

涡街流量计
Vortex Flowmeter

产品选型使用手册 Product Brochure



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公司简介 Company profile

公司创立于2000年，坐落于滨海名城-山东威海，是国内早期生产涡街流量计的厂家，公司集测控系统及产品研发、仪器仪表生产制造、销售和服务于一体的创新科技型企业，公司始终将产品质量放在第一位，以创新与采用国际先进技术相结合的发展宗旨；“打造优质产品，诚信经营，互利共赢”。已拥有十多项实用新型专利和发明专利，使产品在技术上始终走在世界前沿。公司与德国E+H公司同步研发生产的第二代差动电容式涡街流量计为世界首创，曾列为国家级火炬计划项目，获国家科委400万元的科技资金支持。今天，成功推出中国第三代《隔离更换抗震型感应式涡街流量计-LUGG》是一款世界先进的涡街流量计，其性能优于国外同类产品。并获得中国（国际）传感器创新大赛二等奖。

公司生产的各类涡街流量计、热式气体质量流量计、电磁流量计、气体涡轮流量计、旋进旋涡流量计、差压节流装置等流量计广泛应用于航天、石油、化工、供热、发电、造纸、食品等领域。



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第一部分 PART I PRODUCT OVERVIEW

1. 工作原理及特点 Working principle and characteristics

LUB 感应涡街流量计是一种利用卡门涡街原理工作的体积式流量计。在流量计壳体中内置一个三角柱发生体，当流体流经发生体时，发生体后方区域两侧形成低压区，在发生体两侧交替产生有规则的旋涡，这种旋涡称为卡门旋涡。如图 1.1 所示，涡街在发生体下游呈不对称排列。涡街流量计的流速和体积流量与旋涡频率成正比。其特点主要用于工业管道介质流体的流量测量，如气体、蒸气等多种介质小，量程范围大，精度高，在测量工况体积流量时几乎不受流体密度、压力、温度、粘度等参数的影响。无可动机械零件，因此可靠性高，维护量小。仪表参数能长期稳定。

LUB induction vortex flowmeter is a volumetric flowmeter which works on Karman vortex shedding principle. In the flowmeter, a triangular column-shaped bluff body is placed in the fluid. When the fluid flows by it, low-pressure zones are forming behind the bluff body, regular vortices are generating alternately from both sides of the bluff body. This kind of vortex is called Karman vortex. A vortex street is asymmetrically arranged downstream of the bluff body as shown in Figure 1.1. The flow velocity and volumetric flow rate are proportional to the vortex frequency. Its characteristics are mainly used for the flow measurement of industrial pipeline medium fluids, such as gas. The vapor and other media are small, the range is large, the accuracy is high, and the volume flow in the measurement condition is almost not affected by the fluid density, pressure, temperature, viscosity and other parameters. There are no moving mechanical parts, so the reliability is high and the maintenance is small. The instrument parameters can be stable for a long time.

设：旋涡频率为 f ，流体平均流速为 V ，柱体面宽度为 d ，表体内径为 D ，则可得关系式。

Suppose: vortex frequency is f , average flow velocity of the fluid is V , width of the bluff body is d , and flowmeter internal diameter is D , thus, the relational equation can be obtained.

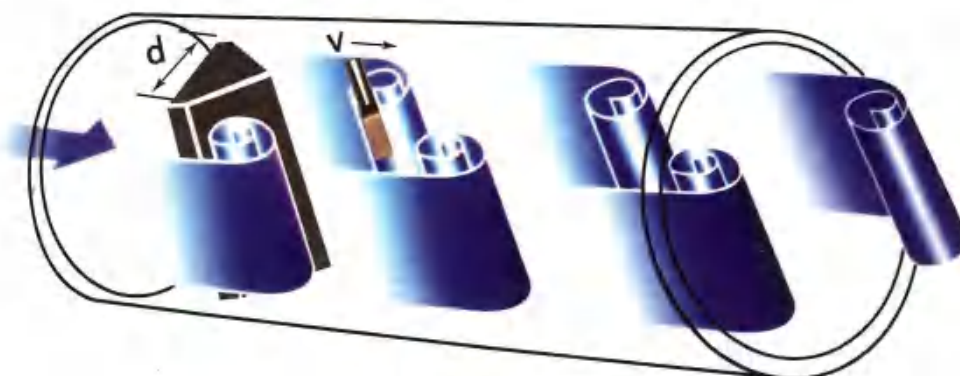
$$f = St * V / [(1 - 1.25 * d/D) * d]$$

式中 Where:

f	卡门漩涡频率 Karman vortex frequency
V	流体平均流速 Flow velocity of the fluid
d	柱体面宽度 Width of the bluff body (or called shedder bar)
D	表体内径 Flowmeter inner diameter
St	斯特罗哈尔数 Strouhal number

Figure 1.1 卡门涡街流量计工作原理示意图

Schematic diagram of the working principle of a Karman vortex flowmeter



2. 技术指标 Specifications

流量计口径 Normal diameter	标准：满管型 DN15~DN400 Standard: Full pip type 插入型 DN200~DN1500 Insertion type DN200~DN1500	小口径 DN6~DN12（协议订货） Small size DN6—DN12 (upon order)
	过程流体 Process fluids 液体、气体、蒸汽（单相介质或可以认为是单相的介质） Liquids, Gas and Steam. Fluids must be homogeneous single-phase 饱和蒸汽在干度>85%，可以认为是单相介质 Saturated steam can be regarded as single-phase fluid when its dryness is greater than 85%	
过程温度	标准范围：-40~+250℃~350℃	扩展范围（协议订货）

Process temperature	Standard: -40~+250℃~350℃	Extended: >+350℃~500℃
压力等级 Pressure rating	标准压力等级≤2.5MPa~4.0Mpa Standard: ≤2.5MPa~4.0Mpa	扩展压力等级（协议订货） Extended: >4.0MPa~45MPa
精度 Accuracy	液 Liquid: ±0.5% ±1.0% ±1.5%	±1.5%
	气 Gas: ±0.5% ±1.0% ±1.5%	±2.5%
量程比 Turndown	标准量程比 Standard: 8:1~20:1	扩展量程比（协议订货） Extended: ≥30:1
雷诺数 Reynolds number	标准范围 Standard: 2x10 ⁴ ~7x10 ⁶	扩展范围 Extended: 1x10 ⁴ ~7x10 ⁶
流速 Flow velocity	液体流速范围 Liquid: 0.21~7m/s	
	气体、蒸汽流速范围 2~60m/s Gas/steam standard velocity range : 2~60m/s	扩展气体流速范围 <2m/s Extended : <2m/s
阻力系数 Resistance factor	满管型 Full pipe type: Cd ≤2.4	
允许振动加速度 Permitted max. vibration acceleration	气体 Gas<0.2g 液体 Liquid<0.5g	
直管段 Straight pipe length	前直管段 Upstream straight pipe length ≥ 20D	
	后直管段 Downstream straight pipe length ≥ 5D	
压力损失 Pressure loss	$\Delta P=1.29 * \rho * V^2$ (单位 Unit: Pa) ρ : 介质密度(kg/m ³), V: 介质流速(m/s) ρ : density (kg/m ³), V: velocity(m/s)	
液体最低压力 Minimum upstream pressure (liquids)	Pmin≥2.7*ΔP+1.3*P0, 其中 P0 液体气化压力(Pa) P0: liquid vapor pressure at operating conditions (Pa)	
防护等级 Protection rating	普通型: IP65 Standard: IP65	潜水型: IP68 Extended: IP68
防爆标志 Ex mark	本安防爆标志 Intrinsically safe type: Ex ia IIC T1~T4 Ga	

环境条件 Ambient conditions	环境温度 Ambient temperature	非防爆场所 -40~+55℃ non-explosion-protected areas	
		防爆场所 -20~+55℃ explosion-protected areas	
	相对湿度 Relative humidity	无冷凝 5%~90% non-condensing	
	大气压 Atmospheric pressure	86~106kPa	
供电电源 Power supply	脉冲: 12VDC~+24VDC Pulse: 12VDC~+24VDC	电流: +24VDC 4-20mA Current:+24VDC 4-20mA	电池: 3.6V Battery: 3.6V
功耗 Power	<1w		
输出信号 Output signals	频率/脉冲输出: 2~3000Hz, 低电平 ≤1V, 高电平 ≥5V Frequency/pulse output: 2~3,000Hz low level ≤1V high level ≥5V		
	两线制, 4-20mA 输出 防爆型负载 ≤300Ω For explosion-protected type, load resistance ≤300Ω 非防爆型负载 ≤500Ω For non-exploration-protected type, load resistance ≤500Ω	2 wires, 4~20mA output:	
显示 Display	瞬时流量、累积流量、流量单位、流量百分比等 Flowrate, volume flow, flow unit, flow percentage, etc.		
通讯协议 Communication protocol	HART、Modbus RTU (RS485), 无线远传 Wireless remote transmission		
电气接口 Conduit	M20*1.5 内螺纹	M20*1.5 (F)	
	1/2" -14 NPT 内螺纹	1/2" -14 NPT (F)	
表体及发生 体材质 Body & bluff body	默认 304 不锈钢 (其它材质协议订货) Standard: 304 SS		

第二部分 仪表口径选型 PART II METER LINE SIZING

1. 流量计选型 Flowmeter Sizing

为确保高性能流量测量，涡街流量计的口径选型必须正确，以便使通过流量计的流速范围位于可测量的速度范围（具有可接受的压损）和线性范围内。

To ensure high performance flow measurement, vortex flow meters must be correctly sized so that the flow velocity range through the meter lies within the measurable velocity range (with acceptable pressure drop) and the linear range.

口径计算用于选择合适的流量计口径。这些计算包括压力损失、精度、最小和最大流量。

Sizing calculations are used to select a proper flowmeter size. These calculations include pressure loss, accuracy, minimum and maximum flow rates.

1.1、流量计口径选择的重要提示 Important Tips of Choosing A Meter Size

注意：在选择合适的流量计口径时应注意以下两点：

Notice: The following two points should be noticed when sizing a proper flowmeter:

- 尽量不要考虑流量计在下限流量下运行。因此，仪表口径应尽可能小，以获得更高的流速和更大的流量范围；

Do not consider a flowmeter to operate at the lower flow limit as much as possible. Thus, meter sizing should be as small as possible to obtain a higher flow velocity and larger flow range;

- 流量计应在工作压力和温度的技术参数范围内运行。

The flowmeter should be operating at technical ranges of operating pressure and temperature.

1.2、体积流量转换计算 1.2 Volume Flow Conversion Calculations

公式如下 Equation:

$$Q_n = \frac{0.101325+p}{0.101325} * \frac{273.15+20}{237.15+t} * Q_{\text{工况}}$$

P:表压 (kpa)

t:被测介质的摄氏温度 (°C)

Q 工况: 实际工作状态下的流量, 单位: m³/h

Qn Standard:temperature 20°C、1atm (101.325kpa) flow, unit: Nm³/h

P:gauge pressure (kpa)

T: The Celsius temperature of the measured medium (°C)

Q Working condition:Flow rate in actual working state, unit: m³/h

1.3、流量范围计算 Flow Range Calculations

注意: 在开始计算流量范围 (或速度范围) 时, 流量极限值不应考虑包含在内, 以确保仪表精度和可靠运行。

Notice: When start calculating flow range (or velocity range), flowrate limits should not be inclusive in order to ensure meter accuracy and reliable operation.

公式如下 Equation:

$$Q = 0.25 * \pi * D^2 * V * 3600$$

$$Q = 3600 * f / K$$

Q	流量 (m ³ /h) Volume flowrate (m ³ /h)
D	流量计口径 (mm) Meter internal diameter(mm)
V	流速 (m/s) Velocity (m/s)
f	频率 (Hz) Frequency (Hz)
K	仪表常数, 脉冲数 (1/m ³) Meter factor, number of pulses (1/m ³)

表 1.3.1 液体 气体流量范围参考表，单位 (m³/h)
Table 1.3.1 Reference table for liquid and gas flow range

特殊要求协议订货

注一：关于表 1.3.1 气体流量范围表，订货中未注明扩展流量范围的将按标准流量范围供货。缩颈根据用户流量由生产厂家设计。

说明：表中气体是指常压状态下，即参比条件下

($t=20^{\circ}\text{C}$, $P_0=0.1\text{MPa}$, $\rho=1.205\text{kg/m}^3$)

Note 1: Regarding the liquid flow range in Table 1.3.1, if the extended flow range is not specified in the order, it will be regarded according to the standard flow range.

Necking is designed by the manufacturer according to the user flow. Note that the liquid in the table refers to the normal temperature water $t_0=20^{\circ}\text{C}$, $\rho_0=1,000\text{kg/m}^3$.

表 1.3.1 工况流量范围参考表 单位(m³/h)

公称直径 (mm) Meter size	液体 fluid		公称直径 (mm) Meter size	气体 gas	
	标准流量范围 Std.flow range	扩展流量范围 Exd.flow range		标准流量范围 Std.flow range	扩展流量范围 Exd.flow range
15	0.2-5	0.1-5	15	4-16	3-20
20	0.35-10	0.2-10	20	5-30	4-40
25	0.55-12	0.3-12	25	8-80	5-90
32	0.9-18	0.5-18	32	10-150	6-200
40	1.5-25	0.9-25	40	14-280	9-310
50	2.5-40	1.5-40	50	20-400	14-490
65	3.5-70	2.5-70	65	35-720	24-840
80	5.5-130	3.5-130	80	55-1100	36-1440
100	8.5-160	5.5-160	100	80-1600	60-2440
125	15-250	8.5-250	125	130-2600	90-3600
150	20-400	12.5-400	150	190-3800	130-5200
200	34-700	22-700	200	330-6600	220-7700
250	53-1200	35-1200	250	530-10600	350-12400
300	76-1800	50-1800	300	760-15200	500-17800
350	104-3100	69-3100	350	1035-21000	690-24000
400	135-3500	90-3500	400	1350-27000	900-31000

表 1.3.2 插入型涡街流量计流量范围参考表 单位 (m³/h)
 Table 1.3.2 Reference Table of Insertion Type flowmeters Unit in m³/h

流量计口径 Meter size(DN)	液体 Liquid		气体 Gas		蒸汽 Steam	
	标准流量范围 Std. flow range	扩展流量范围 Exd. flow range	标准流量范围 Std. flow range	扩展流量范围 Exd. flow range	标准流量范围 Std. flow range	扩展流量范围 Exd. flow range
200	60-1050	27-810	400-1200	320-8000	400-4200	320-8400
250	100-1550	52-1800	618-6300	550-11000	618-6300	550-11000
300	150-2100	88-2500	1000-1060	800-18000	1000-1060	800-18000
350	200-3100	121-3630	1500-15000	1100-26000	1500-15000	1100-26000
400	350-3500	160-4800	1800-11800	1500-34000	1800-18200	1500-34000
450	420-4200	200-6000	2100-21100	2000-40000	2100-21100	2000-40000
500	500-5200	247-7500	2500-25200	2400-18000	2500-25200	2400-48000
600	700-7200	360-10800	3560-35600	2500-59000	3560-35600	2500-59000
700	830-8400	485-14600	4850-48500	3460-69000	4850-48500	3460-69000
800	100-20000	640-19200	6300-63000	4500-91000	630-63800	4500-91000
900	1370-138000	810-24300	8020-80300	5720-114000	8020-80300	5720-114000
1000	1700-170000	990-29000	9900-99000	7060-141200	9800-99000	7060-141200
1200	2500-250000	1400-410000	14200-1420000	10180-2410000	14200-1420000	10180-2410000
DN1500	3800-380000	2300-690000	22200-1250000	15900-3750000	22200-1250000	15900-3750000

注二: 如订单中未注明扩展流量范围, 则按标准流量范围供货。精度 $\leq \pm 2.5\%$ 。

Note 2: If the extended flow range is not specified in the order, it will be supplied according to the standard flow range. products. Accuracy $\leq \pm 2.5\%$.

1.4 饱和蒸汽和过热蒸汽的流量范围计算与选择

Flow Range Calculations and Selections for Saturated & Superheated Steam

$Q_s = 1.5 * Q * \rho * 10^{-3} * \sqrt{\rho_0 / \rho}$	
ρ	蒸汽密度 Steam density
ρ_0	空气密度 Reference air density: 1.205kg/m ³

计算步骤如下 The calculation steps are in the followings:

- 由表 1.3.1 和 1.3.2 查出对应口径空气流量范围

Refer to Table 1.3.1 and Table 1.3.2, check out the air flow range of the corresponding meter size;

- 查有关资料得到蒸汽密度

Check relevant information to get the steam density;

- 由上述公式计算下限和上限流量范围

Calculate the lower and upper limits of the flow range using the above-mentioned equation.

例如 For example:

计算 DN100 口径流量计过热蒸汽 0.8MPa，温度 300℃ 的流量范围

Calculate DN100 superheated steam flow range at 0.8MPa and 300℃.

- 由表 1.3.1 查出 DN100 流量范围，100-1600m³/h

The DN100 flow range is 100~1600m³/h found in Table 1.3.1;

- 由过热蒸汽密度表（附表二）查出 0.8MPa，温度 300℃ 时的密度 $\rho = 3.0239\text{kg/m}^3$

$\rho = 3.0239\text{kg/m}^3$, refer to the superheated steam density table (see Schedule 2), check out ρ is 3.0239kg/m³ at 0.8MPa and 300℃;

- Q_{\min} 和 Q_{\max} 计算如下 Q_{\min} and Q_{\max} calculations are as follows:

$$Q_{\min} = 1.5 * 100 * 3.0239 * 10^{-3} * \sqrt{1.205 / 3.0239} = 0.286(\text{t/h})$$

$$Q_{\max} = 1.5 * 1600 * 3.0239 * 10^{-3} * \sqrt{1.205 / 3.0239} = 4.5816(\text{t/h})$$

1.5 雷诺数计算 Reynolds Number Calculations

流量计的线性范围由雷诺数确定。雷诺数是流动流体中惯性力与粘性力之比。它有助于预测不同流体流动情况下的流动模式。定义如下：

The linear range is defined by the Reynolds number. The Reynolds number is the ratio of the inertial forces to the viscous forces in a flowing fluid. It helps predict flow patterns in different fluid flow situations. It is defined as follows:

$$Re = D \cdot u / \nu = \rho \cdot u \cdot D / \mu$$

式中 Where:

u	管道内过程流体平均流速 (m/s) Average flow velocity of the fluid (m/s)
D	流量计口径 (mm) Meter internal diameter(mm)
ν	过程流体动力粘度 (m ² /s) Kinematic viscosity of the fluid (m ² /s)
ρ	过程流体密度 (kg/m ³) Density of the fluid (kg/m ³)
μ	过程流体运动粘度 [Pa·s 或 N·s/m ² 或 kg/(m·s)] Dynamic viscosity of the fluid [Pa·s or N·s/m ² or kg/(m·s)]
雷诺数应在 2x10 ⁴ ~7x10 ⁶ 范围内。 Reynolds number should be within the range of 2x10 ⁴ ~ 7x10 ⁶ .	

1.6 压力损失计算 Pressure Loss Calculations

$$\Delta P = C_d \cdot \rho \cdot V^2 / (2 \cdot g) = 1.29 \cdot \rho \cdot V^2$$

式中 Where:

ΔP	压力损失(1kPa=102.156mmH ₂ O) Pressure loss (Pa) (1kPa=102.156mmH ₂ O)
ρ	过程流体密度 (kg/m ³) Density of the fluid (kg/m ³)
C_d	阻力系数 (≤2.4) Resistance factor (≤2.4)
V	管道内过程流体平均流速 (m/s) Average flow velocity of the fluid (m/s)

1.7 液体最低压力计算 Minimum Back Pressure Calculations for Liquid

在流体测量期间，当管线压力低且流速高时会发生气蚀，从液体中释放蒸汽，从而妨碍流量测量的正确性。通过保持流量计合适的流量范围并遵循恰当的系统设计，可以避免这种流量测量情况。对于某些液体应用，应考虑使用背压阀。可以按照以下公式计算液体最低管线压力：

Cavitation occurs when the flow line pressure is low and flow velocity is high during fluid measurement. It releases vapor from a liquid, preventing correct measurement of flowrate. This flow situation can be avoided by remaining the proper flow range of a meter and by following up an appropriate system design. For some liquid applications, incorporation of a back pressure valve should take a consideration. The minimum line pressure can be obtained from the following equation.

$$P_{\min} \geq 2.7 * \Delta P + 1.3 * P_v$$

式中 Where:

P_{\min}	最低管线压力（MPa 绝压） The minimum line pressure (MPa absolute)
ΔP	压力损失（MPa 绝压） Pressure loss across the flowmeter (MPa absolute)
P_v	该液体过程温度对应的饱和蒸汽压力（MPa 绝压） Saturation liquid vapor pressure at operating temperature (MPa absolute)

1.8 高温仪表常数修正 High Temperature Meter Factor Corrections

当过程温度大于 150℃时，传感器的仪表系数 K 必须进行温度校正。温度修正为：

When the process temperature is greater than 150℃, the meter factor **K** of the sensor must be temperature-corrected. The compensated factor is calculated by the following equation:

$$K_t = K_{20} * [1 - 5.1 * 10^{-5} * (t - 20)]$$

式中 Where:

K_t	The compensated meter factor of the sensor when it operates at the operating temperature (1/m ³)
K_{20}	The reference meter factor of the sensor when it leaves the factory (1/m ³)
t	Process temperature (°C)

1.9 管道内径与流量计通径不等时的补偿计算

Compensation and Correction of Diameter Deviation

对于允许管道公差（DN25~DN100≤3%，DN150 及以上≤1%）造成的偏差，可以通过对流量系数 K 进行补偿和修正，而不会影响测量精度。

当流量计的通径大于管道的内径时， K_N 将按下式计算。

For the deviation caused by the allowable pipe tolerance (DN25~DN100≤3%, DN150 and above ≤1%), the flow factor **K** needs to be compensated and corrected. It won't effect measurement accuracy.

When the internal diameter of the flowmeter is greater than that of the pipeline, K_N will be calculated by the following equation.

$\Delta D\% = (D_2 - D_1) / D_1 * 100\%$
$F_D = (D_2 / D_1)^2$
$K_N = F_D * K_O$

式中 Where:

$\Delta D\%$	百分数表示直径之差 Percentage change expresses the internal diameter deviation
D_1	管道内径 internal diameter of the pipeline
D_2	流量计通径 internal diameter of the flowmeter
F_D	修正系数 Correction coefficient
K	流量系数 Flow factor, K_N is the new flow factor, K_O is the existing flow factor

1.9.1 温压一体流量计 Temperature and pressure integrated flowmeter

温压一体流量计对气体、蒸汽各种介质进行温度压力补偿，得出标况气体体积流量或蒸汽质量流量。

The temperature and pressure integrated flowmeter compensates the temperature and pressure of various media of gas and steam, and obtains the gas volume flow rate or steam mass flow rate of the standard condition.

2. 仪表类型和尺寸图 Meter Type and Dimensional Drawings

一体式安装流量计作为标准仪表供货，而分体式安装流量计作为选配项供货；一体式安装流量计可分为法兰式、对夹式、异径式和插入式等。

Integral mount flowmeters are available in supplying as standard meters, while remote mount flowmeters are only defined as options; The integral mount flowmeters have been divided into flange, wafer, reducer, and insertion type.

2.1 对夹式流量计安装尺寸图 Installation Dimensional Drawings for Wafer Flowmeters



流量计口径 Meter size	长度 Length	外圆直径 Outer Diameter	常温流量计总高 Height of normal temperature meter		高温流量计总高 Height of high temperature meter
			C1	C2	CH
15	68	54	405	460	460
20	68	54	405	460	460
25	68	54	405	460	460
32	78	68	405	460	460
40	80	78	410	470	470
50	82	86	410	470	470
65	84	104	430	490	490
80	84	118	440	500	500
100	90	138	460	520	520
125	90	168	490	550	550
150	100	194	520	580	580
200	100	248	570	630	630
250	115	298	630	690	690
300	130	348	680	740	740

2.2 法兰式流量计安装尺寸图

Installation Dimensional Drawings for Flanged Flowmeters



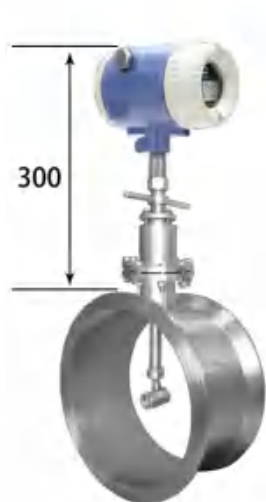
流量计口径 Meter size	长度 Length	螺栓孔中心距 Bolt hole center distance	常温流量计总高 Height of Normal temperature meter	高温流量计总高 Height of high temperature meter	螺栓规格 Bolt	螺栓数量 Bolt Number
DN	A	B	C1	C2	D	N
15	140	65	400	460	M12	4
20	140	75	400	460	M12	4
25	160	85	410	470	M12	4
32	160	100	430	490	M16	4
40	160	110	440	500	M16	4
50	180	125	450	510	M16	4
65	180	145	470	530	M16	4
80	180	160	490	550	M16	4
100	180	180	500	560	M16	8
125	180	210	540	600	M16	8
150	180	240	560	620	M20	8
200	220	295	630	690	M20	12
250	220	355	680	740	M24	12
300	220	410	730	790	M24	12

注意： 法兰尺寸标准按照 HG/T20592-2009 ； 其他标准协议订货

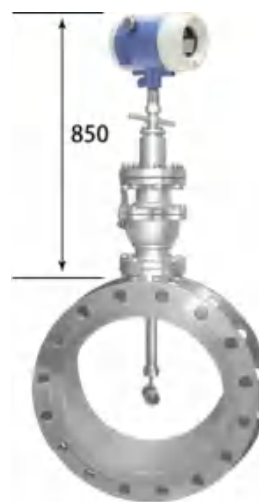
Note: Flanges conform to the China's national standards of HG/T20592-2009

2.3 插入式流量计安装尺寸图

Installation Dimensional Drawings for Insertion Type Flowmeters



简易插入式涡街流量计
Simple Insertion Vortex Flowmeter



球阀插入式涡街流量计
Valve-controlled Insertion Vortex
Flowmeter

3. 涡街流量计安装 Installation

3.1 位置安装注意事项 Installation Precautions for Location

- 1、避免在震动和强磁场附近安装流量计；
- 2、尽量避开强电设备和高频设备，避免与这些设备共用电源；
- 3、避开温度变化大的场所，避免将流量计安装在腐蚀性或极度潮湿的环境中；
- 4、流量计安装在室外时，应避免日晒雨淋。应增设防护罩；
- 5、选择流量计周围有足够空间的位置，以便进行例行检查和调试，并确保易于接线；

Avoid installing a flowmeter near a strong magnetic field;

- Avoid strong electrical equipment and high-frequency equipment as much as possible, and avoid sharing power with these equipment;
- Avoid a location which has wide temperature variations, and avoid installing the flowmeter in a corrosive or extremely humid atmosphere;
- Avoid sun-shining and raining when the flowmeter is installed outdoors. A protective shelter should be added;

- Choose a location where it has sufficient space around the flowmeter to allow routine inspections and ensure easy wiring and piping;

3.2 流量计安装注意事项 Installation Precautions for Piping flowmeter

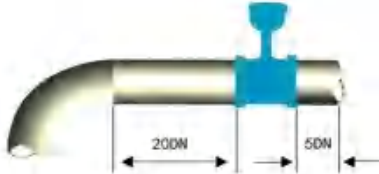
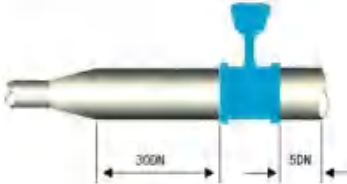
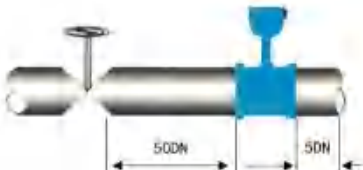
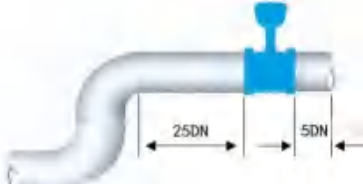
- 1、流量计应水平或垂直安装在管道上；垂直安装时，液体的流动方向应为自下而上；
- 2、流量计的上游直管长度和下游直管长度应符合表 3.1 的要求；
- 3、不要在流量计上游放置调节阀；
- 4、当上游直管长度达不到表 3.1 要求时，建议在流量计上游加装流体整流器；
- 5、当管道需要缩径时，直管长度和梯度管长度应满足表 3.1 的要求；
- 6、压力和温度正确后，将测压口和温度口放置在图 3.1 所示位置；
- 7、选择一个可以最大限度减少机械振动或冲击冲击的位置。禁止将流量计安装在有强烈振动的管道上。如果流量计受到振动，建议提供管道支架和紧固；
- 8、流量计安装在高温管道上时，必须加保温层，防止热辐射；
- 9、流量计必须可靠接地，接地电阻应小于 10 欧姆。

- The flowmeter should be installed horizontally or vertically on the pipeline; for vertical installation, the flow direction of the fluid should be from bottom to top;
- The upstream straight pipe length & downstream straight pipe length of the flowmeter should meet the requirements of Table 3.1;
- Do not place a regulating valve on the upstream of the flowmeter;
- It is recommended that a fluid rectifier be placed on the upstream of the flowmeter when the upstream straight pipe length fails to meet the requirements of Table 3.1;
- Straight pipe length and gradient pipe length should meet the requirements of Table 3.1 when a pipe needs to be reduced in diameter;
- When correct pressure and temperature, place the pressure tap and temperature tap in positions as shown in Figure 3.1;

- Select a location where it is subject to minimize mechanical vibration or impact shock. The flowmeter is forbidden to install on the pipeline with strong vibration. If the flowmeter is subject to vibrations, it is recommended that pipeline supports be provided;
- An insulation layer must be added when the flowmeter is installed on a high-temperature pipeline to prevent heat radiation;
- The flowmeter must be grounded reliably, and the grounding resistance should be less than 10 ohms.

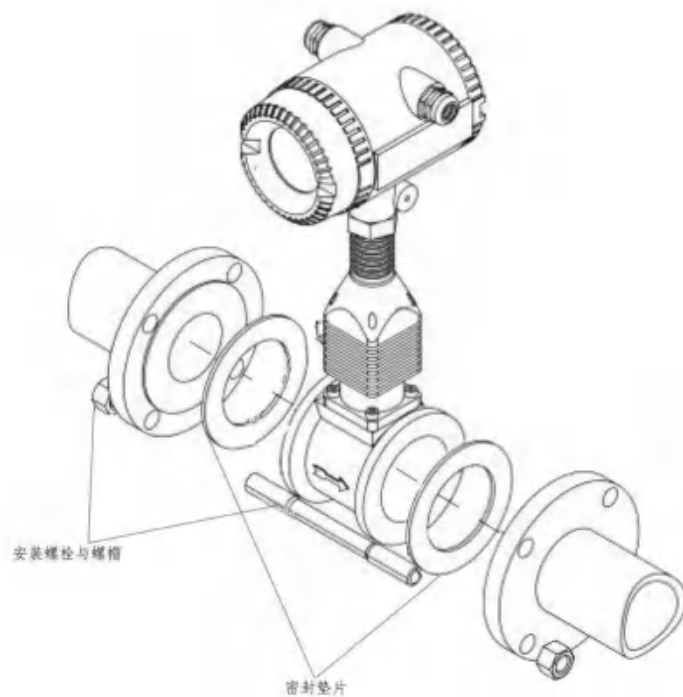
表 3.1 直管段长度推荐 单位 (mm)Table

3.1 Straight pipe length and recommendations Unit in mm

<p>一个 90 度弯头 One 90° elbows before meter</p>	
<p>同心扩管 Expander before meter</p>	
<p>同心收缩全开阀门 Reducer before meter</p>	
<p>同一平面两个 90 度弯头 Two 90° elbows before meter in one plane</p>	

3.2 仪表安装图 Instrument installation diagram

夹装式安装图 Wafer installation drawing



法兰式安装图 Flanged installation drawing

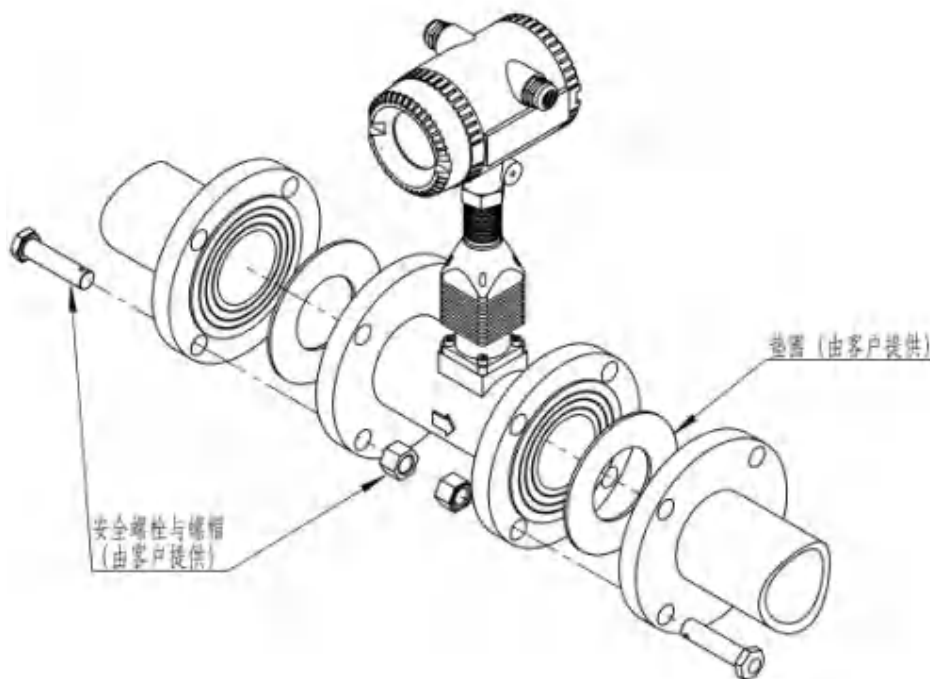
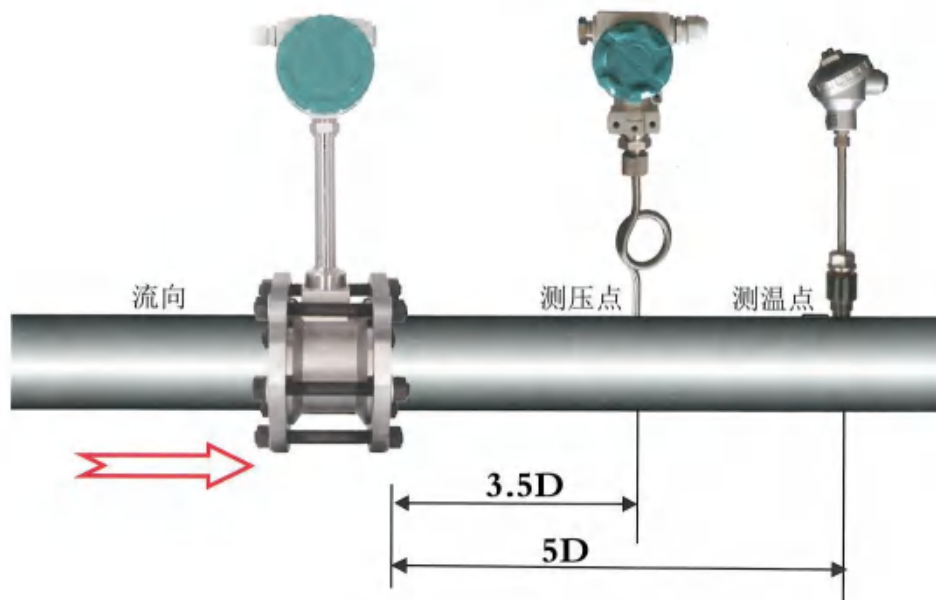


图 3.1 压力和温度取样孔位置 Figure 3.1 Pressure and Temperature Taps



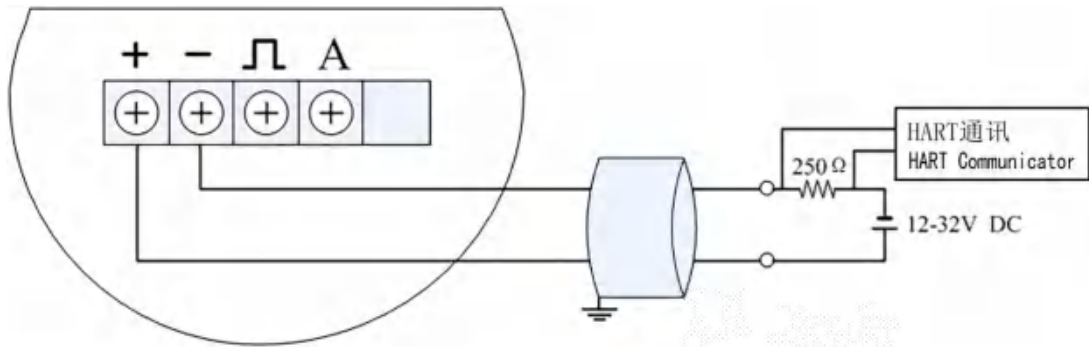
4. 涡街流量计电气接线 Electrical Wiring

4.1 接线图说明（仅供参考） Interface Board Wiring Instructions

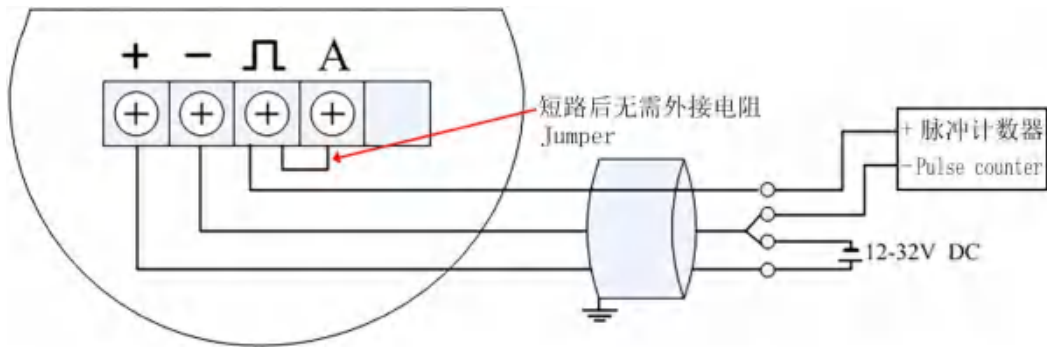
端子板用于接线输入和输出：外部电源、脉冲输出、4~20mA 输出，（可带 HART 通讯）。当连接压力和温度输入时，它将成为流量计的智能集成部件。端子板供电电源为 12~32VDC。

The interface board is used for wiring inputs and outputs: external power supply, pulse output, 4~20mA output with HART communication. It will be a smart integration part for a flowmeter when pressure and temperature inputs being connected. Its power supply is 12~32VDC

4.1.1 4~20mA 电流输出 + HART 通讯接线 4~20mA+HART Wiring

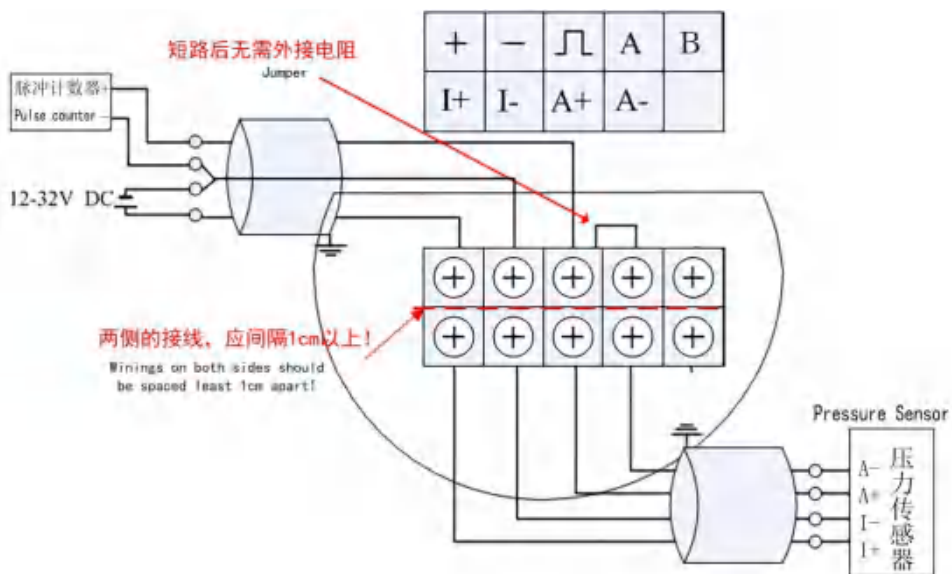


4.1.2 脉冲输出接线 Pulse Output Wiring



4.1.3 4~20mA 电流输出 + HART+485+ 压力补偿通讯接线

4~20mA output+HART + 485+ Pressure Sensor Wiring



第三部分 产品型号与代码

Model Ordering Information Code

流量计型号及型谱代码							Description	备注 Remarks
LUB	2	夹持式 Wafer						连接方式 Process connection
	3	法兰式 Flanged						
4	插入式 Insertion							
5	管螺纹 Threaded							
		2	液体 Liquid					
		3	气体 Gas					
		4	蒸汽 Steam					
		15	DN15	1.满管型; DN15~DN300 > DN300 协议订货 2.插入式; DN200~DN1500 > DN1500 协议订货			公称直径 Nominal diameter	
						
		300	DN300					
						
		1500	DN1500					
			F	分体型	Remote type		使用环境 Ambient conditions	
			G	隔爆型	Flame-protected type			
			B	本安型	Intrinsically safe type			
				1	脉冲信号	Pulse output		输出信号 Output signals
				2	电流信号 4-20mA	4-20mA output 4-		
				3	20mA 电流信号 4-20mA + HART 协议	4-20mA output with HART communication		
				4	4-20mA 电流信号 4-20mA + RS485 通讯	4-20mA output or RS485 communication		
				5	电池供电 (非防爆)	Battery powered (non-explosion-protected)		
				P	通用型	Universal type		产品类型 Product series
				Q	球阀插入型 (不断流更换)	Valve-controlled insertion type		
				J	简易插入型 (需断流更换)	Simple insertion type		
				S	通用双传感器型	Universal type with dual sensors		
LUB	2	4	100	G	3	P	LUB— 24100G3P 夹持式, 蒸汽, DN100 隔爆型, 4-20mA 电流输出, 带 HART 通讯协议, 通用型。	

第四部分 附表 PART III APPENDIX

饱和蒸汽密度及铂电阻--温度对照表 附表一

附表1、饱和蒸汽密度对照表 Schedule 1 Density of Saturated Steam

温度	0		1		2		3		4	
(t)°C	压力(P) MPa	密度(ρ)	压力(P) MPa	密度(ρ)	压力(P) MPa	密度(ρ)	压力(P) MPa	密度(ρ)	压力(P) MPa	密度(ρ)
100	0.1013	0.5977	0.105	0.618	0.1088	0.6388	0.1127	0.6601	0.1167	0.6952
110	0.1433	0.8265	0.1481	0.8528	0.1532	0.8798	0.1583	0.9075	0.1636	0.9359
120	0.1985	1.122	0.2049	1.155	0.2114	1.19	0.2182	1.225	0.225	1.261
130	0.2701	1.497	0.2783	1.539	0.2867	1.583	0.2953	1.627	0.3041	1.672
140	0.3614	1.967	0.3718	2.019	0.3823	2.073	0.3931	2.129	0.4042	2.185
150	0.476	2.548	0.4888	2.613	0.5021	2.679	0.5155	2.747	0.5292	2.816
160	0.6181	3.26	0.6339	3.339	0.6502	3.42	0.6666	3.502	0.6835	3.586
170	0.792	4.123	0.8114	4.218	0.831	4.316	0.8511	4.415	0.8716	4.515
180	1.0027	5.16	1.0259	5.274	1.0496	5.391	1.0737	5.509	1.0983	5.629
190	1.2551	6.397	1.2829	6.532	1.3111	6.671	1.3397	6.812	1.369	6.955
200	1.5548	7.864	1.5876	8.025	1.621	8.188	1.6548	8.354	1.6892	8.522
210	1.9077	9.593	1.9462	9.782	1.9852	9.974	2.0248	10.17	2.065	10.37
220	2.3198	11.62	2.3645	11.84	2.4098	12.07	2.4559	12.3	2.5026	12.53
230	2.7975	14	2.8491	14.25	2.901	14.52	2.9546	14.78	3.0085	15.05
240	3.3477	16.76	3.407	17.06	3.467	17.37	3.5279	17.68	3.5897	17.99

温度	5		6		7		8		9	
(t)°C	压力(P) MPa	密度(ρ)	压力(P) MPa	密度(ρ)	压力(P) MPa	密度(ρ)	压力(P) MPa	密度(ρ)	压力(P) MPa	密度(ρ)
100	0.1208	0.7105	0.125	0.7277	0.1294	0.7515	0.1339	0.7758	0.1385	0.8008
110	0.1691	0.965	0.1746	0.9948	0.1804	1.025	0.1863	1.057	0.1923	1.089
120	0.2321	1.298	0.2393	1.336	0.2467	1.375	0.2543	1.415	0.2621	1.455
130	0.313	1.719	0.3222	1.766	0.3317	1.815	0.3414	1.864	0.3513	1.915
140	0.4155	2.242	0.4271	2.301	0.4389	2.361	0.451	2.422	0.4633	2.484
150	0.5433	2.886	0.5577	2.958	0.5723	3.032	0.5872	3.106	0.6025	3.182
160	0.7008	3.671	0.7183	3.758	0.7362	3.847	0.7544	3.937	0.773	4.029
170	0.8924	4.618	0.9137	4.723	0.9353	4.829	0.9573	4.937	0.9797	5.048
180	1.1233	5.752	1.1487	5.877	1.1746	6.003	1.201	6.312	1.2278	6.264
190	1.3987	7.1	1.4289	7.248	1.4596	7.398	1.4909	7.551	1.5225	7.706
200	1.7242	8.694	1.7597	8.868	1.7959	9.045	1.8326	9.225	1.8699	9.408
210	2.1059	10.57	2.1474	10.77	2.1896	10.98	2.2323	11.19	2.2757	11.41
220	2.55	12.76	2.5981	13	2.6469	13.24	2.6963	13.49	2.7466	13.74
230	3.0631	15.33	3.1185	15.61	3.1746	15.89	3.2316	16.18	3.2892	16.47
240	3.6522	18.31	3.7155	18.64	3.7797	18.97	3.8448	19.3	3.9107	19.64

附表2、过热蒸汽密度与温度、压力的关系（绝对压力）
**Schedule 2 Density of Superheated Steam in Relationship with
 Temperature and Pressure (Absolute)**

表1 Table1

P (MPa)	t(°C)								
	150	170	190	210	230	250	270	290	310
0.1	0.5164	0.4925	0.4707	0.4507	0.4323	0.4156	0.4001	0.3857	0.3724
0.15	0.7781	0.7412	0.7079	0.6777	0.65	0.6246	0.601	0.5795	0.5594
0.2	1.0423	0.9918	0.9466	0.9056	0.8684	0.8342	0.8027	0.7736	0.7465
0.25	1.3089	1.2444	1.1869	1.1349	1.0849	1.0445	1.0048	0.9682	0.9343
0.3	1.5783	1.499	1.4287	1.3653	1.3079	1.254	1.2077	1.1634	1.1224
0.4	2.1237	2.0141	1.9166	1.8297	1.7513	1.6527	1.6152	1.5554	1.5
0.5	2.6658	2.538	2.4121	2.2997	2.1992	2.1081	2.0255	1.9495	1.8802
0.8	4.3966	4.1676	3.9372	3.74	3.5655	3.411	3.2718	3.1453	3.0283
1.1	6.1313	5.8332	5.5342	5.2356	4.9719	4.7459	4.5445	4.3612	4.1943
1.4	7.8785	7.5163	7.154	6.7913	6.4288	6.1147	5.8437	5.6006	5.3794
1.7	9.8464	9.3688	9.2473	8.413	7.9352	7.5219	7.1713	6.8607	6.5815
2	11.6295	11.0985	10.5676	10.0366	9.5054	8.9744	8.535	8.1447	7.8061
2.5	15.189	14.4516	13.715	12.9776	12.2406	11.5036	10.8794	10.35	9.8888
3	18.4168	17.5709	16.7243	15.8776	15.0367	14.1842	13.3377	12.6359	11.9979
3.5	22.7008	21.5713	20.4427	19.3131	18.2266	17.053	15.9243	15.0163	14.2565
4	27.164	25.747	24.3303	22.9129	21.4954	20.0778	18.6603	17.4997	16.5527
4.5	30.3852	28.9163	27.4475	25.9784	24.5096	23.0407	21.5717	20.1028	18.9333
5	35.4243	33.6293	31.8342	30.0384	28.2433	26.4483	24.6532	22.858	21.4221
6	43.8954	41.7475	39.5988	37.4508	35.302	33.1541	31.0062	28.8574	26.7091
7	56.7201	53.6991	50.678	47.6561	44.6352	41.6133	38.5922	35.5704	32.5488
8	65.4713	62.18	58.8883	55.5968	52.3061	49.0145	45.7231	42.4316	39.1399
9	84.5457	79.8261	75.1061	70.3863	65.6665	60.9465	56.22	51.5077	46.7877
10	108.625	102.0289	95.4346	88.8412	82.2486	75.6543	65.7699	62.4676	59.6648
12.5	158.3464	148.7516	139.1578	129.5629	119.9781	110.3842	95.7769	91.1964	81.6034
15	206.4175	194.4276	182.4477	170.4577	158.4766	146.4967	127.682	122.5268	110.5369
17.5	250.3934	236.691	222.8603	209.1592	195.4568	181.6261	163.428	154.2312	140.3919
20	327.8165	309.9521	291.2953	273.4409	255.5786	236.9217	219.0574	201.2031	182.5462
21.5	384.6647	363.2975	341.9027	320.5455	299.1880	277.7931	256.426	235.0688	213.6739

表2 Table2

P (MPa)	t (°C)								
	330	350	370	390	410	430	450	470	490
0.1	0.36	0.3484	0.3375	0.3272	0.3176	0.3086	0.2998	0.2919	0.2842
0.15	0.5404	0.523	0.5066	0.4912	0.4767	0.4631	0.4502	0.4381	0.427
0.2	0.7214	0.698	0.6759	0.6553	0.636	0.6178	0.6005	0.5842	0.5688
0.25	0.9027	0.8732	0.8456	0.8198	0.7955	0.7726	0.7507	0.7316	0.7113
0.3	1.0844	1.0488	1.0156	0.9845	0.9552	0.9277	0.8989	0.8856	0.854
0.4	1.4701	1.401	1.3563	1.3144	1.2753	1.2377	1.2035	1.1708	1.1396
0.5	1.8147	1.7545	1.6983	1.6456	1.5961	1.5498	1.506	1.4648	1.4258
0.8	2.9215	2.8227	2.7305	2.644	2.5635	2.4884	2.4171	2.35	2.2869
1.1	4.0419	3.903	3.7722	3.6512	3.5384	3.4335	3.3345	3.2402	3.1529
1.4	5.1777	4.9945	4.826	4.6673	4.522	4.3857	4.2575	4.3496	4.2291
1.7	6.3309	6.0998	5.7779	5.6936	5.512	5.3441	5.1863	5.0374	4.8972
2	7.4955	7.2186	6.9619	6.726	6.5117	6.309	6.1203	5.9419	5.776
2.5	9.4806	9.1139	8.7802	8.475	8.1938	7.9332	7.6898	7.4632	7.2511
3	11.5143	11.0494	10.6308	10.2493	9.9	9.5775	9.2816	8.9991	8.7388
3.5	13.8501	13.0286	12.6162	12.0528	11.6308	11.2425	10.8842	10.5512	10.2402
4	15.749	15.0539	14.4392	13.8862	13.3077	12.9991	12.5087	12.1835	11.7548
4.5	17.9608	17.1279	16.4018	15.7527	14.7579	14.6679	14.1507	13.7009	13.2822
5	20.2508	19.2627	18.4108	17.6565	16.9827	16.3719	15.8139	15.3017	14.8249
6	25.0502	23.7006	22.557	21.5629	20.69	19.9062	19.1981	18.5495	17.9518
7	30.2231	28.4037	29.9035	25.633	24.5224	23.4021	22.6635	21.8675	21.1373
8	35.8485	33.4179	31.4825	29.8698	28.4969	27.2913	26.017	25.264	24.3864
9	42.068	38.8083	36.3217	34.3044	32.2947	31.1593	29.8733	28.4637	27.6971
10	49.2802	44.756	41.5274	39.0006	36.9344	35.1684	33.6447	32.3002	31.0863
12.5	72.0105	62.4178	56.1496	51.8212	48.5015	45.8023	43.5431	41.5884	39.8569
15	98.5531	86.5688	74.584	66.8341	61.553	57.5137	54.2497	51.5265	49.1381
17.5	126.6895	116.3142	100.8176	85.3228	76.6185	70.5711	65.9331	62.1807	59.005
20	174.3185	166.0907	137.7965	108.543	94.4945	85.3276	78.7759	73.6858	69.5196
21.5	192.3164	171.8651	150.0074	128.1614	106.636	95.1366	87.0939	81.0184	76.1621