NC300G Series Vortex-shedding flowmeter

1. Overview

NC300G vortex-shedding flowmeter is used for measuring the volume, standard condition or mass flow-rate flow rate of gas, steam or liquid under the Karman vortex principle, and used for automatic control system as the flow transmitter.

The instruments applied the advanced line drive technology, and combined the measurements of separation, shielding and filtering, and overcome the difficulties of bad shock resistance and turbulence of the small signal data in the same kind of product, and applied the special sensor encapsulating and protecting technology, ensure the reliability of the product. The product is divided into two kind, one is basic, another is

Mixed, the basic type measures the single flow signal; and the fixed type could measure temperature, pressure and flow rate simultaneously. Each kind has the integral and split structure in order to fit for different mounting environment.

2. Working principle

The vortex-shedding flowmeter is composed by vortex generator, testing probe and corresponding electronic circuit, etc. When liquid is flowing the vortex generator, both sides formed two alternating change vortex, and this kind of vortex is called Karman vortex. The frequency of Karman vortex is proportional to the flow speed of the liquid.

f = St ×V/d

In the formula: f Occurrence of the vortex (Hz)

V The average flow speed of in two side of vortex generator (m/s)

St Strouhal coefficient（constant）

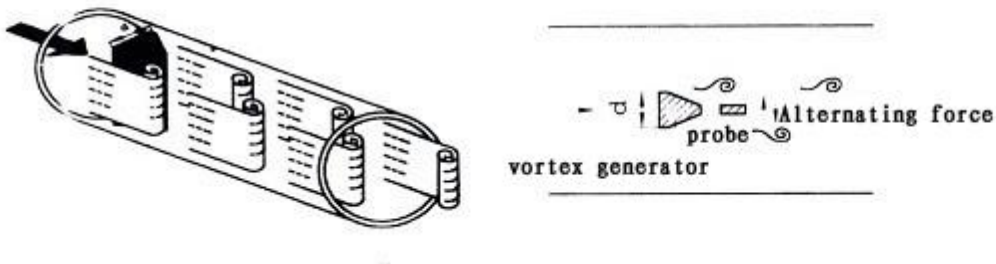

Figure1 The working principle of the vortex-shedding flowmeter

These alternating change vortex are formed a series of alternating change negative pressure, and the pressure takes action on testing probe, then created a series of alternating electric signal, and converse, shape and amplify by preamplifier, then output the pulse frequency signal (or standard signal) that is proportional to vortex synchronization.

3. Figures and application of the instrument

Figures：

- No movable parts, and stable for long term, and simple structure and easy to install and maintain.
- Applied the noise immunization circuit and anti-shock sensor, which made the instrument could resist the shock in working condition.
- Apply the technology of Exceed Low Power Dissipation single chip microcomputer, and one 3.6V10AH lithium battery could be used more than five years.
- Amend the instrument coefficient non-linear by software, and improve the measuring precision.
- Less pressure loss and wide range.

Apply **EEPROM** to process the Power Fail Safeguard for accumulated flow, and the safeguard period is more than 10 years.

Application: The instrument is widely used in measuring the flow in large, middle and small pipelines for drainage, industrial circle, sewage treatment, oil, chemical reagent, compressed air, saturated steam and superheated steam and kinds of media, and characterized in less pressure loss and wide range.

4. Technical parameter

Table1 Technical parameter

Nominal diameter（mm）	20，25，40，50，65，80，100，125，150，200，250，300
Material of the instrument	1Cr18Ni 9Ti
Nominal pressure（MPa）	PN1.6MPa；PN2.5MPa
Temperature of the measured media（℃）	--40～+250℃ ；-40～+350℃
environmental condition	Temperature-10～+55℃ ，relative humidity 5%～90%，atmospheric pressure 86～106kPa
Grade of the precision	±2.5% of the display value
Range ratio	1:10；1:15
resistance loss coefficient	Cd<2.6
Output signal	Sensor：Signal of pulse frequency0.1~3000Hz low level≤1V High level≥6V Transmitter：two wire system 4~20mADC current signal
Power supply	Sensor：+12VDC、+24VDC（Optional）Transmitter：+24VDC Display onsite：Self installed in the instrument3.6Vlithium battery
Signal transmission cable	STVPV3×0.3(three-wire system)，2×0.3(two wire

	system)
Transmission distance Signal cable interface	≤500m Internal thread M20×1.5
Explosion-proof marker	ExdIIBT6
Grade of Protection	IP65
Permitted Acceleration of vibration	1.0g

5. The product model and marking

Table 2 The product model and marking

The product model and marking			Instruction
Type NC300G			Apply the Karman vortex street principle flow transducer
Testing method	B		Stress test
—			
Flange connected	1		Flange standard of the Instrument boy：GB/T9119.10－2000
Flange clamped	2		The product with clamping flange, screw blot and Gasket from factory.
Test media	Gas	1	
	Liquid	2	
	Steam	3	
Caliber	01	20mm	
	02	25mm	
	04	40mm	
	05	50mm	
	06	65mm	
	08	80mm	
	10	100mm	
	12	125mm	
	15	150mm	
	20	200mm	
	25	250mm	
	30	300mm	
Type of the signal and Converter	Z		Integral type
	N	voltage impulse	

A	4～20mADC，two-wire system
B	battery powered，onsite LCD
C	onsite LCD，4～20mADC
F	Split type
N	voltage impulse
C	4～20mADC， Current indicating instrument head
E	explosion proofing，ExdIIBT6
N	NO explosion proofing

For example: Select a flange clamping explosion proofing vortex-shedding flowmeter to measure steam, the pipeline is DN50, and needs to display flow rate and remote transmitting the signal onsite, the product type should be: NC300G-2305ZCE

6. Type selection

1．The flow range of the general liquid and gas see table 3

Table 3 The flow range of the general liquid and gas

Caliber (mm)	Liquid		Gas	
	Flow rate (m^3/h)	Frequency （Hz)	Frequency (Hz)	Flow rate (m^3/h)
20	1~10	40~396	5.5~50	218~1982
25	1.6~16	32~325	8.5~70	172~1420
40	2.5~25	13~130	22~220	115~1147
50	3.5~35	9~93	36~320	96~854
65	6.5~68	8~82	50~480	61~583
80	10~100	6~65	70~640	45~417
100	15~150	5~50	130~1100	43~367
125	27~275	5~47	200~1700	33~290
150	40~400	4~40	280~2240	27~221
200	80~800	3~33	580~4960	24~207
250	120~1200	3~26	970~8000	20~171
300	180~1800	2~22	1380~11000	17~136

The frequency in the table is theoretical value, and the liquid used for measuring test is room temperature water（t=20℃，ρ=1000Kg/m^3). And the liquid used for measuring test is normal temperature and pressure air （t=20℃，P=101.325KPa，ρ=1.205 Kg/m^3）

2 The given volume flow-rate from standard to working condition

The measuring unit of the general gas always used the standard volume flow rate, namely Nm3/h. Use the following formula to converse the standard volume flow rate to working condition volume flow rate, namely, Nm3/h, then compare with the applicable flow range in Table 3.

$$Q_{工} = Q_{标} \times \frac{0.10325 \times (T_{工} + 273.15)}{293.15 \times (P_{工} + 0.101325)}$$

Q工---Q Working condition

Q標---Q standard condition

In the formula：Q 工 The volume flow rate of the measured media in the working condition （m3/h）

Q 標：The volume flow rate of the measured media in the standard condition

（Nm3/h，20℃ ，0.1013MPa under the Absolute pressure）

T 工： The media temperature of the measured media in the working condition.

P 工： The media pressure of the measured media in the working condition. (MPa)

3． For saturated steam, Select the Mass flow-rate from Table 4

4． For superheated steam, first refer superheated steam table (Table 5) and search the corresponding temperature and pressure (take the Absolute pressure: Instrument pressure+1), then calculate the corresponding volume flow rate, and then compare with the steam flow in Table 4 and select the type.

$$Q(m^3/h) = \frac{G(kg/h)}{\rho(kg/m^3)}$$

In the formula：G：Mass flow-rate)□ □

p□ ： Medium density

Table 4 The flow range of the saturated stea

Absolute pressure MPa		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	Flow unit
Temperature °C		120	133	144	152	159	165	170	175	180	184	189	192	195	198	201	204	
Density kg/m3		1.13	1.66	2.18	2.67	3.17	3.67	4.16	4.66	5.15	5.64	6.13	6.62	7.11	7.6	8.09	8.58	
DN20	Qmin	6.22	9.13	12	14.7	17.4	20.2	23	25.6	28.3	31	33.7	36.4	39	41.8	44.5	47.2	
	Qmax	56.5	83	43.6	133.5	158.5	183.5	208	233	257.5	282	306.5	331	355.5	380	404.5	429	
DN25	Qmin	9.6	14	18.53	22.7	27	31.2	35.3	39.6	43.7	48	52	56.2	60.4	64.6	68.7	72.9	
	Qmax	79.1	116.2	152.6	186.9	222	256.9	291.2	326.2	360.5	394.8	429.1	463.4	498	532	566.3	600.6	
DN40	Qmin	24.9	36.5	48	58.7	69.7	80.7	91.5	102.5	113	124	135	145.6	156.4	167.2	180	188.8	
	Qmax	249	365	480	587	697	807	915	1025	1130	1240	1350	1456	1564	1672	1800	1888	
DN50	Qmin	40.7	59.8	78.5	96	114	132	150	168	185	203	221	238	256	274	291	309	
	Qmax	362	531	698	854	1014	1174	1331	1491	1648	1805	1962	2118	2275	2432	2589	2746	
DN65	Qmin	56.5	83	109	133.5	158.5	183.5	208	233	257.5	282	306.5	331	355.5	380	404.5	429	
	Qmax	542	797	1046	1282	1522	1762	1997	2237	2472	2707	2942	3178	3413	3648	3883	4118	
DN80	Qmin	79	116	153	187	222	257	291	326	361	395	429	463	498	532	566	600	
	Qmax	723	1062	1395	1709	2029	2349	2662	2982	3296	3610	3923	4237	4550	4864	5178	5491	
DN100	Qmin	147	216	283	347	412	477	541	606	670	733	797	861	924	988	1052	1115	kg/h
	Qmax	1243	1826	2398	2937	3487	4037	4576	5126	5665	6204	6743	7282	7821	8360	8899	9348	
DN125	Qmin	226	332	436	534	634	734	832	932	1030	1128	1226	1324	1422	1520	1618	1716	
	Qmax	1921	2822	3706	4539	5389	6239	7022	7922	8755	9588	10421	11254	12087	12920	13753	14586	
DN150	Qmin	316	465	610	748	888	1028	1165	1305	1442	1579	1716	1854	1991	2128	2265	2402	
	Qmax	2531	3718	4883	5981	7101	8221	9318	10438	11536	12634	13731	14829	15926	17024	18122	19209	
DN200	Qmin	655	963	1264	1549	1839	2129	2413	2703	2987	3271	3555	3840	4124	4408	4692	4976	
	Qmax	5605	8234	10813	13243	15723	18203	20634	23114	25544	27974	30405	32835	35266	37696	40126	42557	
DN250	Qmin	1096	1610	2115	2590	3075	3560	4035	4520	4996	5471	5946	6421	6683	7322	7847	8323	
	Qmax	9040	13280	17440	21360	25360	29360	33280	37280	41200	45120	49040	52960	56880	60800	64720	68640	
DN300	Qmin	1560	2290	3008	3684	4375	5056	5741	6431	7107	7783	8459	9136	9812	10488	11164	11840	
	Qmax	12430	18260	23980	29370	34870	40370	45760	51260	56650	62040	67430	72820	78210	83600	88990	93480	

Table 5 The density table of the superheated steam

Temperature C / Absolute temperature MPa	140	180	220	260	300	340	380	420	460
0.15	0.78	0.71	0.65	0.6	0.56	0.52	0.49	0.46	0.44
0.2	1.05	0.95	0.87	0.8	0.75	0.7	0.65	0.62	0.58
0.25	1.32	1.19	1.09	1	0.93	0.87	0.82	0.77	0.73
0.3	1.59	1.43	1.31	1.21	1.12	1.05	0.98	0.93	0.87
0.36	1.92	1.73	1.58	1.45	1.35	1.26	1.18	1.11	1.05
0.4		1.93	1.75	1.62	1.5	1.4	1.31	1.23	1.16
0.5		2.42	2.2	1.99	1.88	1.72	1.64	1.54	1.46
0.6		2.93	2.66	2.44	2.26	2.1	1.97	1.85	1.75
0.7		3.44	3.11	2.86	2.64	2.46	2.3	2.16	2.04
0.8		3.96	3.58	3.27	3.02	2.82	2.64	2.48	2.34
0.9		4.5	4.04	3.69	3.41	3.17	2.98	2.79	2.63
1		5.04	4.52	4.12	3.8	3.53	3.5	3.1	2.93
1.4			6.46	5.85	5.37	4.98	4.65	4.37	4.05
1.8			8.51	7.64	7	6.46	6.02	5.64	5.31
2			9.58	8.56	7.81	7.21	6.71	6.28	5.91
2.4				10.45	9.48	8.72	8.1	7.57	7.12
2.8				12.41	11.19	10.26	9.51	8.88	8.34
3.2				14.46	12.94	11.83	10.94	10.2	9.57
3.6				16.61	14.76	13.43	12.39	11.54	10.91

5・ The calculation of the pressure loss

Calculate the pressure loss whether affects the process pipeline, and calculated by following formula: □

$P=1.2\ V_2$(Pa)

In the formula：□ P：pressure loss (Pa) □

p： Medium density

V： The average flow speed in pipeline (m/s)

6・If the measured media is liquid, in order to prevent gasify and cavitation erosion, the liquid pressure of the sensor should reach to following requirement:

$P \geqslant 2.6$□ $P + 1.25P_1$（**Pa** Absolute pressure）

In the formula：□ P： Value of the pressure loss（Pa）

P_1 ：Vapor pressure of the liquid（Pa Absolute pressure）

7・Structure and mounting

1 · Structure

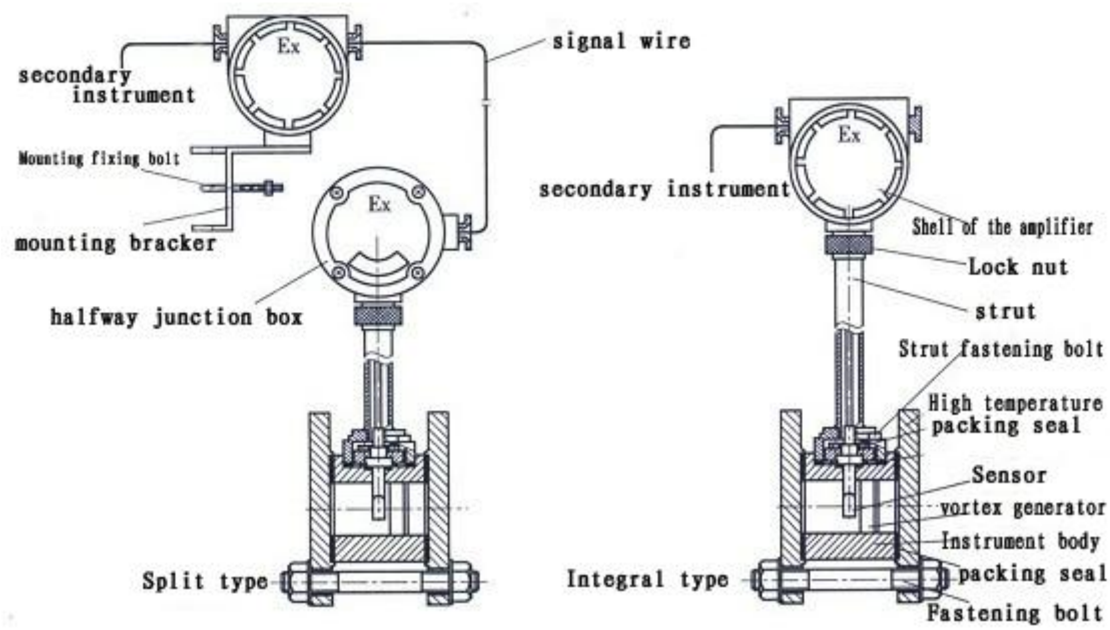

Figure2 The schematic diagram of instrument structure

2 · The shade and specification

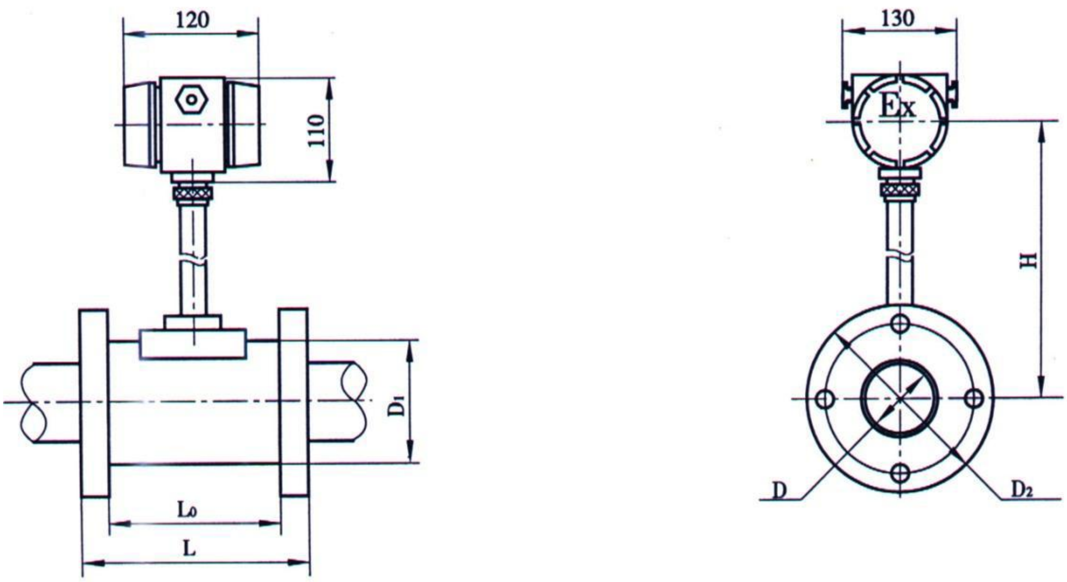

Figure 3 The schematic diagram of the shade and specification of the instrument

Table 6 The shade and specification of the instrument

Caliber （D）	Specification of the pipeline	H	L	L0	D1	D2
20	Φ26×3	290	116	80	68	135
25	Φ32×3.5	290	116	80	68	135
32	Φ39×3.5	290	116	80	68	135
40	Φ49×4.5	295	120	80	80	140
50	Φ59×4.5	300	124	80	88	145
65	Φ74×4.5	308	128	80	105	165
80	Φ89×4.5	315	128	80	120	180
100	Φ109×4.5	328	132	80	148	210
125	Φ133×4.5	340	137	85	174	235
150	Φ159×4.5	351	146	90	196	270
200	Φ219×9	378	169	105	250	325
250	Φ273×11	402	184	120	300	375
300	Φ325×12	428	199	135	350	425