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FT60

Liquid Turbine Flowmeter

Working principle

When the measured body flows through the sensor, under the action of fluid, the impeller is forced to rotate, and its speed is proportional to the average flow rate of the pipeline, and the rotation of the impeller periodically changes the magnetic resistance value of the magnetolectric converter. The magnetic flux in the detection coil changes periodically, resulting in a periodic induction potential, that is, an electrical pulse signal, which is amplified by the amplifier and sent to the display instrument.

The flow equation of turbine flowmeter can be divided into two types: practical flow equation and theoretical flow equation.

$Q_v = fK$ formula 1

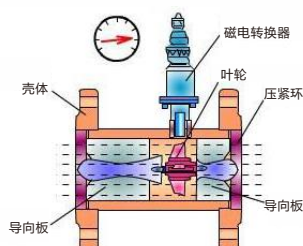
$q_m = q_v \rho$ Formula 2

q in formula

q ----- is the volume flow rate, m^3/s , mass flow rate, kg/st

f -- Frequency of flowmeter output signal, Hz,

K -- meter coefficient of the flow meter, P/m^3



Product description

FT60 series turbine flowmeter is a speed measuring instrument. It is used to measure the volume flow of liquid filled with closed pipes and flowing continuously. Turbine sensors are suitable for measuring liquids with low viscosity, with high accuracy and high working pressure. The preamplifier has pulse output, 4-20mA current signal output, and the flow detector has the ordinary type, wear-resistant type and anti-corrosion type, among which the wear-resistant type in addition to the bearing and shaft using carbide, and the impeller has the appropriate reverse thrust design, making it more suitable for measuring gasoline and other liquids with poor lubrication performance.

Functional characteristics

When the measured body flows through the sensor, under the action of fluid, the impeller is forced to rotate, and its speed is proportional to the average flow rate of the pipeline, and the rotation of the impeller periodically changes the magnetic resistance value of the magnetolectric converter. The magnetic flux in the detection coil then changes periodically to produce a periodic induction potential, that is, the electrical pulse signal, which is amplified by the amplifier and sent to the display instrument. With simple structure, light weight, high precision, good repeatability, sensitive response, easy installation and maintenance, the new generation of turbine flowmeter is widely used to measure the closed pipeline with stainless steel 1Cr18Ni9Ti, 2Cr13 and Al2O3, tungsten carbide does not corrode, and no fibers, particles and other impurities. For liquids with kinematic viscosity less than $10^{-6}m^2/s$ at operating temperature, for liquids with kinematic viscosity of $10^{-6}m^2/s$, the flowmeter can be used after solid liquid calibration. If it is matched with a display instrument with special functions, it can also carry out quantitative control, excessive alarm, etc., which is an ideal instrument for flow measurement and energy saving.

Product application

Mainly applicable to liquefied natural gas (LNG) Liquid nitrogen, liquid oxygen, Liquid CO2, liquid argon, liquid plant, receiving station, terminal, laboratory, gas plant Low temperature pump valve manufacturer test center, liquid ammonia flow



Technical parameter

Instrument diameter and connection mode	4, 6, 10, 15, 20, 25, 32, 40 threaded connection
	(15, 20, 25, 32, 40) 50, 65, 80, 100, 125, 150, 200 flange connection
accuracy class	±1.5%R, ±1.0%R, ±0.5%R, ±0.2%R (special)
Range ratio	1:10, 1:15, 1:20
Instrument material	304,316 (L) stainless steel, etc
Temperature of measured medium (°C)	- 40 ~ + 150 °C
environmental conditions	Temperature -30~+85°C, relative humidity 5%~90%, atmospheric pressure 86~106KPa
output signal	Sensor: Pulse frequency signal, low < 0.8V high > 8V
	Transmitter: two-wire system 4~20mA DC current signal
Power supply	Sensor: +12VDC, +24VDC (optional)
	Transmitter: +24VDC
	Field display type: The meter comes with 3.2V lithium battery
Signal output line	STVPV3X0.3 (three-wire system), 2X0.3 (two-wire system)
transmission distance	< 1000m
Signal line interface	Basic type: Herson connector, explosion-proof type: internal thread M20×1.5
explosive-proof grade	Basic type: non-explosion-proof products, explosion-proof type: Ex ia IIC T3... T6, Ex db IIC T6... T1 Gb
the protection grades	IP65, TP65, IP66, IP67 OptionalIP65

Meter coefficient of flowmeter

The instrument coefficient of flowmeter can be divided into two sections, namely linear section and nonlinear section. The linear section is about two-thirds of its working section, and its characteristics are related to the sensor structure size and fluid viscosity. In the nonlinear section, the characteristics are greatly influenced by bearing friction and fluid viscous resistance. When the flow rate is lower than the lower limit of sensor flow rate, the instrument coefficient changes rapidly with the flow rate. The relationship between pressure loss and flow is approximately square. When the flow exceeds the upper limit of flow, attention should be paid to prevent cavitation. The TUF characteristic curves with similar structures are similar in shape, but they differ only in the level of system error.

The instrument coefficient of the sensor is verified by the flow calibration device, which completely ignores the internal fluid mechanism of the sensor and takes the sensor as a black box, and determines its conversion coefficient according to the input (flow) and output (frequency pulse signal), which is convenient for practical application. However, it should be noted that this conversion coefficient (instrument coefficient) is conditional, and its calibration condition is a reference condition. If it deviates from this condition during use, the coefficient will change, depending on the sensor type, pipeline installation conditions and fluid physical parameters.

Theoretical flow equation

According to the theorem of moment of momentum, the motion equation of impeller can be listed.

Where J is the moment of inertia of the impeller; Formula 3

$\frac{dw}{dt}$: rotational acceleration of impeller;

M_1 : the driving force of fluid;

M_2 : viscous resistance moment;

M_3 : friction resistance moment of bearing, M_4 : magnetic resistance moment.

When the impeller rotates at a constant speed, $J = 0$, then $M_1 = M_2 + M_3 + M_4$ can be obtained through theoretical analysis and experimental verification.

$$n = \frac{Aq_v}{c} + \dots \dots \dots \text{formula 4}$$

Where n : impeller speed, q_v

q_v : Volume flow;

A : coefficient related to fluid physical properties (density, viscosity, etc.) and impeller structural parameters (blade inclination angle, impeller diameter, cross-sectional area of flow passage, etc.)

B : coefficient related to blade tip clearance and fluid velocity distribution;

C : coefficient related to friction torque.

Scholars at home and abroad have put forward many theoretical flow equations, which are suitable for various sensor structures and fluid working conditions. Up to now, the hydrodynamic characteristics of turbine instrument characteristics are still not very clear, and it has a complicated relationship with fluid physical properties and flow characteristics. For example, when there is vortex and asymmetric velocity distribution in the field, the hydrodynamic characteristics are very complicated. The instrument coefficient cannot be deduced by theoretical formula, and it still needs to be determined by real flow verification. However, the theoretical flow equation has great practical significance, which can be used to guide the design of sensor structural parameters and the prediction and estimation of the variation law of instrument coefficient when the field use conditions change.



Measuring range and working pressure

Instrument caliber (mm)	Normal flow range (m ³ /h)	Expand the flow range (m ³ /h)	Conventional endurance pressure (MPa)	Special withstand voltage grade (MPa) (Flange connection mode)
DN4	0.04~0.25	0.04~0.4	6.3	12、16、25
DN6	0.1~0.6	0.06~0.6	6.3	12、16、25
DN10	0.2~1.2	0.15~1.5	6.3	12、16、25
DN15	0.6~6	0.4~8	6.3、2.5 (flange)	4.0、6.3、12、16、25
DN20	0.8~8	0.45~9	6.3、2.5 (flange)	4.0、6.3、12、16、25
DN25	1~10	0.5~10	6.3、2.5 (flange)	4.0、6.3、12、16、25
DN32	1.5~15	0.8~15	6.3、2.5 (flange)	4.0、6.3、12、16、25
DN40	2~20	1~20	6.3、2.5 (flange)	4.0、6.3、12、16、25
DN50	4~40	2~40	2.5	4.0、6.3、12、16、25
DN65	7~70	4~70	2.5	4.0、6.3、12、16、25
DN80	10~100	5~100	2.5	4.0、6.3、12、16、25
DN100	20~200	10~200	2.5	4.0、6.3、12、16、25
DN125	25~250	13~250	1.6	2.5、4.0、6.3、12、16
DN150	30~300	15~300	1.6	2.5、4.0、6.3、12、16
DN200	80~800	40~800	1.6	2.5、4.0、6.3、12、16

Instrument classification

1. According to the instrument function, FT series turbine flowmeters can be divided into two categories, namely:

- Turbine flow sensor/transmitter
- intelligent integrated turbine flowmeter

2. function description

Turbine flow sensor/transmitter

This kind of turbine flow product itself does not have the function of on-site display, and only transmits the flow signal far away. The flow signal can be divided into pulse signal or flow signal (4-20mA); The instrument has the advantages of low price, high integration and small size, and is especially suitable for cooperating with computer control systems such as secondary display instrument, PLC and DCS.

According to different output signals, this kind of products can be divided into type I and type A.

Type I sensor: 12-24VDC power supply, three-wire pulse output, high level > 8V, low level < 0.8V, signal transmission distance < 1000m; Pulse width ≤ 1000(ms);

Type A transmitter: 24VDC power supply, 2-wire 4-20mA output, signal transmission distance < 1000.

This kind of turbine flow products are divided into basic type and explosion-proof type (Exd IIBT6).

Intelligent integrated turbine flowmeter

The advanced ultra-low power single-chip microcomputer technology is adopted to develop a new intelligent instrument integrating turbine flow sensor and display integration, which adopts double-row liquid crystal field display, and has obvious advantages such as compact structure, intuitive and clear reading, high reliability, no interference from external power supply, lightning resistance and low cost. The instrument has three-point correction of instrument coefficient, which can intelligently compensate the nonlinearity of instrument coefficient and can be corrected on site. High-definition liquid crystal display displays instantaneous flow (4 significant figures) and cumulative flow (8 significant figures with zero clearing function) at the same time. All valid data will not be lost for 10 years after power failure. This kind of turbine flowmeters are all explosion-proof products, and the explosion-proof grade is Exd II BT6.

This kind of turbine flowmeter can be divided into B type and C type according to the power supply mode and whether it has long-distance signal output.

Type B: The power supply adopts 3.2V 10AH lithium battery (which can run continuously for more than 4 years) and has no signal output function.

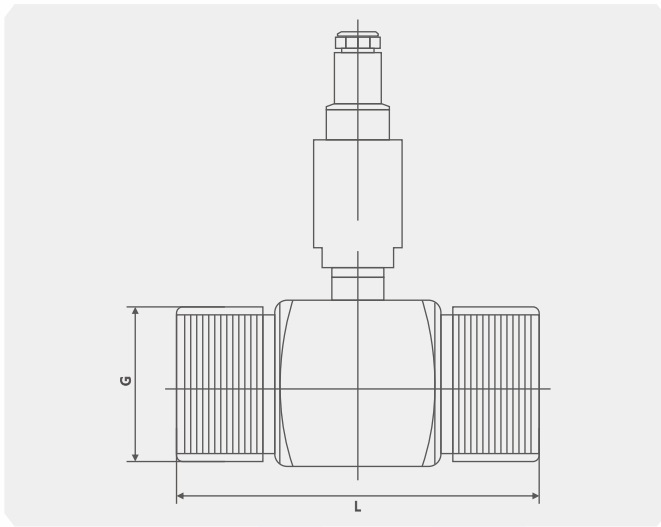
Type C: The power supply adopts 24VDC external power supply, and outputs 4-20mA standard two-wire, three-wire and four-wire current signals or 1-5v voltage signals. RS485 or HART communication can be added according to different field needs.



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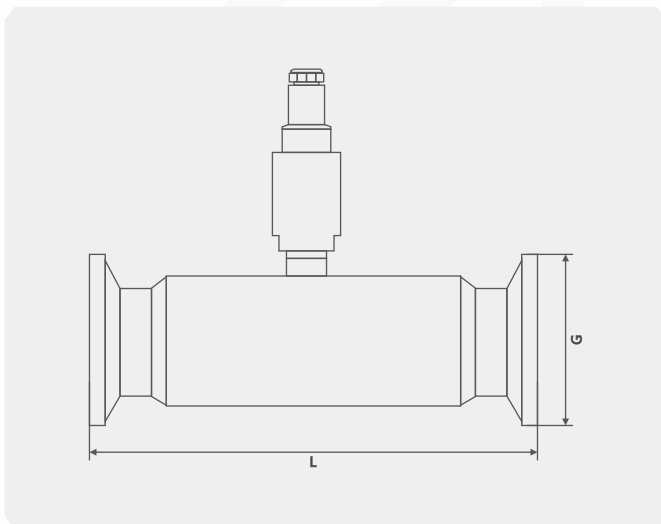


Size mm



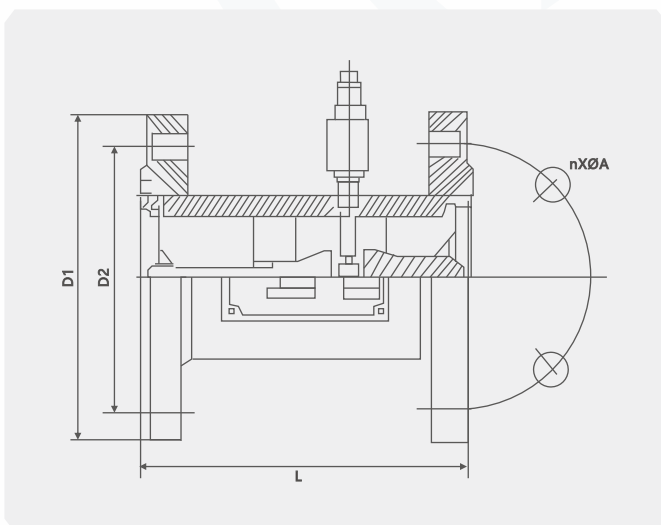
DN	2、3、4	6	10	15	20	25	32		
G	1/4	3/8	1/2	1	1	1½	1½		
L mm	40	55	40	50	60	75	75	100	120
weight kg	0.5	0.7	0.5	0.6	0.65	1.0	1.2	1.7	2.2

"*" Special customization



Ferrule connection size

caliber (DN)		G	L	weight (kg)
10	3/8"	51	100	1
15	1/2"	51	100	1.1
20	3/4"	51	100	1.5
25	1"	51	100	2
32	1¼"	64	140	3.5
40	1½"	64	140	5
50	2"	77.5	150	6.5
65	2½"	91	182	8



Flange connection size

DN	D1	D2	nXØA	L	weight (kg)
10	90	60	4X14	60	1.9
15	95	65	4X14	75	2.0
20	105	75	4X14	75	2.9
25	115	85	4X14	100	3.7
32	140	100	4X18	120	5
40	150	110	4X18	140	7
50	165	125	4X18	150	9
65	185	145	4X18	180	11
80	200	160	8X18	200	14
100	220	180	8X18	220	21
150	285	240	8X22	300	36
200	340	295	12X22	360	57

FT60-Selection composition

Selection example **FT60** / **A** / **H** / **1-10** / **L** / **S** / **F** / **V** / **B** / **G** / **Y** / **0.5** / **100** / **13.9**

1 2 3 4 5 6 7 8 9 10 11 12 13

1.Instrument signal output	A	4~20mA	
	B	4 to 20mA, HART protocol signal	
	C	4-20mA, switching output	
	D	4~20mA+RS485	
	E	4 to 20mA+MODBUS	
	F	4 to 20mA+RS485+MODBUS	
	Z	4~20mA+ pulse output	
2.Accuracy class	G	Accuracy level 1.0	
	H	Accuracy level 1.5	
	I	Accuracy level 0.5	
3.Range range	R ()	Range (Note Range)	
4.Ontology material	S	304 stainless steel	
	L	316l stainless steel	
	T ()	Other materials	
5.attended mode	S	Flange	
	U	Chuck connection	
6.Flange connection specification	B	DN6	
	C	DN10	
	D	DN15	
	E	DN20	
	F	DN25	
	G	DN32	
	H	DN40	
	I	DN50	
	J	DN65	
	K	DN80	
	L	DN100	
	M	DN125	
	N	DN150	
	F	DN200	
6-1.Threaded connection (Flange item is not selected)	T ()	Other specifications	
	G	1/2NPT	
	H	3/4NPT	
	I	1/4NPT	
	J	M8×1.0	
	K	M10×1.0	
	M	M12×1.5	
	N	M14×1.5	
	O	M18×1.5	
	P	M20×1.5	
	Q	G1/2	
R	G3/4		
S	G1/4		

FT60-Selection composition

Selection example **FT60** / 1 **A** / 2 **H** / 3 **1-10** / 4 **L** / 5 **S** / 6 **F** / 7 **V** / 8 **B** / 9 **G** / 10 **Y** / 11 **0.5** / 12 **100** / 13 **13.9**

6-1.Threaded connection (Flange item is not selected)	U	G1/8
	V	G3/8
	T()	Other specifications
7.Pressure rating	U	PN10
	V	PN16
	W	PN25
	X	PN40
	Y	PN63
	Z	PN100
	T()	Other pressure levels
8.Impeller material	A	304SS
	B	316L
	C	Duplex steel (recommended for corrosive media or food industry)
	D	Other materials (Remarks)
9.Explosion-proof requirement	G	Intrinsically safe explosion protection
	H	flameproof
	I	Non-explosion proof
10.Medium name	Y	liquid
11.Dielectric density	M()	(Remarks medium density)
12.Medium temperature	M()	(Note temperature)
13.Medium viscosity	N()	(Remarks medium viscosity)

Instructions:

It indicates that the signal output of FT60 liquid turbine flowmeter is 4-20mA , with accuracy level of 1.5 and measuring range of 1-10m/h. The main body is made of 316 stainless steel with flange connection, flange specification DN25mm, pressure resistance level PN16, and the impeller is made of 316 stainless steel, which is intrinsically safe and explosion-proof. The medium is liquid, with density of 0.5 kg/m, medium temperature of 100°C and medium.

Product Certification

Compliance and approval; Rodwig flow meters meet key standards and certifications for process measurement technology; To ensure the highest reliability in such settings;

