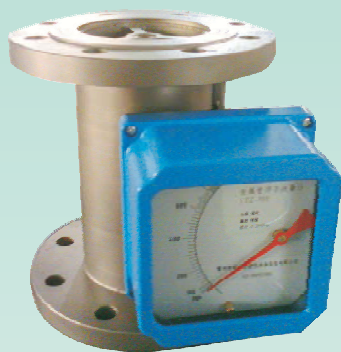# PRODUCTS BROCHURE ❙ 产品手册

LZ系列智能金属管浮子流量计
LZ series Intelligent mental tube rotameter flowmeter

低流速测量
Measurement of low flow

非接触磁耦合传动
Non-contact magnetic coupled tramission

单轴灵敏指示
Single-shaft sensitivity indicator

有限公司
XIAMEN HOMKOM AUTOMATION INSTRUMENT CO.,LTD.

2010

从本公司购买智能金属管浮子流量计（LZ系列）的五大理由

- 一流的生产设施
  High-class manufacture equipment

- 持久稳定的质量
  Deport and stable quality

- 每台产品出厂前必经过实流标定
  Demarcate which was performed using actually fluid before leaving the factory

- 绝无烦恼的安装和运行
  No troble about installation and running

- 专业跟踪服务
  Professional track and service
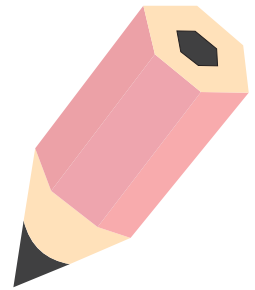
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LZ系列 智能金属管浮子流量计
LZ series Intelligent metal tube rotameter Flowmeter

智能金属管浮子流量计（LZ系列）
LZ series Intelligenti metal tube rotameter

双指示系统 | 磁耦合与磁信号分离 | 双行液晶数字显示 | 管道口径 | 耐高温高压

防护防爆 | 全系列安装方式 | 供电方式 | 高集成化电路 | 通信方式

特点

- 体积小，检测范围大，使用方便
- 采用了16位微处理工业化组件，保证了优良性能；
- 可根据客户不同要求选择不同的测量方式；
- 具有自主知识产权的智能流量计指示器
- 适用于小口径和低流速介质流量测量
- 工作可靠，维护量小，寿命长
- 对于直管段要求不高，较宽的流量比10：1
- 双行大液晶指示，可同时显示瞬时流量和累积流量，可带背光
- 单轴灵敏指示，非接触磁耦合传动
- 全金属结构，适合于高温，高压和强腐蚀介质
- 可用于易燃，易爆危险场合
- 可选二线制，电池，交直流供电方式
- 多参数标定功能
- 带有数据恢复，数据备份及掉电保护功能

Accessories with the instrument

- Small volume, large flow range, convenient operation
- Select the mode of measurement by the different require of the consumer
- Indicator of the intelligent flowmeter which have intellectual Property
- Suitable to measurement of flow quantity of low velocity and small diameter media
- Reliable operation, small maintenance work loads and long life low straight pipe condition required and wide twrn-down10:1
- Double line large liquid crystal display, displaying instantaneous flow quantity and accumulated flow quantity simultaneously, can be equipped with back light
- Single axis sensitive indication and Driving by non contact magnetic coupling
- Whole metal structure, suitable for high temperature, high pressure and strongly corrosive media
- Can be used in flammable, explosive and dangerous situations
- Such power supply patterns as two-wire system, battery and AC for selection
- Multi-parameter calibration function
- Having the function of data recovery,data backup and power failure protection

Introduction 简介

金属管浮子流量计是工业自动化过程控制中常用的一种变面积流量测量仪表。它具有体积小，检测范围大，使用方便等特点。它可用来测量液体，气体以及蒸汽的流量。特别适宜低流速小流量的介质流量测量。

智能金属管浮子流量计有就地显示型和智能远传型，支持多种输出协议，为用户提供了非常广阔的选择空间；另外该仪表采用先进的16位微处理器及高质量工业化组件，保证了流量计在各种应用场所的优良性能。

The metal tube ratometer flowmeter is a kind of variable area flow quantity measuring instrument. It has such features as small volume, large detection range and convenient operation. It is especially suitable to measure flow quantity of media with small flow velocity and small flow quantity.

Intelligentized metal tube rotameters have field indication type and intelligentized remote transmission type. So it provides the customers with very wide selection spaces. In addition, advanced 16 bits micro processor and high quality industrialized components are adopted in the instrument, which ensures excellent performances of the flowmeter in various kinds of application situations.

典型应用　Type Application

多年来，金属管浮子流量计的各种优良性能和可靠性，以及较好的性能价格比，广泛受到了石化，钢铁，冶金轻工，食品，制药，水处理等行业的青睐。

Over the past years, metal tube rotameter Flowmeter is widely applied in the industries such as petrochemical, steel, power, metallurgy, light industry , food , pharmacy and water treatment, due to its superior performances and satisfactory performance- price.

LZ系列智能金属管浮子流量计的优点
LZ Advantages of LZ series intelligent metal tube rotameter flowmeter

● **双指示系统**

　　LZ系列智能金属管浮子流量计采用磁耦合原理，通过机械传递指示瞬时流量，同时带动传感磁钢将对应流量信号的磁信号通过电子转换成数字信号，通过液晶显示瞬时及累积流量。这样的好处是：一旦电子部分出现故障，独立的机械指示系统仍然 以 反映现场流量的大小，提高了仪表的　靠性。

● **磁耦合与磁信号分离**

　　LZ系列智能金属管浮子流量计采用独立的磁耦合系统。它的变送部分的信号来自专门的传感受磁钢。这样的优点是在测量时不受介质温度，铁磁颗粒的影响。另外不受口径大小的影响。传感磁钢与磁阻传感器保持固定的距离。因此保证每台不同口径的仪表有足够的磁信号，带来高分辨率，分辨率 达 0.07　，同时带来高精度。

● **双行液晶数字显示**

　　LZ系列智能金属管浮子流量计采用双行大液晶数字字屏，同时显示瞬时流量及累积流量，瞬时流量显示范围0-50000，累积值显示范围0-99999999，自动复位，并且小数点任选。另外，液晶屏采用宽温液晶。

　　在仪表运行中，　随时 插拔液晶屏，不会影响仪表正常工作，带电插拔液晶屏，仪表也　正常工作。

　　另外，LZ系列智能金属管浮子流量计还有电池供电型产品，其电池电量显示色条类似手机电量指示一样清晰　了。

● **流量计测量管道口径齐全**

　　LZ系列智能金属管浮子流量计　提供包括从常规口径：DN15-DN100到特殊口径：DN8，DN10，DN150，DN200等所用金属管浮子流量计能够达到管道口径。在小流量测量上非常有优势。

● **耐高温高压**

　　LZ系列智能金属管浮子流量计耦合磁钢及浮子磁钢全部采用A1NiCo优质磁钢，退磁温度在500度以下，因此在450度高温介质完全 以 测量。

　　由于采用耦合原理，因此金属管浮子流量计属于无泄露流量计，压力对流量计无影响。因此LZ系列智能金属管浮子流量计　耐16MP以上压力。

● **防护防爆性能好**

　　LZ系列智能本安金属管浮子流量计采用铸铝外壳，防护等级达到IP65，完全　以在室外露天场合使用。另外，LZ系列智能金属管浮子流量计有型及隔爆型两种类型，均已取得国家级防爆认证。

● **全系列安装方式**

　　Lz系列智能金属管浮子流量计提供给用户全面的安装方式：下进上出，下进上横出，下横进上出，右进左出，左进右出，上进下出等。

● **各种供电方式**

　　LZ系列智能金属管浮子流量计　以提供24VCD二、三线制供电，220VAC供电，电池供电等方式，也　带背光，电池采用高能锂电池，一节电池 供 仪表使用三年以上。

● **高集成化电路**

　　LZ系列智能金属管浮子流量计的电路采用美国最新推出的16位MCU，高集成化全贴片，因此给此产品带来高　靠性。

● **系统的软件功能，带标准Hart通信方式**

　　仪表采用11点软件标定，确保被校标准仪表精度，此外还　选带Hart通信方式供选型时选择。

● Double indication system

The magnetic coupling principle is adopted in adopted in LZ series intelligent metal tube rotameters flowmeter and the instantaneous flow quantity is indicated through mechanical transmission . At the same time, the sensing magnet steel is driven to convert the magnetic signal corresponding to the flow signal into digital signal through electrons and the instantaneous and accumulated flow quantity are displayed through liquid crystal display. Advantages of such pattern are that: once there are faults in the electronic part, independent mechanical indication system can still reflect the field flow quantity, so that the reliability of the instrument is improved.

● Separation of magnetic coupling and magnetic signals

Independent magnetic coupling system is adopted for LZ intelligent metal tube rotameter. Signals of its transmission part come from special sensing magnetic steels. Advantages of such are that it will not be affected by temperature of media and ferromagnet particles in measurement. In addition, it will not be affected by the size of bore diameter. Fixed distance is kept between sensing magnetic steels and the magnetic resistance transducer, So it can be ensured that every instrument with different bore diameter can have enough magnetic signals and high resolution can be brought, which can 0.07º At the same time, it can bring high precision.

● Double line liquid crystal digital display

Double line liquid crystal digital display screen is adopted for LZ intelligent metal tube rotameter flowmeter. It will display instantaneous flow quantity and accumulated flow quantity simultaneously. The display range of instantaneous flow quantity is 0-50000 and the display range of accumulated value is 0-99999999. It will reset automatically and the decimal points can be selected randomly. In addition, wide temperature liquid crystal is adopted for the liquid crystal screen.
During the running of the instrument, the liquid crystal screen can be hot-plugged and the normal operation of the instrument will not be affected . When the liquid crystal screen is hot-plugged,the instrument can run normally.
In addition, LZ intelligent metal tube rotameter also has the battery power supply type product. The electric quantity display stripe of the battery is similarly clear to that of the electric quantity of mobile phones.

● Bore diameter of the measuring tube of the flowmeter is complete

LZ intelligent metal tube rotameter flowmeter can provide all bore diameter from normal bore diameter DN15-DN100 to special bore diameter DN8.DN10-DN150.DN200 which can be reached by metal rotameter. Flowmeter it has special advantages in measuring small flow quantity.

● Resistance to high temperature and high pressure

AINico excellent magnetic steels are adopted for the coupling magnetic steels or magnetic steels of rotator of the LZ intelligent metal tube rotameter. The demagnetization temperature is above 500℃, so it can be used in 450℃ of high temperature media.
As the coupling principle is adopted, the metal tube rotameter belongs to no leakage flowmeter and press doesn't have effect on the flowmeter, so the LZ intelligent metal tube rotameter can bear the pressure above 16MPa.

● Good protection and explosion proofing performance

Aluminum casting shell is adopted for the LZ intelligent metal tube rotameter and the protection level reaches up to IP65, so it can be used in the outdoor open situations. In addition, the LZ intelligent metal tube rotameter flowmeter. has two types such as intrinsic safety type and explosion proofing type and both of them obtain the national grade explosion proofing certification.

● Full series of installation pattern

LZ intelligent metal tube rotameter flowmeter provides the customer with comprehensive installation patterns: down in up out, down in up horizontal out, down horizontal in up out, right in left out, left in fight out and up in down out.

● Various kinds of power supply patterns

The LZ intelligent metal tube rotameter flowmeter can provide such power supply patterns as 24VDC two or three- wires power supply,220VACpower supply and battery power supply. It can also be equipped with back light. High power lithium batteries are adopted for batteries and one battery can be used for the instrument above three years.

● Highly integrated circuit

16 bits MCU developed by U.S recently is adopted for the LZ intelligent metal tube rotameter flowmeter and it is equipped with highly integrated paster, so the product has high reliability.

● Systematical software function and standard Hart communication pattern

The instrument is calibrated by adopting the 11-point software to ensure the precision of the instrument to be calibrated. In addition, the Hart communication pattern can be optional for selection.

LZ系列智能金属管浮子流量计技术参数
## Main technical parameters of LZ series intelligent metal tube rotameter flowmeter

测量范围 Measurement range	水(water)(20℃):1-200000l/h 空气(air)(20℃, 0.1013Mpa):0.03～4000m³/h
量程比 Ratio of range	标准型10:1，特殊型20:1 10:1 for standard type，20:1 for special type
精确度 Precision degree	标准型1.5级 特殊型1.0级 standard type 1.5 grade, special type 1.0 grade
压力等级 Special standard	标准型 (standard type):DN15-DN50 4.0MPa 特殊型(special grade):DN15-DN50 25MPa 夹套的压力等级为1.6MPa，特殊型在选型和订货前应与工厂协商 The pressure grade of the flowmeter with the jacket is 1.6MPa and it should be agreed with the plant for special type before selection and ordering
压力损失 Pressure loss	7KPa-70KPa
介质温度 Media temperature	标准型(standard type):-40℃～100℃, PTFE:0℃～120℃ 高温型(High temperature type):100℃～450℃
介质粘度 Media viscosity	DN15：η＜5mPa.s(F15.1-F15.3) η＜30mPa.s(F15.4-F15.8) DN25：η＜30mPa.s DN50-DN150:＜η＜30mPa.s
环境温度 Environment temperature	远传型：40℃～185℃(液晶不会损坏)液晶正常工作在-30℃～80℃ long transmission type:-40℃～185℃(liquiid crystal will not be damaged), normal operation temperature of liquid crystal is -30℃～80℃ 就地指针型(Field pointer type):-40℃～100℃
连接形式 (Connection pattern)	标准型：DIN2501标准法兰 Standard type:DIN2501standard flange
特殊型 Special type	由用户指定的任意标准法兰或螺纹 random standard flanges or screw threads appointed by the customers
电缆接口 Cable interface	隔爆型为1/2NPT内螺纹，其它M20*1.5内螺纹 1/2NPT internal thread for explosion proof type and M20*1.5 internal thread for other types
供电电源 Power supply	标准型：24VDC二线制4-20mA(12VDC-32VDC) Standard type: 24VD(two wires system 4-20mA(12VDC-32VDC) 报警型：24VDC三线制4-20mA(18VDC-28VDC) Alarm type: 24VDCthree wires system 4-20mA(18VDC-28VDC) 交流型：85-265VAC 50Hz Ac type: 85-265VAC 50Hz 电池型：3.6V，7.5AH锂电池， 连续 使用三年 Battery type:3.6V,7.5AH lithium battery, can be used continuously for three years
负载特性 Load characteristic	二线制(two-wire system):RLmax=50*(-12)Ω=600Ω @24V 报警型：最大负载电阻为200Ω 交流型：最大负载电阻为200Ω Alarm type:maximum load resistance is 200Ω AC type:maximum load resistance is 200Ω
报警输出 Alarm output	上限或下限瞬时流量报警 Upper limit or lower limit instantaneous flow quantity alarm 开关量报警Switching value alarm 继电器输出Relay output
液晶显示 Liquid crystal display	瞬时流量显示值范围：0-50000(带小数点) Range of instantaneous flow quantity display value:0-50000(may include decimal) 累积流量显示值范围：0-99999999(带小数点)自动复位 Range of accumulated flow quantity display value:0-99999999(may include decimal),automatic reset
防护等级 Protection level	Ip65

LZ系列智能金属管浮子流量计结构组成

## Structural composition of LZ series intelligent metal tube totameter flowmeter

　　本系列金属管浮子流量计符合中国JB/T6844-1993国家标准，主要由两大部分组成：测量管和指示器。测量管包括锥管，导向器，止动器，浮子等部件。指示器包括磁随动系统，指针，刻盘，线路等组件。分为就地型和智能型。对于就地型，由就地指示器中的随动磁钢与浮子内磁钢耦合，而发生转动，同时带动指针，通过刻度盘指示此时流量大小。
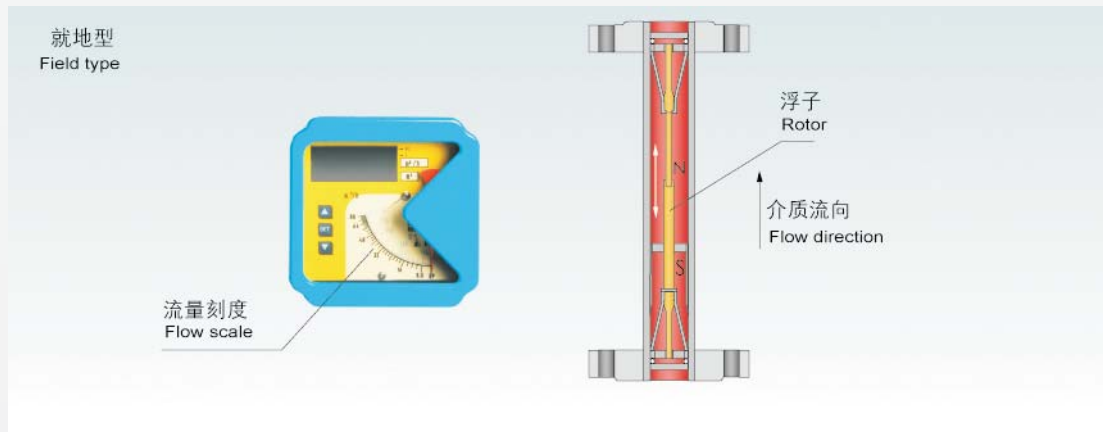
The series of metal tube rotameters flowmeter comply with National standard JB/T6844-1993 of China and they mainly consist of two parts: measuring tube and indicators. The measuring tube includes cone-shaped tube , guide apparatus, retainer and rotor. The indicator includes such components as magnetic servo system, pointer, scale plate and circuit. They are divided into field type and intelligent type.

For the field type,rotation is generated by coupling of servo magnetic steels in the field indicator and magnetic steel in the rotor. At the same time, it drives the pointer to indicate flow quantity through the scale plate.

　　对于智能型，由智能型指示器中的随动磁钢与浮子内磁钢耦合，而发生转动。同时带动传感磁钢及指针。通过磁传感器将磁场变化转化成电信号，经A/D变换，数字滤波，温度补偿，微处理器处理，D/A输出，LCD液晶显示，来显示出瞬时流量及累积流量的大小。
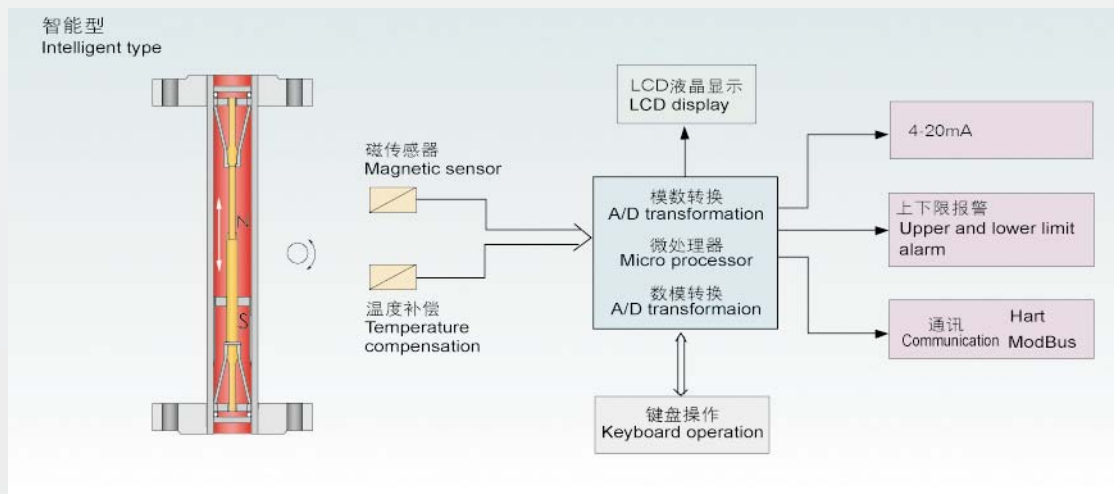
For intelligent type, rotation is generated by coupling of servo magnetic steels in the intelligent type indicator and magnetic steels. At the same time, sensing magnetic steels and the pointer are driven.The instantaneous flow quantity and accumulated flow quantity are displayed through A/D transformation, digital filtering, temperature compensation, treatment of micro processor, D/A output and LCD liquid crystal display.

LZ系列智能金属管流量计的型号及规格代码

Type and specification codes of LZ series intelligent metal tube rotameter flowmeter

仪表种类 Flowmeter variety	LZ				
通径代码 Diameter code	-XXX	例子：100表示DN100　　Example:100 indicates DN100			
结构形式 Structural patterns	FA	下进上出	Low:in;top:out		
	FB	下进上横出	Low:in;top:horizontally out		
	FC	下横进上横出	Low:horizontally in;top:horizontally out		
	FDR	右进左出	right in Left out		
	FDL	左进右出	Left in right out		
测量管材质 Material of measurement tube	-R0	0Cr18Ni12Mo2Ti			
	R1	1Cr18Ni9Ti(321)			
	R2	1Cr18Ni9(302)			
	R4	0Cr18Ni9(304)			
	RL	00Cr17Ni14Mo2(316L)			
	RP	PTFE			
	Ti	钛合金　Titanium alloy			
附加机构 Accessory mechanism	O	无	None		
	T	夹套型	Clamped type		
	G	高温型	High temperature type		
	Y	高压型	High pressure type		
	Z	阻尼型	Damping type		
额定压力(MPa) Reted pressure	-1.6	DN80~DN200　1.6MPa			
	4.0	DN15~DN50　4.0MPa			
	16	DN80~DN200　16MPa			
	25	DN15~DN50　25MPa			
工作温度 Operation temperature	E	-80℃~200℃			
	H	-80℃~300℃			
指示器形式 The form of indicator	-M1	就地指示型　　Field indication			
	M2	智能型　Intelligent			
	M4	智能型　Intelligent(隔爆：Explosion suppression)			
输出信号及通讯 Output sight and communication	N	无输出 No output			
	A	4~20mA			
	P	脉冲输出 Pulse output			
供电电源 Power supply	0A/0B	220VAC　60Hz（不带背光/带背光） 220VAC　60Hz（without/with back light）			
	1A/1B	24VDC　（二线制/三线四线制） 24VDC　（two wire system/three-four wire system）			
	2	3.6V 锂电池 3.6V Li-ion Battery			
安装配套法兰 Supporting flange for installation	-N	不带　　Without flange			
	C	带碳钢法兰　With carbon steel flange			
	B	带不锈钢法兰　With stainless steel flange			
法兰标准 flange standard	0	HG20594			
	1	HG20595			
	2	其他法兰标准 other flongs standard			
防爆等级 explosion proofing degree	0	不防爆　non explosion proof			
	1	隔爆　Exd Ⅱ BT6 Explosion suppression			
	2	本安 Exia Ⅱ CT5 Intrisically safe			
附加装置 Accessories	直管段　Straight tube	0/1/2	不带/带/带衬PTFE Without/with/with PTFE		
	磁过滤器　magnetic filetr	0/1/2	不带/带/带衬PTFE Without/with/with PTFE		

注：1、24VDC电池供电可选择1A为二线制，不带背光，1B为三线四线制，带背光
　　2、220VAC交流供电可选OA为不带光背，0B为带背光

LZ系列智能金属管浮子流量计的随机附件

Accessories of seriesintelligent metal tube rotameter flowmeter

仪表出厂已包装完善，随机附件有：

- 说　书
- 合格证
- 装箱单
- 其它附件（如配对法兰，磁过滤器，直管段）

The instrument has been packed perfectly before leaving the factory and accessories with the instrument include:
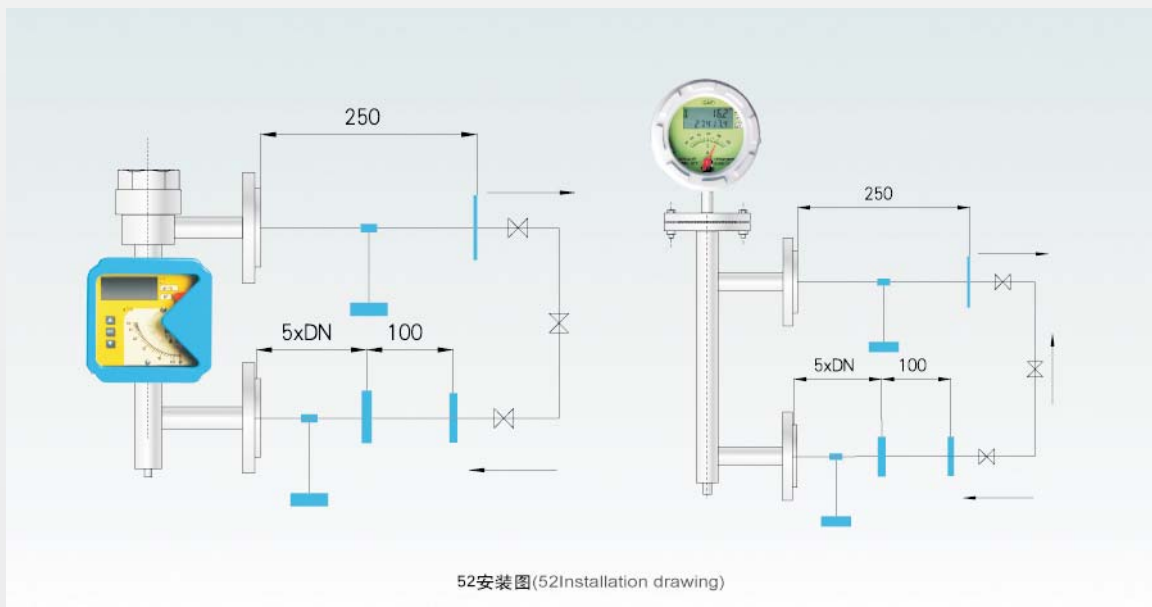
- Specification
- Qualification certificate
- Packing list
- Other accessories (such as companion flange, magnetic filter, straight tube)

智 能 金 属 管 浮 子 流 量 计 的 安 装
Installation of LZ series intelligent metal tube rotameter flowmeter

其中:5XDN及250为前后直管段，100为安装磁过滤器预留位置

Where:5xDN and 250 are the straight tube section in the front and rear of the flowmeter,100 is the
pre-left position for installation of magnetic filter

50安装图(50Installation drawing)　　　51安装图(51Installation drawing)

52安装图(52Installation drawing)

53安装图
(53Installation drawing)

54安装图
(54Installation drawing)
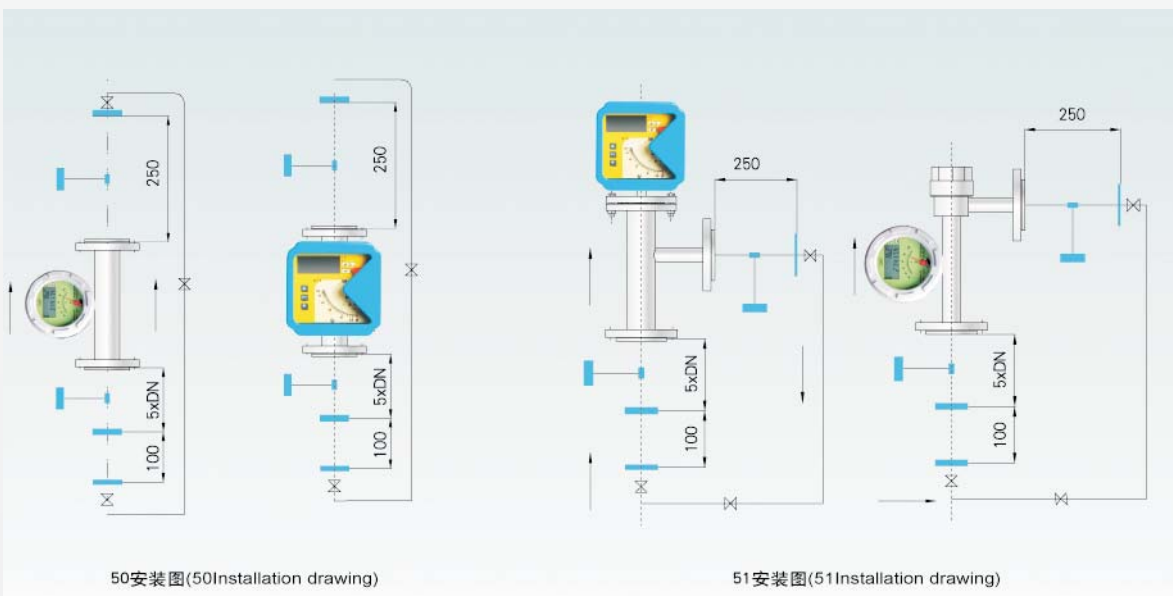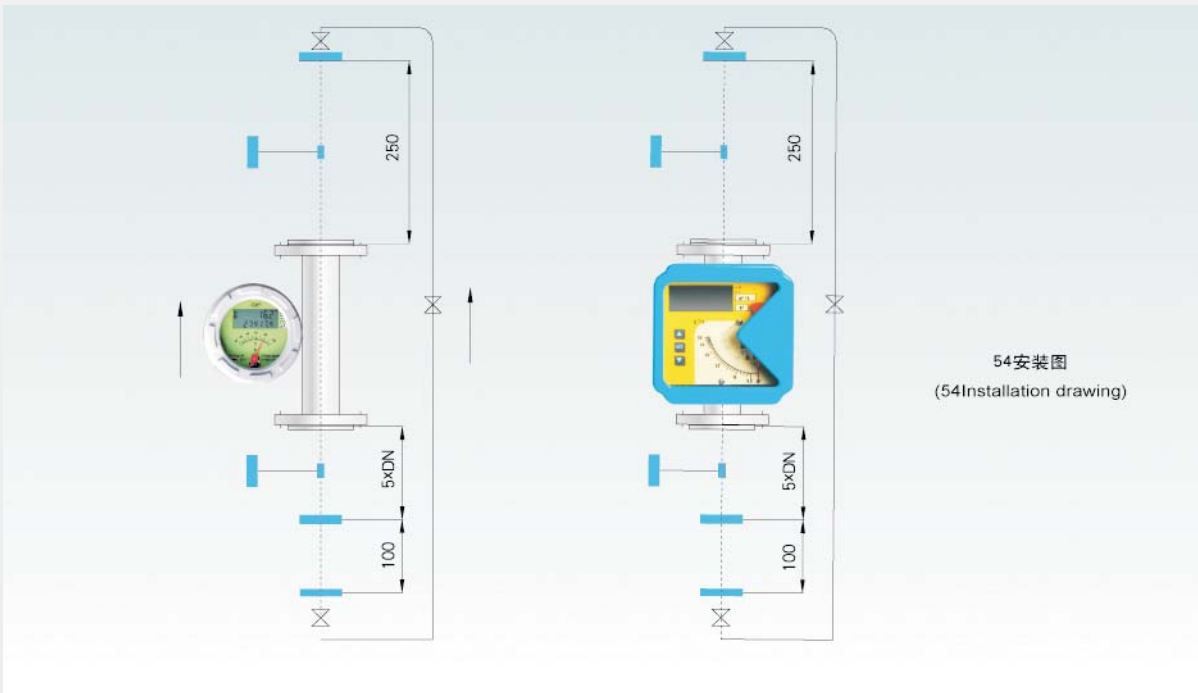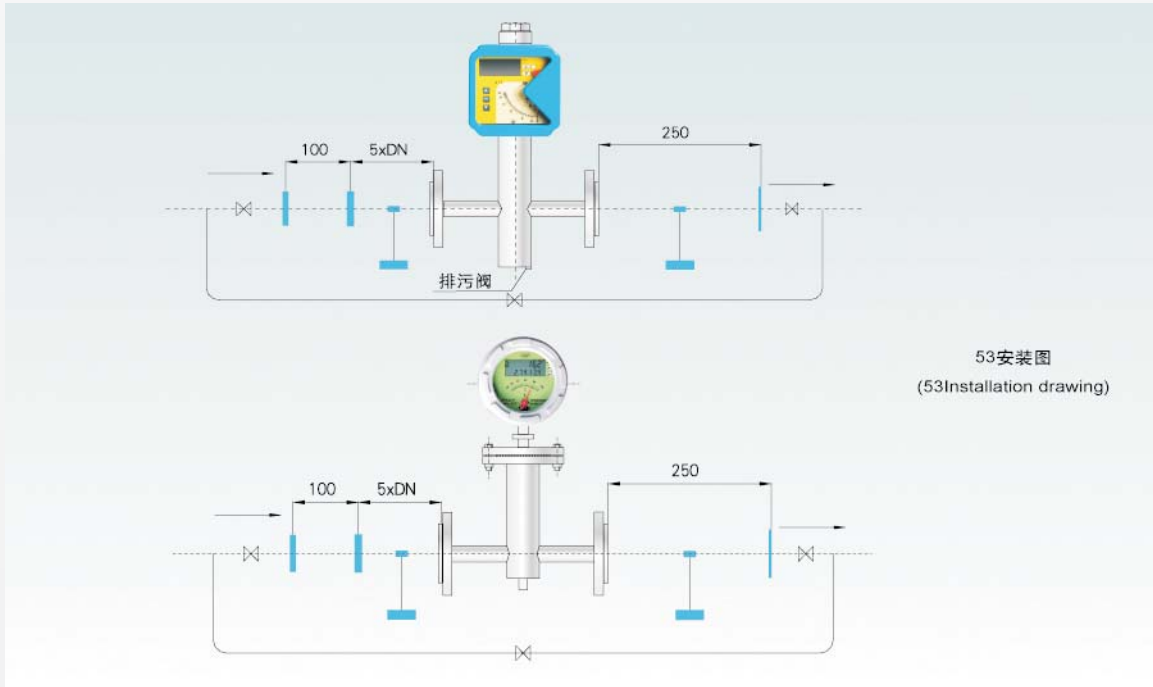
其中:5XDN及250为前后直管段，100为安装磁过滤器预留位置

Where:5xDN and 250 are the straight tube section in the front and rear of the flowmeter,100 is the pre-left position for installation of magnetic filter

安装注意事项
Notices on installation instrument

- 仪表安装前，工艺管道应进行吹扫，防止管道中滞留的铁磁性物质附着在仪表里。影响仪表的性能，甚至会损坏仪表。如果不　避免，应在仪表的入口安装磁过滤器。仪表本身不参加投产前的气扫，以免损坏仪表。
- 仪表在安装到工艺管道之前，应拆卸所有包装并检查有没有运输损坏。并打开壳体，将固定指针的填充物取走。
- 仪表的安装形式分为垂直安装和水平安装，如果是垂直安装方式，应保证仪表的中心垂线与铅垂线夹角小于2　，如果是水平安装，应保证仪表的水平中心线与水平线夹角小于2　。
- 仪表的上下游管道应与仪表的口径相同。连接法兰或螺纹匹配。仪表上游直管段长度应保证是仪表公称口径的5倍，下游直管段长度不小于250。
- 由于仪表是通过磁耦合传递信号的，所以为了保证仪表的性能。安装周围至少□0米处不允许有铁磁性物质存在。
- 测量气体的仪表，是在特定压力下校准的。如果气体在仪表的出口直接排放到大气，将会在浮子处产生气压降，并引起失真，如果是这样的工况条件，应在仪表的出口安装一个阀门。
- 安装在管道中的仪表不应受到压力的作用，仪表的出入口应有合适的管道支撑，　以　使仪表处于最小的应力状态。
- 安装PTFE衬里的仪表时，要特别小心。由于在压力的作用下PTFE会变形。所以法兰螺母不要随意拧得过紧。
- 带有液晶显示的仪表，安装时要尽量避免阳光直射显示器，从而降低液晶使用寿命。
- 低温介质测量时，需选夹套型。

- Before installation of the instrument, the process lines should be blown off to prevent ferromagnetic substances staying in pipes from adhering in the instrument to affect performances of the instrument or even damage the instrument. If it is unavoidable, a magnetic filter should be installed before the entrance of the instrument. The instrument itself doesn't take part in the blowing off to avoid damage of the instrument.
- Before the instrument is installed in the process lines, all packing should be unpacked to check whether there are damages by transportation. In addition, the shell should be dismantled to take out the filler fixing pointers.
- The installation patterns of the instrument are divided into vertical installation and horizontal installation. If the vertical installation pattern is adopted, it should be ensured that the included angle between the central vertical line of the instrument and the plumb line should be smaller than2º. If the horizontal installation pattern is adopted, it should be ensured that the included angle between the horizontally central line of the instrument and the horizontal line should be smaller than2º
- Upstream and downstream pipes of the instrument should have the same bore diameter with the instrument. The connection flanges or screw threads should be matched. It should be ensured that the length of straight tube at the upstream of the instrument should be 5 times of the bore diameter of the instrument (5D) and the length of straight tube at the downstream of the instrument should not be smaller than 250.
- As signals are transmitted through magnetic coupling in the instrument, it is not permitted for ferromagnetic substances to exist within at least ten meters around the installation place in order to ensure the performances of the instrument.
- The instrument which is used to measure flow quantity of gases is calibrated under special pressure. If the gases are discharged to atmosphere directly at the outlet of the instrument, then pressure drop will be generated at the rotor and data distortion will be caused. If such operation conditions happen, then a valve should be installed at the outlet of the instrument.
- Instruments installed in pipes should not be affected by stress and there should have proper pipe support at the inlet and outlet of the instrument so that to make the instrument to locate in the minimum stress state.
- It should be especially careful in installing the instrument with PTFE liner. As PTFE will deform under the function of pressure, bolts of the flanges should not be tightened too severely.
- For the instrument with LCD, it should avoid that sunshine irradiates the display directly in the installation so that avoid decreasing of use life of the liquid crystal.
- When measuring low temperature media, the clamped type flowmeter should be selected.
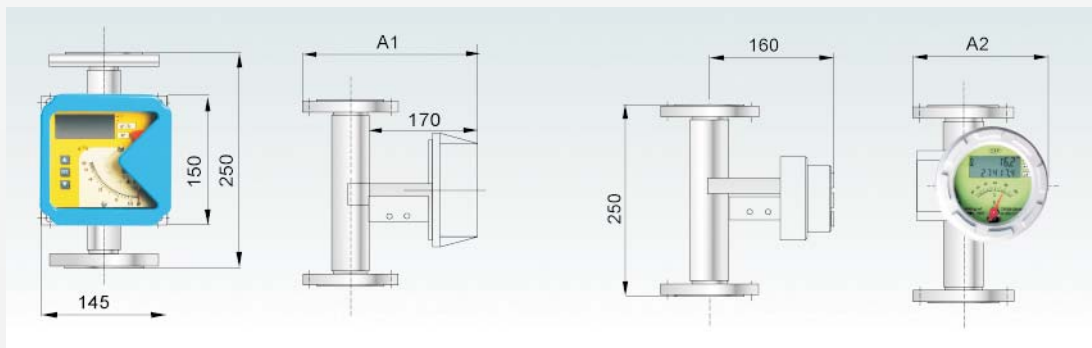
外形尺寸及数据表：

Overall dimensions and weight and pressure loss table of the standard type

FA 型
FAtype

● 标准型外形尺寸及重量压损表
Overall dimensions and weight and pressure loss table of the standard type

50型安装M2指示器（M1指示器同）
Installation of M2 indicator for 50 type
（M1 indicator is the same）

50型安装M4指示器
Installation of M4 indicator for 50 type

● 夹套型外形尺寸及重量压损表
Overall dimensions and weight and pressure loss table of the clamped type

50夹套型外形尺寸
Overall dimension of 50 clamped type

规格 specification	标准型外形尺寸及重量压损表 Overall dimensions,weight and pressure loss of 50 standard type			
符号 Symbol	A1	A2	G₁	△P
DN15	220	241	3.7	14
DN25	230	280	5.2	19
DN50	255	300	8.7	23
DN80	270	330	14.2	33
DN100	280	350	15.2	42
DN150	320	405	33.7	60
DN200	350	460	48.7	70

50/T夹套型外形尺寸及重量压损表 Overall dimensions,weight and pressure loss of 50 standard type		
A3	A	G₂
135	100	6.5
155	110	10.5
195	120	14
225	140	20
250	150	21

其中：G_1 为仪表重量（kg）　　G_1 is the weight of the instrument(kg)
　　　△P为压力损失（KPa）　　△P is the pressure loss
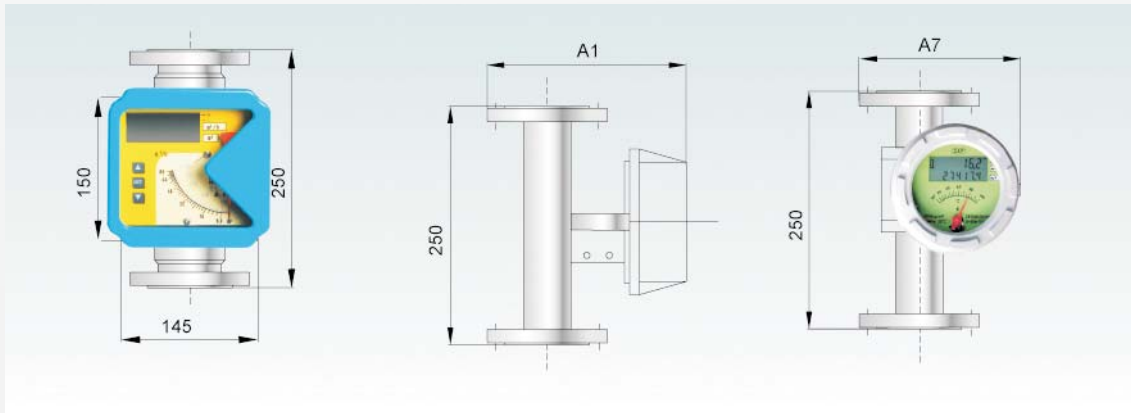　　　DN200安装高度为350mm　　the installation height of DN200 is 350mm

注：G_2 为仪表重量（kg）
　　G_2 is the weight of the instrument(kg)

智能金属管浮子流量计的外型尺寸及重量
Overall dimensions of LZ series intelligent metal tube rotameter flowmeter

● PTFE 型外形尺寸及重量表

Overall dimensions and weight of flowmeter with PTFE Line

衬PTFE测量外形尺寸

Overall dimension of measuring tube with PTFE liner

● 卫生型抛光管外形尺寸及重量压损表

Overall dimensions and weight and pressure loss table of the sanitary type polished tube
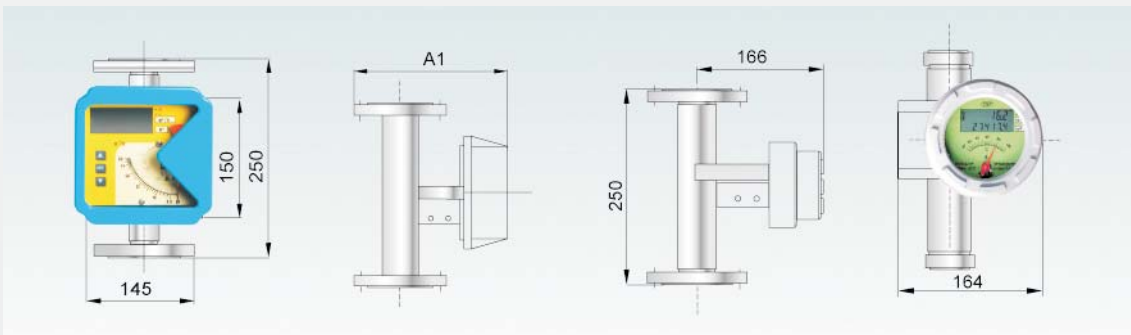
规格 Specification	50/RP外型尺寸及重量表 Overall dimensions and weight of 50/RP type		
符号 Symbol	A1	A7	G_3
DN15	220	135	6
DN25	230	155	7.5
DN50	235	195	11
DN80	270	225	16.5
DN100	260	250	17.5

注：G_3为仪表重量（kg）
G_3 is the weight of the instrument(kg)

规格 Specification	50/RW外型尺寸及重量压损表 Overall dimensions and weight of 50/RW type		
符号 Symbol	A1	A7	G_3
DN15	190	14	2.4
DN25	200	19	3.5
DN50	215	23	4.8
DN80	230	33	7.2
DN100	240	42	8.1

注：G_4为仪表重量（kg）　　G_4 is the weight of the instrument(kg)
△P为压力损失（KPa）　　△P is the pressure loss(KPa)

● FB型外形尺寸及重量
Overall dimensions and weight and pressure loss table of FB type
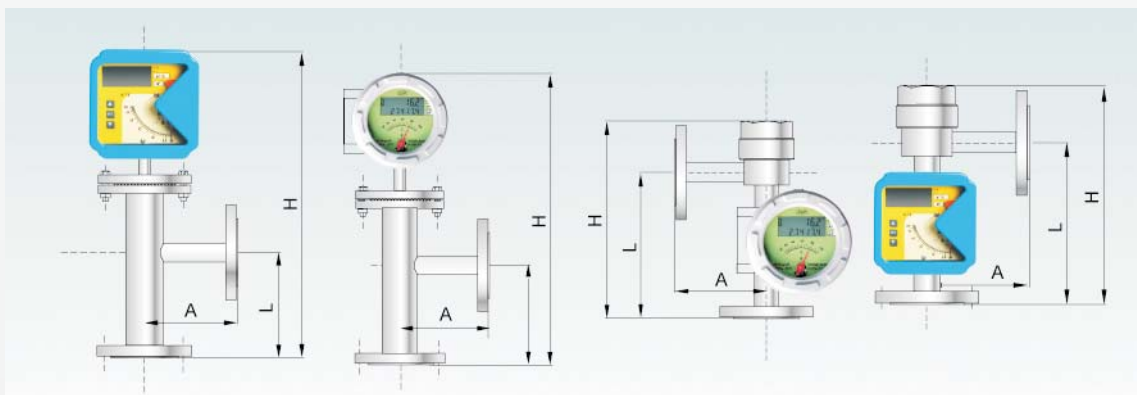
51型(type):DN15-DN200

● FC型外形尺寸及重量压损表
Overall dimensions and weight and pressure loss table of FC type
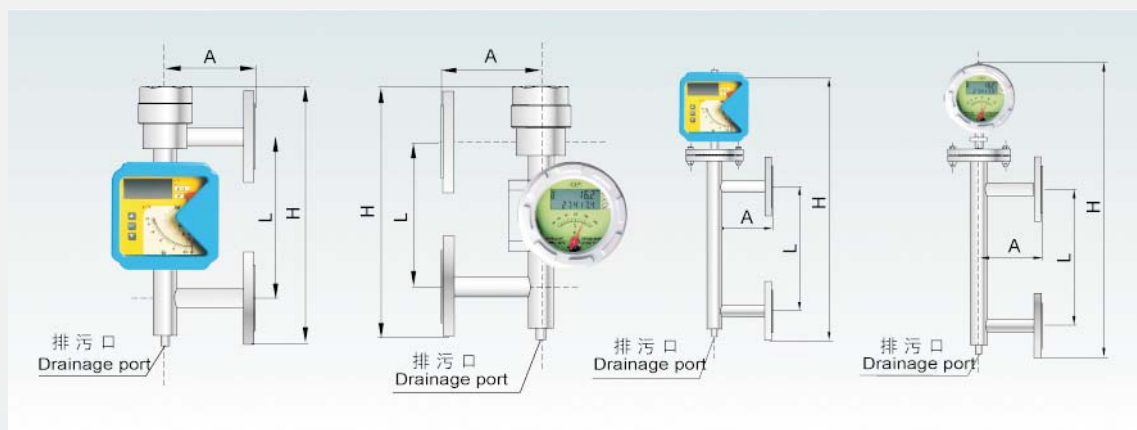
52型（type):DN15-DN200

规格 Specification	5□型外形尺寸及重量压损表 Overall dimensions and weight of 51 type				
口径 Symbol	H(mm)	L(mm)	A(mm)	G5	△P
DN15	560	260	120	7	18
DN25	560	260	120	8	22
DN50	600	260	120	15	228
DN80	700	260	150	25	36
DN100	700	260	150	29	45
DN150	760	300	150	50	58
DN200	800	300	200	61	70

注:G₅为仪表重量（kg）　　G₅ is the weight of the instrument(kg)
　　△P为压力损失（KPa）　　△P is the pressure loss(KPa)

规格 Specification	52型外形尺寸及重量压损表 Overall dimensions and weight of 52 type				
口径 Symbol	H(mm)	L(mm)	A(mm)	G5	△P
DN15	500	250	120	5	20
DN25	500	250	120	8	28
DN50	650	250	120	14	33
DN80	800	300	150	31	45
DN100	800	300	150	50	53
DN150	850	350	180	67	63
DN200	880	400	200	81	70

注:G₅为仪表重量（kg）　　G₅ is the weight of the instrument(kg)
　　△P为压力损失（KPa）　　△P is the pressure loss(KPa)

● FDR型外型尺寸及重量
Overall dimensions and weight and pressure loss table of FDR type

排污口
Drainage port
250

排污口
Drainage port
250

排污口
Drainage port
250

排污口
Drainage port
250

53型 (type)

规格 Specification	53/PP型外形尺寸及重量压损表 Overall dimensions and weight of 53/PP type							
口径 Symbol	H(mm)	G_7(kg)	△P	口径 Symbol	H(mm)	L(mm)	G_8(kg)	△P
DN15	430	6.5	30	DN50	540	250	21	40
DN25	450	10.5	35	DN80	557	400	32	45
				DN100	570	400	48	50

注:G_7为仪表重量(kg)　　G_7 is the weight of the instrument(kg)
△P为压力损失（KPa)　△P is the pressure loss(KPa)
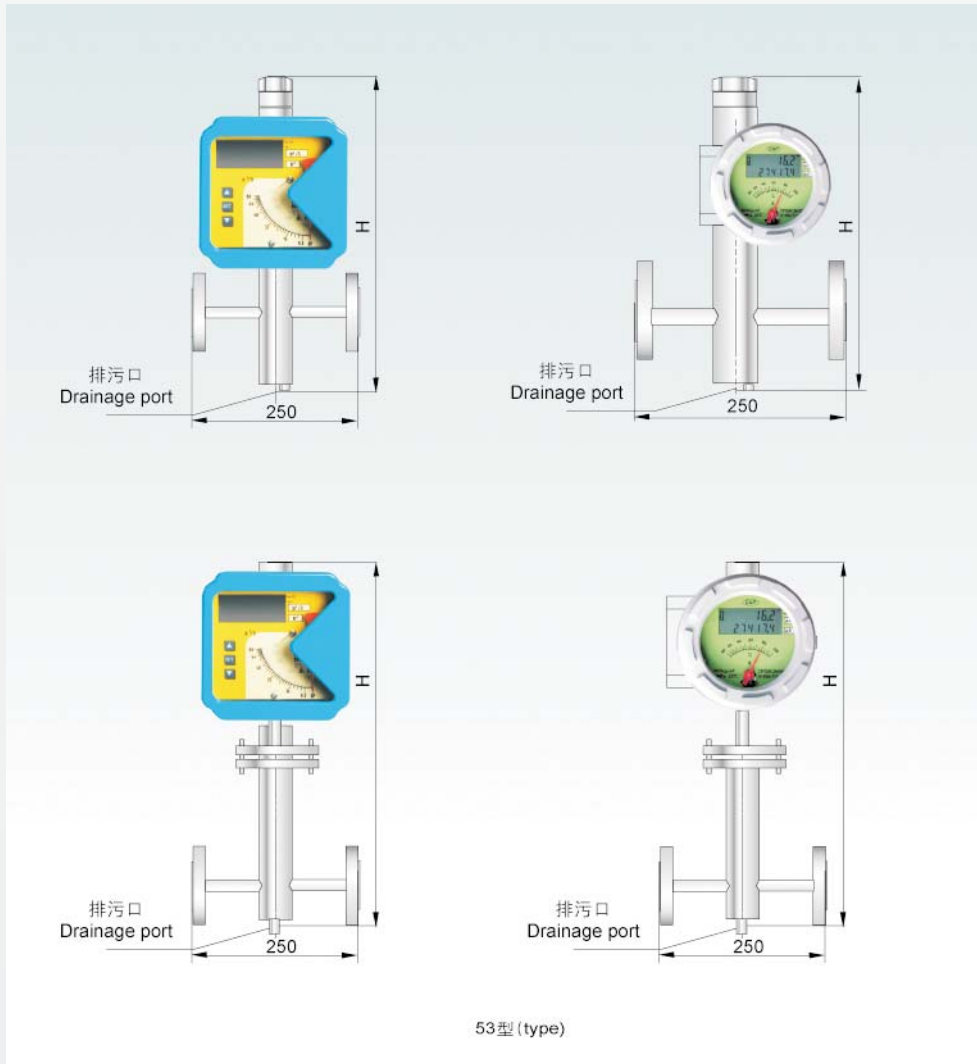
注:G_8为仪表重量(kg)　　G_8 is the weight of the instrument(kg)
△P为压力损失（KPa)　△P is the pressure loss(KPa)

● FDL型外型尺寸及重量压损表
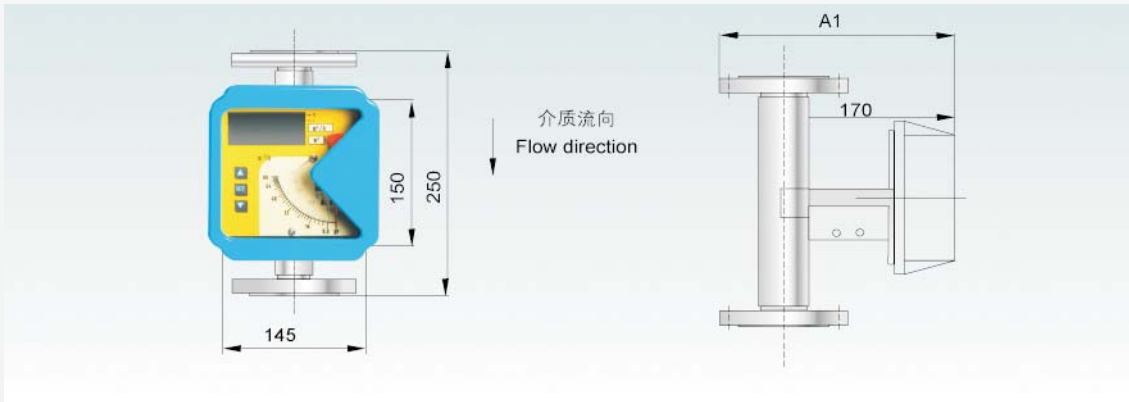### Overall dimensions and weight and pressure loss table of FDL type

54型安装M2指示器(M1指示器同)
Installation of M2 indicator for 54type(M1 indicator is the same)
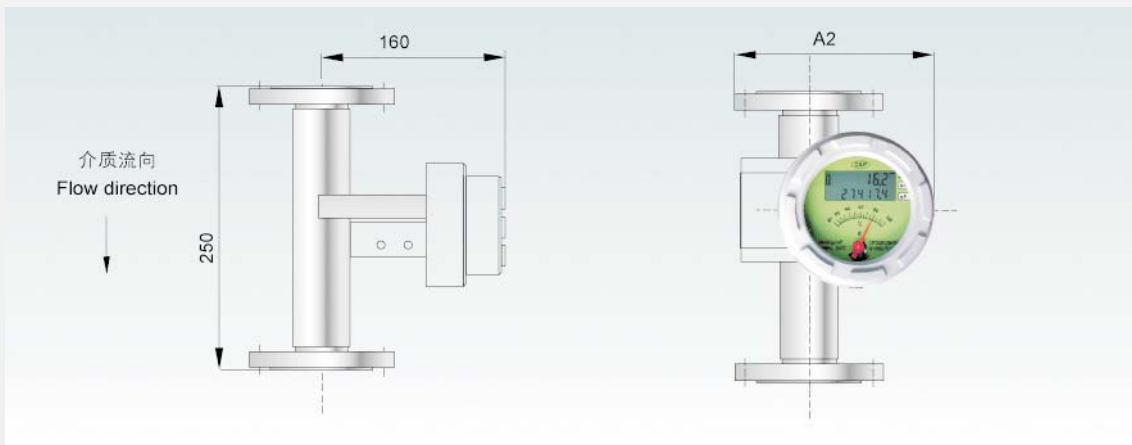
54型安装M4指示器
Installation of M4 indicator for 54type

规格 Specification	54标准型外形尺寸及重量压损表 Overall dimensions and weight of 54 type			
符号 Symbol	A1	A2	G_9	△P
DN15	220	211	3.7	14
DN25	230	280	5.2	19
DN50	255	300	8.7	23
DN80	270	330	14.2	33
DN100	280	350	15.2	42
DN150	320	405	33.7	60
DN200	350	460	48.7	70

注：G_9为仪表重量（kg）　　G_9 is the weight of the instrument(kg)
　　△P为压力损失（KPa）　△P is the pressure loss(KPa)
　　DN200安装高度为350mm　the installation height of DN200 is 350mm

指示器说明
Explanations on indicators

主要有M1、M2、M4三种型号的指示器。其中M1指示器主要用于就地指示，M2指示器用于远传信号，本安防爆场合，M4指示器为多功能指示器，三种指示器与不同的测量管配合构成多样的金属管浮子流量计。

It mainly has three types of indicators such as M1, M2 and M4 for customers choose. M4 is mechanical type of flow indicator for local instantaneous display by pointer indication only; M2 is used for remote type of flow indicator which suitable to the situation of Expplosion suppressnor and intrinsic safely; M4 is multi-function type of flow indicator. Three kinds of indicators cooperate with different measuring tubes to compose diverse metal tube rotameter flowmeter.

● M1型指示器

(1) M1型指示器是直接用测量管中浮子带动随动磁钢旋转从而带动指针轴，通过刻度盘直接显示瞬时流量值，因此结构简单，无任何修正，可靠性高。在用户要求下，可绘制两种不同介质的刻度。
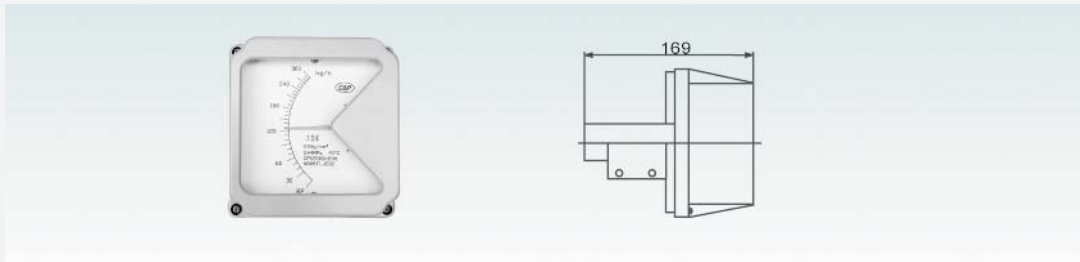
M1型指示器外形图　Outing drawing of M1 type indicator

(2) 限位报警装置

在M1指示器内由SJ3.5型起始器.铝片等组成限位报警装置.起始器被安装在能被指针轴带动的铝片切割位置,通过改变铝片的位置,可以任意设定报警限;SJ3.5型起始器与晶体管继电器WE77/EX-1和WE77/EX-2配合使用.可实现上下限报警信号的远传,并具有本安防爆性能.防爆标志为iaIICT5，其中WE77/EX-1可配合一个SJ3.5起始器,实现一个报警限,WE77/EX-2可配合两个SJ3.5起始器,实现上下限报警.
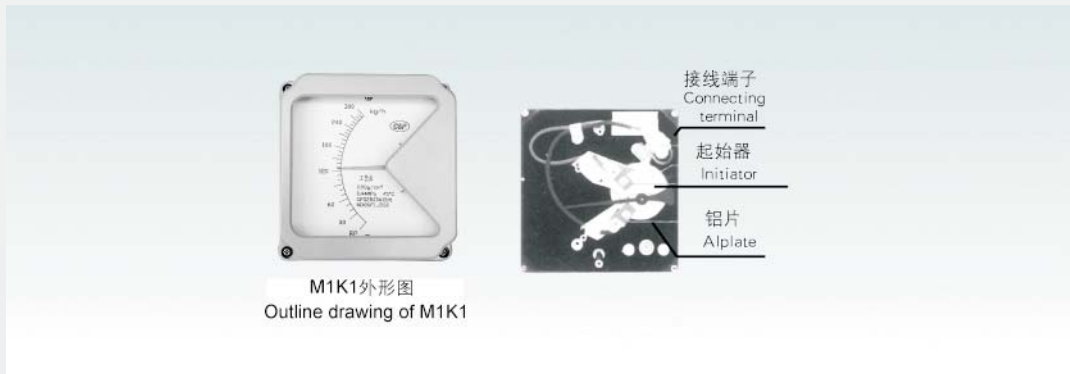
M1K1外形图
Outline drawing of M1K1

● M1 type indicator

(1) Mechanical Flow Indicator untilizes the rotator in the metering tube to rotate the following magnet with pointer cylinder, and then flow value can be indicated on the scale directly. Therefore it has simple structure, high reliable performance and needs no calibration. Two different media of scales can be drawn out under the requirements of users.

(2) Limit alarming device

In M1 indicator, SJ3.5type initiator and aluminum plate compose the limit alarming device. The initiator is installed at the position which can be cut by the aluminum plate which can be driven by the pointer axis. The alarming limit can be set randomly by changing the position of aluminum plate. Long transmission of upper and lower limit alarming signal can be realized through cooperative use of SJ3.5 type initator with transistor relay WE77/EX-1 and WE77-2/EX-2. In addition, it has intrinsically safe explosive proofing function. The explosive symbol is ia_CT5, in which WE77/EX-1 can cooperate with one SJ3.5 initiator to realize one alarming limit and WE77/EX-2 can cooperate with two SJ3.5 initiators to realize upper and lower limit alarms.

（3）WE77晶体管继电器及SJ3.5起始器技术参数Technical parameters of WE77 transistor and SJ3.5 initiator

型号Type	WE77/EX-1	WE77/EX-2
供电电源 Power supply	220VAC、24VDC	
消耗功率 Power consumption	约3.5VA about 3.5VA	
工作温度 Operation temperature	-25℃-+60℃	
开路电压 Open circuit voltage	8(13.5)V	8(13.5)V
短路电流 Short circuit current	8(31)mA	8(62)mA
允许电感 Permissible capacitance	3(31)mH	1(7.6)mH
允许电容 Permissible capacitance	230(609)nF	160(539)nF
型号 Type	SJ3.5-N	SJ3.5-SN
供电电源 Power supply	8VDC	8VDC
有效面积开 Effective area on	≥3mADC	
有效面积关 Effective area off	≤1mADC	≤1mADC
自身电感 Self inductance	250μH	100μH
自身电容 Self capacitance	50nF	60nF
工作温度 Operation temperature	-25℃-+70℃	-40℃-+100℃

（4）WE77晶体管继电器一般接成常开工作方式也　通过跳线改变为常闭工作方式,见下图跳线方式：

型号Type	WE77/EX-1	WE77/EX-2
工作状态 Operation state	端子连接状态 Terminal state	
闭路电流回路 closed circuit current loop	4-5	3-4 、6-7
开路电流回路 Open circuit current loop	3-4	2-3 、7-8

（4）WE77 transistor relay is generally connected to the normal open operation pattern, and it can also be changed into normal off operation pattern through jumper. The jumper patterns are as shown in the following table:

(5)SJ3.5起始器与WE77/晶体管继电器的接线

其中：（1）SJ3.5起始器 （2）WE77/Ex （3）继电器工作指示灯 （4）继电器输出 （5）WE77/Ex的供电电源
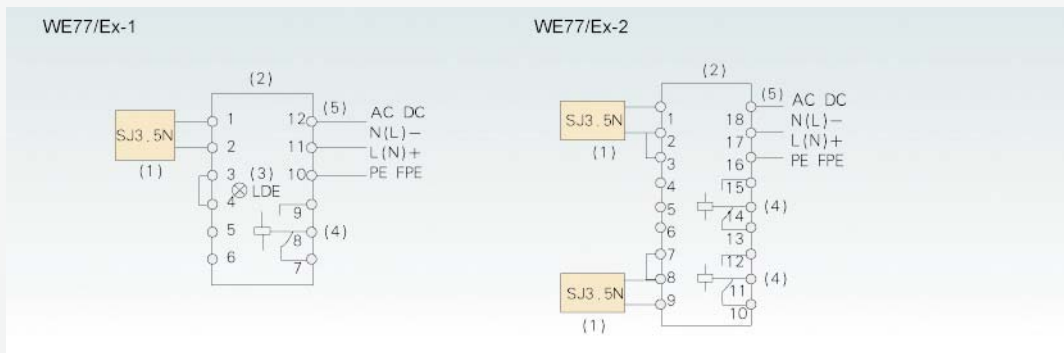
wiring of SJ3.5 initiator and WE77/EX transistor relay

Where:(1)SJ3.5 initiator; (2)WE77/Ex; (3)Operation indicator light of relay; (4)Output of relay; (5)Power supply of WE77/Ex

(6)WE77/EX晶体管继电器安装及外型尺寸图

Installation of WE77/EX trasistor relay and outline drawing

● **M2指示器**

⑴ M2指示器如图所示，该壳体为方形，金属壳体内置CPD型智能线路板。本安防爆结构设计，防爆标志为iaIICT5，该指示器既有单独的机械指针瞬时流量，还有五位液晶数字显示瞬时流量及八位数字显示累积流量，并配有按键操作，人机交互界面，还 以 输出4-20MA电流信号，上下限报警等多种信号。

⑵ 报警方式

　　M2指示器的上下限报警方式与M1指示器不同，M2指示器采用继电器输出方式，不用机械设定开关报警限，而是采用键盘盘操作方式，此方式方便灵活，而且有掉电保护功能，还具有逻辑功能，开/闭点即上/下限不用跳线即　在软件中设定报警输出，　通过中间继电器或安全栅与PLC连接。

⑶ M2指示器还具有多种参数标定，设定功能，数据备份，数据恢复及掉电保护功能。另外在不是二线制供电方式下，还选液晶背光显示功能。

⑷ 电池型M2还　实现电池供电，它采用一节高能锂电池3.6V@7.5AH供电方式，　连续工作三年以上，在液晶显示右下角有电量显示条，　提醒用户及时更换电池，另外电池在10-45℃范围内效率最高，放电稳定，工作时间延长。

● **M4指示器**

M2型指示器外形图
Outline drawing of M2 type indicator
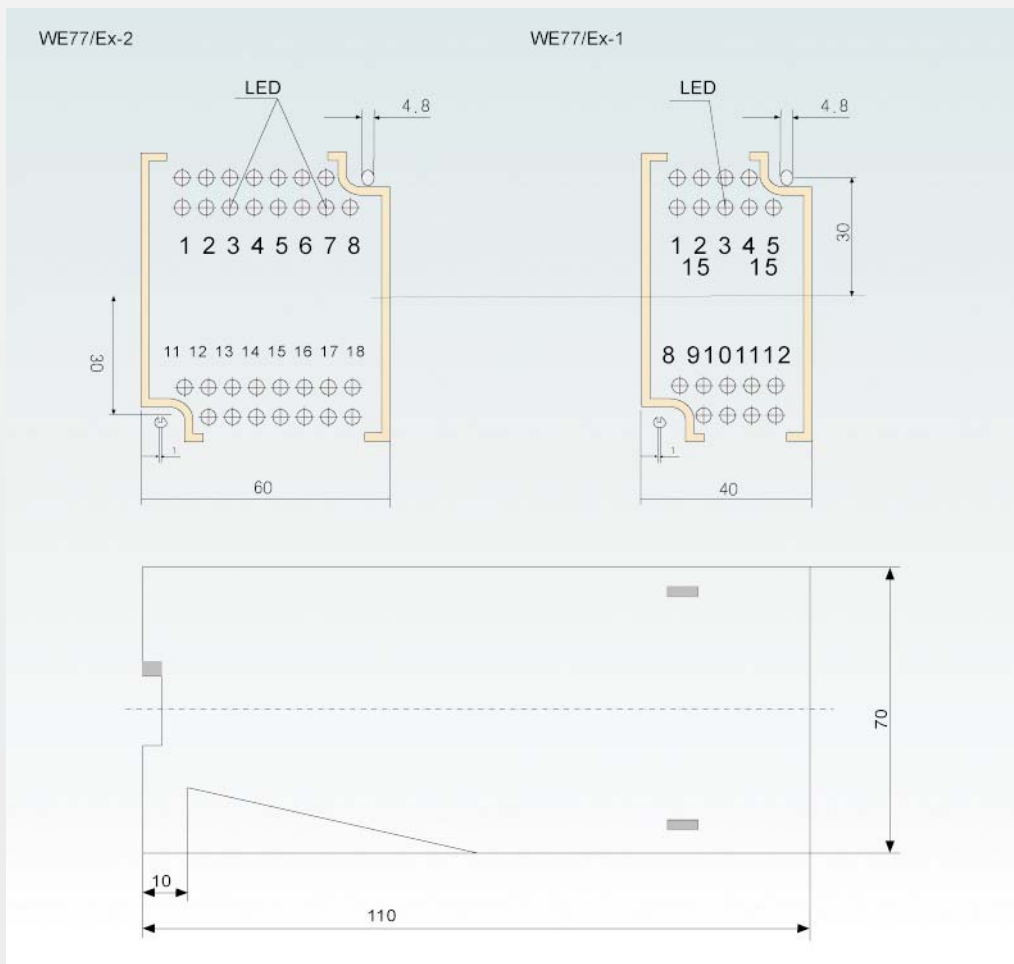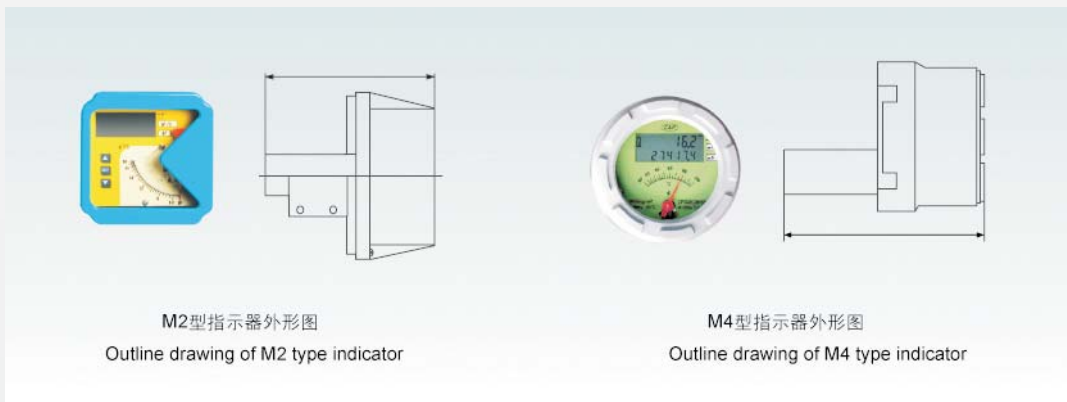
M4型指示器外形图
Outline drawing of M4 type indicator

● **M2 indicator**

(1) M2 indicator is as shown in the figure. The shell is a square and a CPD type intelligent circuit plate is built in the metal shell. It is intrinsically safe design and the explosive proof symbol is ia Ⅱ CT5.It not only has independently mechanical pointer to indicate instantaneous flow quantity, but also has five bits liquid crystal to digitally display instantaneous flow quantity and eight bits digitally display accumulated flow quantity. It is also equipped with panel operation and human-machine icterface. It can also output many kinds of signals such as 4-20mA current signals, upper and lower limit alarm.

(2) Alarming patterns: the upper and lower alarming patterns of M2 indicator are different from those of M1.Relay output is adopted for M2 indicator. The switch alarming limit is not set mechanically but by adopting keyboard operation. This pattern is flexible and convenient, but also it is accurate and reliable. In addition, it has the function of power failure protection. It also has the logic function and the alarming output can be set in the software for upper/lower limit without jumper. It can be connected to PLC through intermediate relay or safety barrier.

(3) M2 indicator also has such functions as multi-parameter calibration, setting function, data backup, data recover and power failure protection. In addition, the liquid crystal back light display function can be selected if it is not under the power supply of two-wire system.

(4) Battery type: battery power supply can be realized for M2. It adopts one 3.6V @7.5H high power lithium battery to supply power and it can operate continuously for three years. There is an electric quantity display bar at the low right of the liquid crystal display to remind the customer of replacing the battery on time. In addition, the efficiency of the battery is the highest in the range of 10-45℃. In this range, the discharging is table and operation time is extended.

● **M4 indicator**

　M4 indicator contains all functions of M1, M2 and M3 indicators and an independent pointer indication system is installed in it.

计算口径，浮子号及刻度
Calculation of diameter, rotor No. and scale

● 计算方法

（1）根据用户给出的数据，选择适当的公式算相应标校介质的流量Qs：

$$Qs=K \times Q$$

其中：Qs - 标校介质（水或空气）在标准状态下（20，0.1013MPa）的流量

Q - 用户介质流量

K - 修正系统

（2）根据计算得到的Qs值，查流量表来确定选用的浮子号及测量管的口径，流量表中的数值都是水或空气在标准状态下的流量值。

（3）确定测量管口径和浮子号后，建议用下式确定被测介质流量刻度的上限值Q：

$$0.9\frac{Qi}{K} \leq Q \leq 1.1\frac{Qi}{K}$$

其中：Qi查流量表中选取某一浮子号对应的水或空气流量的最大值。

（4）由于计算中没有考虑粘度的修正，有可能 与工厂计算的结果产生差异，届时请用户予以理解

● Calculation method

(1) According to data provided by the customers,proper equations are selected to calculate the flow quantity of corresponding calibrating media Qs:

$$Qs=K \times Q$$

Where :Qs-flow quantity of the calibrating media (water or air)under standard state(20,0.1013MPa)

Q- Flow quantity of customers'edia

K-correction coefficient

(2) According to the Qs value obtained from calculation, the rotor No. and diameter of the measuring tube are determined by vonsulting the flow table. The values in the flow table are the flow quantity of water or air under standard states.

(3) After diameter of the measuring tube and rotor No. are determined, it is suggested that the following equation is used to determine the upper limit Q of the flow scale of the measured media:

$$0.9\frac{Qi}{K} \leq Q \leq 1.1\frac{Qi}{K}$$

Where: Qi-maximum of flow quantity of water or air corresponded by rotor No. which is selected by consulting the flow table.

(4) As correction of viscosity is not considered in the calculation, there might have differences between the result and that calculated in the plant, please under this situation.

● 修正系统K的确定

（1）对于液体介质

（a) 如果用户给出的Q是液体体积流量则用下式计　K：

$$K=\sqrt{\frac{(\rho_s-1)\times\rho}{\rho_s-\rho}}$$

（b) 如果用户给出的Q是液体质量流量则用下式计　K

$$K=\sqrt{\frac{\rho_s-1}{(\rho_s-\rho)\times\rho}}$$

其中ρ_s：所选浮子密度（g/m3）
　　　不锈钢浮子密度为7.8
　　　聚四氟乙烯浮子密度（PTFE）密度为3.4
　　　镍基合金（Hastelloy）密度为8.3
　　　ρ：被测介质的密度

● Caclculation of the correction coefficient K

(1) For liquid media

(a) If Q provided by the customer is volu me flow of liquid,then following equation is used to calculate K:

$$K=\sqrt{\frac{(\rho_s-1)\times\rho}{\rho_s-\rho}}$$

(b) If Q provided by the customer is mass flow of liquid, then following equation is used to calculate K:

$$K=\sqrt{\frac{\rho_s-1}{(\rho_s-\rho)\times\rho}}$$

Where ρ_s：density of selected rotor (kg/ m^3)
　　　　Density of stainless steel rotor is 7.8
　　　　Density of (PTFE) rotor is 3.4
　　　　Density of Ni-based alloy(Hastelloy) is 8.3
　　ρ :Density of measured media

● 对于气体介质

(a) 如果用户给出的Q是标态下（20℃，0.1013MPa)气体的体积流量，则用下式计　K:

$$K=\sqrt{\frac{\rho \times P_0 \times T}{\rho_0 \times P \times T_0}}$$

(b) 如果用户给出的Q是工况下气体的体积流量，则用下式计　K:

$$K=\sqrt{\frac{\rho \times P \times T_0}{\rho_0 \times P_0 \times T}}$$

(c) 如果用户给出的Q是气体的质量流量，则用下式计　K:

$$K=\frac{1}{1.205}\sqrt{\frac{\rho_0 \times P_0 \times T_0}{\rho \times P \times T}}$$

在以上各式中：ρ：被测气体介质在标态下的密度(Kg/m³)

P：被测气体介质的绝对压力(MPa)

P：被测气体介质的绝对温度(K)

ρ_0：空气在标态下的密度(□205Kg/m³)

P_0：校标介质的绝对压力(0.□□3MPa)

T_0：校标介质的绝对温度(293.□5)

(d) 辅助密度换　公式：

$$\rho_{st}=\rho_t \frac{\rho_0 \times T_t}{\rho \times T_0}$$

其中：ρ_{st}被测气体介质在标况下的密度(Kg/m³)

ρ_t：被测气体介质在工况下的密度(Kg/m³)

T_t：被测气体介质在工况下的绝对温度(K)

p_t：被测气体介质在工况下的绝对压力(MPa)

p_0：被测气体介质在标况下的绝对压力(MPa)

T_0：被测气体介质在标况下的绝对温度(K)

● Ror gas media

(a) If Q provided by the customer is volume flow of gas under standard state(20℃, 0.1013MPa), then following equation is used to calculate K:

$$K=\sqrt{\frac{\rho \times P_0 \times T}{\rho_0 \times P \times T_0}}$$

(b) If Q provided by the customer is volume flow of gas under operation conditions, then following equation is used to calculate K:

$$K=\sqrt{\frac{\rho \times P \times T_0}{\rho_0 \times P_0 \times T}}$$

(c) If Q provided by the customer is mass flow of gas, then following equation is used to calculate k:

$$K=\frac{1}{1.205}\sqrt{\frac{\rho_0 \times P_0 \times T_0}{\rho \times P \times T}}$$

In above equations:

ρ : Density of gas media to be measured under standard condition(Kg/m^3)
P:Absolute pressure of gas media to be measured(MPa)
T:Absolute temperature of gas media to be measured(K)
ρ_0 : Density of air under standard conditions(1.205Kg/m^3)
P$_0$: Absolute Pressure of calibrating Media(0.1013MPa)
T$_0$:Absolute temperature of calibrating Media(293.15)

(d) Conversion equation of auxiliary density:

$$\rho_{st}=\rho_t \frac{\rho_0 \times T_t}{\rho \times T_0}$$

Where:

ρ_{st} : Density of gas media to be measured under standard condition(Kg/m^3)
ρ_t : Density of gas media to be measured under operation conditions(Kg/m^3)
T$_t$: Absolute temperature of gas media to be measured under operation conditions(K)
P$_t$: Absolute Pressure of gas media to be measured under operation conditions(MPa)
P$_0$: Absolute Pressure of gas media to be measured under standard conditions(MPa)
T$_0$: Absolute temperature of gas media to be measured under standard conditions(K)

流量表
Flow table

水(L/h)water(L/h)			空气 Air	
口径 Nominal bore	浮子号 Rotator No.	材质RO,R1,R2,Ti,RL Material RO,R1,R2,Ti,RL	材质PTFE Material PTFE	Nm³/h(标态下) Nm³/h(under standard state)
DN15	F15.0 F15.1 F15.2 F15.3 F15.4 F15.5 F15.6 F15.7 F15.8 F15.9 F25.0	1～10 6～16 2.5～25 4.0～40 6.3～63 10～100 16～160 25～250 40～400 63～630 63～630	1.6～16 2.5～25 4.0～40 6.0～60 10～100 16～160 25～250 40～400	0.03～0.3 0.05～0.5 0.07～0.7 0.11～1.1 0.18～1.8 0.28～2.8 0.4～4 0.7～7 1.0～10 1.6～16 3.0～30
DN25	F25.1 F25.2 F25.3 F25.4 F25.5	100～1000 160～1600 200～2000 250～2500 320～3200	63～630 100～1000 160～1600	3.0～30 4.5～45 7.0～70
DN50	F25.6 F25.7 F25.8 F50.0 F50.1 F50.2 F50.3 F50.4 F50.5 F80.0 F80.1	400～4000 500～5000 630～6300 500～5000 630～6300 1000～10000 1600～16000 2000～20000 2500～25000 1600～16000 2000～20000	200～2000 250～2500 320～3200 400～4000 630～6300 1000～10000 1600～16000	12～120 18～180 18～180 25～250 40～400 63～630
DN80	F80.2 F80.3 F80.4 F100.0	2500～25000 4000～40000 6300～63000 4000～40000	1600～16000 2500～25000 4000～40000	70～700 120～1200 180～1800
DN100	F100.1 F100.2 F100.3 F150.0	6300～630000 8000～80000 1000～10000 8000～80000	4000～40000 6000～60000 8000～80000	180～1800 300～3000
DN150	F150.1 F150.2 F200.0	10000～100000 15000～150000 15000～150000	8000～80000	300～3000
DN200	F200.1	20000～200000	特殊口径为DN20,DN32,DN40,D65,DN125,请提前与厂家联络咨询。 　It can be DN20,DN32,DN40 for special bore DN65,DN125, please contact and consultant with the manufacturer	

工作原理
Operation principle

　　浮子流量计的构造是在一根截面积自下而上逐渐扩大的垂直锥形金属管□内，装有一个能够旋转自如的由金属或其它材质制成的转子2（或称浮子）。被测流体从金属管底部进入，从顶部流出。
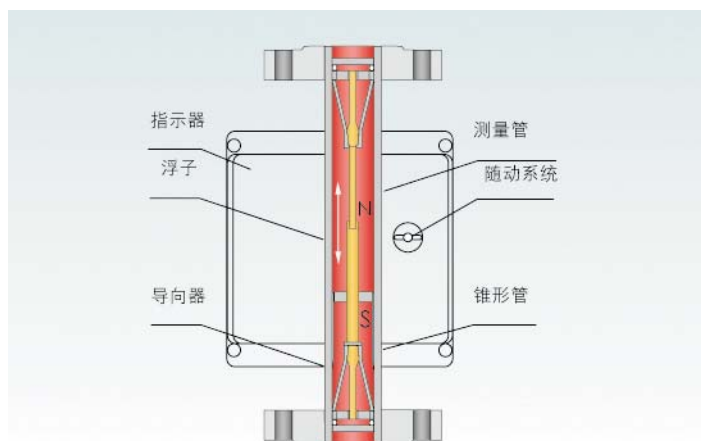
　　当流体自下而上流过垂直锥形管时，转子受到两个力的作用：一是垂直向上的推动力，它等于流体流经转了与锥形管间的环形截面所产生的压力差；另一是垂直向下的净重力，它等于转子所受重力减去流体对转子的浮力。当流量加大使压力差大于转子净重力时，转子就上升。当压力差与转子的净重力相等时，转子处于平衡状态，即停留在一定位置上。在金属管外表面上刻有读数，根据转子的停留位置，即 读 出被测流体的流量。

　　转达子流量计是变截面定压差流量计。作用在浮子上下游的压力差为定值，而浮子与锥管间环形截面积随流量而变。浮子在锥形管中的位置高低即反映流量的大小。

　　设Vf为转子的体积，Af为转子最大部分的截面积，pf为转子材质的密度，p为被测流体的密度。若上游环形截面为□□ ，下游环形截面为2-2 ，则流体流经环形截面所产生的压强差为（P□P2）。当转达子在流体中处于平衡状态时，即转子承受的压力=转子所受的重力流体对转子的浮力：

　　于是：

$$(P_1-P_2)A_f = V_r\rho_f\,g - V_r\rho g$$

　　所以：

$$P_1-P_2 = \frac{V_rg(\rho_t-\rho)}{A_r}$$ 　　　　(2-1)

　　从上式 以看出，当用固定的转子流量计测量某流体流量时，式中的Vf, Af, P均为定值，所以（P□P2）亦为恒定，与流量无关。仿照孔板流量计的流量公式 以写 出转子流量计的流量公式，即

$$V_s=C_RA_R\sqrt{\frac{2(P_1-P_2)}{\rho}} =C_RA_R\sqrt{\frac{2gV_f(\rho_t-\rho)}{A_f\rho}}$$ 　　(2-2)

式中：A_R--转子与金属管的环形截面积，m^2；
　　　　C_R--转子流量计的流量系数、无因次、与Re值及转子形状有关，由实验测定或从有关仪表手册中查得。
　　　　当环隙间的Re>104时，C_R 取 0.98

由上式 知。对某一转子流量计，如果在所测量的流量范围内，流量系数CR为常数时，则流量只随环形截面积AR而变。由于金属管是上大下小的锥体。所以环形截面积的大小随转子所处的位置而变。因而 用转子所处位置的高低来反映流量的大小。

流通环形面积与浮子高度之间的关系职（2-3）所示，当结构设计已定，则d为常量，式中有的二次项，一般不能忽略次非线形关系，只有在圆锥角很小时，才 以视 为近似线形。非线形关系，只有在圆锥角很小时，才 以视 为近似线形。

$$VF = \pi \left(dh \, tg \frac{\beta}{2} + h^2 tg^2 \frac{\beta}{2} \right) = ah + bh^2$$
(2-3)（单位：m^2）

式中：d-浮子最大值径（即工作直径）单位:m

　　　h-浮子从锥管内径等于从浮子最大直径上升高度，单位：m

　　　β-锥管的圆锥角

　　　a.b-常数

● 转子流量计刻度的校正

转子流量计的刻度与被测流体的密度有关。通常流量计在出厂之前，先用水和空气分别作为标定流量计刻度的介质。当应用于测量其它流体时，需要对原有的刻度加以校正。

假定出厂标定所用液体与实际工作时的液体的流量系数CR相等，并忽略粘度变化的影响。根据式□69，在同一刻度下，两种液体的流量关系为：

$$\frac{V_{s,2}}{V_{s,1}} = C_R A_R \sqrt{\frac{\rho_1 (\rho_f - \rho_2)}{\rho_2 (\rho_f - \rho_1)}}$$
(2-4)

式中下标□表示出厂标定时所用的液体；下标2表示实际工作时的液体。同理对用于气体的流量计。在同一刻度下，两种气体的流量关系为：

$$\frac{V_{s,g_2}}{V_{s,g_1}} = \sqrt{\frac{\rho_{g1} (\rho_f - \rho_2)}{\rho_{g2} (\rho_f - \rho_1)}}$$

因转子材质的密度比任何气体的密度ρg要大得多，帮上式 简化为：

$$\frac{V_{s,g_2}}{V_{s,g_1}} = \sqrt{\frac{\rho_{g1}}{\rho_{g2}}}$$
(2-5)

式中下标g_1表示出厂标定时所用气体；下标g_2表示实际工作时的气体。

The structure of a rotameter is that a rotor 2(or called as floater)made from metal or other materials which can rotate freely is installed in a vertical cone-shaped metal tube 1 whose sectional area is increased gradually from down to up. The fluid to be measured enters from the bottom of the metal tube and effluent from the top.

When the fluid flows upwards through the vertical cone-shaped tube, the rotor is affected by two forces: one is the driving force vertically upwards, it is equal to pressure difference generated by that the fluid flows upward through the annular section between the rotor and the cone-shaped tube; the other is vertically downwards net gravity, it is equal to the difference between the gravity encountered by the rotor and the float force of the fluid on the rotor. When the flow quantity is increased to make that the pressure difference is larger than the net gravity of the rotor, the rotor will rise. When the pressure difference is equal to the net gravity, the rotor will stay in a certain position. There are scales on the external surface of the metal tube and the flow quantity of measured fluid can be read according to the staying position of the rotor.

The rotameter is a variable area and constant pressure difference flowmeter. The pressure difference acting on upstream and downstream of the rotor is a constant value while the annular section area between the rotor and the cone-shaped tube changes with flow quantity. The position of the rotor in the cone-shaped tube reflects the value of flow quantity.

If it is assumed that Vf is the volume of the rotor, Af is the sectional area of the largest part of the rotor, _f is the density of the rotor material and _is the density of measured fluid. If the annular section at the upstream is 1-1' and the annular section at the downstream is 2-2' , then the pressure difference generated by flowing of the fluid through the annular section is (p1-p2). When the rotor is in equilibrium state in the fluid.

Then:
$$(P_1 - P_2)A_f = V_f \rho_f g - V_f \rho g$$

Therefore
$$P_1 - P_2 = \frac{V_f g(\rho_t - \rho)}{A_f} \qquad (2\text{-}1)$$

It can be seen from the above equation that Vf, Af, ρ f and ρ are constant when a fixed rotor is used to measure the flow quantity of one fluid, therefor (p1-p2) is also constant and it is unrelated to the flow quantity
Referring to the formula of flow quantity for orifice plate flowmeter, the formula of flow quantity for rotameter canbe obtained, that is :

$$V_b = C_R A_R \sqrt{\frac{2(P_1 - P_2)}{\rho}} = C_R A_R \sqrt{\frac{2g V_f(\rho_t - \rho)}{A_f \rho}} \qquad (2\text{-}2)$$

Where: AR--annular sectional area between the rotor and metal tube m²;
      CR--flow coefficient of rotameter, zero dimension, it is relatedtothe Re value and the shape of rotor, it can be obtained from experimental measurement or related instrument manuals. When the Re between the annular gap.104,CR may be selected as 0.98.

It can be known from the above equation that for one rotameter, if the flow coefficient CR is a constant in the measured flow quantity range, then the flow quantity only changes with the annular sectional area AR. As the metal tube is a cone, the annular sectional area will change with the position of the rotor, therefore the height of the position located by the rotor can be used to reflect the value of flow quantity.

The relation between the circulating annular area and the height of the rotor is as shown in equation (2-3).When the structural design is determined, then d and are constant. Generally the second order nonlinear relation can not be ignored for quadratic terms in the equation. Only when the cone angle is very small can it be regarded as approximate linearity.

$$VF = \pi \left(dh \, tg\frac{\beta}{2} + h^2 tg^2\frac{\beta}{2} \right) = ah + bh^2 \qquad (2\text{-}3) \ (unit:m^2)$$

Where:

d-maximum diameter of the rotor(that is operation diameter)

h-lifting height of the rotor from the place where the internal diameter of the cone shaped tube is equal to the maximum diameter of the rotor, unit: m

β -one angle of the cone shaped tube

a , b-constant

● **Calibration of the scale of the rotameter**

The scale of rotameter is related to the density of measure fluid. Before the rotameter leaves the factory, water and air are generally used as the media for calibrating the scale of the rotameter. When the rotameter is used to measure other fluids, original scales should be calibrated

If the flow coefficient CR of the used liquid in calibration at leaving the factory is equal to that of the liquid in actual operation and the effects of change of viscosity are ignored, then according to equation 1-69, the relation between flow quantities of these two kinds of liquids at the same scale is :

$$\frac{V_{s.2}}{V_{s.1}} = C_R A_R \sqrt{\frac{\rho_1 (\rho_f - \rho_2)}{\rho_2 (\rho_f - \rho_1)}} \qquad (2\text{-}4)$$

Where the subscript 1 represents the liquid used in calibration at leaving the factory; subscript 2 represents the liquid in actual operation.

In the similar way , the relation between flow quantities of two kinds of gases at the same scale is :

$$\frac{V_{s.}g_2}{V_{s.}g_1} = \sqrt{\frac{\rho_{g1} (\rho_f - \rho_2)}{\rho_{g2} (\rho_f - \rho_1)}}$$

As the density of the rotor material is much larger than the density ρ g of any gases, above equation can be simplified as:

$$\frac{V_{s.}g_2}{V_{s.}g_1} = \sqrt{\frac{\rho_{g1}}{\rho_{g2}}} \qquad (2\text{-}5)$$

Where the subscript g1 represents the gas used in calibration at leaving the factory; subscrit g2 represents the gas in actual operation.

附录1　法兰规格表
Appendixl Flange specification

● 常用气体密度表
Density of normal gases

压力(Pressure): 0.1013MP　温度(Temperature): 20℃　单位(unit): kg/m³

名称 Name	密度 Density	名称 Name	密度 Density	名称 Name	密度 Density	名称 Name	密度 Density
空气 Air	1.2041	丙烷 Propane	1.8332	苯 Benzene	3.2476	氟 Fluorine	1.5798
氮 Nitrogen	1.1646	正丁烷 Normal butane	2.4163	一氧化碳 Carbon monoxide	1.1650	氯 Chlorine	2.9476
氧 Oxygen	1.3302	异丁烷 Iso-butane	2.4163	二氧化碳 Carbon dioxide	1.8290	氯甲烷 Chloromethane	2.0990
氦 Helium	0.1664	正戊烷 Normal-pentane	2.9994	一氧化氮 nitrogen monoside	1.2474	氯乙烷 ethyl chloride	2.6821
氢 Hydrogen	0.0838	乙烯 Ethylene	1.1660	二氧化氮 nitrogen dioxide	1.9121	氨 Ammonia	0.7080
氪 Hryton	3.4835	丙烯 Prolylene	1.7495	一氧化二氮 nitrous oxide	1.8302	氟里昂-11 freon-11	5.7110
氙 Xenon	5.4582	丁烯-1 1-butene	2.3326	硫化氢 hydrogen sulphide	1.4169	氟里昂-12 freon-12	5.0269
氖 Neon	0.8391	顺丁烯-2 Syn-butane-2	2.3327	氟化氢 Hydrogen fluoride	1.1235	氟里昂-13 freon-13	4.3428
氩 Argon	1.6605	反丁烯-2 Trans-butane-2	2.3327	氧硫化碳 carbon oxysulfide	2.4973	氟里昂-113 freon-113	7.7900
甲烷 Methane	0.6669	异丁烯 Iso-butene	2.3327	臭氧 Ozone	1.9952		
乙烷 Ethane	1.2500	乙炔 Acetylene	1.0830	二氧化硫 Sulfur dioxide	2.7260		

● 常用夜体密度表
Density of normal liquids

温度(temperature):20℃　单位(unit):kg/m³

名称 Name	密度 Density	名称 Name	密度 Density	名称 Name	密度 Density	名称 Name	密度 Density
水 Water	998.3	乙醇 Ethanol	789.2	间甲酚 m-cresol	1034	氟仿 Chloroform	1490
水银 Mercury	13545	乙二醇 Ethylene glycol	1113	对甲酚 P-cresol	1011	四氯化碳 carbon tetrachloride	1594
溴 Bromine	3120	正丙醇 Normal propanol	804.4	甲酸甲酯 methyl formate	975	邻二甲苯 o-xylene	880
硫酸 Sulfuric acid	1834	乙丙醇 Iso-propanol	785.1	丙酸甲酯 methy propionate	915	间二甲苯 m-xylene	864
硝酸 Phosphoric acid	1512	正丁醇 n-butyl alcohol	809.6	甲酸 Formic acid	1220	对二甲苯 P-xylene	861
盐酸(30%) Hydrochloric acid	1193	乙腈 Acetonitrile	783	乙酸 Acetic acid	1049	甲苯 Toluene	866
环丁 Cyclobutane	1261	正戊醇 Normal pentanol	813	丙酸 Propionic acid	993	邻氯甲苯 o-chlorotoluene	1081
丙嗣 Acetone	791	乙醛 Aldehyde	783	苯胺 Aniline	1021	间氯甲苯 m-chlorotoluene	1072
甲乙嗣 Methylethyl ketone	803	丙醛 Propionic aldehyde	808	丙腈 Propionitrile	781.8	环己烷 Cyclohexane	778
酚 Phenol	1050	环己酮 Cyclo-hexanone	946.6	丁腈 Butyronitrile	790	己烷 Hexane	660
二氧化碳 Carbon bisulfide	1262	二乙醚 Diethylether	714	噻吩 Thiophene	1065	庚烷 Heptane	684
乙醇胺 Ethanolamine		甘油 Glycerol	1261.3	二氯甲烷 Methylene dichloride	1326	辛烷 Octane	702
甲醇 methanol	791.3	邻甲酚 Orthocresol	1020	醋酸甲酯 methyi acetate	934		

附录2 流速、流量对照表

Appendix2 the comparison list of flowrate and flow

公称通经 inch(mm)	流速(m/s) Attached(m/s)									
	0.01	0.10	0.30	0.50	1.00	2.00	3.00	4.00	5.00	10.00
	流量(m³/h) flowrate(m³/h)									
10	0.00283	0.02827	0.08482	0.14137	0.28274	0.56549	0.84823	1.13097	1.41372	2.82743
15	0.00636	0.06362	0.19085	0.31807	0.63617	1.27235	1.90852	2.54469	3.18086	6.36173
20	0.01131	0.11309	0.33929	0.56549	1.13097	2.26195	3.39292	4.52389	5.65487	11.3097
25	0.01767	0.17672	0.53014	0.88357	1.76715	3.50429	5.30144	7.06858	8.83573	17.6715
32	0.2895	0.28953	0.86859	1.44765	2.89529	5.79058	8.68588	11.5812	14.4765	28.9529
40	0.04524	0.45239	1.35717	2.26195	4.52389	9.04779	13.5717	18.0956	22.6195	45.2389
50	0.07069	0.70687	2.12058	3.53429	7.06858	14.1372	21.2058	28.2743	35.3429	70.6858
65	0.11945	1.19459	3.58377	5.97295	11.9459	23.8918	35.8377	47.7356	59.7295	119.459
80	0.18096	1.80956	5.42867	9.04779	18.0956	36.0911	54.2867	72.3823	90.4779	190.956
100	0.28274	2.82743	8.4832	14.1372	28.2743	56.5487	84.823	113.097	141.372	282.743
125	0.44178	4.41786	13.2536	22.0893	44.1786	88.3573	132.536	176.715	220.893	441.786
150	0.63617	6.36173	19.0852	31.8086	63.6173	127.2345	190.852	254.469	318.086	636.173
200	1.13097	11.3097	33.9292	56.5487	113.097	226.195	339.292	452.389	565.487	1130.973
250	1.76715	17.6715	53.0144	88.3573	176.715	353.429	530.144	706.585	883.573	1767.15
300	2.54469	25.4469	76.3407	127.235	254.469	508.938	763.407	1017.88	1272.35	2544.69

★管道适宜流速在3m/s以下

★Flowrate of media is suitable to below 3m/s

1、标准法兰规格表 normal flage specification

标准HG20594-97
Normal HG20594-97
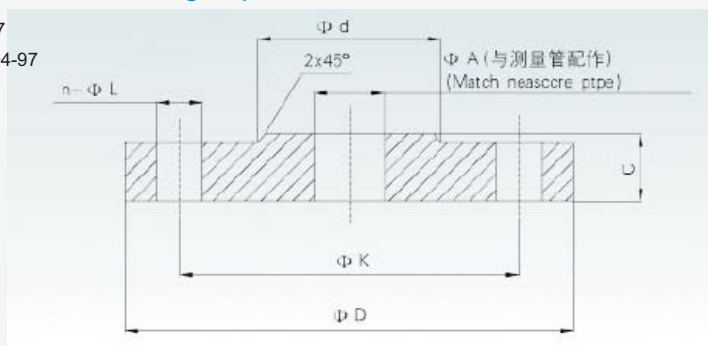
DN		ΦD	K	d	n	ΦL	螺栓Bolt
15	4.0	95	65	35	4	14	M12
25	4.0	115	85	52	4	14	M12
50	4.0	165	125	84	4	18	M16
80	1.6	200	160	118	8	18	M16
100	1.6	220	180	140	8	18	M16
150	1.6	285	240	195	8	22	M20
200	1.6	340	295	246	12	22	M20

2、高压法兰规格表 high pressure flange specificootion Table

标准HG20594-97
压力PN25MPa
normalHG20595-97
Pressure PN25MPa
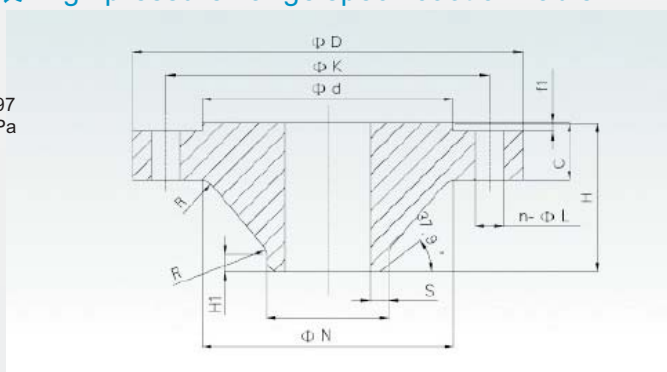
						H	n	L	R		A1	N	S	螺栓Bolt
DN15	130	90	46	26	2	60	4	18	3	6	18	48	3.2	M16
DN25	150	105	65	28	2	65	4	22	3	8	32	60	3.6	M20
DN40	185	135	84	34	2	80	4	26	3	10	45	84	5	M24
DN50	200	150	99	38	2	85	8	26	3	10	57	95	6.3	M24
DN80	255	200	132	46	2	102	8	30	3	12	102	136	11	M27
DN100	300	235	156	54	2	120	8	33	3	14	127	164	14.2	M30x2
DN125	340	275	184	60	2	140	12	33	3	16	159	206	16	M30x2
DN150	390	320	211	68	2	160	12	36	3	18	180	242	17.5	M33x2
DN200	485	400	284	82	2	190	12	42	3	25	244.5	305	25	M39x3

附录4 法兰标准引用一览表

Appendix4 list of Flange specification

|	
HG20594-1997	带颈平焊钢制管法兰(欧洲体系)
HG20593-1997	板式平焊钢制管法兰(欧洲体系)
HG20617-1997	带颈对焊钢制管法兰(欧洲体系)
HG20595-1997	带颈对焊钢制管法兰(美洲体系)
GB/T9115.1-2000	平面、突面对焊钢制管法兰
GB/T9115.4-2000	环连接面对焊钢制管法兰
GB/T9115.3-2000	槽面对焊钢制管法兰
GB/T9115.2-2000	凹凸面对焊钢制管法兰
JB/T82.2-1994(2005复审)	凹凸面对焊钢制管法兰
JB/T82.1-1994(2005复审)	凸面对焊钢制管法兰
JB/T82.4-1994(2005复审)	环连接面对焊钢制管法兰

附录5 金属管浮子流量计制造标准、计量检定规范

Appendix5 Manufacturing Standard and Inspection Criterion of Metal Tube Rotary Flowmeter

- GB/T 6844-93 金属管浮子流量计
- JJB 257-94 转子流量计检定规范
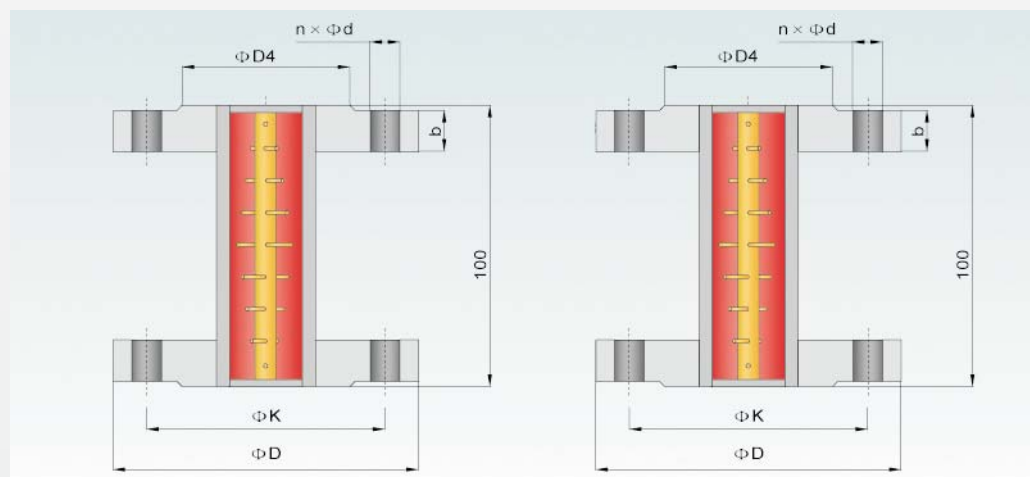- GB/T 15464-1995 仪器、仪表包装通用技术守则

附录6 磁过滤器及直管段外形尺寸
Appendix6 Overall dimensions of magnetic filter and straight tube
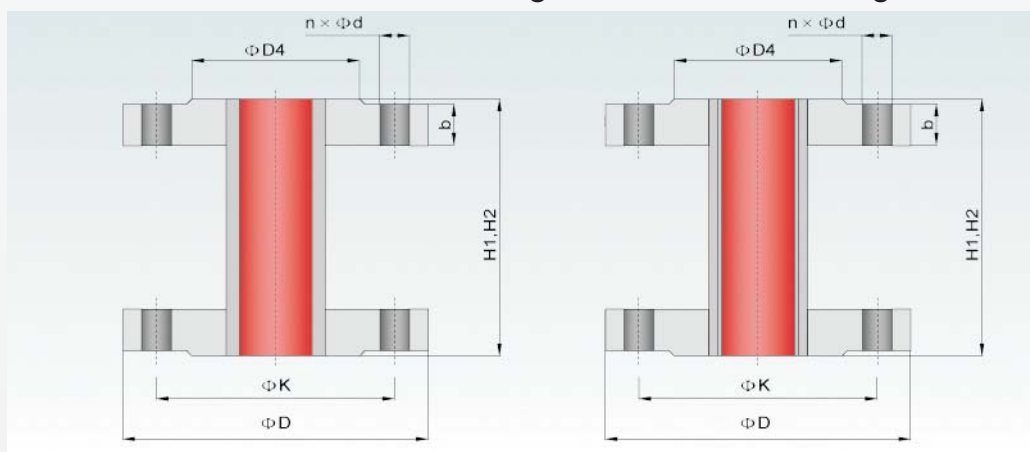
直管段straight tube

衬PTFE直管段straight tube withPTFE lines

磁过滤器magentic filer

衬PTEE磁过滤器filter withPTFE lines

DN	PN	D	K	nxcd	b		H1	H2
15	4.0	95	65	45	4	14	75	250
25	4.0	115	85	68	4	14	125	250
50	4.0	165	125	102	4	18	250	250
80	1.6	200	160	138	4	18	400	250
100	1.6	220	180	162	4	18	500	250
150	1.6	285	240	212	4	23	750	250

注:H1为入口直管段长度,H2为出口直管段长度

H1 is the length of straight tube in inlet

H1 is the length of straight tube in outlet

全国统一客服热线 : 400-0592-364

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