2881 | 24.46 |
| 410 | 515.842 | 3300.75 | 10.930 | 636.99 | 1.2869 | 24.87 |
| 420 | 523.393 | 3321.48 | 10.960 | 641.34 | 1.2858 | 25.28 |
| 430 | 530.944 | 3342.28 | 10.990 | 645.65 | 1.2846 | 25.69 |
| 440 | 538.495 | 3363.15 | 11.019 | 649.93 | 1.2834 | 26.10 |
|  |  |  |  |  |  |  |
| 450 | 546.046 | 3384.08 | 11.048 | 654.18 | 1.2822 | 26.51 |
| 460 | 553.598 | 3405.09 | 11.077 | 658.39 | 1.2811 | 26.93 |
| 470 | 561.149 | 3426.16 | 11.106 | 662.56 | 1.2799 | 27.34 |
| 480 | 568.700 | 3447.29 | 11.134 | 666.70 | 1.2788 | 27.74 |
| 490 | 576.251 | 3468.50 | 11.162 | 670.81 | 1.2776 | 28.15 |
|  |  |  |  |  |  |  |
| 500 | 583.802 | 3489.77 | 11.190 | 674.89 | 1.2765 | 28.56 |
| 510 | 591.353 | 3511.12 | 11.217 | 678.94 | 1.2753 | 28.97 |
| 520 | 598.904 | 3532.53 | 11.244 | 682.96 | 1.2742 | 29.38 |
| 530 | 606.455 | 3554.01 | 11.271 | 686.95 | 1.2731 | 29.78 |
| 540 | 614.006 | 3575.56 | 11.298 | 690.90 | 1.2720 | 30.19 |
|  |  |  |  |  |  |  |
| 550 | 621.557 | 3597.18 | 11.324 | 694.83 | 1.2708 | 30.59 |
| 560 | 629.108 | 3618.88 | 11.351 | 698.74 | 1.2697 | 31.00 |
| 570 | 636.660 | 3640.64 | 11.376 | 702.61 | 1.2686 | 31.40 |
| 580 | 644.211 | 3662.47 | 11.402 | 706.46 | 1.2675 | 31.80 |
| 590 | 651.762 | 3684.37 | 11.428 | 710.29 | 1.2664 | 32.20 |
|  |  |  |  |  |  |  |
| 600 | 659.313 | 3706.34 | 11.453 | 714.08 | 1.2654 | 32.60 |
| 650 | 697.068 | 3817.27 | 11.577 | 732.71 | 1.2601 | 34.60 |
| 700 | 734.823 | 3929.96 | 11.695 | 750.77 | 1.2550 | 36.56 |
| 750 | 772.578 | 4044.43 | 11.810 | 768.31 | 1.2501 | 38.51 |
| 800 | 810.333 | 4160.66 | 11.921 | 785.38 | 1.2454 | 40.43 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.001MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs*=6.96963°C 饱和状态 | | | | | | |
| 液 | 0.00100014 | 29.2982 | 0.10591 | 1434.7 | 2058167 | 1428.5 |
| 汽 | 129.183 | 2513.68 | 8.9749 | 413.95 | 1.3265 | 9.148 |
| 8 | 129.662 | 2515.63 | 8.9819 | 414.78 | 1.3269 | 9.179 |
| 10 | 130.590 | 2519.41 | 8.9953 | 416.36 | 1.3275 | 9.239 |
|  |  |  |  |  |  |  |
| 12 | 131.517 | 2523.17 | 9.0085 | 417.91 | 1.3279 | 9.300 |
| 14 | 132.444 | 2526.93 | 9.0216 | 419.42 | 1.3282 | 9.361 |
| 16 | 133.370 | 2530.68 | 9.0347 | 420.91 | 1.3284 | 9.423 |
| 18 | 134.296 | 2534.44 | 9.0476 | 422.39 | 1.3285 | 9.485 |
| 20 | 135.222 | 2538.19 | 9.0604 | 423.85 | 1.3285 | 9.548 |
|  |  |  |  |  |  |  |
| 25 | 137.536 | 2547.55 | 9.0921 | 427.45 | 1.3285 | 9.706 |
| 30 | 139.849 | 2556.92 | 9.1233 | 431.00 | 1.3283 | 9.868 |
| 35 | 142.162 | 2566.28 | 9.1539 | 434.51 | 1.3281 | 10.03 |
| 40 | 144.474 | 2575.65 | 9.1841 | 437.99 | 1.3278 | 10.20 |
| 45 | 146.785 | 2585.02 | 9.2138 | 441.43 | 1.3275 | 10.37 |
|  |  |  |  |  |  |  |
| 50 | 149.096 | 2594.40 | 9.2430 | 444.83 | 1.3272 | 10.54 |
| 55 | 151.407 | 2603.78 | 9.2718 | 448.21 | 1.3268 | 10.71 |
| 60 | 153.717 | 2613.17 | 9.3002 | 451.56 | 1.3265 | 10.88 |
| 65 | 156.027 | 2622.56 | 9.3282 | 454.87 | 1.3261 | 11.06 |
| 70 | 158.337 | 2631.96 | 9.3558 | 458.16 | 1.3257 | 11.24 |
|  |  |  |  |  |  |  |
| 75 | 160.647 | 2641.37 | 9.3830 | 461.42 | 1.3253 | 11.42 |
| 80 | 162.957 | 2650.79 | 9.4099 | 464.65 | 1.3249 | 11.60 |
| 85 | 165.266 | 2660.21 | 9.4364 | 467.85 | 1.3245 | 11.78 |
| 90 | 167.575 | 2669.64 | 9.4625 | 471.03 | 1.3240 | 11.96 |
| 95 | 169.884 | 2679.08 | 9.4883 | 474.19 | 1.3236 | 12.15 |
|  |  |  |  |  |  |  |
| 100 | 172.193 | 2688.54 | 9.5138 | 477.31 | 1.3231 | 12.34 |
| 110 | 176.811 | 2707.47 | 9.5639 | 483.49 | 1.3221 | 12.71 |
| 120 | 181.428 | 2726.44 | 9.6128 | 489.58 | 1.3211 | 13.09 |
| 130 | 186.045 | 2745.46 | 9.6606 | 495.57 | 1.3201 | 13.47 |
| 140 | 190.662 | 2764.53 | 9.7073 | 501.48 | 1.3190 | 13.86 |
|  |  |  |  |  |  |  |
| 150 | 195.279 | 2783.65 | 9.7530 | 507.30 | 1.3179 | 14.25 |
| 160 | 199.895 | 2802.81 | 9.7978 | 513.04 | 1.3168 | 14.64 |
| 170 | 204.512 | 2822.03 | 9.8416 | 518.71 | 1.3156 | 15.04 |
| 180 | 209.128 | 2841.30 | 9.8846 | 524.30 | 1.3145 | 15.44 |
| 190 | 213.744 | 2860.62 | 9.9268 | 529.82 | 1.3133 | 15.84 |
|  |  |  |  |  |  |  |
| 200 | 218.360 | 2880.00 | 9.9682 | 535.27 | 1.3121 | 16.24 |
| 210 | 222.976 | 2899.43 | 10.009 | 540.65 | 1.3109 | 16.64 |
| 220 | 227.592 | 2918.92 | 10.049 | 545.97 | 1.3097 | 17.05 |
| 230 | 232.208 | 2938.47 | 10.088 | 551.23 | 1.3085 | 17.45 |
| 240 | 236.823 | 2958.07 | 10.127 | 556.42 | 1.3073 | 17.86 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.001 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| 250 | 241.439 | 2977.73 | 10.165 | 561.56 | 1.3061 | 18.27 |
| 260 | 246.055 | 2997.46 | 10.202 | 566.64 | 1.3049 | 18.68 |
| 270 | 250.670 | 3017.24 | 10.239 | 571.67 | 1.3037 | 19.09 |
| 280 | 255.286 | 3037.08 | 10.275 | 576.64 | 1.3025 | 19.50 |
| 290 | 259.902 | 3056.99 | 10.310 | 581.56 | 1.3013 | 19.91 |
|  |  |  |  |  |  |  |
| 300 | 264.517 | 3076.95 | 10.346 | 586.43 | 1.3001 | 20.32 |
| 310 | 269.133 | 3096.98 | 10.380 | 591.24 | 1.2989 | 20.74 |
| 320 | 273.748 | 3117.07 | 10.414 | 596.02 | 1.2977 | 21.15 |
| 330 | 278.364 | 3137.22 | 10.448 | 600.74 | 1.2965 | 21.56 |
| 340 | 282.979 | 3157.44 | 10.481 | 605.42 | 1.2953 | 21.98 |
|  |  |  |  |  |  |  |
| 350 | 287.595 | 3177.72 | 10.514 | 610.05 | 1.2941 | 22.39 |
| 360 | 292.210 | 3198.06 | 10.547 | 614.65 | 1.2929 | 22.80 |
| 370 | 296.826 | 3218.47 | 10.579 | 619.20 | 1.2917 | 23.22 |
| 380 | 301.441 | 3238.94 | 10.610 | 623.70 | 1.2905 | 23.63 |
| 390 | 306.057 | 3259.47 | 10.641 | 628.17 | 1.2893 | 24.04 |
|  |  |  |  |  |  |  |
| 400 | 310.672 | 3280.08 | 10.672 | 632.60 | 1.2881 | 24.46 |
| 410 | 315.288 | 3300.74 | 10.703 | 636.99 | 1.2869 | 24.87 |
| 420 | 319.903 | 3321.48 | 10.733 | 641.34 | 1.2858 | 25.28 |
| 430 | 324.518 | 3342.28 | 10.763 | 645.65 | 1.2846 | 25.69 |
| 440 | 329.134 | 3363.15 | 10.792 | 649.93 | 1.2834 | 26.10 |
|  |  |  |  |  |  |  |
| 450 | 333.749 | 3384.08 | 10.821 | 654.18 | 1.2822 | 26.51 |
| 460 | 338.365 | 3405.08 | 10.850 | 658.38 | 1.2811 | 26.93 |
| 470 | 342.980 | 3426.15 | 10.879 | 662.56 | 1.2799 | 27.34 |
| 480 | 347.595 | 3447.29 | 10.907 | 666.70 | 1.2788 | 27.74 |
| 490 | 352.211 | 3468.50 | 10.935 | 670.81 | 1.2776 | 28.15 |
|  |  |  |  |  |  |  |
| 500 | 356.826 | 3489.77 | 10.962 | 674.89 | 1.2765 | 28.56 |
| 510 | 361.441 | 3511.11 | 10.990 | 678.94 | 1.2753 | 28.97 |
| 520 | 366.057 | 3532.53 | 11.017 | 682.96 | 1.2742 | 29.38 |
| 530 | 370.672 | 3554.01 | 11.044 | 686.94 | 1.2731 | 29.78 |
| 540 | 375.288 | 3575.56 | 11.071 | 690.90 | 1.2720 | 30.19 |
|  |  |  |  |  |  |  |
| 550 | 379.903 | 3597.18 | 11.097 | 694.83 | 1.2708 | 30.59 |
| 560 | 384.518 | 3618.87 | 11.123 | 698.74 | 1.2697 | 31.00 |
| 570 | 389.134 | 3640.63 | 11.149 | 702.61 | 1.2686 | 31.40 |
| 580 | 393.749 | 3662.47 | 11.175 | 706.46 | 1.2675 | 31.80 |
| 590 | 398.364 | 3684.37 | 11.201 | 710.29 | 1.2664 | 32.20 |
|  |  |  |  |  |  |  |
| 600 | 402.980 | 3706.34 | 11.226 | 714.08 | 1.2654 | 32.60 |
| 650 | 426.056 | 3817.26 | 11.349 | 732.71 | 1.2601 | 34.60 |
| 700 | 449.133 | 3929.96 | 11.468 | 750.77 | 1.2550 | 36.56 |
| 750 | 472.209 | 4044.43 | 11.583 | 768.31 | 1.2501 | 38.51 |
| 800 | 495.286 | 4160.66 | 11.694 | 785.38 | 1.2454 | 40.43 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.005 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =32.8755 °C 饱和状态 | | | | | | |
| 液 | 0.00100532 | 137.765 | 0.47625 | 1517.4 | 458044 | 750.7 |
| 汽 | 28.1863 | 2560.77 | 8.3939 | 431.98 | 1.3241 | 9.953 |
| 35 | 28.3849 | 2564.84 | 8.4072 | 433.63 | 1.3249 | 10.02 |
| 40 | 28.8514 | 2574.38 | 8.4379 | 437.34 | 1.3259 | 10.19 |
| 45 | 29.3170 | 2583.88 | 8.4680 | 440.91 | 1.3262 | 10.36 |
|  |  |  |  |  |  |  |
| 50 | 29.7822 | 2593.36 | 8.4976 | 444.40 | 1.3262 | 10.53 |
| 55 | 30.2469 | 2602.83 | 8.5266 | 447.83 | 1.3261 | 10.70 |
| 60 | 30.7112 | 2612.29 | 8.5553 | 451.21 | 1.3258 | 10.88 |
| 65 | 31.1753 | 2621.75 | 8.5834 | 454.56 | 1.3256 | 11.05 |
| 70 | 31.6392 | 2631.21 | 8.6112 | 457.87 | 1.3252 | 11.23 |
|  |  |  |  |  |  |  |
| 75 | 32.1028 | 2640.68 | 8.6386 | 461.15 | 1.3249 | 11.41 |
| 80 | 32.5663 | 2650.14 | 8.6656 | 464.40 | 1.3245 | 11.59 |
| 85 | 33.0296 | 2659.61 | 8.6922 | 467.62 | 1.3241 | 11.78 |
| 90 | 33.4927 | 2669.08 | 8.7185 | 470.82 | 1.3237 | 11.96 |
| 95 | 33.9557 | 2678.56 | 8.7444 | 473.98 | 1.3233 | 12.15 |
|  |  |  |  |  |  |  |
| 100 | 34.4186 | 2688.05 | 8.7700 | 477.12 | 1.3228 | 12.33 |
| 110 | 35.3441 | 2707.04 | 8.8202 | 483.33 | 1.3219 | 12.71 |
| 120 | 36.2692 | 2726.06 | 8.8692 | 489.43 | 1.3209 | 13.09 |
| 130 | 37.1941 | 2745.12 | 8.9171 | 495.44 | 1.3199 | 13.47 |
| 140 | 38.1187 | 2764.22 | 8.9639 | 501.36 | 1.3189 | 13.86 |
|  |  |  |  |  |  |  |
| 150 | 39.0431 | 2783.37 | 9.0097 | 507.20 | 1.3178 | 14.25 |
| 160 | 39.9673 | 2802.56 | 9.0545 | 512.95 | 1.3167 | 14.64 |
| 170 | 40.8914 | 2821.80 | 9.0984 | 518.63 | 1.3155 | 15.04 |
| 180 | 41.8154 | 2841.08 | 9.1415 | 524.22 | 1.3144 | 15.44 |
| 190 | 42.7393 | 2860.42 | 9.1837 | 529.75 | 1.3132 | 15.84 |
|  |  |  |  |  |  |  |
| 200 | 43.6631 | 2879.82 | 9.2251 | 535.21 | 1.3121 | 16.24 |
| 210 | 44.5868 | 2899.26 | 9.2658 | 540.59 | 1.3109 | 16.64 |
| 220 | 45.5105 | 2918.76 | 9.3057 | 545.92 | 1.3097 | 17.05 |
| 230 | 46.4341 | 2938.32 | 9.3450 | 551.18 | 1.3085 | 17.45 |
| 240 | 47.3577 | 2957.93 | 9.3836 | 556.38 | 1.3073 | 17.86 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.005 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| 250 | 48.2812 | 2977.61 | 9.4216 | 561.52 | 1.3061 | 18.27 |
| 260 | 49.2047 | 2997.34 | 9.4589 | 566.60 | 1.3049 | 18.68 |
| 270 | 50.1282 | 3017.13 | 9.4957 | 571.63 | 1.3037 | 19.09 |
| 280 | 51.0516 | 3036.98 | 9.5319 | 576.60 | 1.3025 | 19.50 |
| 290 | 51.9750 | 3056.89 | 9.5676 | 581.52 | 1.3013 | 19.91 |
|  |  |  |  |  |  |  |
| 300 | 52.8984 | 3076.86 | 9.6027 | 586.39 | 1.3001 | 20.32 |
| 310 | 53.8217 | 3096.89 | 9.6374 | 591.22 | 1.2989 | 20.74 |
| 320 | 54.7451 | 3116.98 | 9.6715 | 595.99 | 1.2977 | 21.15 |
| 330 | 55.6684 | 3137.14 | 9.7052 | 600.72 | 1.2965 | 21.56 |
| 340 | 56.5917 | 3157.36 | 9.7385 | 605.40 | 1.2953 | 21.98 |
|  |  |  |  |  |  |  |
| 350 | 57.5150 | 3177.64 | 9.7713 | 610.03 | 1.2941 | 22.39 |
| 360 | 58.4382 | 3197.99 | 9.8037 | 614.63 | 1.2929 | 22.80 |
| 370 | 59.3615 | 3218.40 | 9.8357 | 619.18 | 1.2917 | 23.22 |
| 380 | 60.2847 | 3238.87 | 9.8673 | 623.68 | 1.2905 | 23.63 |
| 390 | 61.2080 | 3259.41 | 9.8985 | 628.15 | 1.2893 | 24.04 |
|  |  |  |  |  |  |  |
| 400 | 62.1312 | 3280.01 | 9.9293 | 632.58 | 1.2881 | 24.46 |
| 410 | 63.0544 | 3300.68 | 9.9598 | 636.97 | 1.2869 | 24.87 |
| 420 | 63.9776 | 3321.42 | 9.9899 | 641.32 | 1.2857 | 25.28 |
| 430 | 64.9008 | 3342.22 | 10.020 | 645.64 | 1.2846 | 25.69 |
| 440 | 65.8240 | 3363.09 | 10.049 | 649.92 | 1.2834 | 26.10 |
|  |  |  |  |  |  |  |
| 450 | 66.7472 | 3384.03 | 10.078 | 654.16 | 1.2822 | 26.51 |
| 460 | 67.6704 | 3405.03 | 10.107 | 658.37 | 1.2811 | 26.93 |
| 470 | 68.5936 | 3426.10 | 10.136 | 662.55 | 1.2799 | 27.34 |
| 480 | 69.5167 | 3447.24 | 10.164 | 666.69 | 1.2788 | 27.74 |
| 490 | 70.4399 | 3468.45 | 10.192 | 670.80 | 1.2776 | 28.15 |
|  |  |  |  |  |  |  |
| 500 | 71.3631 | 3489.73 | 10.220 | 674.88 | 1.2765 | 28.56 |
| 510 | 72.2862 | 3511.07 | 10.247 | 678.93 | 1.2753 | 28.97 |
| 520 | 73.2094 | 3532.49 | 10.274 | 682.95 | 1.2742 | 29.38 |
| 530 | 74.1325 | 3553.97 | 10.301 | 686.94 | 1.2731 | 29.78 |
| 540 | 75.0556 | 3575.52 | 10.328 | 690.90 | 1.2720 | 30.19 |
|  |  |  |  |  |  |  |
| 550 | 75.9788 | 3597.14 | 10.354 | 694.83 | 1.2708 | 30.59 |
| 560 | 76.9019 | 3618.84 | 10.380 | 698.73 | 1.2697 | 31.00 |
| 570 | 77.8250 | 3640.60 | 10.406 | 702.61 | 1.2686 | 31.40 |
| 580 | 78.7482 | 3662.43 | 10.432 | 706.46 | 1.2675 | 31.80 |
| 590 | 79.6713 | 3684.34 | 10.458 | 710.28 | 1.2664 | 32.20 |
|  |  |  |  |  |  |  |
| 600 | 80.5944 | 3706.31 | 10.483 | 714.08 | 1.2654 | 32.60 |
| 650 | 85.2100 | 3817.24 | 10.607 | 732.70 | 1.2601 | 34.60 |
| 700 | 89.8255 | 3929.94 | 10.725 | 750.76 | 1.2550 | 36.56 |
| 750 | 94.4410 | 4044.41 | 10.840 | 768.31 | 1.2501 | 38.51 |
| 800 | 99.0564 | 4160.64 | 10.951 | 785.38 | 1.2454 | 40.43 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.01 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =45.8075°C 饱和状态 | | | | | | |
| 液 | 0.00101026 | 191.812 | 0.64922 | 1540.0 | 234753 | 587.3 |
| 汽 | 14.6706 | 2583.89 | 8.1489 | 440.51 | 1.3227 | 10.38 |
| 50 | 14.8674 | 2591.99 | 8.1741 | 443.67 | 1.3240 | 10.52 |
| 55 | 15.1015 | 2601.60 | 8.2037 | 447.26 | 1.3246 | 10.69 |
| 60 | 15.3353 | 2611.18 | 8.2326 | 450.74 | 1.3248 | 10.87 |
| 65 | 15.5687 | 2620.73 | 8.2611 | 454.14 | 1.3247 | 11.05 |
| 70 | 15.8018 | 2630.27 | 8.2891 | 457.50 | 1.3246 | 11.23 |
|  |  |  |  |  |  |  |
| 75 | 16.0347 | 2639.80 | 8.3167 | 460.81 | 1.3243 | 11.41 |
| 80 | 16.2674 | 2649.33 | 8.3438 | 464.09 | 1.3240 | 11.59 |
| 85 | 16.4999 | 2658.86 | 8.3706 | 467.33 | 1.3236 | 11.77 |
| 90 | 16.7323 | 2668.38 | 8.3970 | 470.55 | 1.3233 | 11.95 |
| 95 | 16.9646 | 2677.90 | 8.4231 | 473.73 | 1.3229 | 12.14 |
|  |  |  |  |  |  |  |
| 100 | 17.1967 | 2687.43 | 8.4488 | 476.89 | 1.3225 | 12.33 |
| 110 | 17.6607 | 2706.50 | 8.4992 | 483.12 | 1.3216 | 12.70 |
| 120 | 18.1243 | 2725.58 | 8.5484 | 489.25 | 1.3207 | 13.08 |
| 130 | 18.5876 | 2744.69 | 8.5964 | 495.28 | 1.3197 | 13.47 |
| 140 | 19.0507 | 2763.84 | 8.6433 | 501.22 | 1.3187 | 13.86 |
|  |  |  |  |  |  |  |
| 150 | 19.5136 | 2783.02 | 8.6892 | 507.07 | 1.3176 | 14.25 |
| 160 | 19.9763 | 2802.24 | 8.7340 | 512.83 | 1.3166 | 14.64 |
| 170 | 20.4389 | 2821.51 | 8.7780 | 518.52 | 1.3154 | 15.04 |
| 180 | 20.9013 | 2840.82 | 8.8211 | 524.13 | 1.3143 | 15.43 |
| 190 | 21.3637 | 2860.18 | 8.8634 | 529.66 | 1.3132 | 15.83 |
|  |  |  |  |  |  |  |
| 200 | 21.8260 | 2879.59 | 8.9048 | 535.13 | 1.3120 | 16.24 |
| 210 | 22.2882 | 2899.05 | 8.9455 | 540.52 | 1.3108 | 16.64 |
| 220 | 22.7504 | 2918.57 | 8.9855 | 545.85 | 1.3097 | 17.05 |
| 230 | 23.2124 | 2938.14 | 9.0248 | 551.12 | 1.3085 | 17.45 |
| 240 | 23.6745 | 2957.76 | 9.0634 | 556.32 | 1.3073 | 17.86 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.01 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| 250 | 24.1365 | 2977.45 | 9.1014 | 561.46 | 1.3061 | 18.27 |
| 260 | 24.5985 | 2997.19 | 9.1388 | 566.55 | 1.3049 | 18.68 |
| 270 | 25.0604 | 3016.98 | 9.1756 | 571.58 | 1.3037 | 19.09 |
| 280 | 25.5223 | 3036.84 | 9.2118 | 576.56 | 1.3025 | 19.50 |
| 290 | 25.9842 | 3056.76 | 9.2475 | 581.48 | 1.3013 | 19.91 |
|  |  |  |  |  |  |  |
| 300 | 26.4460 | 3076.73 | 9.2827 | 586.36 | 1.3001 | 20.32 |
| 310 | 26.9078 | 3096.77 | 9.3173 | 591.18 | 1.2989 | 20.74 |
| 320 | 27.3696 | 3116.87 | 9.3515 | 595.96 | 1.2977 | 21.15 |
| 330 | 27.8314 | 3137.03 | 9.3852 | 600.68 | 1.2965 | 21.56 |
| 340 | 28.2932 | 3157.26 | 9.4185 | 605.37 | 1.2953 | 21.98 |
|  |  |  |  |  |  |  |
| 350 | 28.7550 | 3177.54 | 9.4513 | 610.00 | 1.2941 | 22.39 |
| 360 | 29.2167 | 3197.89 | 9.4837 | 614.60 | 1.2929 | 22.80 |
| 370 | 29.6785 | 3218.31 | 9.5157 | 619.15 | 1.2917 | 23.22 |
| 380 | 30.1402 | 3238.79 | 9.5473 | 623.66 | 1.2905 | 23.63 |
| 390 | 30.6019 | 3259.33 | 9.5785 | 628.13 | 1.2893 | 24.04 |
|  |  |  |  |  |  |  |
| 400 | 31.0636 | 3279.94 | 9.6093 | 632.56 | 1.2881 | 24.46 |
| 410 | 31.5253 | 3300.61 | 9.6398 | 636.95 | 1.2869 | 24.87 |
| 420 | 31.9870 | 3321.35 | 9.6699 | 641.30 | 1.2857 | 25.28 |
| 430 | 32.4486 | 3342.15 | 9.6997 | 645.62 | 1.2846 | 25.69 |
| 440 | 32.9103 | 3363.03 | 9.7292 | 649.90 | 1.2834 | 26.10 |
|  |  |  |  |  |  |  |
| 450 | 33.3720 | 3383.96 | 9.7584 | 654.15 | 1.2822 | 26.51 |
| 460 | 33.8336 | 3404.97 | 9.7872 | 658.36 | 1.2811 | 26.93 |
| 470 | 34.2953 | 3426.04 | 9.8158 | 662.53 | 1.2799 | 27.34 |
| 480 | 34.7569 | 3447.19 | 9.8440 | 666.68 | 1.2788 | 27.74 |
| 490 | 35.2185 | 3468.40 | 9.8720 | 670.79 | 1.2776 | 28.15 |
|  |  |  |  |  |  |  |
| 500 | 35.6802 | 3489.67 | 9.8997 | 674.87 | 1.2765 | 28.56 |
| 510 | 36.1418 | 3511.02 | 9.9271 | 678.92 | 1.2753 | 28.97 |
| 520 | 36.6034 | 3532.44 | 9.9543 | 682.94 | 1.2742 | 29.38 |
| 530 | 37.0650 | 3553.92 | 9.9812 | 686.92 | 1.2731 | 29.78 |
| 540 | 37.5267 | 3575.48 | 10.008 | 690.88 | 1.2720 | 30.19 |
|  |  |  |  |  |  |  |
| 550 | 37.9883 | 3597.10 | 10.034 | 694.82 | 1.2708 | 30.59 |
| 560 | 38.4499 | 3618.79 | 10.061 | 698.72 | 1.2697 | 31.00 |
| 570 | 38.9115 | 3640.56 | 10.086 | 702.60 | 1.2686 | 31.40 |
| 580 | 39.3731 | 3662.39 | 10.112 | 706.45 | 1.2675 | 31.80 |
| 590 | 39.8347 | 3684.30 | 10.138 | 710.27 | 1.2664 | 32.20 |
|  |  |  |  |  |  |  |
| 600 | 40.2963 | 3706.27 | 10.163 | 714.07 | 1.2654 | 32.61 |
| 650 | 42.6042 | 3817.20 | 10.287 | 732.70 | 1.2601 | 34.60 |
| 700 | 44.9121 | 3929.91 | 10.405 | 750.76 | 1.2550 | 36.56 |
| 750 | 47.2199 | 4044.38 | 10.520 | 768.31 | 1.2501 | 38.51 |
| 800 | 49.5278 | 4160.62 | 10.631 | 785.38 | 1.2454 | 40.43 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.05 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =81.3167°C 饱和状态 | | | | | | |
| 液 | 0.00102991 | 340.476 | 1.0910 | 1556.6 | 47053 | 348.3 |
| 汽 | 3.24015 | 2645.21 | 7.5930 | 462.16 | 1.3184 | 11.58 |
| 85 | 3.27556 | 2652.61 | 7.6137 | 464.81 | 1.3191 | 11.72 |
| 90 | 3.32345 | 2662.59 | 7.6414 | 468.28 | 1.3196 | 11.91 |
| 95 | 3.37119 | 2672.51 | 7.6685 | 471.66 | 1.3198 | 12.10 |
|  |  |  |  |  |  |  |
| 100 | 3.41878 | 2682.40 | 7.6952 | 474.97 | 1.3197 | 12.29 |
| 110 | 3.51362 | 2702.07 | 7.7472 | 481.45 | 1.3194 | 12.67 |
| 120 | 3.60809 | 2721.67 | 7.7977 | 487.78 | 1.3189 | 13.05 |
| 130 | 3.70224 | 2741.21 | 7.8468 | 493.98 | 1.3182 | 13.44 |
| 140 | 3.79615 | 2760.71 | 7.8946 | 500.06 | 1.3174 | 13.83 |
|  |  |  |  |  |  |  |
| 150 | 3.88985 | 2780.20 | 7.9412 | 506.03 | 1.3166 | 14.22 |
| 160 | 3.98338 | 2799.68 | 7.9867 | 511.90 | 1.3157 | 14.62 |
| 170 | 4.07677 | 2819.18 | 8.0312 | 517.67 | 1.3147 | 15.02 |
| 180 | 4.17003 | 2838.68 | 8.0747 | 523.36 | 1.3137 | 15.42 |
| 190 | 4.26319 | 2858.21 | 8.1174 | 528.96 | 1.3126 | 15.82 |
|  |  |  |  |  |  |  |
| 200 | 4.35627 | 2877.77 | 8.1591 | 534.48 | 1.3115 | 16.22 |
| 210 | 4.44926 | 2897.37 | 8.2001 | 539.93 | 1.3104 | 16.63 |
| 220 | 4.54220 | 2917.00 | 8.2403 | 545.31 | 1.3093 | 17.03 |
| 230 | 4.63507 | 2936.67 | 8.2798 | 550.61 | 1.3082 | 17.44 |
| 240 | 4.72790 | 2956.39 | 8.3186 | 555.86 | 1.3070 | 17.85 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.05 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| 250 | 4.82069 | 2976.16 | 8.3568 | 561.03 | 1.3059 | 18.26 |
| 260 | 4.91343 | 2995.97 | 8.3943 | 566.15 | 1.3047 | 18.67 |
| 270 | 5.00615 | 3015.84 | 8.4312 | 571.21 | 1.3035 | 19.08 |
| 280 | 5.09883 | 3035.76 | 8.4676 | 576.21 | 1.3023 | 19.49 |
| 290 | 5.19148 | 3055.73 | 8.5034 | 581.16 | 1.3011 | 19.91 |
|  |  |  |  |  |  |  |
| 300 | 5.28411 | 3075.76 | 8.5386 | 586.05 | 1.3000 | 20.32 |
| 310 | 5.37672 | 3095.85 | 8.5733 | 590.89 | 1.2988 | 20.73 |
| 320 | 5.46931 | 3115.99 | 8.6076 | 595.69 | 1.2976 | 21.15 |
| 330 | 5.56188 | 3136.19 | 8.6414 | 600.43 | 1.2964 | 21.56 |
| 340 | 5.65444 | 3156.46 | 8.6747 | 605.13 | 1.2952 | 21.97 |
|  |  |  |  |  |  |  |
| 350 | 5.74698 | 3176.78 | 8.7076 | 609.78 | 1.2940 | 22.39 |
| 360 | 5.83950 | 3197.16 | 8.7400 | 614.39 | 1.2928 | 22.80 |
| 370 | 5.93201 | 3217.61 | 8.7721 | 618.95 | 1.2916 | 23.21 |
| 380 | 6.02452 | 3238.11 | 8.8037 | 623.47 | 1.2904 | 23.63 |
| 390 | 6.11701 | 3258.68 | 8.8349 | 627.95 | 1.2893 | 24.04 |
|  |  |  |  |  |  |  |
| 400 | 6.20949 | 3279.32 | 8.8658 | 632.39 | 1.2881 | 24.45 |
| 410 | 6.30196 | 3300.01 | 8.8964 | 636.79 | 1.2869 | 24.87 |
| 420 | 6.39442 | 3320.78 | 8.9265 | 641.15 | 1.2857 | 25.28 |
| 430 | 6.48687 | 3341.60 | 8.9564 | 645.48 | 1.2846 | 25.69 |
| 440 | 6.57932 | 3362.49 | 8.9859 | 649.76 | 1.2834 | 26.10 |
|  |  |  |  |  |  |  |
| 450 | 6.67176 | 3383.45 | 9.0150 | 654.02 | 1.2822 | 26.51 |
| 460 | 6.76420 | 3404.48 | 9.0439 | 658.23 | 1.2811 | 26.93 |
| 470 | 6.85662 | 3425.57 | 9.0725 | 662.42 | 1.2799 | 27.34 |
| 480 | 6.94904 | 3446.73 | 9.1008 | 666.57 | 1.2788 | 27.75 |
| 490 | 7.04146 | 3467.95 | 9.1288 | 670.68 | 1.2776 | 28.15 |
|  |  |  |  |  |  |  |
| 500 | 7.13387 | 3489.24 | 9.1565 | 674.77 | 1.2765 | 28.56 |
| 510 | 7.22628 | 3510.61 | 9.1839 | 678.82 | 1.2753 | 28.97 |
| 520 | 7.31868 | 3532.04 | 9.2111 | 682.84 | 1.2742 | 29.38 |
| 530 | 7.41108 | 3553.53 | 9.2381 | 686.84 | 1.2731 | 29.78 |
| 540 | 7.50347 | 3575.10 | 9.2648 | 690.80 | 1.2720 | 30.19 |
|  |  |  |  |  |  |  |
| 550 | 7.59586 | 3596.74 | 9.2912 | 694.74 | 1.2708 | 30.59 |
| 560 | 7.68825 | 3618.44 | 9.3174 | 698.64 | 1.2697 | 31.00 |
| 570 | 7.78063 | 3640.22 | 9.3434 | 702.52 | 1.2686 | 31.40 |
| 580 | 7.87301 | 3662.06 | 9.3691 | 706.38 | 1.2675 | 31.80 |
| 590 | 7.96539 | 3683.98 | 9.3947 | 710.21 | 1.2665 | 32.21 |
|  |  |  |  |  |  |  |
| 600 | 8.05776 | 3705.96 | 9.4200 | 714.01 | 1.2654 | 32.61 |
| 650 | 8.51960 | 3816.94 | 9.5436 | 732.65 | 1.2601 | 34.60 |
| 700 | 8.98138 | 3929.67 | 9.6625 | 750.72 | 1.2550 | 36.57 |
| 750 | 9.44312 | 4044.18 | 9.7772 | 768.28 | 1.2501 | 38.51 |
| 800 | 9.90483 | 4160.44 | 9.8882 | 785.36 | 1.2454 | 40.43 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.1 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =99.6059°C 饱和状态 | | | | | | |
| 液 | 0.00104315 | 417.436 | 1.3026 | 1545.5 | 22896 | 282.8 |
| 汽 | 1.69402 | 2674.95 | 7.3588 | 472.05 | 1.3154 | 12.22 |
| 100 | 1.69596 | 2675.77 | 7.3610 | 472.34 | 1.3155 | 12.23 |
| 110 | 1.74482 | 2696.32 | 7.4154 | 479.27 | 1.3165 | 12.62 |
| 120 | 1.79324 | 2716.61 | 7.4676 | 485.89 | 1.3166 | 13.01 |
| 130 | 1.84132 | 2736.72 | 7.5181 | 492.31 | 1.3163 | 13.40 |
| 140 | 1.88913 | 2756.70 | 7.5671 | 498.57 | 1.3158 | 13.80 |
|  |  |  |  |  |  |  |
| 150 | 1.93673 | 2776.59 | 7.6147 | 504.70 | 1.3152 | 14.19 |
| 160 | 1.98414 | 2796.42 | 7.6610 | 510.70 | 1.3145 | 14.59 |
| 170 | 2.03140 | 2816.21 | 7.7062 | 516.59 | 1.3137 | 14.99 |
| 180 | 2.07853 | 2835.97 | 7.7503 | 522.38 | 1.3129 | 15.39 |
| 190 | 2.12556 | 2855.72 | 7.7934 | 528.07 | 1.3119 | 15.80 |
|  |  |  |  |  |  |  |
| 200 | 2.17249 | 2875.48 | 7.8356 | 533.67 | 1.3110 | 16.20 |
| 210 | 2.21935 | 2895.24 | 7.8769 | 539.19 | 1.3099 | 16.61 |
| 220 | 2.26614 | 2915.02 | 7.9174 | 544.62 | 1.3089 | 17.02 |
| 230 | 2.31287 | 2934.83 | 7.9572 | 549.98 | 1.3078 | 17.43 |
| 240 | 2.35955 | 2954.66 | 7.9962 | 555.27 | 1.3067 | 17.84 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.1 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| 250 | 2.40619 | 2974.54 | 8.0346 | 560.49 | 1.3056 | 18.25 |
| 260 | 2.45279 | 2994.45 | 8.0723 | 565.65 | 1.3045 | 18.66 |
| 270 | 2.49935 | 3014.40 | 8.1094 | 570.74 | 1.3033 | 19.07 |
| 280 | 2.54588 | 3034.40 | 8.1458 | 575.77 | 1.3022 | 19.49 |
| 290 | 2.59239 | 3054.45 | 8.1818 | 580.75 | 1.3010 | 19.90 |
|  |  |  |  |  |  |  |
| 300 | 2.63887 | 3074.54 | 8.2171 | 585.67 | 1.2998 | 20.31 |
| 310 | 2.68533 | 3094.69 | 8.2520 | 590.54 | 1.2987 | 20.73 |
| 320 | 2.73176 | 3114.89 | 8.2863 | 595.35 | 1.2975 | 21.14 |
| 330 | 2.77818 | 3135.14 | 8.3202 | 600.11 | 1.2963 | 21.56 |
| 340 | 2.82458 | 3155.45 | 8.3536 | 604.83 | 1.2951 | 21.97 |
|  |  |  |  |  |  |  |
| 350 | 2.87097 | 3175.82 | 8.3865 | 609.50 | 1.2939 | 22.38 |
| 360 | 2.91735 | 3196.24 | 8.4190 | 614.12 | 1.2928 | 22.80 |
| 370 | 2.96371 | 3216.73 | 8.4511 | 618.70 | 1.2916 | 23.21 |
| 380 | 3.01006 | 3237.27 | 8.4828 | 623.23 | 1.2904 | 23.63 |
| 390 | 3.05639 | 3257.87 | 8.5141 | 627.73 | 1.2892 | 24.04 |
|  |  |  |  |  |  |  |
| 400 | 3.10272 | 3278.54 | 8.5451 | 632.18 | 1.2881 | 24.45 |
| 410 | 3.14904 | 3299.27 | 8.5756 | 636.59 | 1.2869 | 24.87 |
| 420 | 3.19535 | 3320.06 | 8.6059 | 640.96 | 1.2857 | 25.28 |
| 430 | 3.24165 | 3340.91 | 8.6357 | 645.30 | 1.2845 | 25.69 |
| 440 | 3.28795 | 3361.83 | 8.6653 | 649.59 | 1.2834 | 26.10 |
|  |  |  |  |  |  |  |
| 450 | 3.33424 | 3382.81 | 8.6945 | 653.85 | 1.2822 | 26.51 |
| 460 | 3.38052 | 3403.86 | 8.7234 | 658.08 | 1.2811 | 26.93 |
| 470 | 3.42679 | 3424.97 | 8.7520 | 662.27 | 1.2799 | 27.34 |
| 480 | 3.47306 | 3446.15 | 8.7803 | 666.43 | 1.2788 | 27.75 |
| 490 | 3.51932 | 3467.40 | 8.8083 | 670.55 | 1.2776 | 28.16 |
|  |  |  |  |  |  |  |
| 500 | 3.56558 | 3488.71 | 8.8361 | 674.64 | 1.2765 | 28.56 |
| 510 | 3.61184 | 3510.09 | 8.8635 | 678.70 | 1.2753 | 28.97 |
| 520 | 3.65809 | 3531.53 | 8.8907 | 682.73 | 1.2742 | 29.38 |
| 530 | 3.70433 | 3553.05 | 8.9177 | 686.73 | 1.2731 | 29.78 |
| 540 | 3.75057 | 3574.63 | 8.9444 | 690.70 | 1.2720 | 30.19 |
|  |  |  |  |  |  |  |
| 550 | 3.79681 | 3596.28 | 8.9709 | 694.64 | 1.2709 | 30.60 |
| 560 | 3.84304 | 3618.00 | 8.9971 | 698.55 | 1.2698 | 31.00 |
| 570 | 3.88928 | 3639.79 | 9.0231 | 702.44 | 1.2687 | 31.40 |
| 580 | 3.93550 | 3661.65 | 9.0489 | 706.29 | 1.2676 | 31.81 |
| 590 | 3.98173 | 3683.58 | 9.0744 | 710.12 | 1.2665 | 32.21 |
|  |  |  |  |  |  |  |
| 600 | 4.02795 | 3705.57 | 9.0998 | 713.93 | 1.2654 | 32.61 |
| 650 | 4.25902 | 3816.60 | 9.2234 | 732.59 | 1.2601 | 34.60 |
| 700 | 4.49004 | 3929.38 | 9.3424 | 730.68 | 1.2550 | 36.57 |
| 750 | 4.72101 | 4043.92 | 9.4571 | 768.24 | 1.2502 | 38.51 |
| 800 | 4.95196 | 4160.21 | 9.5681 | 785.34 | 1.2455 | 40.43 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.2 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θ*s=120.212°C 饱和状态 | | | | | | |
| 液 | 0.00106052 | 504.684 | 1.5301 | 1520.7 | 10903 | 231.6 |
| 汽 | 0.885735 | 2706.24 | 7.1269 | 481.88 | 1.3108 | 12.93 |
| 130 | 0.910412 | 2727.25 | 7.1796 | 488.81 | 1.3122 | 13.33 |
| 140 | 0.935281 | 2748.31 | 7.2312 | 495.51 | 1.3126 | 13.73 |
|  |  |  |  |  |  |  |
| 150 | 0.959894 | 2769.09 | 7.2809 | 501.97 | 1.3125 | 14.13 |
| 160 | 0.984303 | 2789.66 | 7.3290 | 508.26 | 1.3122 | 14.54 |
| 170 | 1.00854 | 2810.09 | 7.3756 | 514.39 | 1.3118 | 14.94 |
| 180 | 1.03265 | 2830.39 | 7.4209 | 520.39 | 1.3112 | 15.35 |
| 190 | 1.05663 | 2850.62 | 7.4650 | 526.26 | 1.3105 | 15.76 |
|  |  |  |  |  |  |  |
| 200 | 1.08052 | 2870.78 | 7.5081 | 532.02 | 1.3098 | 16.17 |
| 210 | 1.10432 | 2890.90 | 7.5502 | 537.68 | 1.3089 | 16.58 |
| 220 | 1.12805 | 2911.00 | 7.5914 | 543.23 | 1.3080 | 16.99 |
| 230 | 1.15172 | 2931.08 | 7.6317 | 548.70 | 1.3071 | 17.40 |
| 240 | 1.17534 | 2951.17 | 7.6712 | 554.09 | 1.3061 | 17.81 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.2 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| 250 | 1.19891 | 2971.26 | 7.7100 | 559.40 | 1.3050 | 18.23 |
| 260 | 1.22244 | 2991.37 | 7.7481 | 564.63 | 1.3040 | 18.64 |
| 270 | 1.24593 | 3011.50 | 7.7855 | 569.80 | 1.3029 | 19.06 |
| 280 | 1.26939 | 3031.66 | 7.8223 | 574.89 | 1.3018 | 19.47 |
| 290 | 1.29282 | 3051.85 | 7.8584 | 579.93 | 1.3007 | 19.89 |
|  |  |  |  |  |  |  |
| 300 | 1.31623 | 3072.08 | 7.8940 | 584.90 | 1.2996 | 20.30 |
| 310 | 1.33962 | 3092.35 | 7.9291 | 589.81 | 1.2984 | 20.72 |
| 320 | 1.36298 | 3112.67 | 7.9636 | 594.67 | 1.2973 | 21.13 |
| 330 | 1.38632 | 3133.03 | 7.9977 | 599.48 | 1.2961 | 21.55 |
| 340 | 1.40965 | 3153.43 | 8.0312 | 604.23 | 1.2950 | 21.96 |
|  |  |  |  |  |  |  |
| 350 | 1.43296 | 3173.89 | 8.0643 | 608.93 | 1.2938 | 22.38 |
| 360 | 1.45626 | 3194.40 | 8.0970 | 613.59 | 1.2927 | 22.79 |
| 370 | 1.47955 | 3214.96 | 8.1292 | 618.20 | 1.2915 | 23.21 |
| 380 | 1.50282 | 3235.58 | 8.1610 | 622.76 | 1.2903 | 23.62 |
| 390 | 1.52608 | 3256.25 | 8.1924 | 627.28 | 1.2892 | 24.04 |
|  |  |  |  |  |  |  |
| 400 | 1.54934 | 3276.98 | 8.2235 | 631.75 | 1.2880 | 24.45 |
| 410 | 1.57258 | 3297.77 | 8.2541 | 636.19 | 1.2868 | 24.86 |
| 420 | 1.59581 | 3318.62 | 8.2844 | 640.58 | 1.2857 | 25.28 |
| 430 | 1.61904 | 3339.53 | 8.3144 | 644.93 | 1.2845 | 25.69 |
| 440 | 1.64226 | 3360.50 | 8.3440 | 649.25 | 1.2834 | 26.10 |
|  |  |  |  |  |  |  |
| 450 | 1.66547 | 3381.53 | 8.3733 | 653.53 | 1.2822 | 26.51 |
| 460 | 1.68868 | 3402.62 | 8.4022 | 657.77 | 1.2811 | 26.93 |
| 470 | 1.71187 | 3423.78 | 8.4309 | 661.97 | 1.2799 | 27.34 |
| 480 | 1.73507 | 3445.00 | 8.4593 | 666.14 | 1.2788 | 27.75 |
| 490 | 1.75825 | 3466.29 | 8.4873 | 670.28 | 1.2776 | 28.16 |
|  |  |  |  |  |  |  |
| 500 | 1.78144 | 3487.64 | 8.5151 | 674.39 | 1.2765 | 28.57 |
| 510 | 1.80462 | 3509.05 | 8.5426 | 678.46 | 1.2754 | 28.97 |
| 520 | 1.82779 | 3530.53 | 8.5699 | 682.50 | 1.2742 | 29.38 |
| 530 | 1.85096 | 3552.08 | 8.5969 | 686.51 | 1.2731 | 29.79 |
| 540 | 1.87412 | 3573.69 | 8.6236 | 690.49 | 1.2720 | 30.19 |
|  |  |  |  |  |  |  |
| 550 | 1.89728 | 3595.37 | 8.6501 | 694.44 | 1.2709 | 30.60 |
| 560 | 1.92044 | 3617.12 | 8.6764 | 698.36 | 1.2698 | 31.00 |
| 570 | 1.94360 | 3638.94 | 8.7024 | 702.26 | 1.2687 | 31.41 |
| 580 | 1.96675 | 3660.82 | 8.7282 | 706.12 | 1.2676 | 31.81 |
| 590 | 1.98990 | 3682.77 | 8.7538 | 709.96 | 1.2665 | 32.21 |
|  |  |  |  |  |  |  |
| 600 | 2.01304 | 3704.79 | 8.7792 | 713.78 | 1.2654 | 32.61 |
| 650 | 2.12873 | 3815.93 | 8.9029 | 732.47 | 1.2602 | 34.60 |
| 700 | 2.24437 | 3928.80 | 9.0220 | 750.59 | 1.2551 | 36.57 |
| 750 | 2.35996 | 4043.41 | 9.1368 | 768.18 | 1.2502 | 38.52 |
| 800 | 2.47553 | 4159.76 | 9.2479 | 785.29 | 1.2455 | 40.44 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.3 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =133.525°C 饱和状态 | | | | | | |
| 液 | 0.00107318 | 561.455 | 1.6718 | 1498.8 | 6977.4 | 206.9 |
| 汽 | 0.605785 | 2724.89 | 6.9916 | 487.39 | 1.3071 | 13.39 |
| 140 | 0.616994 | 2739.36 | 7.0269 | 492.17 | 1.3087 | 13.66 |
| 150 | 0.634032 | 2761.18 | 7.0791 | 499.11 | 1.3097 | 14.07 |
| 160 | 0.650828 | 2782.60 | 7.1291 | 505.73 | 1.3099 | 14.48 |
| 170 | 0.667436 | 2803.72 | 7.1773 | 512.12 | 1.3098 | 14.89 |
| 180 | 0.683892 | 2824.62 | 7.2239 | 518.34 | 1.3096 | 15.31 |
| 190 | 0.700221 | 2845.35 | 7.2692 | 524.41 | 1.3091 | 15.72 |
|  |  |  |  |  |  |  |
| 200 | 0.716445 | 2865.95 | 7.3132 | 530.33 | 1.3086 | 16.13 |
| 210 | 0.732579 | 2886.46 | 7.3561 | 536.13 | 1.3079 | 16.55 |
| 220 | 0.748636 | 2906.89 | 7.3979 | 541.82 | 1.3071 | 16.96 |
| 230 | 0.764629 | 2927.26 | 7.4388 | 547.40 | 1.3063 | 17.38 |
| 240 | 0.780565 | 2947.61 | 7.4789 | 552.89 | 1.3054 | 17.79 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.3 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| 250 | 0.796452 | 2967.93 | 7.5181 | 558.29 | 1.3045 | 18.21 |
| 260 | 0.812296 | 2988.25 | 7.5566 | 563.60 | 1.3035 | 18.62 |
| 270 | 0.828103 | 3008.57 | 7.5943 | 568.84 | 1.3025 | 19.04 |
| 280 | 0.843877 | 3028.89 | 7.6314 | 574.00 | 1.3015 | 19.46 |
| 290 | 0.859621 | 3049.24 | 7.6679 | 579.10 | 1.3004 | 19.87 |
|  |  |  |  |  |  |  |
| 300 | 0.875339 | 3069.61 | 7.7037 | 584.12 | 1.2993 | 20.29 |
| 310 | 0.891034 | 3090.01 | 7.7390 | 589.09 | 1.2982 | 20.71 |
| 320 | 0.906708 | 3110.43 | 7.7737 | 593.99 | 1.2971 | 21.12 |
| 330 | 0.922363 | 3130.90 | 7.8079 | 598.84 | 1.2960 | 21.54 |
| 340 | 0.938000 | 3151.41 | 7.8417 | 603.63 | 1.2948 | 21.95 |
|  |  |  |  |  |  |  |
| 350 | 0.953622 | 3171.96 | 7.8749 | 608.37 | 1.2937 | 22.37 |
| 360 | 0.969230 | 3192.55 | 7.9077 | 613.05 | 1.2926 | 22.79 |
| 370 | 0.984824 | 3213.19 | 7.9400 | 617.69 | 1.2914 | 23.20 |
| 380 | 1.00041 | 3233.89 | 7.9720 | 622.28 | 1.2903 | 23.62 |
| 390 | 1.01598 | 3254.63 | 8.0035 | 626.83 | 1.2891 | 24.03 |
|  |  |  |  |  |  |  |
| 400 | 1.03154 | 3275.42 | 8.0346 | 631.33 | 1.2880 | 24.45 |
| 410 | 1.04709 | 3296.27 | 8.0654 | 635.78 | 1.2868 | 24.86 |
| 420 | 1.06263 | 3317.18 | 8.0957 | 640.20 | 1.2856 | 25.28 |
| 430 | 1.07817 | 3338.14 | 8.1258 | 644.57 | 1.2845 | 25.69 |
| 440 | 1.09369 | 3359.17 | 8.1554 | 648.90 | 1.2833 | 26.10 |
|  |  |  |  |  |  |  |
| 450 | 1.10921 | 3380.25 | 8.1848 | 653.20 | 1.2822 | 26.52 |
| 460 | 1.12473 | 3401.39 | 8.2138 | 657.46 | 1.2810 | 26.93 |
| 470 | 1.14023 | 3422.59 | 8.2426 | 661.68 | 1.2799 | 27.34 |
| 480 | 1.15573 | 3443.85 | 8.2710 | 665.86 | 1.2788 | 27.75 |
| 490 | 1.17123 | 3465.17 | 8.2991 | 670.02 | 1.2776 | 28.16 |
|  |  |  |  |  |  |  |
| 500 | 1.18672 | 3486.56 | 8.3269 | 674.13 | 1.2765 | 28.57 |
| 510 | 1.20221 | 3508.01 | 8.3545 | 678.22 | 1.2754 | 28.98 |
| 520 | 1.21769 | 3529.53 | 8.3818 | 682.27 | 1.2743 | 29.38 |
| 530 | 1.23317 | 3551.11 | 8.4089 | 686.29 | 1.2731 | 29.79 |
| 540 | 1.24864 | 3572.75 | 8.4356 | 690.28 | 1.2720 | 30.20 |
|  |  |  |  |  |  |  |
| 550 | 1.26411 | 3594.46 | 8.4622 | 694.24 | 1.2709 | 30.60 |
| 560 | 1.27957 | 3616.24 | 8.4885 | 698.17 | 1.2698 | 31.01 |
| 570 | 1.29504 | 3638.08 | 8.5145 | 702.08 | 1.2687 | 31.41 |
| 580 | 1.31050 | 3659.99 | 8.5404 | 705.95 | 1.2676 | 31.81 |
| 590 | 1.32595 | 3681.97 | 8.5660 | 709.80 | 1.2666 | 32.21 |
|  |  |  |  |  |  |  |
| 600 | 1.34141 | 3704.02 | 8.5914 | 713.62 | 1.2655 | 32.62 |
| 650 | 1.41863 | 3815.26 | 8.7152 | 732.35 | 1.2602 | 34.61 |
| 700 | 1.49581 | 3928.21 | 8.8344 | 750.49 | 1.2552 | 36.58 |
| 750 | 1.57295 | 4042.90 | 8.9493 | 768.11 | 1.2503 | 38.52 |
| 800 | 1.65005 | 4159.31 | 9.0604 | 785.24 | 1.2456 | 40.44 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.4 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs*=143.613°C 饱和状态 | | | | | | |
| 液 | 0.00108356 | 604.723 | 1.7766 | 1479.4 | 5049.8 | 191.3 |
| 汽 | 0.462392 | 2738.06 | 6.8954 | 491.09 | 1.3039 | 13.74 |
| 150 | 0.470887 | 2752.78 | 6.9305 | 495.98 | 1.3060 | 14.01 |
| 160 | 0.483935 | 2775.19 | 6.9828 | 503.07 | 1.3074 | 14.43 |
| 170 | 0.496761 | 2797.09 | 7.0328 | 509.78 | 1.3078 | 14.84 |
| 180 | 0.509418 | 2818.64 | 7.0809 | 516.24 | 1.3079 | 15.26 |
| 190 | 0.521938 | 2839.92 | 7.1274 | 522.51 | 1.3077 | 15.68 |
|  |  |  |  |  |  |  |
| 200 | 0.534345 | 2860.99 | 7.1724 | 528.61 | 1.3073 | 16.10 |
| 210 | 0.546656 | 2881.90 | 7.2161 | 534.56 | 1.3068 | 16.51 |
| 220 | 0.558886 | 2902.69 | 7.2587 | 540.38 | 1.3062 | 16.93 |
| 230 | 0.571047 | 2923.37 | 7.3002 | 546.08 | 1.3055 | 17.35 |
| 240  250 | 0.583149  0.595199 | 2943.99  2964.56 | 7.3408  7.3805 | 551.68  557.17 | 1.3048  1.3039 | 17.77  18.19 |
| 260 | 0.607205 | 2985.09 | 7.4194 | 562.57 | 1.3030 | 18.60 |
| 270 | 0.619173 | 3005.60 | 7.4575 | 567.88 | 1.3021 | 19.02 |
| 280 | 0.631106 | 3026.10 | 7.4949 | 573.11 | 1.3011 | 19.44 |
| 290 | 0.643008 | 3046.60 | 7.5316 | 578.26 | 1.3001 | 19.86 |
|  |  |  |  |  |  |  |
| 300 | 0.654884 | 3067.11 | 7.5677 | 583.34 | 1.2990 | 20.28 |
| 310 | 0.666736 | 3087.64 | 7.6032 | 588.36 | 1.2980 | 20.69 |
| 320 | 0.678566 | 3108.19 | 7.6381 | 593.31 | 1.2969 | 21.11 |
| 330 | 0.690376 | 3128.76 | 7.6725 | 598.19 | 1.2958 | 21.53 |
| 340 | 0.702170 | 3149.37 | 7.7064 | 603.02 | 1.2947 | 21.95 |
|  |  |  |  |  |  |  |
| 350 | 0.713947 | 3170.01 | 7.7398 | 607.80 | 1.2936 | 22.37 |
| 360 | 0.725709 | 3190.69 | 7.7728 | 612.52 | 1.2924 | 22.78 |
| 370 | 0.737458 | 3211.42 | 7.8052 | 617.18 | 1.2913 | 23.20 |
| 380 | 0.749196 | 3232.18 | 7.8373 | 621.80 | 1.2902 | 23.61 |
| 390 | 0.760921 | 3253.00 | 7.8689 | 626.37 | 1.2890 | 24.03 |
|  |  |  |  |  |  |  |
| 400 | 0.772637 | 3273.86 | 7.9001 | 630.90 | 1.2879 | 24.45 |
| 410 | 0.784343 | 3294.77 | 7.9310 | 635.38 | 1.2868 | 24.86 |
| 420 | 0.796040 | 3315.74 | 7.9614 | 639.81 | 1.2856 | 25.28 |
| 430 | 0.807729 | 3336.76 | 7.9915 | 644.20 | 1.2845 | 25.69 |
| 440 | 0.819410 | 3357.83 | 8.0213 | 648.56 | 1.2833 | 26.10 |
|  |  |  |  |  |  |  |
| 450 | 0.831084 | 3378.96 | 8.0507 | 652.87 | 1.2822 | 26.52 |
| 460 | 0.842751 | 3400.15 | 8.0798 | 657.14 | 1.2810 | 26.93 |
| 470 | 0.854413 | 3421.39 | 8.1086 | 661.38 | 1.2799 | 27.34 |
| 480 | 0.866068 | 3442.69 | 8.1371 | 665.58 | 1.2788 | 27.75 |
| 490 | 0.877718 | 3464.06 | 8.1652 | 669.75 | 1.2776 | 28.16 |
|  |  |  |  |  |  |  |
| 500 | 0.889363 | 3485.49 | 8.1931 | 673.88 | 1.2765 | 28.57 |
| 510 | 0.901003 | 3506.97 | 8.2207 | 677.98 | 1.2754 | 28.98 |
| 520 | 0.912638 | 3528.52 | 8.2481 | 682.04 | 1.2743 | 29.39 |
| 530 | 0.924269 | 3550.14 | 8.2752 | 686.07 | 1.2732 | 29.79 |
| 540 | 0.935896 | 3571.81 | 8.3020 | 690.07 | 1.2720 | 30.20 |
|  |  |  |  |  |  |  |
| 550 | 0.947520 | 3593.55 | 8.3286 | 694.04 | 1.2709 | 30.60 |
| 560 | 0.959139 | 3615.36 | 8.3549 | 697.99 | 1.2698 | 31.01 |
| 570 | 0.970756 | 3637.23 | 8.3810 | 701.90 | 1.2688 | 31.41 |
| 580 | 0.982369 | 3659.17 | 8.4069 | 705.78 | 1.2677 | 31.82 |
| 590 | 0.993979 | 3681.17 | 8.4325 | 709.64 | 1.2666 | 32.22 |
|  |  |  |  |  |  |  |
| 600 | 1.00559 | 3703.24 | 8.4579 | 713.47 | 1.2655 | 32.62 |
| 650 | 1.06359 | 3814.59 | 8.5819 | 732.23 | 1.2603 | 34.61 |
| 700 | 1.12153 | 3927.63 | 8.7012 | 750.40 | 1.2552 | 36.58 |
| 750 | 1.17944 | 4042.38 | 8.8161 | 768.04 | 1.2504 | 38.53 |
| 800 | 1.23731 | 4158.85 | 8.9273 | 785.19 | 1.2457 | 40.45 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=0.5 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs*=151.836°C 饱和状态 | | | | | | |
| 液 | 0.00109256 | 640.185 | 1.8606 | 1462.0 | 3912.5 | 180.2 |
| 汽 | 0.374804 | 2748.11 | 6.8206 | 493.80 | 1.3011 | 14.02 |
| 160 | 0.383660 | 2767.38 | 6.8655 | 500.18 | 1.3042 | 14.37 |
| 170 | 0.394255 | 2790.19 | 6.9176 | 507.32 | 1.3056 | 14.79 |
| 180 | 0.404655 | 2812.45 | 6.9672 | 514.07 | 1.3061 | 15.22 |
| 190 | 0414905 | 2834.32 | 7.0150 | 520.56 | 1.3062 | 15.64 |
|  |  |  |  |  |  |  |
| 200 | 0.425034 | 2855.90 | 7.0611 | 526.84 | 1.3061 | 16.06 |
| 210 | 0.435060 | 2877.24 | 7.1057 | 532.96 | 1.3058 | 16.48 |
| 220 | 0.445001 | 2898.40 | 7.1491 | 538.92 | 1.3053 | 16.90 |
| 230 | 0.454870 | 2919.41 | 7.1912 | 544.74 | 1.3047 | 17.32 |
| 240  250 | 0.464676  0.474429 | 2940.31  2961.13 | 7.2324  7.2726 | 550.44  556.03 | 1.3041  1.3033 | 17.74 |
| 18.16 |
| 260 | 0.484135 | 2981.88 | 7.3119 | 561.51 | 1.3025 | 18.58 |
| 270 | 0.493801 | 3002.59 | 7.3503 | 566.90 | 1.3016 | 19.00 |
| 280 | 0.503432 | 3023.28 | 7.3881 | 572.20 | 1.3007 | 19.42 |
| 290 | 0.513031 | 3043.94 | 7.4251 | 577.42 | 1.2998 | 19.84 |
|  |  |  |  |  |  |  |
| 300 | 0.522603 | 3064.60 | 7.4614 | 582.55 | 1.2988 | 20.26 |
| 310 | 0.532150 | 3085.26 | 7.4972 | 587.62 | 1.2977 | 20.68 |
| 320 | 0.541675 | 3105.93 | 7.5323 | 592.61 | 1.2967 | 21.10 |
| 330 | 0.551180 | 3126.61 | 7.5669 | 597.55 | 1.2956 | 21.52 |
| 340 | 0.560667 | 3147.32 | 7.6010 | 602.41 | 1.2945 | 21.94 |
|  |  |  |  |  |  |  |
| 350 | 0.570138 | 3168.06 | 7.6345 | 607.22 | 1.2934 | 22.36 |
| 360 | 0.579594 | 3188.83 | 7.6676 | 611.98 | 1.2923 | 22.78 |
| 370 | 0.589037 | 3209.63 | 7.7002 | 616.68 | 1.2912 | 23.19 |
| 380 | 0.598467 | 3230.48 | 7.7323 | 621.32 | 1.2901 | 23.61 |
| 390 | 0.607886 | 3251.36 | 7.7641 | 625.92 | 1.2890 | 24.03 |
|  |  |  |  |  |  |  |
| 400 | 0.617294 | 3272.29 | 7.7954 | 630.47 | 1.2878 | 24.44 |
| 410 | 0.626693 | 3293.27 | 7.8263 | 634.97 | 1.2867 | 24.86 |
| 420 | 0.636083 | 3314.29 | 7.8569 | 639.43 | 1.2856 | 25.27 |
| 430 | 0.645465 | 3335.36 | 7.8871 | 643.84 | 1.2844 | 25.69 |
| 440 | 0.654838 | 3356.49 | 7.9169 | 648.21 | 1.2833 | 26.10 |
|  |  |  |  |  |  |  |
| 450 | 0.664205 | 3377.67 | 7.9464 | 652.54 | 1.2822 | 26.52 |
| 460 | 0.673565 | 3398.90 | 7.9756 | 656.83 | 1.2810 | 26.93 |
| 470 | 0.682919 | 3420.19 | 8.0044 | 661.09 | 1.2799 | 27.34 |
| 480 | 0.692267 | 3441.54 | 8.0329 | 665.30 | 1.2788 | 27.75 |
| 490 | 0.701609 | 3462.94 | 8.0612 | 669.48 | 1.2776 | 28.16 |
|  |  |  |  |  |  |  |
| 500 | 0.710947 | 3484.41 | 8.0891 | 673.62 | 1.2765 | 28.57 |
| 510 | 0.720279 | 3505.93 | 8.1168 | 677.73 | 1.2754 | 28.98 |
| 520 | 0.729607 | 3527.52 | 8.1442 | 681.81 | 1.2743 | 29.39 |
| 530 | 0.738931 | 3549.16 | 8.1713 | 685.85 | 1.2732 | 29.80 |
| 540 | 0.748250 | 3570.87 | 8.1981 | 689.86 | 1.2721 | 30.20 |
|  |  |  |  |  |  |  |
| 550 | 0.757566 | 3592.64 | 8.2247 | 693.85 | 1.2710 | 30.61 |
| 560 | 0.766878 | 3614.48 | 8.2511 | 697.80 | 1.2699 | 31.01 |
| 570 | 0.776187 | 3636.38 | 8.2772 | 701.72 | 1.2688 | 31.42 |
| 580 | 0.785493 | 3658.34 | 8.3031 | 705.61 | 1.2677 | 31.82 |
| 590 | 0.794796 | 3680.37 | 8.3288 | 709.48 | 1.2666 | 32.22 |
|  |  |  |  |  |  |  |
| 600 | 0.804095 | 3702.46 | 8.3543 | 713.31 | 1.2656 | 32.62 |
| 650 | 0.850556 | 3813.91 | 8.4784 | 732.11 | 1.2603 | 34.62 |
| 700 | 0.896964 | 3927.05 | 8.5977 | 750.31 | 1.2553 | 36.59 |
| 750 | 0.943332 | 4041.87 | 8.7128 | 767.98 | 1.2504 | 38.53 |
| 800 | 0.989667 | 4158.40 | 8.8240 | 785.14 | 1.2458 | 40.45 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=1 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs*=179.886°C 饱和状态 | | | | | | |
| 液 | 0.00112723 | 762.683 | 2.1384 | 1391.6 | 1718.1 | 150.5 |
| 汽 | 0.194349 | 2777.12 | 6.5850 | 500.89 | 1.2910 | 14.98 |
| 180 | 0.194418 | 2777.43 | 6.5857 | 501.00 | 1.2911 | 14.99 |
| 190 | 0.200319 | 2803.52 | 6.6426 | 509.69 | 1.2969 | 15.43 |
|  |  |  |  |  |  |  |
| 200 | 0.206004 | 2828.27 | 6.6955 | 517.32 | 1.2991 | 15.88 |
| 210 | 0.211542 | 2852.20 | 6.7455 | 524.41 | 1.3000 | 16.32 |
| 220 | 0.216966 | 2875.55 | 6.7934 | 531.18 | 1.3005 | 16.75 |
| 230 | 0.222297 | 2898.45 | 6.8393 | 537.69 | 1.3006 | 17.19 |
| 240 | 0.227551 | 2920.98 | 6.8837 | 543.99  550.11 | 1.3005  1.3002 | 17.63  18.06 |
| 250 | 0.232739 | 2943.22 | 6.9266 |
| 260 | 0.237871 | 2965.23 | 6.9683 | 556.06 | 1.2999 | 18.49 |
| 270 | 0.242955 | 2987.05 | 7.0088 | 561.86 | 1.2994 | 18.92 |
| 280 | 0.247998 | 3008.71 | 7.0484 | 567.53 | 1.2988 | 19.35 |
| 290 | 0.253004 | 3030.25 | 7.0870 | 573.08 | 1.2981 | 19.78 |
|  |  |  |  |  |  |  |
| 300 | 0.257979 | 3051.70 | 7.1247 | 578.51 | 1.2973 | 20.21 |
| 310 | 0.262926 | 3073.08 | 7.1617 | 583.85 | 1.2965 | 20.63 |
| 320 | 0.267848 | 3094.40 | 7.1979 | 589.09 | 1.2956 | 21.06 |
| 330 | 0.272749 | 3115.68 | 7.2335 | 594.25 | 1.2947 | 21.48 |
| 340 | 0.277629 | 3136.93 | 7.2685 | 599.32 | 1.2938 | 21.91 |
|  |  |  |  |  |  |  |
| 350 | 0.282492 | 3158.16 | 7.3028 | 604.32 | 1.2928 | 22.33 |
| 360 | 0.287339 | 3179.39 | 7.3366 | 609.24 | 1.2918 | 22.75 |
| 370 | 0.292172 | 3200.62 | 7.3699 | 614.10 | 1.2907 | 23.17 |
| 380 | 0.296991 | 3221.86 | 7.4026 | 618.89 | 1.2897 | 23.59 |
| 390 | 0.301799 | 3243.11 | 7.4349 | 623.62 | 1.2886 | 24.01 |
|  |  |  |  |  |  |  |
| 400 | 0.306595 | 3264.39 | 7.4668 | 628.30 | 1.2876 | 24.43 |
| 410 | 0.311381 | 3285.68 | 7.4982 | 632.92 | 1.2865 | 24.85 |
| 420 | 0.316158 | 3307.01 | 7.5292 | 637.48 | 1.2854 | 25.27 |
| 430 | 0.320927 | 3328.37 | 7.5598 | 642.00 | 1.2843 | 25.69 |
| 440 | 0.325687 | 3349.76 | 7.5900 | 646.47 | 1.2832 | 26.10 |
|  |  |  |  |  |  |  |
| 450 | 0.330440 | 3371.19 | 7.6198 | 650.89 | 1.2821 | 26.52 |
| 460 | 0.335186 | 3392.66 | 7.6493 | 655.26 | 1.2810 | 26.93 |
| 470 | 0.339926 | 3414.18 | 7.6785 | 659.59 | 1.2799 | 27.35 |
| 480 | 0.344659 | 3435.74 | 7.7073 | 663.88 | 1.2788 | 27.76 |
| 490 | 0.349387 | 3457.35 | 7.7358 | 668.13 | 1.2777 | 28.17 |
|  |  |  |  |  |  |  |
| 500 | 0.354110 | 3479.00 | 7.7640 | 672.34 | 1.2766 | 28.58 |
| 510 | 0.358828 | 3500.71 | 7.7919 | 676.52 | 1.2755 | 28.99 |
| 520 | 0.363541 | 3522.47 | 7.8195 | 680.65 | 1.2744 | 29.40 |
| 530 | 0.368250 | 3544.28 | 7.8468 | 684.75 | 1.2733 | 29.81 |
| 540 | 0.372955 | 3566.15 | 7.8739 | 688.82 | 1.2722 | 30.22 |
|  |  |  |  |  |  |  |
| 550 | 0.377656 | 3588.07 | 7.9007 | 692.85 | 1.2711 | 30.62 |
| 560 | 0.382354 | 3610.05 | 7.9272 | 696.85 | 1.2700 | 31.03 |
| 570 | 0.387048 | 3632.09 | 7.9535 | 700.82 | 1.2690 | 31.43 |
| 580 | 0.391738 | 3654.19 | 7.9795 | 704.76 | 1.2679 | 31.84 |
| 590 | 0.396426 | 3676.34 | 8.0054 | 708.66 | 1.2668 | 32.24 |
|  |  |  |  |  |  |  |
| 600 | 0.401111 | 3698.56 | 8.0309 | 712.54 | 1.2658 | 32.64 |
| 650 | 0.424497 | 3810.55 | 8.1557 | 731.51 | 1.2606 | 34.64 |
| 700 | 0.447829 | 3924.12 | 8.2755 | 749.86 | 1.2556 | 36.61 |
| 750 | 0.471121 | 4039.31 | 8.3909 | 767.64 | 1.2508 | 38.55 |
| 800 | 0.494380 | 4156.14 | 8.5024 | 784.91 | 1.2462 | 40.47 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=2 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =212.385°C 饱和状态 | | | | | | |
| 液 | 0.00117675 | 908.622 | 2.4470 | 1290.6 | 707.68 | 126.4 |
| 汽 | 0.0995805 | 2798.38 | 6.3392 | 504.66 | 1.2788 | 16.09 |
| 220  230  240  250 | 0.102167  0.105394  0.108488  0.111484 | 2821.67  2850.17  2877.21  2903.23 | 6.3868  6.4440  6.4972  6.5474 | 512.58  521.47  529.47  536.96 | 1.2858  1.2901  1.2920  1.2931 | 16.45  16.92  17.39  17.85 |
| 260 | 0.114400 | 2928.47 | 6.5952 | 544.07 | 1.2938 | 18.30 |
| 270 | 0.117251 | 2953.09 | 6.6410 | 550.89 | 1.2941 | 18.75 |
| 280 | 0.120046 | 2977.21 | 6.6850 | 557.44 | 1.2943 | 19.20 |
| 290 | 0.122794 | 3000.90 | 6.7274 | 563.78 | 1.2942 | 19.65 |
|  |  |  |  |  |  |  |
| 300 | 0.125501 | 3024.25 | 6.7685 | 569.91 | 1.2940 | 20.09 |
| 310 | 0.128174 | 3047.32 | 6.8084 | 575.87 | 1.2937 | 20.53 |
| 320 | 0.130816 | 3070.16 | 6.8472 | 581.67 | 1.2932 | 20.97 |
| 330 | 0.133431 | 3092.80 | 6.8851 | 587.33 | 1.2926 | 21.41 |
| 340 | 0.136023 | 3115.28 | 6.9221 | 592.86 | 1.2920 | 21.84 |
|  |  |  |  |  |  |  |
| 350 | 0.138594 | 3137.64 | 6.9582 | 598.27 | 1.2913 | 22.28 |
| 360 | 0.141147 | 3159.89 | 6.9937 | 603.57 | 1.2905 | 22.71 |
| 370 | 0.143683 | 3182.06 | 7.0284 | 608.77 | 1.2897 | 23.14 |
| 380 | 0.146205 | 3204.16 | 7.0625 | 613.88 | 1.2888 | 23.56 |
| 390 | 0.148712 | 3226.21 | 7.0960 | 618.91 | 1.2879 | 23.99 |
|  |  |  |  |  |  |  |
| 400 | 0.151208 | 3248.23 | 7.1290 | 623.85 | 1.2869 | 24.42 |
| 410 | 0.153693 | 3270.21 | 7.1614 | 628.72 | 1.2860 | 24.84 |
| 420 | 0.156167 | 3292.18 | 7.1933 | 633.52 | 1.2850 | 25.26 |
| 430 | 0.158632 | 3314.14 | 7.2248 | 638.25 | 1.2840 | 25.69 |
| 440 | 0.161088 | 3336.09 | 7.2558 | 642.92 | 1.2830 | 26.11 |
|  |  |  |  |  |  |  |
| 450 | 0.163537 | 3358.05 | 7.2863 | 647.52 | 1.2819 | 26.53 |
| 460 | 0.165978 | 3380.02 | 7.3165 | 652.08 | 1.2809 | 26.94 |
| 470 | 0.168413 | 3402.01 | 7.3463 | 656.57 | 1.2799 | 27.36 |
| 480 | 0.170841 | 3424.01 | 7.3757 | 661.02 | 1.2788 | 27.78 |
| 490 | 0.173263 | 3446.04 | 7.4048 | 665.41 | 1.2777 | 28.19 |
|  |  |  |  |  |  |  |
| 500 | 0.175680 | 3468.09 | 7.4335 | 669.76 | 1.2767 | 28.60 |
| 510 | 0.178092 | 3490.18 | 7.4619 | 674.06 | 1.2756 | 29.02 |
| 520 | 0.180499 | 3512.30 | 7.4899 | 678.32 | 1.2746 | 29.43 |
| 530 | 0.182902 | 3534.45 | 7.5177 | 682.54 | 1.2735 | 29.84 |
| 540 | 0.185300 | 3556.64 | 7.5451 | 686.71 | 1.2725 | 30.25 |
|  |  |  |  |  |  |  |
| 550 | 0.187694 | 3578.88 | 7.5723 | 690.85 | 1.2714 | 30.66 |
| 560 | 0.190085 | 3601.15 | 7.5992 | 694.95 | 1.2704 | 31.06 |
| 570 | 0.192472 | 3623.47 | 7.6258 | 699.01 | 1.2693 | 31.47 |
| 580 | 0.194856 | 3645.84 | 7.6522 | 703.04 | 1.2683 | 31.88 |
| 590 | 0.197237 | 3668.25 | 7.6783 | 707.03 | 1.2672 | 32.28 |
|  |  |  |  |  |  |  |
| 600 | 0.199614 | 3690.71 | 7.7042 | 710.99 | 1.2662 | 32.68 |
| 650 | 0.211464 | 3803.79 | 7.8301 | 730.32 | 1.2611 | 34.68 |
| 700 | 0.223260 | 3918.24 | 7.9509 | 748.96 | 1.2562 | 36.65 |
| 750 | 0.235015 | 4034.16 | 8.0670 | 766.98 | 1.2515 | 38.60 |
| 800 | 0.246737 | 4151.59 | 8.1791 | 784.44 | 1.2470 | 40.52 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=3 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =233.858°C 饱和状态 | | | | | | |
| 液 | 0.00121670 | 1008.37 | 2.6456 | 1212.7 | 402.91 | 114.2 |
| 汽 | 0.0666641 | 2803.26 | 6.1858 | 504.07 | 1.2705 | 16.84 |
| 240  250 | 0.0682274  0.0706225 | 2824.56  2856.55 | 6.2275  6.2893 | 511.35  521.44 | 1.2775  1.2834 | 17.15  17.64 |
| 260 | 0.0728884 | 2886.42 | 6.3458 | 530.33 | 1.2862 | 18.12 |
| 270 | 0.0750596 | 2914.84 | 6.3987 | 538.52 | 1.2879 | 18.59 |
| 280 | 0.0771560 | 2942.16 | 6.4485 | 546.22 | 1.2890 | 19.06 |
| 290 | 0.0791913 | 2968.61 | 6.4959 | 553.54 | 1.2897 | 19.53 |
|  |  |  |  |  |  |  |
| 300 | 0.0811753 | 2994.35 | 6.5412 | 560.52 | 1.2902 | 19.98 |
| 310 | 0.0831160 | 3019.51 | 6.5847 | 567.23 | 1.2904 | 20.44 |
| 320 | 0.0850197 | 3044.18 | 6.6267 | 573.70 | 1.2904 | 20.89 |
| 330 | 0.0868914 | 3068.46 | 6.6673 | 579.95 | 1.2903 | 21.34 |
| 340 | 0.0887354 | 3092.40 | 6.7066 | 586.00 | 1.2900 | 21.79 |
|  |  |  |  |  |  |  |
| 350 | 0.0905550 | 3116.06 | 6.7449 | 591.89 | 1.2896 | 22.23 |
| 360 | 0.0923533 | 3139.49 | 6.7822 | 597.62 | 1.2891 | 22.67 |
| 370 | 0.0941327 | 3162.73 | 6.8186 | 603.21 | 1.2885 | 23.11 |
| 380 | 0.0958952 | 3185.80 | 6.8542 | 608.67 | 1.2878 | 23.54 |
| 390 | 0.0976427 | 3208.74 | 6.8891 | 614.01 | 1.2870 | 23.97 |
|  |  |  |  |  |  |  |
| 400 | 0.0993766 | 3231.57 | 6.9233 | 619.25 | 1.2863 | 24.41 |
| 410 | 0.101098 | 3254.31 | 6.9568 | 624.39 | 1.2854 | 24.84 |
| 420 | 0.102809 | 3276.97 | 6.9897 | 629.44 | 1.2846 | 25.26 |
| 430 | 0.104510 | 3299.58 | 7.0221 | 634.40 | 1.2837 | 25.69 |
| 440 | 0.106201 | 3322.14 | 7.0540 | 639.28 | 1.2827 | 26.12 |
|  |  |  |  |  |  |  |
| 450 | 0.107884 | 3344.66 | 7.0853 | 644.09 | 1.2818 | 26.54 |
| 460 | 0.109559 | 3367.16 | 7.1162 | 648.82 | 1.2808 | 26.96 |
| 470 | 0.111227 | 3389.64 | 7.1467 | 653.49 | 1.2798 | 27.38 |
| 480 | 0.112888 | 3412.10 | 7.1767 | 658.10 | 1.2788 | 27.80 |
| 490 | 0.114544 | 3434.57 | 7.2063 | 662.65 | 1.2778 | 28.22 |
|  |  |  |  |  |  |  |
| 500 | 0.116193 | 3457.04 | 7.2356 | 667.14 | 1.2768 | 28.63 |
| 510 | 0.117837 | 3479.52 | 7.2645 | 671.58 | 1.2758 | 29.05 |
| 520 | 0.119476 | 3502.01 | 7.2930 | 675.96 | 1.2748 | 29.46 |
| 530 | 0.121111 | 3524.51 | 7.3212 | 680.30 | 1.2738 | 29.87 |
| 540 | 0.122741 | 3547.04 | 7.3491 | 684.59 | 1.2728 | 30.28 |
|  |  |  |  |  |  |  |
| 550 | 0.124367 | 3569.59 | 7.3767 | 688.83 | 1.2717 | 30.69 |
| 560 | 0.125990 | 3592.17 | 7.4039 | 693.03 | 1.2707 | 31.10 |
| 570 | 0.127608 | 3614.78 | 7.4309 | 697.19 | 1.2697 | 31.51 |
| 580 | 0.129224 | 3637.42 | 7.4576 | 701.31 | 1.2687 | 31.92 |
| 590 | 0.130836 | 3660.09 | 7.4840 | 705.39 | 1.2677 | 32.32 |
|  |  |  |  |  |  |  |
| 600 | 0.132445 | 3682.81 | 7.5102 | 709.43 | 1.2667 | 32.73 |
| 650 | 0.140451 | 3796.99 | 7.6373 | 729.13 | 1.2617 | 34.73 |
| 700 | 0.148403 | 3912.34 | 7.7590 | 748.06 | 1.2569 | 36.70 |
| 750 | 0.156312 | 4028.99 | 7.8759 | 766.32 | 1.2523 | 38.65 |
| 800 | 0.164189 | 4147.03 | 7.9885 | 783.99 | 1.2478 | 40.57 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=4 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =250.358°C 饱和状态 | | | | | | |
| 液 | 0.00125257 | 1087.43 | 2.7967 | 1146.9 | 262.53 | 106.1 |
| 汽 | 0.0497766 | 2800.90 | 6.0697 | 501.64 | 1.2639 | 17.44 |
| 260 | 0.0517770 | 2837.19 | 6.1384 | 513.78 | 1.2746 | 17.94 |
| 270 | 0.0536916 | 2871.20 | 6.2016 | 524.26 | 1.2797 | 18.44 |
| 280 | 0.0554948 | 2902.88 | 6.2594 | 533.58 | 1.2826 | 18.93 |
| 290 | 0.0572145 | 2932.91 | 6.3132 | 542.18 | 1.2844 | 19.41 |
|  |  |  |  |  |  |  |
| 300 | 0.0588680 | 2961.65 | 6.3638 | 550.23 | 1.2857 | 19.89 |
| 310 | 0.0604671 | 2989.38 | 6.4118 | 557.85 | 1.2866 | 20.36 |
| 320 | 0.0620211 | 3016.28 | 6.4575 | 565.10 | 1.2872 | 20.82 |
| 330 | 0.0635367 | 3042.49 | 6.5014 | 572.04 | 1.2876 | 21.28 |
| 340 | 0.0650195 | 3068.14 | 6.5435 | 578.71 | 1.2877 | 21.74 |
|  |  |  |  |  |  |  |
| 350 | 0.0664740 | 3093.32 | 6.5843 | 585.14 | 1.2877 | 22.19 |
| 360 | 0.0679040 | 3118.10 | 6.6237 | 591.35 | 1.2875 | 22.64 |
| 370 | 0.0693123 | 3142.55 | 6.6620 | 597.38 | 1.2871 | 23.08 |
| 380 | 0.0707017 | 3166.71 | 6.6993 | 603.23 | 1.2867 | 23.53 |
| 390 | 0.0720743 | 3190.64 | 6.7357 | 608.93 | 1.2862 | 23.97 |
|  |  |  |  |  |  |  |
| 400 | 0.0734318 | 3214.37 | 6.7712 | 614.49 | 1.2855 | 24.40 |
| 410 | 0.0747759 | 3237.94 | 6.8059 | 619.92 | 1.2849 | 24.84 |
| 420 | 0.0761079 | 3261.36 | 6.8400 | 625.24 | 1.2841 | 25.27 |
| 430 | 0.0774290 | 3284.66 | 6.8734 | 630.45 | 1.2833 | 25.70 |
| 440 | 0.0787401 | 3307.87 | 6.9061 | 635.56 | 1.2825 | 26.13 |
|  |  |  |  |  |  |  |
| 450 | 0.0800422 | 3330.99 | 6.9383 | 640.58 | 1.2816 | 26.56 |
| 460 | 0.0813360 | 3354.05 | 6.9700 | 645.51 | 1.2807 | 26.98 |
| 470 | 0.0826222 | 3377.05 | 7.0012 | 650.36 | 1.2798 | 27.41 |
| 480 | 0.0839015 | 3400.01 | 7.0318 | 655.14 | 1.2789 | 27.83 |
| 490 | 0.0851742 | 3422.94 | 7.0621 | 659.84 | 1.2780 | 28.25 |
|  |  |  |  |  |  |  |
| 500 | 0.0864410 | 3445.84 | 7.0919 | 664.48 | 1.2770 | 28.67 |
| 510 | 0.0877022 | 3468.72 | 7.1213 | 669.06 | 1.2760 | 29.08 |
| 520 | 0.0889583 | 3491.60 | 7.1503 | 673.58 | 1.2751 | 29.50 |
| 530 | 0.0902096 | 3514.47 | 7.1790 | 678.04 | 1.2741 | 29.91 |
| 540 | 0.0914564 | 3537.34 | 7.2073 | 682.44 | 1.2731 | 30.32 |
|  |  |  |  |  |  |  |
| 550 | 0.0926990 | 3560.22 | 7.2353 | 686.80 | 1.2721 | 30.74 |
| 560 | 0.0939376 | 3583.11 | 7.2629 | 691.10 | 1.2711 | 31.15 |
| 570 | 0.0951726 | 3606.01 | 7.2902 | 695.36 | 1.2701 | 31.55 |
| 580 | 0.0964041 | 3628.93 | 7.3172 | 699.58 | 1.2692 | 31.96 |
| 590 | 0.0976323 | 3651.88 | 7.3440 | 703.75 | 1.2682 | 32.37 |
|  |  |  |  |  |  |  |
| 600 | 0.0988574 | 3674.85 | 7.3704 | 707.87 | 1.2672 | 32.77 |
| 650 | 0.104943 | 3790.15 | 7.4989 | 727.94 | 1.2624 | 34.78 |
| 700 | 0.110973 | 3906.41 | 7.6215 | 747.17 | 1.2577 | 36.75 |
| 750 | 0.116961 | 4023.80 | 7.7391 | 765.68 | 1.2531 | 38.70 |
| 800 | 0.122915 | 4142.46 | 7.8523 | 783.55 | 1.2487 | 40.62 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=5 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =263.943°C 饱和状态 | | | | | | |
| 液 | 0.00128641 | 1154.50 | 2.9207 | 1088.4 | 184.19 | 100.1 |
| 汽 | 0.0394463 | 2794.23 | 5.9737 | 498.18 | 1.2584 | 17.96 |
| 270 | 0.0405675 | 2819.84 | 6.0211 | 506.87 | 1.2666 | 18.28 |
| 280 | 0.0422746 | 2858.08 | 6.0909 | 518.94 | 1.2740 | 18.80 |
| 290 | 0.0438562 | 2893.00 | 6.1535 | 529.38 | 1.2780 | 19.30 |
|  |  |  |  |  |  |  |
| 300 | 0.0453466 | 2925.64 | 6.2109 | 538.84 | 1.2806 | 19.79 |
| 310 | 0.0467667 | 2956.58 | 6.2645 | 547.60 | 1.2824 | 20.28 |
| 320 | 0.0481304 | 2986.18 | 6.3148 | 555.81 | 1.2837 | 20.76 |
| 330 | 0.0494477 | 3014.71 | 6.3625 | 563.57 | 1.2846 | 21.23 |
| 340 | 0.0507261 | 3042.36 | 6.4080 | 570.94 | 1.2852 | 21.70 |
|  |  |  |  |  |  |  |
| 350 | 0.0519714 | 3069.29 | 6.4515 | 577.99 | 1.2856 | 22.16 |
| 360 | 0.0531884 | 3095.62 | 6.4934 | 584.75 | 1.2858 | 22.61 |
| 370 | 0.0543809 | 3121.44 | 6.5339 | 591.26 | 1.2857 | 23.07 |
| 380 | 0.0555520 | 3146.83 | 6.5731 | 597.55 | 1.2855 | 23.52 |
| 390 | 0.0567042 | 3171.86 | 6.6111 | 603.64 | 1.2852 | 23.96 |
|  |  |  |  |  |  |  |
| 400 | 0.0578398 | 3196.59 | 6.6481 | 609.56 | 1.2848 | 24.41 |
| 410 | 0.0589607 | 3221.06 | 6.6842 | 615.31 | 1.2843 | 24.85 |
| 420 | 0.0600683 | 3245.31 | 6.7194 | 620.92 | 1.2837 | 25.28 |
| 430 | 0.0611641 | 3269.37 | 6.7539 | 626.39 | 1.2830 | 25.72 |
| 440 | 0.0622491 | 3293.27 | 6.7877 | 631.75 | 1.2823 | 26.15 |
|  |  |  |  |  |  |  |
| 450 | 0.0633245 | 3317.03 | 6.8208 | 636.99 | 1.2815 | 26.58 |
| 460 | 0.0643910 | 3340.68 | 6.8532 | 642.13 | 1.2807 | 27.01 |
| 470 | 0.0654495 | 3364.24 | 6.8851 | 647.17 | 1.2799 | 27.44 |
| 480 | 0.0665006 | 3387.71 | 6.9165 | 652.13 | 1.2790 | 27.86 |
| 490 | 0.0675449 | 3411.12 | 6.9474 | 657.00 | 1.2781 | 28.28 |
|  |  |  |  |  |  |  |
| 500 | 0.0685829 | 3434.48 | 6.9778 | 661.80 | 1.2772 | 28.70 |
| 510 | 0.0696152 | 3457.79 | 7.0078 | 666.52 | 1.2763 | 29.12 |
| 520 | 0.0706420 | 3481.06 | 7.0373 | 671.17 | 1.2754 | 29.54 |
| 530 | 0.0716639 | 3504.31 | 7.0664 | 675.76 | 1.2744 | 29.95 |
| 540 | 0.0726812 | 3527.54 | 7.0952 | 680.29 | 1.2735 | 30.37 |
|  |  |  |  |  |  |  |
| 550 | 0.0736941 | 3550.75 | 7.1235 | 684.75 | 1.2725 | 30.78 |
| 560 | 0.0747029 | 3573.96 | 7.1516 | 689.17 | 1.2716 | 31.19 |
| 570 | 0.0757080 | 3597.17 | 7.1793 | 693.53 | 1.2706 | 31.60 |
| 580 | 0.0767095 | 3620.38 | 7.2066 | 697.84 | 1.2697 | 32.01 |
| 590 | 0.0777077 | 3643.60 | 7.2337 | 702.10 | 1.2687 | 32.42 |
|  |  |  |  |  |  |  |
| 600 | 0.0787027 | 3666.83 | 7.2604 | 706.31 | 1.2678 | 32.82 |
| 650 | 0.0836367 | 3783.28 | 7.3901 | 726.76 | 1.2630 | 34.83 |
| 700 | 0.0885146 | 3900.45 | 7.5137 | 746.29 | 1.2584 | 36.80 |
| 750 | 0.0933495 | 4018.59 | 7.6321 | 765.04 | 1.2540 | 38.75 |
| 800 | 0.0981510 | 4137.87 | 7.7459 | 783.12 | 1.2496 | 40.67 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=6 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =275.586°C 饱和状态 | | | | | | |
| 液 | 0.00131927 | 1213.73 | 3.0274 | 1034.8 | 135.28 | 95.31 |
| 汽 | 0.0324487 | 2784.56 | 5.8901 | 494.01 | 1.2535 | 18.44 |
| 280 | 0.0331998 | 2805.25 | 5.9276 | 501.07 | 1.2604 | 18.68 |
| 290 | 0.0347631 | 2847.50 | 6.0033 | 514.56 | 1.2694 | 19.20 |
|  |  |  |  |  |  |  |
| 300 | 0.0361911 | 2885.49 | 6.0702 | 526.04 | 1.2743 | 19.71 |
| 310 | 0.0375230 | 2920.58 | 6.1309 | 536.29 | 1.2775 | 20.21 |
| 320 | 0.0387819 | 2953.55 | 6.1870 | 545.69 | 1.2797 | 20.70 |
| 330 | 0.0399833 | 2984.87 | 6.2393 | 554.43 | 1.2813 | 21.19 |
| 340 | 0.0411378 | 3014.89 | 6.2887 | 562.64 | 1.2825 | 21.66 |
|  |  |  |  |  |  |  |
| 350 | 0.0422535 | 3043.86 | 6.3356 | 570.41 | 1.2834 | 22.14 |
| 360 | 0.0433364 | 3071.96 | 6.3803 | 577.79 | 1.2839 | 22.60 |
| 370 | 0.0443912 | 3099.33 | 6.4232 | 584.85 | 1.2842 | 23.06 |
| 380 | 0.0454220 | 3126.10 | 6.4645 | 591.62 | 1.2843 | 23.52 |
| 390 | 0.0464317 | 3152.36 | 6.5044 | 598.14 | 1.2842 | 23.97 |
|  |  |  |  |  |  |  |
| 400 | 0.0474230 | 3178.18 | 6.5431 | 604.44 | 1.2840 | 24.42 |
| 410 | 0.0483980 | 3203.64 | 6.5806 | 610.54 | 1.2837 | 24.86 |
| 420 | 0.0493586 | 3228.79 | 6.6171 | 616.47 | 1.2832 | 25.30 |
| 430 | 0.0503063 | 3253.66 | 6.6528 | 622.23 | 1.2827 | 25.74 |
| 440 | 0.0512425 | 3278.31 | 6.6876 | 627.84 | 1.2821 | 26.18 |
|  |  |  |  |  |  |  |
| 450 | 0.0521683 | 3302.76 | 6.7216 | 633.32 | 1.2814 | 26.61 |
| 460 | 0.0530847 | 3327.05 | 6.7550 | 638.68 | 1.2807 | 27.04 |
| 470 | 0.0539925 | 3351.19 | 6.7877 | 643.93 | 1.2799 | 27.47 |
| 480 | 0.0548925 | 3375.21 | 6.8198 | 649.07 | 1.2791 | 27.90 |
| 490 | 0.0557854 | 3399.12 | 6.8513 | 654.12 | 1.2783 | 28.32 |
|  |  |  |  |  |  |  |
| 500 | 0.0566717 | 3422.95 | 6.8824 | 659.07 | 1.2775 | 28.75 |
| 510 | 0.0575519 | 3446.70 | 6.9129 | 663.95 | 1.2766 | 29.17 |
| 520 | 0.0584266 | 3470.39 | 6.9429 | 668.74 | 1.2757 | 29.58 |
| 530 | 0.0592960 | 3494.03 | 6.9726 | 673.46 | 1.2748 | 30.00 |
| 540 | 0.0601607 | 3517.63 | 7.0018 | 678.11 | 1.2739 | 30.42 |
|  |  |  |  |  |  |  |
| 550 | 0.0610209 | 3541.19 | 7.0306 | 682.70 | 1.2730 | 30.83 |
| 560 | 0.0618769 | 3564.73 | 7.0590 | 687.22 | 1.2721 | 31.24 |
| 570 | 0.0627290 | 3588.25 | 7.0870 | 691.69 | 1.2712 | 31.65 |
| 580 | 0.0635775 | 3611.76 | 7.1148 | 696.09 | 1.2702 | 32.06 |
| 590 | 0.0644225 | 3635.26 | 7.1421 | 700.45 | 1.2693 | 32.47 |
|  |  |  |  |  |  |  |
| 600 | 0.0652644 | 3658.76 | 7.1692 | 704.75 | 1.2684 | 32.87 |
| 650 | 0.0694316 | 3776.36 | 7.3002 | 725.58 | 1.2638 | 34.88 |
| 700 | 0.0735419 | 3894.47 | 7.4248 | 745.42 | 1.2593 | 36.86 |
| 750 | 0.0776087 | 4013.37 | 7.5439 | 764.42 | 1.2549 | 38.80 |
| 800 | 0.0816416 | 4133.27 | 7.6583 | 782.69 | 1.2506 | 40.72 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=7 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =285.830°C 饱和状态 | | | | | | |
| 液 | 0.00135186 | 1267.44 | 3.1220 | 984.51 | 102.43 | 91.27 |
| 汽 | 0.0273796 | 2772.57 | 5.8146 | 489.28 | 1.2491 | 18.89 |
| 290 | 0.0280439 | 2793.98 | 5.8528 | 496.60 | 1.2563 | 19.12 |
|  |  |  |  |  |  |  |
| 300 | 0.0294938 | 2839.83 | 5.9335 | 511.27 | 1.2661 | 19.65 |
| 310 | 0.0308034 | 2880.57 | 6.0040 | 523.61 | 1.2715 | 20.16 |
| 320 | 0.0320146 | 2917.86 | 6.0674 | 534.56 | 1.2751 | 20.66 |
| 330 | 0.0331520 | 2952.63 | 6.1255 | 544.52 | 1.2777 | 21.16 |
| 340 | 0.0342317 | 2985.50 | 6.1796 | 553.73 | 1.2796 | 21.65 |
|  |  |  |  |  |  |  |
| 350 | 0.0352650 | 3016.85 | 6.2303 | 562.33 | 1.2810 | 22.12 |
| 360 | 0.0362600 | 3046.99 | 6.2783 | 570.43 | 1.2820 | 22.60 |
| 370 | 0.0372229 | 3076.13 | 6.3240 | 578.11 | 1.2827 | 23.06 |
| 380 | 0.0381585 | 3104.44 | 6.3677 | 585.42 | 1.2831 | 23.53 |
| 390 | 0.0390705 | 3132.07 | 6.4096 | 592.42 | 1.2833 | 23.98 |
|  |  |  |  |  |  |  |
| 400 | 0.0399621 | 3159.10 | 6.4501 | 599.14 | 1.2833 | 24.44 |
| 410 | 0.0408358 | 3185.65 | 6.4892 | 605.62 | 1.2831 | 24.89 |
| 420 | 0.0416938 | 3211.77 | 6.5272 | 611.88 | 1.2828 | 25.33 |
| 430 | 0.0425378 | 3237.53 | 6.5641 | 617.95 | 1.2824 | 25.77 |
| 440 | 0.0433694 | 3262.98 | 6.6000 | 623.84 | 1.2819 | 26.21 |
|  |  |  |  |  |  |  |
| 450 | 0.0441898 | 3288.17 | 6.6351 | 629.58 | 1.2814 | 26.65 |
| 460 | 0.0450001 | 3313.13 | 6.6694 | 635.17 | 1.2808 | 27.08 |
| 470 | 0.0458014 | 3337.89 | 6.7029 | 640.63 | 1.2801 | 27.51 |
| 480 | 0.0465944 | 3362.48 | 6.7358 | 645.97 | 1.2793 | 27.94 |
| 490 | 0.0473799 | 3386.93 | 6.7681 | 651.19 | 1.2786 | 28.37 |
|  |  |  |  |  |  |  |
| 500 | 0.0481585 | 3411.25 | 6.7997 | 656.32 | 1.2778 | 28.79 |
| 510 | 0.0489308 | 3435.46 | 6.8308 | 661.35 | 1.2770 | 29.21 |
| 520 | 0.0496972 | 3459.59 | 6.8614 | 666.29 | 1.2761 | 29.63 |
| 530 | 0.0504583 | 3483.63 | 6.8916 | 671.15 | 1.2753 | 30.05 |
| 540 | 0.0512144 | 3507.61 | 6.9212 | 675.93 | 1.2744 | 30.47 |
|  |  |  |  |  |  |  |
| 550 | 0.0519658 | 3531.53 | 6.9505 | 680.63 | 1.2735 | 30.88 |
| 560 | 0.0527130 | 3555.41 | 6.9793 | 685.27 | 1.2726 | 31.30 |
| 570 | 0.0534561 | 3579.25 | 7.0078 | 689.84 | 1.2717 | 31.71 |
| 580 | 0.0541955 | 3603.06 | 7.0358 | 694.35 | 1.2708 | 32.12 |
| 590 | 0.0549314 | 3626.85 | 7.0635 | 698.80 | 1.2699 | 32.52 |
|  |  |  |  |  |  |  |
| 600 | 0.0556641 | 3650.62 | 7.0909 | 703.19 | 1.2690 | 32.93 |
| 650 | 0.0592843 | 3769.41 | 7.2232 | 724.41 | 1.2645 | 34.94 |
| 700 | 0.0628467 | 3888.46 | 7.3488 | 744.55 | 1.2601 | 36.92 |
| 750 | 0.0663652 | 4008.12 | 7.4687 | 763.80 | 1.2558 | 38.86 |
| 800 | 0.0698494 | 4128.65 | 7.5837 | 782.28 | 1.2516 | 40.78 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=8 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =295.009°C 饱和状态 | | | | | | |
| 液 | 0.00138466 | 1317.08 | 3.2077 | 936.73 | 79.212 | 87.74 |
| 汽 | 0.0235275 | 2758.61 | 5.7448 | 484.07 | 1.2450 | 19.33 |
| 300 | 0.0242802 | 2786.38 | 5.7935 | 493.56 | 1.2541 | 19.60 |
| 310 | 0.0256318 | 2835.27 | 5.8781 | 509.11 | 1.2640 | 20.12 |
| 320 | 0.0268425 | 2878.35 | 5.9514 | 522.16 | 1.2697 | 20.64 |
| 330 | 0.0279551 | 2917.53 | 6.0169 | 533.69 | 1.2736 | 21.14 |
| 340 | 0.0289946 | 2953.87 | 6.0766 | 544.12 | 1.2764 | 21.64 |
|  |  |  |  |  |  |  |
| 350 | 0.0299776 | 2988.06 | 6.1319 | 553.71 | 1.2785 | 22.13 |
| 360 | 0.0309152 | 3020.57 | 6.1837 | 562.64 | 1.2800 | 22.61 |
| 370 | 0.0318155 | 3051.73 | 6.2325 | 571.02 | 1.2811 | 23.08 |
| 380 | 0.0326848 | 3081.79 | 6.2789 | 578.94 | 1.2818 | 23.55 |
| 390 | 0.0335276 | 3110.93 | 6.3232 | 586.46 | 1.2823 | 24.01 |
|  |  |  |  |  |  |  |
| 400 | 0.0343477 | 3139.31 | 6.3657 | 593.65 | 1.2825 | 24.46 |
| 410 | 0.0351482 | 3167.04 | 6.4066 | 600.54 | 1.2826 | 24.92 |
| 420 | 0.0359315 | 3194.23 | 6.4461 | 607.17 | 1.2825 | 25.37 |
| 430 | 0.0366996 | 3220.95 | 6.4843 | 613.56 | 1.2822 | 25.81 |
| 440 | 0.0374543 | 3247.26 | 6.5215 | 619.75 | 1.2819 | 26.25 |
|  |  |  |  |  |  |  |
| 450 | 0.0381970 | 3273.23 | 6.5577 | 625.75 | 1.2814 | 26.69 |
| 460 | 0.0389290 | 3298.91 | 6.5929 | 631.59 | 1.2809 | 27.13 |
| 470 | 0.0396513 | 3324.33 | 6.6274 | 637.27 | 1.2803 | 27.56 |
| 480 | 0.0403649 | 3349.53 | 6.6611 | 642.82 | 1.2796 | 27.99 |
| 490 | 0.0410706 | 3374.53 | 6.6940 | 648.24 | 1.2789 | 28.42 |
|  |  |  |  |  |  |  |
| 500 | 0.0417691 | 3399.37 | 6.7264 | 653.54 | 1.2782 | 28.84 |
| 510 | 0.0424609 | 3424.07 | 6.7581 | 658.73 | 1.2774 | 29.27 |
| 520 | 0.0431467 | 3448.64 | 6.7893 | 663.82 | 1.2766 | 29.69 |
| 530 | 0.0438269 | 3473.11 | 6.8199 | 668.82 | 1.2758 | 30.11 |
| 540 | 0.0445019 | 3497.48 | 6.8501 | 673.73 | 1.2750 | 30.52 |
|  |  |  |  |  |  |  |
| 550 | 0.0451721 | 3521.77 | 6.8798 | 678.56 | 1.2741 | 30.94 |
| 560 | 0.0458379 | 3546.00 | 6.9091 | 683.31 | 1.2733 | 31.35 |
| 570 | 0.0464996 | 3570.17 | 6.9379 | 687.99 | 1.2724 | 31.76 |
| 580 | 0.0471574 | 3594.29 | 6.9663 | 692.60 | 1.2715 | 31.17 |
| 590 | 0.0478117 | 3618.37 | 6.9944 | 697.15 | 1.2707 | 32.58 |
|  |  |  |  |  |  |  |
| 600 | 0.0484625 | 3642.42 | 7.0221 | 701.64 | 1.2698 | 32.99 |
| 650 | 0.0516732 | 3762.42 | 7.1557 | 723.25 | 1.2654 | 35.00 |
| 700 | 0.0548251 | 3882.42 | 7.2823 | 743.70 | 1.2610 | 36.97 |
| 750 | 0.0579325 | 4002.86 | 7.4030 | 763.20 | 1.2568 | 38.92 |
| 800 | 0.0610054 | 4124.02 | 7.5186 | 781.88 | 1.2526 | 40.83 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=9 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =303.347°C 饱和状态 | | | | | | |
| 液 | 0.00141812 | 1363.65 | 3.2866 | 891.17 | 62.225 | 84.59 |
| 汽 | 0.0204929 | 2742.88 | 5.6790 | 478.44 | 1.2411 | 19.76 |
| 310 | 0.0214493 | 2782.61 | 5.7475 | 491.95 | 1.2537 | 20.11 |
| 320 | 0.0227102 | 2833.89 | 5.8348 | 508.10 | 1.2631 | 20.64 |
| 330 | 0.0238335 | 2878.87 | 5.9100 | 521.69 | 1.2688 | 21.15 |
| 340 | 0.0248613 | 2919.58 | 5.9769 | 533.66 | 1.2728 | 21.65 |
|  |  |  |  |  |  |  |
| 350 | 0.0258184 | 2957.22 | 6.0378 | 544.46 | 1.2757 | 22.14 |
| 360 | 0.0267208 | 2992.53 | 6.0940 | 554.36 | 1.2779 | 22.63 |
| 370 | 0.0275795 | 3026.01 | 6.1465 | 563.55 | 1.2795 | 23.11 |
| 380 | 0.0284025 | 3058.05 | 6.1959 | 572.15 | 1.2806 | 23.58 |
| 390 | 0.0291956 | 3088.89 | 6.2428 | 580.26 | 1.2814 | 24.04 |
|  |  |  |  |  |  |  |
| 400 | 0.0299635 | 3118.75 | 6.2875 | 587.95 | 1.2819 | 24.50 |
| 410 | 0.0307096 | 3147.79 | 6.3303 | 595.29 | 1.2821 | 24.96 |
| 420 | 0.0314369 | 3176.13 | 6.3715 | 602.31 | 1.2822 | 25.41 |
| 430 | 0.0321478 | 3203.88 | 6.4113 | 609.06 | 1.2821 | 25.86 |
| 440 | 0.0328442 | 3231.13 | 6.4497 | 615.56 | 1.2819 | 26.30 |
|  |  |  |  |  |  |  |
| 450 | 0.0335278 | 3257.94 | 6.4871 | 621.85 | 1.2815 | 26.74 |
| 460 | 0.0341999 | 3284.38 | 6.5234 | 627.95 | 1.2811 | 27.18 |
| 470 | 0.0348618 | 3310.50 | 6.5588 | 633.87 | 1.2806 | 27.62 |
| 480 | 0.0355145 | 3336.33 | 6.5933 | 639.63 | 1.2800 | 28.05 |
| 490 | 0.0361587 | 3361.93 | 6.6271 | 645.24 | 1.2793 | 28.48 |
|  |  |  |  |  |  |  |
| 500 | 0.0367955 | 3387.31 | 6.6601 | 650.72 | 1.2787 | 28.90 |
| 510 | 0.0374252 | 3412.51 | 6.6925 | 656.08 | 1.2779 | 29.33 |
| 520 | 0.0380487 | 3437.55 | 6.7243 | 661.33 | 1.2772 | 29.75 |
| 530 | 0.0386664 | 3462.45 | 6.7555 | 666.48 | 1.2764 | 30.17 |
| 540 | 0.0392787 | 3487.23 | 6.7861 | 671.52 | 1.2756 | 30.59 |
|  |  |  |  |  |  |  |
| 550 | 0.0398860 | 3511.91 | 6.8163 | 676.48 | 1.2748 | 31.00 |
| 560 | 0.0404888 | 3536.49 | 6.8460 | 681.35 | 1.2740 | 31.41 |
| 570 | 0.0410873 | 3561.00 | 6.8752 | 686.14 | 1.2731 | 31.83 |
| 580 | 0.0416819 | 3585.44 | 6.9040 | 690.86 | 1.2723 | 32.24 |
| 590 | 0.0422728 | 3609.83 | 6.9324 | 695.50 | 1.2714 | 32.64 |
|  |  |  |  |  |  |  |
| 600 | 0.0428602 | 3634.16 | 6.9605 | 700.08 | 1.2706 | 33.05 |
| 650 | 0.0457529 | 3755.39 | 7.0955 | 722.10 | 1.2663 | 35.06 |
| 700 | 0.0485859 | 3876.36 | 7.2231 | 742.86 | 1.2620 | 37.04 |
| 750 | 0.0513738 | 3997.58 | 7.3446 | 762.61 | 1.2578 | 38.98 |
| 800 | 0.0541269 | 4119.38 | 7.4608 | 781.49 | 1.2537 | 40.89 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=10 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =310.999°C 饱和状态 | | | | | | |
| 液 | 0.00145262 | 1407.87 | 3.3603 | 847.74 | 49.474 | 81.72 |
| 汽 | 0.0180336 | 2725.47 | 5.6159 | 472.44 | 1.2377 | 20.19 |
| 320 | 0.0192716 | 2782.66 | 5.7131 | 491.71 | 1.2546 | 20.66 |
| 330 | 0.0204462 | 2835.67 | 5.8017 | 508.20 | 1.2632 | 21.18 |
| 340 | 0.0214897 | 2882.06 | 5.8780 | 522.16 | 1.2688 | 21.68 |
|  |  |  |  |  |  |  |
| 350 | 0.0224422 | 2923.96 | 5.9458 | 534.45 | 1.2728 | 22.18 |
| 360 | 0.0233274 | 2962.61 | 6.0073 | 545.52 | 1.2757 | 22.67 |
| 370 | 0.0241605 | 2998.82 | 6.0641 | 555.64 | 1.2779 | 23.15 |
| 380 | 0.0249522 | 3033.11 | 6.1170 | 565.02 | 1.2794 | 23.62 |
| 390 | 0.0257099 | 3065.87 | 6.1668 | 573.79 | 1.2806 | 24.09 |
|  |  |  |  |  |  |  |
| 400 | 0.0264393 | 3097.38 | 6.2139 | 582.04 | 1.2813 | 24.55 |
| 410 | 0.0271447 | 3127.85 | 6.2589 | 589.86 | 1.2818 | 25.01 |
| 420 | 0.0278294 | 3157.45 | 6.3019 | 597.31 | 1.2820 | 25.46 |
| 430 | 0.0284963 | 3186.32 | 6.3432 | 604.44 | 1.2821 | 25.91 |
| 440 | 0.0291475 | 3214.57 | 6.3831 | 611.28 | 1.2820 | 26.36 |
|  |  |  |  |  |  |  |
| 450 | 0.0297850 | 3242.28 | 6.4217 | 617.87 | 1.2817 | 26.80 |
| 460 | 0.0304102 | 3269.53 | 6.4591 | 624.24 | 1.2814 | 27.24 |
| 470 | 0.0310246 | 3296.38 | 6.4955 | 630.41 | 1.2810 | 27.68 |
| 480 | 0.0316292 | 3322.89 | 6.5310 | 636.39 | 1.2804 | 28.11 |
| 490 | 0.0322250 | 3349.11 | 6.5655 | 642.21 | 1.2799 | 28.54 |
|  |  |  |  |  |  |  |
| 500 | 0.0328129 | 3375.06 | 6.5993 | 647.89 | 1.2792 | 28.97 |
| 510 | 0.0333935 | 3400.78 | 6.6324 | 653.42 | 1.2786 | 29.39 |
| 520 | 0.0339675 | 3426.31 | 6.6648 | 658.83 | 1.2779 | 29.81 |
| 530 | 0.0345355 | 3451.67 | 6.6965 | 664.12 | 1.2771 | 30.23 |
| 540 | 0.0350979 | 3476.87 | 6.7277 | 669.31 | 1.2764 | 30.65 |
|  |  |  |  |  |  |  |
| 550 | 0.0356552 | 3501.94 | 6.7584 | 674.39 | 1.2756 | 31.07 |
| 560 | 0.0362078 | 3526.90 | 6.7885 | 679.39 | 1.2748 | 31.48 |
| 570 | 0.0367561 | 3551.75 | 6.8182 | 684.29 | 1.2740 | 31.89 |
| 580 | 0.0373002 | 3576.52 | 6.8474 | 689.11 | 1.2731 | 32.30 |
| 590 | 0.0378406 | 3601.22 | 6.8761 | 693.86 | 1.2723 | 32.71 |
|  |  |  |  |  |  |  |
| 600 | 0.0383775 | 3625.84 | 6.9045 | 698.54 | 1.2715 | 33.12 |
| 650 | 0.0410163 | 3748.32 | 7.0409 | 720.95 | 1.2672 | 35.13 |
| 700 | 0.0435944 | 3870.27 | 7.1696 | 742.03 | 1.2630 | 37.10 |
| 750 | 0.0461269 | 3992.28 | 7.2918 | 762.03 | 1.2589 | 39.04 |
| 800 | 0.0486242 | 4114.73 | 7.4087 | 781.12 | 1.2548 | 40.95 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=11 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =318.081°C 饱和状态 | | | | | | |
| 液 | 0.00148855 | 1450.28 | 3.4300 | 806.15 | 39.689 | 79.04 |
| 汽 | 0.0159939 | 2706.39 | 5.5545 | 466.11 | 1.2349 | 20.64 |
| 320 | 0.0162775 | 2721.07 | 5.5793 | 471.35 | 1.2408 | 20.74 |
| 330 | 0.0175664 | 2786.37 | 5.6885 | 492.74 | 1.2565 | 21.24 |
| 340 | 0.0186580 | 2840.45 | 5.7775 | 509.38 | 1.2642 | 21.74 |
|  |  |  |  |  |  |  |
| 350 | 0.0196272 | 2887.79 | 5.8541 | 523.55 | 1.2696 | 22.23 |
| 360 | 0.0205114 | 2930.53 | 5.9221 | 536.03 | 1.2735 | 22.72 |
| 370 | 0.0213326 | 2969.95 | 5.9839 | 547.26 | 1.2763 | 23.20 |
| 380 | 0.0221050 | 3006.84 | 6.0408 | 557.53 | 1.2784 | 23.68 |
| 390 | 0.0228384 | 3041.77 | 6.0939 | 567.03 | 1.2798 | 24.15 |
|  |  |  |  |  |  |  |
| 400 | 0.0235398 | 3075.12 | 6.1438 | 575.91 | 1.2809 | 24.61 |
| 410 | 0.0242145 | 3107.17 | 6.1911 | 584.26 | 1.2816 | 25.07 |
| 420 | 0.0248665 | 3138.15 | 6.2361 | 592.17 | 1.2820 | 25.53 |
| 430 | 0.0254991 | 3168.23 | 6.2792 | 599.70 | 1.2822 | 25.98 |
| 440 | 0.0261148 | 3197.55 | 6.3206 | 606.91 | 1.2822 | 26.43 |
|  |  |  |  |  |  |  |
| 450 | 0.0267157 | 3226.23 | 6.3605 | 613.82 | 1.2821 | 26.87 |
| 460 | 0.0273036 | 3254.34 | 6.3991 | 620.47 | 1.2818 | 27.31 |
| 470 | 0.0278799 | 3281.98 | 6.4366 | 626.90 | 1.2815 | 27.74 |
| 480 | 0.0284459 | 3309.20 | 6.4730 | 633.12 | 1.2810 | 28.18 |
| 490 | 0.0290026 | 3336.06 | 6.5084 | 639.15 | 1.2805 | 28.61 |
|  |  |  |  |  |  |  |
| 500 | 0.0295510 | 3362.61 | 6.5430 | 645.02 | 1.2799 | 29.04 |
| 510 | 0.0300918 | 3388.89 | 6.5767 | 650.74 | 1.2793 | 29.46 |
| 520 | 0.0306258 | 3414.92 | 6.6098 | 656.31 | 1.2786 | 29.88 |
| 530 | 0.0311535 | 3440.74 | 6.6421 | 661.76 | 1.2779 | 30.30 |
| 540 | 0.0316754 | 3466.39 | 6.6738 | 667.09 | 1.2772 | 30.72 |
|  |  |  |  |  |  |  |
| 550 | 0.0321920 | 3491.87 | 6.7050 | 672.31 | 1.2764 | 31.14 |
| 560 | 0.0327038 | 3517.20 | 6.7356 | 677.42 | 1.2756 | 31.55 |
| 570 | 0.0332110 | 3542.42 | 6.7657 | 682.44 | 1.2748 | 31.96 |
| 580 | 0.0337141 | 3567.52 | 6.7953 | 687.38 | 1.2740 | 32.37 |
| 590 | 0.0342133 | 3592.53 | 6.8244 | 692.22 | 1.2732 | 32.78 |
|  |  |  |  |  |  |  |
| 600 | 0.0347089 | 3617.46 | 6.8531 | 697.00 | 1.2724 | 33.19 |
| 650 | 0.0371405 | 3741.21 | 6.9910 | 719.82 | 1.2682 | 35.19 |
| 700 | 0.0395103 | 3864.16 | 7.1207 | 741.21 | 1.2641 | 37.16 |
| 750 | 0.0418340 | 3986.97 | 7.2437 | 761.46 | 1.2600 | 39.10 |
| 800 | 0.0441222 | 4110.07 | 7.3612 | 780.75 | 1.2560 | 41.01 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=12 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =324.678°C 饱和状态 | | | | | | |
| 液 | 0.00152633 | 1491.33 | 3.4965 | 765.59 | 32.001 | 76.51 |
| 汽 | 0.0142689 | 2685.58 | 5.4941 | 459.46 | 1.2329 | 21.11 |
| 330 | 0.0150236 | 2728.14 | 5.5650 | 474.22 | 1.2474 | 21.36 |
| 340 | 0.0162112 | 2793.47 | 5.6725 | 494.92 | 1.2591 | 21.84 |
|  |  |  |  |  |  |  |
| 350 | 0.0172227 | 2848.01 | 5.7607 | 511.54 | 1.2661 | 22.32 |
| 360 | 0.0181226 | 2895.87 | 5.8369 | 525.77 | 1.2711 | 22.80 |
| 370 | 0.0189442 | 2939.15 | 5.9047 | 538.33 | 1.2748 | 23.28 |
| 380 | 0.0197077 | 2979.09 | 5.9664 | 549.63 | 1.2774 | 23.76 |
| 390 | 0.0204258 | 3016.49 | 6.0232 | 559.97 | 1.2793 | 24.23 |
|  |  |  |  |  |  |  |
| 400 | 0.0211077 | 3051.90 | 6.0762 | 569.54 | 1.2806 | 24.69 |
| 410 | 0.0217597 | 3085.70 | 6.1261 | 578.47 | 1.2815 | 25.15 |
| 420 | 0.0223867 | 3118.19 | 6.1733 | 586.89 | 1.2821 | 25.60 |
| 430 | 0.0229924 | 3149.59 | 6.2182 | 594.85 | 1.2825 | 26.05 |
| 440 | 0.0235799 | 3180.07 | 6.2613 | 602.43 | 1.2826 | 26.50 |
|  |  |  |  |  |  |  |
| 450 | 0.0241515 | 3209.77 | 6.3027 | 609.68 | 1.2826 | 26.94 |
| 460 | 0.0247091 | 3238.81 | 6.3425 | 616.64 | 1.2824 | 27.38 |
| 470 | 0.0252545 | 3267.28 | 6.3811 | 623.34 | 1.2821 | 27.82 |
| 480 | 0.0257890 | 3295.25 | 6.4185 | 629.81 | 1.2817 | 28.25 |
| 490 | 0.0263138 | 3322.79 | 6.4548 | 636.07 | 1.2813 | 28.68 |
|  |  |  |  |  |  |  |
| 500 | 0.0268298 | 3349.97 | 6.4902 | 642.14 | 1.2807 | 29.11 |
| 510 | 0.0273378 | 3376.81 | 6.5247 | 648.04 | 1.2801 | 29.54 |
| 520 | 0.0278387 | 3403.37 | 6.5584 | 653.79 | 1.2795 | 29.96 |
| 530 | 0.0283331 | 3429.69 | 6.5914 | 659.39 | 1.2788 | 30.38 |
| 540 | 0.0288215 | 3455.78 | 6.6237 | 664.86 | 1.2781 | 30.80 |
|  |  |  |  |  |  |  |
| 550 | 0.0293045 | 3481.68 | 6.6553 | 670.22 | 1.2774 | 31.21 |
| 560 | 0.0297824 | 3507.41 | 6.6864 | 675.46 | 1.2766 | 31.62 |
| 570 | 0.0302557 | 3533.00 | 6.7169 | 680.60 | 1.2758 | 32.04 |
| 580 | 0.0307247 | 3558.45 | 6.7469 | 685.64 | 1.2751 | 32.45 |
| 590 | 0.0311897 | 3583.78 | 6.7764 | 690.60 | 1.2743 | 32.85 |
|  |  |  |  |  |  |  |
| 600 | 0.0316511 | 3609.02 | 6.8055 | 695.46 | 1.2734 | 33.26 |
| 650 | 0.0339104 | 3734.07 | 6.9448 | 718.70 | 1.2693 | 35.26 |
| 700 | 0.0361069 | 3858.03 | 7.0756 | 740.40 | 1.2652 | 37.23 |
| 750 | 0.0382567 | 3981.64 | 7.1994 | 760.90 | 1.2612 | 39.16 |
| 800 | 0.0403706 | 4105.40 | 7.3175 | 780.40 | 1.2571 | 41.07 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=13 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =330.857°C 饱和状态 | | | | | | |
| 液 | 0.00156649 | 1531.40 | 3.5606 | 724.84 | 25.799 | 74.09 |
| 汽 | 0.0127851 | 2662.89 | 5.4339 | 452.50 | 1.2320 | 21.60 |
| 340 | 0.0140296 | 2738.92 | 5.5589 | 478.10 | 1.2533 | 21.99 |
|  |  |  |  |  |  |  |
| 350 | 0.0151195 | 2803.61 | 5.6635 | 498.14 | 1.2625 | 22.45 |
| 360 | 0.0160546 | 2858.09 | 5.7503 | 514.59 | 1.2688 | 22.92 |
| 370 | 0.0168896 | 2906.10 | 5.8255 | 528.76 | 1.2734 | 23.39 |
| 380 | 0.0176538 | 2949.64 | 5.8927 | 541.28 | 1.2766 | 23.85 |
| 390 | 0.0183647 | 2989.90 | 5.9539 | 552.57 | 1.2789 | 24.32 |
|  |  |  |  |  |  |  |
| 400 | 0.0190341 | 3027.64 | 6.0104 | 562.91 | 1.2806 | 24.78 |
| 410 | 0.0196699 | 3063.39 | 6.0631 | 572.49 | 1.2817 | 25.24 |
| 420 | 0.0202779 | 3097.54 | 6.1127 | 581.45 | 1.2825 | 25.69 |
| 430 | 0.0208627 | 3130.37 | 6.1598 | 589.88 | 1.2830 | 26.14 |
| 440 | 0.0214277 | 3162.10 | 6.2046 | 597.87 | 1.2832 | 26.59 |
|  |  |  |  |  |  |  |
| 450 | 0.0219756 | 3192.90 | 6.2475 | 605.48 | 1.2833 | 27.03 |
| 460 | 0.0225087 | 3222.92 | 6.2887 | 612.75 | 1.2832 | 27.47 |
| 470 | 0.0230287 | 3252.27 | 6.3285 | 619.74 | 1.2829 | 27.90 |
| 480 | 0.0235371 | 3281.03 | 6.3669 | 626.46 | 1.2826 | 28.34 |
| 490 | 0.0240353 | 3309.29 | 6.4042 | 632.95 | 1.2822 | 28.77 |
|  |  |  |  |  |  |  |
| 500 | 0.0245243 | 3337.12 | 6.4404 | 639.23 | 1.2817 | 29.19 |
| 510 | 0.0250051 | 3364.56 | 6.4757 | 645.33 | 1.2811 | 29.62 |
| 520 | 0.0254784 | 3391.67 | 6.5101 | 651.25 | 1.2805 | 30.04 |
| 530 | 0.0259448 | 3418.49 | 6.5437 | 657.02 | 1.2798 | 30.46 |
| 540 | 0.0264052 | 3445.05 | 6.5765 | 662.64 | 1.2792 | 30.88 |
|  |  |  |  |  |  |  |
| 550 | 0.0268598 | 3471.39 | 6.6087 | 668.13 | 1.2784 | 31.29 |
| 560 | 0.0273093 | 3497.53 | 6.6403 | 673.50 | 1.2777 | 31.70 |
| 570 | 0.0277541 | 3523.49 | 6.6713 | 678.76 | 1.2769 | 32.11 |
| 580 | 0.0281944 | 3549.29 | 6.7017 | 683.92 | 1.2762 | 32.52 |
| 590 | 0.0286306 | 3574.96 | 6.7316 | 688.98 | 1.2754 | 32.93 |
|  |  |  |  |  |  |  |
| 600 | 0.0290630 | 3600.51 | 6.7610 | 693.94 | 1.2746 | 33.34 |
| 650 | 0.0311769 | 3726.89 | 6.9018 | 717.59 | 1.2705 | 35.34 |
| 700 | 0.0332270 | 3851.87 | 7.0336 | 739.61 | 1.2664 | 37.30 |
| 750 | 0.0352298 | 3976.29 | 7.1583 | 760.36 | 1.2624 | 39.23 |
| 800 | 0.0371964 | 4100.72 | 7.2771 | 780.05 | 1.2584 | 41.13 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=14 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =336.669°C 饱和状态 | | | | | | |
| 液 | 0.00160971 | 1570.88 | 3.6230 | 682.84 | 20.690 | 71.73 |
| 汽 | 0.0114889 | 2638.09 | 5.3730 | 445.18 | 1.2322 | 22.13 |
| 340 | 0.0119989 | 2672.38 | 5.4291 | 457.16 | 1.2442 | 22.24 |
|  |  |  |  |  |  |  |
| 350 | 0.0132316 | 2752.92 | 5.5595 | 482.90 | 1.2588 | 22.63 |
| 360 | 0.0142288 | 2816.39 | 5.6605 | 502.28 | 1.2665 | 23.07 |
| 370 | 0.0150919 | 2870.38 | 5.7452 | 518.43 | 1.2721 | 23.52 |
| 380 | 0.0158666 | 2918.26 | 5.8190 | 532.40 | 1.2761 | 23.98 |
| 390 | 0.0165779 | 2961.83 | 5.8853 | 544.80 | 1.2789 | 24.43 |
|  |  |  |  |  |  |  |
| 400 | 0.0172410 | 3002.23 | 5.9457 | 556.02 | 1.2808 | 24.89 |
| 410 | 0.0178661 | 3040.16 | 6.0017 | 566.31 | 1.2822 | 25.34 |
| 420 | 0.0184603 | 3076.14 | 6.0539 | 575.85 | 1.2831 | 25.79 |
| 430 | 0.0190290 | 3110.53 | 6.1032 | 584.79 | 1.2837 | 26.24 |
| 440 | 0.0195762 | 3143.61 | 6.1499 | 593.21 | 1.2840 | 26.68 |
|  |  |  |  |  |  |  |
| 450 | 0.0201049 | 3175.60 | 6.1945 | 601.20 | 1.2841 | 27.12 |
| 460 | 0.0206177 | 3206.66 | 6.2371 | 608.81 | 1.2841 | 27.56 |
| 470 | 0.0211167 | 3236.94 | 6.2782 | 616.09 | 1.2839 | 28.00 |
| 480 | 0.0216034 | 3266.54 | 6.3177 | 623.08 | 1.2836 | 28.43 |
| 490 | 0.0220794 | 3295.55 | 6.3560 | 629.81 | 1.2832 | 28.86 |
|  |  |  |  |  |  |  |
| 500 | 0.0225457 | 3324.06 | 6.3931 | 636.31 | 1.2828 | 29.28 |
| 510 | 0.0230034 | 3352.13 | 6.4292 | 642.60 | 1.2822 | 29.70 |
| 520 | 0.0234533 | 3379.81 | 6.4643 | 648.71 | 1.2816 | 30.13 |
| 530 | 0.0238961 | 3407.15 | 6.4986 | 654.64 | 1.2810 | 30.54 |
| 540 | 0.0243326 | 3434.20 | 6.5320 | 660.42 | 1.2803 | 30.96 |
|  |  |  |  |  |  |  |
| 550 | 0.0247632 | 3460.99 | 6.5648 | 666.05 | 1.2796 | 31.37 |
| 560 | 0.0251885 | 3487.54 | 6.5968 | 671.55 | 1.2789 | 31.79 |
| 570 | 0.0256089 | 3513.89 | 6.6283 | 676.93 | 1.2781 | 32.20 |
| 580 | 0.0260247 | 3540.06 | 6.6591 | 682.20 | 1.2774 | 32.60 |
| 590 | 0.0264364 | 3566.07 | 6.6894 | 687.37 | 1.2766 | 33.01 |
|  |  |  |  |  |  |  |
| 600 | 0.0268442 | 3591.94 | 6.7192 | 692.43 | 1.2758 | 33.42 |
| 650 | 0.0288338 | 3719.67 | 6.8615 | 716.49 | 1.2717 | 35.41 |
| 700 | 0.0307586 | 3845.69 | 6.9944 | 738.83 | 1.2676 | 37.37 |
| 750 | 0.0326354 | 3970.94 | 7.1200 | 759.83 | 1.2636 | 39.30 |
| 800 | 0.0344758 | 4096.02 | 7.2393 | 779.72 | 1.2596 | 41.19 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=15 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =342.158°C 饱和状态 | | | | | | |
| 液 | 0.00165696 | 1610.15 | 3.6844 | 639.77 | 16.468 | 69.40 |
| 汽 | 0.0103401 | 2610.86 | 5.3108 | 437.44 | 1.2337 | 22.72 |
| 350 | 0.0114807 | 2693.00 | 5.4435 | 464.90 | 1.2551 | 22.91 |
| 360 | 0.0125823 | 2769.56 | 5.5654 | 488.52 | 1.2645 | 23.28 |
| 370 | 0.0134930 | 2831.40 | 5.6624 | 507.20 | 1.2710 | 23.69 |
| 380 | 0.0142893 | 2884.61 | 5.7445 | 522.93 | 1.2758 | 24.13 |
| 390 | 0.0150084 | 2932.11 | 5.8166 | 536.62 | 1.2791 | 24.57 |
|  |  |  |  |  |  |  |
| 400 | 0.0156711 | 2975.55 | 5.8817 | 548.83 | 1.2814 | 25.02 |
| 410 | 0.0162904 | 3015.93 | 5.9412 | 559.91 | 1.2829 | 25.46 |
| 420 | 0.0168752 | 3053.94 | 5.9965 | 570.10 | 1.2840 | 25.91 |
| 430 | 0.0174318 | 3090.04 | 6.0482 | 579.58 | 1.2847 | 26.35 |
| 440 | 0.0179649 | 3124.58 | 6.0970 | 588.46 | 1.2851 | 26.79 |
|  |  |  |  |  |  |  |
| 450 | 0.0184781 | 3157.84 | 6.1433 | 596.85 | 1.2852 | 27.23 |
| 460 | 0.0189743 | 3190.02 | 6.1875 | 604.81 | 1.2852 | 27.66 |
| 470 | 0.0194557 | 3221.28 | 6.2298 | 612.40 | 1.2851 | 28.10 |
| 480 | 0.0199243 | 3251.76 | 6.2706 | 619.67 | 1.2848 | 28.53 |
| 490 | 0.0203814 | 3281.57 | 6.3099 | 626.65 | 1.2845 | 28.95 |
|  |  |  |  |  |  |  |
| 500 | 0.0208285 | 3310.79 | 6.3479 | 633.37 | 1.2840 | 29.38 |
| 510 | 0.0212665 | 3339.51 | 6.3848 | 639.87 | 1.2835 | 29.80 |
| 520 | 0.0216964 | 3367.79 | 6.4207 | 646.16 | 1.2829 | 30.22 |
| 530 | 0.0221191 | 3395.68 | 6.4556 | 652.26 | 1.2823 | 30.64 |
| 540 | 0.0225351 | 3423.22 | 6.4897 | 658.20 | 1.2816 | 31.05 |
|  |  |  |  |  |  |  |
| 550 | 0.0229451 | 3450.47 | 6.5230 | 663.97 | 1.2809 | 31.46 |
| 560 | 0.0233495 | 3477.46 | 6.5556 | 669.61 | 1.2802 | 31.87 |
| 570 | 0.0237489 | 3504.21 | 6.5875 | 675.11 | 1.2794 | 32.28 |
| 580 | 0.0241437 | 3530.75 | 6.6188 | 680.50 | 1.2787 | 32.69 |
| 590 | 0.0245342 | 3557.11 | 6.6496 | 685.77 | 1.2779 | 33.10 |
|  |  |  |  |  |  |  |
| 600 | 0.0249207 | 3583.31 | 6.6797 | 690.93 | 1.2771 | 33.50 |
| 650 | 0.0268030 | 3712.41 | 6.8235 | 715.41 | 1.2730 | 35.49 |
| 700 | 0.0286193 | 3839.48 | 6.9576 | 738.07 | 1.2689 | 37.45 |
| 750 | 0.0303871 | 3965.56 | 7.0839 | 759.31 | 1.2649 | 39.37 |
| 800 | 0.0321182 | 4091.33 | 7.2039 | 779.40 | 1.2609 | 41.26 |

表A.3单相区的物性值表（饱和蒸汽温度至800℃） （续）

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***p*=16 MPa** | | | | | | |
| *θ* | *v* | *h* | *s* | *w* | *к* | *η* |
| [°C] | [m3/kg] | [kJ/kg] | [kJ/(kg·K)] | [m/s] | [-] | [10-6Pa·s] |
| *θs* =347.357°C 饱和状态 | | | | | | |
| 液 | 0.00170954 | 1649.67 | 3.7457 | 597.67 | 13.059 | 67.06 |
| 汽 | 0.00930813 | 2580.80 | 5.2463 | 429.20 | 1.2369 | 23.36 |
| 350 | 0.00976565 | 2616.99 | 5.3045 | 441.49 | 1.2475 | 23.36 |
| 360 | 0.0110599 | 2715.63 | 5.4616 | 472.82 | 1.2634 | 23.57 |
| 370 | 0.0120464 | 2788.30 | 5.5755 | 494.85 | 1.2705 | 23.92 |
| 380 | 0.0128781 | 2848.27 | 5.6680 | 512.76 | 1.2760 | 24.32 |
| 390 | 0.0136131 | 2900.49 | 5.7474 | 527.98 | 1.2798 | 24.74 |
|  |  |  |  |  |  |  |
| 400 | 0.0142810 | 2947.46 | 5.8177 | 541.32 | 1.2824 | 25.17 |
| 410 | 0.0148991 | 2990.62 | 5.8814 | 553.28 | 1.2841 | 25.61 |
| 420 | 0.0154783 | 3030.88 | 5.9399 | 564.18 | 1.2853 | 26.04 |
| 430 | 0.0160263 | 3068.85 | 5.9943 | 574.24 | 1.2860 | 26.48 |
| 440 | 0.0165486 | 3104.99 | 6.0453 | 583.62 | 1.2864 | 26.91 |
|  |  |  |  |  |  |  |
| 450 | 0.0170494 | 3139.61 | 6.0935 | 592.43 | 1.2866 | 27.35 |
| 460 | 0.0175320 | 3172.98 | 6.1393 | 600.76 | 1.2866 | 27.78 |
| 470 | 0.0179988 | 3205.29 | 6.1831 | 608.68 | 1.2865 | 28.21 |
| 480 | 0.0184520 | 3236.70 | 6.2251 | 616.23 | 1.2862 | 28.63 |
| 490 | 0.0188931 | 3267.34 | 6.2655 | 623.47 | 1.2859 | 29.06 |
|  |  |  |  |  |  |  |
| 500 | 0.0193237 | 3297.31 | 6.3045 | 630.42 | 1.2854 | 29.48 |
| 510 | 0.0197449 | 3326.71 | 6.3423 | 637.13 | 1.2849 | 29.90 |
| 520 | 0.0201577 | 3355.60 | 6.3790 | 643.61 | 1.2844 | 30.32 |
| 530 | 0.0205628 | 3384.05 | 6.4146 | 649.89 | 1.2837 | 30.73 |
| 540 | 0.0209611 | 3412.12 | 6.4494 | 655.98 | 1.2831 | 31.15 |
|  |  |  |  |  |  |  |
| 550 | 0.0213532 | 3439.85 | 6.4832 | 661.91 | 1.2824 | 31.56 |
| 560 | 0.0217396 | 3467.28 | 6.5164 | 667.68 | 1.2816 | 31.97 |
| 570 | 0.0221208 | 3494.44 | 6.5488 | 673.31 | 1.2809 | 32.37 |
| 580 | 0.0224972 | 3521.37 | 6.5805 | 678.81 | 1.2801 | 32.78 |
| 590 | 0.0228693 | 3548.08 | 6.6117 | 684.18 | 1.2793 | 33.18 |
|  |  |  |  |  |  |  |
| 600 | 0.0232373 | 3574.61 | 6.6422 | 689.45 | 1.2785 | 33.59 |
| 650 | 0.0250259 | 3705.11 | 6.7876 | 714.35 | 1.2744 | 35.57 |
| 700 | 0.0267475 | 3833.26 | 6.9228 | 737.32 | 1.2703 | 37.52 |
| 750 | 0.0284200 | 3960.18 | 7.0499 | 758.80 | 1.2662 | 39.44 |
| 800 | 0.0300554 | 4086.62 | 7.1706 | 779.09 | 1.2622 | 41.33 |

# A.4饱和状态的蒸汽运动粘度表

本表包括了温度自0℃至临界温度*θ*c=373.946℃以下的饱和蒸汽运动粘度*v''*值

表A.4饱和状态的运动粘度*ν*（0℃～373.946℃）

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *θ* | *v*'' | *θ* | *v*'' | *θ* | *v*'' |
| [°C] | [10-6m2s-1] | [°C] | [10-6m2s-1] | [°C] | [10-6m2s-1] |
| 0 | 1844.0 | 58 | 90.264 | 200 | 1.9931 |
| 0.01a | 1842.8 | 60 | 83.221 | 205 | 1.8227 |
| 1 | 1727.0 | 62 | 76.820 | 210 | 1.6698 |
| 2 | 1618.4 | 64 | 70.994 | 215 | 1.5322 |
| 3 | 1517.5 | 66 | 65.686 | 220 | 1.4081 |
| 4 | 1423.7 | 68 | 60.843 |  |  |
|  |  |  |  | 225 | 1.2961 |
| 5 | 1336.4 | 70 | 56.419 | 230 | 1.1946 |
| 6 | 1255.2 | 72 | 52.373 | 235 | 1.1025 |
| 7 | 1179.6 | 74 | 48.668 | 240 | 1.0188 |
| 8 | 1109.1 | 76 | 45.272 | 245 | 0.94254 |
| 9 | 1043.4 | 78 | 42.156 |  |  |
|  |  |  |  | 250 | 0.87297 |
| 10 | 982.13 | 80 | 39.293 | 255 | 0.80937 |
| 11 | 924.92 | 82 | 36.660 | 260 | 0.75113 |
| 12 | 871.51 | 84 | 34.236 | 265 | 0.69770 |
| 13 | 821.59 | 86 | 32.002 | 270 | 0.64860 |
| 14 | 774.93 | 88 | 29.942 |  |  |
|  |  |  |  | 275 | 0.60341 |
| 15 | 731.29 | 90 | 28.039 | 280 | 0.56175 |
| 16 | 690.44 | 92 | 26.279 | 285 | 0.52329 |
| 17 | 652.19 | 94 | 24.652 | 290 | 0.48771 |
| 18 | 616.36 | 96 | 23.144 | 295 | 0.45474 |
| 19 | 582.77 | 98 | 21.747 |  |  |
|  |  |  |  | 300 | 0.42416 |
| 20 | 551.28 | 100 | 20.450 | 305 | 0.39572 |
| 22 | 493.99 | 105 | 17.597 | 310 | 0.36925 |
| 24 | 443.46 | 110 | 15.214 | 315 | 0.34456 |
| 25 | 420.45 | 115 | 13.211 | 320 | 0.32148 |
| 26 | 398.81 | 120 | 11.521 |  |  |
| 28 | 359.28 |  |  | 325 | 0.29986 |
|  |  | 125 | 10.088 | 330 | 0.27956 |
| 30 | 324.22 | 130 | 8.8673 | 335 | 0.26044 |
| 32 | 293.06 | 135 | 7.8225 | 340 | 0.24238 |
| 34 | 265.33 | 140 | 6.9248 | 345 | 0.22525 |
| 36 | 240.61 | 145 | 6.1504 |  |  |
| 38 | 218.53 |  |  | 350 | 0.20893 |
|  |  | 150 | 5.4798 | 355 | 0.19329 |
| 40 | 198.78 | 155 | 4.8970 | 360 | 0.17807 |
| 42 | 181.08 | 160 | 4.3886 | 365 | 0.16284 |
| 44 | 165.20 | 165 | 3.9437 |  |  |
| 46 | 150.92 | 170 | 3.5531 | 370 | 0.14639 |
| 48 | 138.07 |  |  | 371 | 0.14260 |
|  |  | 175 | 3.2090 | 372 | 0.13836 |
| 50 | 126.49 | 180 | 2.9051 | 373 | 0.13313 |
| 52 | 116.03 | 185 | 2.6358 | 373.946a | 0.12214b |
| 54  56 | 106.58  98.022 | 190  195 | 2.3965  2.1834 |  |  |

a 临界温度，b 在靠近临界点附近时。

# A.5运动粘度（单相区）

在单相范围内，本表包括了温度自0℃至800℃而压力自0.0006112127MPa至20MPa的水及蒸汽运动粘度*ν*=*ηρ*-1值。

表A.5 运动粘度*ν*[10-6m2s-1]

（单相范围：0℃～800℃，0.0006112127MPa～20MPa）

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *θ* | *p*[MPa] | | | | | | | | | | |
| [°C] | 0.0006112127 | 0.001 | 0.01 | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 |
| 0 | 1.7923 | 1.7923 | 1.7923 | 1.7922 | 1.7920 | 1.7917 | 1.7914 | 1.7911 | 1.7908 | 1.7905 | 1.7901 |
| 5 | 1908.5 | 1.5184 | 1.5184 | 1.5183 | 1.5182 | 1.5180 | 1.5178 | 1.5176 | 1.5174 | 1.5171 | 1.5169 |
| 10 | 1974.8 | 1206.5 | 1.3064 | 1.3064 | 1.3063 | 1.3061 | 1.3060 | 1.3058 | 1.3057 | 1.3055 | 1.3054 |
| 15 | 2043.0 | 1248.2 | 1.1387 | 1.1386 | 1.1386 | 1.1385 | 1.1384 | 1.1383 | 1.1382 | 1.1381 | 1.1379 |
| 20 | 2113.0 | 1291.1 | 1.0035 | 1.0034 | 1.0034 | 1.0033 | 1.0032 | 1.0032 | 1.0031 | 1.0030 | 1.0029 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 25 | 2184.8 | 1335.0 | 0.89271 | 0.89269 | 0.89266 | 0.89260 | 0.89255 | 0.89250 | 0.89244 | 0.89239 | 0.89233 |
| 30 | 2258.5 | 1380.0 | 0.80074 | 0.80072 | 0.80070 | 0.80067 | 0.80063 | 0.80059 | 0.80055 | 0.80052 | 0.80048 |
| 35 | 2333.9 | 1426.2 | 0.72346 | 0.72345 | 0.72344 | 0.72341 | 0.72339 | 0.72336 | 0.72334 | 0.72331 | 0.72329 |
| 40 | 2411.1 | 1473.4 | 0.65786 | 0.65785 | 0.65785 | 0.65783 | 0.65781 | 0.65780 | 0.65778 | 0.65776 | 0.65775 |
| 45 | 2490.1 | 1521.7 | 0.60166 | 0.60166 | 0.60166 | 0.60165 | 0.60164 | 0.60163 | 0.60162 | 0.60161 | 0.60160 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 50 | 2570.9 | 1571.1 | 156.42 | 0.55314 | 0.55313 | 0.55313 | 0.55313 | 0.55312 | 0.55312 | 0.55311 | 0.55311 |
| 60 | 2737.9 | 1673.1 | 166.69 | 0.47400 | 0.47400 | 0.47400 | 0.47401 | 0.47401 | 0.47401 | 0.47402 | 0.47402 |
| 70 | 2911.8 | 1779.5 | 177.38 | 0.41272 | 0.41273 | 0.41274 | 0.41274 | 0.41275 | 0.41276 | 0.41277 | 0.41278 |
| 80 | 3092.8 | 1890.1 | 188.50 | 0.36433 | 0.36433 | 0.36434 | 0.36435 | 0.36436 | 0.36437 | 0.36439 | 0.36440 |
| 90 | 3280.7 | 2005.0 | 200.03 | 39.577 | 0.32547 | 0.32548 | 0.32549 | 0.32551 | 0.32552 | 0.32553 | 0.32554 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 100 | 3475.7 | 2124.2 | 211.98 | 42.002 | 20.748 | 0.29384 | 0.29385 | 0.29386 | 0.29388 | 0.29389 | 0.29390 |
| 125 | 3993.2 | 2440.5 | 243.69 | 48.411 | 23.998 | 11.785 | 0.23653 | 0.23655 | 0.23656 | 0.23658 | 0.23659 |
| 150 | 4553.6 | 2783.1 | 278.00 | 55.324 | 27.487 | 13.565 | 8.9212 | 6.5966 | 0.19914 | 0.19916 | 0.19917 |
| 175 | 5156.7 | 3151.7 | 314.90 | 62.742 | 31.221 | 15.458 | 10.202 | 7.5729 | 5.9941 | 4.9405 | 4.1868 |
| 200 | 5801.8 | 3546.1 | 354.37 | 70.667 | 35.203 | 17.470 | 11.558 | 8.6007 | 6.8258 | 5.6420 | 4.7959 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 225 | 6488.8 | 3966.0 | 396.39 | 79.096 | 39.433 | 19.601 | 12.990 | 9.6837 | 7.6996 | 6.3765 | 5.4311 |
| 250 | 7217.2 | 4411.1 | 440.93 | 88.025 | 43.911 | 21.853 | 14.501 | 10.824 | 8.6175 | 7.1465 | 6.0955 |
| 275 | 7986.4 | 4881.3 | 487.97 | 97.450 | 48.635 | 24.227 | 16.090 | 12.022 | 9.5809 | 7.9533 | 6.7907 |
| 300 | 8796.2 | 5376.3 | 537.48 | 107.37 | 53.603 | 26.720 | 17.759 | 13.279 | 10.590 | 8.7979 | 7.5175 |
| 325 | 9646.0 | 5895.7 | 589.44 | 117.77 | 58.813 | 29.334 | 19.507 | 14.594 | 11.646 | 9.6805 | 8.2766 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 350 | 10535 | 6439.3 | 643.81 | 128.66 | 64.263 | 32.066 | 21.334 | 15.967 | 12.748 | 10.601 | 9.0679 |
| 375 | 11464 | 7006.7 | 700.56 | 140.02 | 69.950 | 34.916 | 23.238 | 17.399 | 13.896 | 11.560 | 9.8915 |
| 400 | 12431 | 7597.7 | 759.68 | 151.85 | 75.872 | 37.883 | 25.220 | 18.888 | 15.089 | 12.556 | 10.747 |
| 425 | 13436 | 8212.0 | 821.12 | 164.15 | 82.025 | 40.964 | 27.277 | 20.434 | 16.328 | 13.591 | 11.635 |
| 450 | 14478 | 8849.3 | 884.85 | 176.90 | 88.407 | 44.160 | 29.411 | 22.036 | 17.612 | 14.662 | 12.555 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 475 | 15558 | 9509.3 | 950.86 | 190.11 | 95.015 | 47.468 | 31.619 | 23.695 | 18.940 | 15.770 | 13.506 |
| 500 | 16674 | 10192 | 1019.1 | 203.76 | 101.85 | 50.887 | 33.901 | 25.408 | 20.312 | 16.915 | 14.489 |
| 525 | 17827 | 10896 | 1089.5 | 217.86 | 108.90 | 54.417 | 36.256 | 27.176 | 21.728 | 18.096 | 15.502 |
| 550 | 19015 | 11622 | 1162.2 | 232.39 | 116.17 | 58.054 | 38.684 | 28.998 | 23.187 | 19.313 | 16.546 |
| 575 | 20239 | 12370 | 1237.0 | 247.35 | 123.65 | 61.799 | 41.182 | 30.874 | 24.689 | 20.565 | 17.620 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 600 | 21497 | 13139 | 1313.9 | 262.74 | 131.34 | 65.649 | 43.751 | 32.801 | 26.232 | 21.852 | 18.724 |
| 625 | 22789 | 13929 | 1392.9 | 278.54 | 139.25 | 69.604 | 46.389 | 34.781 | 27.817 | 23.174 | 19.857 |
| 650 | 24115 | 14740 | 1473.9 | 294.76 | 147.36 | 73.662 | 49.096 | 36.813 | 29.443 | 24.530 | 21.020 |
| 675 | 25475 | 15571 | 1557.0 | 311.38 | 155.67 | 77.821 | 51.870 | 38.895 | 31.109 | 25.919 | 22.212 |
| 700 | 26868 | 16422 | 1642.2 | 328.41 | 164.19 | 82.081 | 54.712 | 41.027 | 32.816 | 27.342 | 23.432 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 725 | 28293 | 17293 | 1729.3 | 345.84 | 172.91 | 86.441 | 57.619 | 43.208 | 34.562 | 28.797 | 24.680 |
| 750 | 29750 | 18184 | 1818.4 | 363.66 | 181.82 | 90.898 | 60.592 | 45.439 | 36.347 | 30.286 | 25.956 |
| 775 | 31240 | 19094 | 1909.4 | 381.86 | 190.92 | 95.453 | 63.629 | 47.718 | 38.171 | 31.806 | 27.260 |
| 800 | 32760 | 20023 | 2002.3 | 400.45 | 200.22 | 100.10 | 66.730 | 50.044 | 40.032 | 33.358 | 28.591 |

列中的水平横线表示由液相向气相的转换。

表A.5运动粘度*ν*[10-6m2s-1]（续）

（单相范围：0℃～800℃，0.0006112127MPa～20MPa）

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *θ* | *p*[MPa] | | | | | | | | | | |
| [°C] | 0.8 | 0.9 | 1.0 | 1.5 | 2.0 | 2.5 | 5.0 | 7.5 | 10.0 | 15.0 | 20.0 |
| 0 | 1.7898 | 1.7895 | 1.7892 | 1.7876 | 1.7861 | 1.7845 | 1.7769 | 1.7694 | 1.7621 | 1.7479 | 1.7344 |
| 5 | 1.5167 | 1.5165 | 1.5163 | 1.5152 | 1.5141 | 1.5130 | 1.5078 | 1.5026 | 1.4975 | 1.4877 | 1.4783 |
| 10 | 1.3052 | 1.3051 | 1.3049 | 1.3042 | 1.3034 | 1.3027 | 1.2989 | 1.2953 | 1.2918 | 1.2849 | 1.2783 |
| 15 | 1.1378 | 1.1377 | 1.1376 | 1.1371 | 1.1366 | 1.1360 | 1.1334 | 1.1308 | 1.1283 | 1.1234 | 1.1188 |
| 20 | 1.0029 | 1.0028 | 1.0027 | 1.0023 | 1.0020 | 1.0016 | 0.99971 | 0.99789 | 0.99610 | 0.99265 | 0.98934 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 25 | 0.89228 | 0.89223 | 0.89217 | 0.89190 | 0.89164 | 0.89137 | 0.89005 | 0.88877 | 0.88751 | 0.88508 | 0.88277 |
| 30 | 0.80044 | 0.80040 | 0.80036 | 0.80018 | 0.79999 | 0.79981 | 0.79889 | 0.79800 | 0.79713 | 0.79545 | 0.79386 |
| 35 | 0.72326 | 0.72324 | 0.72321 | 0.72308 | 0.72296 | 0.72283 | 0.72222 | 0.72162 | 0.72103 | 0.71992 | 0.71886 |
| 40 | 0.65773 | 0.65772 | 0.65770 | 0.65762 | 0.65754 | 0.65746 | 0.65707 | 0.65669 | 0.65632 | 0.65562 | 0.65497 |
| 45 | 0.60159 | 0.60158 | 0.60157 | 0.60153 | 0.60148 | 0.60143 | 0.60121 | 0.60100 | 0.60080 | 0.60042 | 0.60008 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 50 | 0.55311 | 0.55310 | 0.55310 | 0.55308 | 0.55306 | 0.55304 | 0.55295 | 0.55287 | 0.55279 | 0.55266 | 0.55256 |
| 60 | 0.47403 | 0.47403 | 0.47403 | 0.47405 | 0.47407 | 0.47408 | 0.47417 | 0.47427 | 0.47437 | 0.47458 | 0.47481 |
| 70 | 0.41278 | 0.41279 | 0.41280 | 0.41284 | 0.41288 | 0.41292 | 0.41312 | 0.41333 | 0.41353 | 0.41396 | 0.41439 |
| 80 | 0.36441 | 0.36442 | 0.36443 | 0.36448 | 0.36454 | 0.36459 | 0.36486 | 0.36514 | 0.36541 | 0.36597 | 0.36653 |
| 90 | 0.32556 | 0.32557 | 0.32558 | 0.32565 | 0.32571 | 0.32577 | 0.32609 | 0.32641 | 0.32672 | 0.32736 | 0.32800 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 100 | 0.29392 | 0.29393 | 0.29395 | 0.29401 | 0.29408 | 0.29415 | 0.29450 | 0.29484 | 0.29519 | 0.29588 | 0.29657 |
| 125 | 0.23661 | 0.23662 | 0.23664 | 0.23671 | 0.23679 | 0.23686 | 0.23724 | 0.23762 | 0.23799 | 0.23874 | 0.23949 |
| 150 | 0.19919 | 0.19920 | 0.19922 | 0.19930 | 0.19937 | 0.19945 | 0.19984 | 0.20022 | 0.20061 | 0.20137 | 0.20212 |
| 175 | 3.6206 | 0.17364 | 0.17366 | 0.17373 | 0.17381 | 0.17389 | 0.17428 | 0.17466 | 0.17505 | 0.17581 | 0.17656 |
| 200 | 4.1608 | 3.6664 | 3.2705 | 2.0777 | 0.15572 | 0.15580 | 0.15619 | 0.15658 | 0.15697 | 0.15773 | 0.15847 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 225 | 4.7217 | 4.1698 | 3.7280 | 2.4000 | 1.7324 | 1.3277 | 0.14303 | 0.14342 | 0.14382 | 0.14458 | 0.14534 |
| 250 | 5.3071 | 4.6937 | 4.2029 | 2.7288 | 1.9897 | 1.5444 | 0.13321 | 0.13362 | 0.13403 | 0.13482 | 0.13559 |
| 275 | 5.9186 | 5.2402 | 4.6973 | 3.0680 | 2.2520 | 1.7613 | 0.76838 | 0.12616 | 0.12659 | 0.12743 | 0.12824 |
| 300 | 6.5572 | 5.8102 | 5.2126 | 3.4191 | 2.5216 | 1.9824 | 0.89758 | 0.52465 | 0.12084 | 0.12177 | 0.12263 |
| 325 | 7.2236 | 6.4046 | 5.7493 | 3.7832 | 2.7997 | 2.2092 | 1.0244 | 0.62369 | 0.41590 | 0.11738 | 0.11837 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 350 | 7.9179 | 7.0235 | 6.3079 | 4.1610 | 3.0872 | 2.4427 | 1.1515 | 0.71794 | 0.49771 | 0.26300 | 0.11532 |
| 375 | 8.6403 | 7.6671 | 6.8885 | 4.5526 | 3.3846 | 2.6836 | 1.2804 | 0.81086 | 0.57434 | 0.33241 | 0.19900 |
| 400 | 9.3906 | 8.3354 | 7.4911 | 4.9584 | 3.6920 | 2.9321 | 1.4117 | 0.90391 | 0.64915 | 0.39206 | 0.26005 |
| 425 | 10.169 | 9.0283 | 8.1158 | 5.3785 | 4.0098 | 3.1885 | 1.5458 | 0.99790 | 0.72355 | 0.44830 | 0.30966 |
| 450 | 10.975 | 9.7457 | 8.7625 | 5.8127 | 4.3379 | 3.4530 | 1.6833 | 1.0933 | 0.79830 | 0.50314 | 0.35557 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 475 | 11.808 | 10.487 | 9.4309 | 6.2612 | 4.6764 | 3.7256 | 1.8241 | 1.1905 | 0.87384 | 0.55749 | 0.39982 |
| 500 | 12.669 | 11.253 | 10.121 | 6.7238 | 5.0253 | 4.0063 | 1.9685 | 1.2896 | 0.95046 | 0.61187 | 0.44335 |
| 525 | 13.556 | 12.043 | 10.832 | 7.2004 | 5.3846 | 4.2951 | 2.1166 | 1.3909 | 1.0284 | 0.66662 | 0.48666 |
| 550 | 14.470 | 12.856 | 11.565 | 7.6910 | 5.7541 | 4.5920 | 2.2684 | 1.4943 | 1.1077 | 0.72193 | 0.53005 |
| 575 | 15.411 | 13.693 | 12.319 | 8.1954 | 6.1339 | 4.8970 | 2.4239 | 1.6000 | 1.1885 | 0.77797 | 0.57372 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 600 | 16.378 | 14.553 | 13.093 | 8.7135 | 6.5238 | 5.2101 | 2.5831 | 1.7080 | 1.2710 | 0.83482 | 0.61780 |
| 625 | 17.370 | 15.436 | 13.888 | 9.2451 | 6.9238 | 5.5311 | 2.7461 | 1.8184 | 1.3550 | 0.89258 | 0.66240 |
| 650 | 18.388 | 16.341 | 14.703 | 9.7902 | 7.3338 | 5.8600 | 2.9129 | 1.9312 | 1.4407 | 0.95129 | 0.70758 |
| 675 | 19.431 | 17.269 | 15.539 | 10.349 | 7.7536 | 6.1967 | 3.0834 | 2.0463 | 1.5282 | 1.0110 | 0.75340 |
| 700 | 20.499 | 18.219 | 16.394 | 10.920 | 8.1833 | 6.5412 | 3.2577 | 2.1638 | 1.6173 | 1.0717 | 0.79990 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 725 | 21.592 | 19.190 | 17.269 | 11.505 | 8.6226 | 6.8934 | 3.4357 | 2.2837 | 1.7081 | 1.1335 | 0.84710 |
| 750 | 22.709 | 20.184 | 18.163 | 12.102 | 9.0715 | 7.2533 | 3.6174 | 2.4060 | 1.8007 | 1.1963 | 0.89504 |
| 775 | 23.850 | 21.198 | 19.077 | 12.712 | 9.5299 | 7.6207 | 3.8027 | 2.5306 | 1.8950 | 1.2602 | 0.94372 |
| 800 | 25.015 | 22.234 | 20.009 | 13.335 | 9.9977 | 7.9956 | 3.9917 | 2.6576 | 1.9910 | 1.3252 | 0.99317 |

列中的水平横线表示由液相向气相的转换。

**附录B**

**不确定度评估示例**

B.1 数学模型和不确定度合成公式

B.1.1蒸汽热功率数学模型：

 （B-1）

B.1.2不确定合成公式：

 （B-2）

B.2 常用蒸汽热功率测量不确定度评定

B.2.1用差压式流量计测量蒸汽热能

被测对象：以蒸汽计量常用DN100的标准孔板为例，系数检定法准确度等级：0.5级；配套的压力变送器，测量范围：（0~1.6）MPa，0.2级；热电阻，Pt100，**B**级；热能积算仪，0.2级。蒸汽工况压力：0.8MPa，工况温度：200℃，常用流量：50%*q*max。

B.2.1.1数学模型

 （B-3）

蒸汽热能的相对不确定度等于各个时间段内蒸汽热能的不确定度。各个时间段的不确定度可由质量流量和比焓的不确定度方差合成得到。



（B-4）

因*d*和*D*是根据计算书给出，直接使用得到β，然后标定出流出系数*C*，*C*中已经包含了*d*和*D*的不确定度，不再评定。

 （B-5）

B.2.1.2各输入量的标准不确定度评定

（1）输入量*C*的标准不确定度的评定

根据校准证书信息，若差压式流量传感器流出系数的准确度等级为0.5级，按照正态分布考虑，包含因子为2，其相对标准不确定度为：



（2）输入量的标准不确定度的评定

根据GB/T2624进行评定。标准孔板根据GB/T2624.2中给出的可膨胀系数计算公式：

， （B-6）

其中=1.3，一般最大差压值40kPa，其相对标准不确定度为：



（3）输入量的标准不确定度的评定

密度计算依据IAPWS-IF97公式。根据文献得到使用IAPWS-IF97计算密度引入的相对标准不确定度为不超过0.05%。密度和焓值均需要使用温度测量和压力测量，由热能计算机采集相关信号计算得到的。

蒸汽温度测量常使用Pt100热电阻，要求其最大允许误差±0.3%，以蒸汽温度200℃为例，考虑其为均匀分布，其引入的相对标准不确定度为：



蒸汽压力测量使用压力变送器，要求其最大允许误差±0.2%FS，蒸汽工况压力0.8MPa，考虑其为均匀分布，其引入的相对标准不确定度为：



热能计算机最大允许误差±0.2%，考虑其为均匀分布，其引入的相对标准不确定度为：



（4）输入量的标准不确定度的评定

根据校准证书信息，蒸汽常用差压变送器的准确度等级为0.075级，其最大允许误差：±0.075%FS，常用流量是最大流量的50%，对应差压值是最大差压的25%，按照均匀分布考虑，其相对标准不确定度为：



（5）输入量的标准不确定度的评定

按照GB34060给出的蒸汽比焓计算方法引入的相对标准不确定度：0MPa＜*P*＜10MPa：0.15%；10MPa＜*P*＜16.53MPa：0.25%。焓值需要使用温度测量和压力测量，由热能计算机采集相关信号计算得到的，由三者引入不确定度已经在前面计算。

B.2.1.3 计算合成标准不确定度





=0.33%

B.2.1.4 计算扩展不确定度



B.2.2用频率输出型涡街流量计测量蒸汽热能（热功率）

以蒸汽计量常用DN100的涡街流量计为例，其体积流量测量范围：（140~1400）m3/h，检定仪表系数：1200 1/m3，0.5级；配套的压力变送器，测量范围：（0~1.6）MPa，0.2级；热电阻，Pt100，**B**级；热能积算仪，0.2级。蒸汽工况压力：0.8MPa，工况温度：200℃，涡街频率：200Hz。

B.2.2.1数学模型

 （B-7）

蒸汽热能的相对不确定度等于各个时间段内的蒸汽热能的不确定度。各个时间段的不确定度可由质量流量和比焓的不确定度方差合成得到。

 （B-8）

B.2.2.2各输入量的标准不确定度评定

（1）输入量*f*的标准不确定度的评定

输入量*f*由流量计算机流量通道采集，其体积流量计算和密度计算总的最大允许误差±0.2%，考虑其为均匀分布，其引入的相对标准不确定度为：



（2）输入量*K*的标准不确定度的评定

根据校准证书信息，涡街流量传感器*K*系数的准确度等级为0.5级，按照正态分布考虑，其包含因子为2，其相对标准不确定度为：



（3）输入量的标准不确定度的评定

密度计算依据IAPWS-IF97公式。根据文献得到使用IAPWS-IF97计算密度引入的相对标准不确定度为不超过0.05%。密度和焓值均需要使用温度测量和压力测量，由热能计算机采集相关信号计算得到的。

蒸汽温度测量使用Pt100热电阻，要求其最大允许误差±0.3%，蒸汽工况温度为200℃，考虑其为均匀分布，其引入的相对标准不确定度为：



蒸汽压力测量使用压力变送器，要求其最大允许误差±0.2%FS，蒸汽工况压力0.8MPa，考虑其为均匀分布，其引入的相对标准不确定度为：



热能计算机最大允许误差±0.2%，考虑其为均匀分布，其引入的相对标准不确定度为：



（4）输入量的标准不确定度的评定

按照GB34060给出的蒸汽比焓计算方法引入的相对标准不确定度：0MPa＜*P*＜10MPa：0.15%；10MPa＜*P*＜16.53MPa：0.25%。

B.2.2.3 计算合成标准不确定度





= 0.41%

B.2.2.4 计算扩展不确定度

