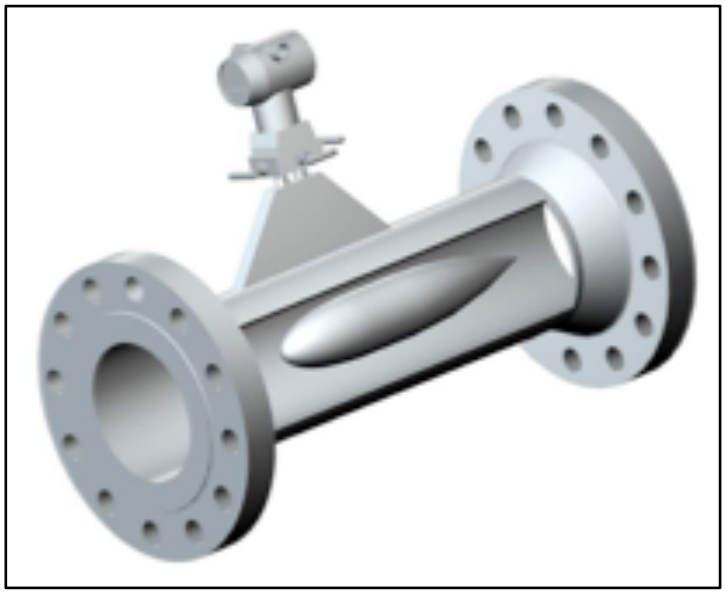
CLJ Series SPINDLE Flowmeter

- Patented Innovation
- Annular Channel Flow Shaped
- High Accuracy and High Repeatability
- Extensive Turndown (500:1)
- No Requirement for Straight Run
- Low Pressure Lost
- Self-Cleaning in Measuring Tube
- Applicable for most fluid, and situation of high temperature and high pressure.

Content

Principle



- Flow rate formula by dimensional analysis

$$f_1(\Delta p, \rho_1, p_1, v_1, D, d_s, \mu) = 0$$

Base quantities:

$$\rho_1, v_1, D$$

$$\frac{\Delta p}{\frac{1}{2}\rho_1 v_1^2} \qquad \frac{d}{D} = \beta \qquad \frac{\mu}{\rho_1 v_1 D} = \frac{1}{\mathrm{Re}} \qquad \frac{p_1}{\frac{1}{2}\rho_1 v_1^2} = \frac{1}{\frac{1}{2}kM^2}$$

$$\frac{\Delta p}{\frac{1}{2}\rho_1 v_1^2} = f_1(\mathrm{Re}, \beta, kM^2)$$

$$v_1 = f_2(\mathrm{Re}, \beta, kM^2)\sqrt{2\Delta p / \rho_1}$$

$$q_m = \rho_1 v_1 A_1 = f_2(\mathrm{Re}, \beta, kM^2)\frac{\pi D^2}{4}\sqrt{2\rho_1 \Delta p}$$

$$q_m = f\,(\mathrm{Re}, \beta, kM^2)\frac{\pi d^2}{4}\sqrt{2\rho_1 \Delta p}$$

- **Conclusion: the flow coefficient C is only related to Re, and expansibility factor ε is only related to compressibilty。**

A Patented Innovation

- European Patent:
  - EP 2787329
- Chinese Patent:
  - 201420159456.8

Europäisches Patentamt
European Patent Office
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URKUNDE | **CERTIFICATE** | **CERTIFICAT**

Es wird hiermit bescheinigt, dass für die in der Patentschrift beschriebene Erfindung ein europäisches Patent für die in der Patentschrift bezeichneten Vertragsstaaten erteilt worden ist.

It is hereby certified that a European patent has been granted in respect of the invention described in the patent specification for the Contracting States designated in the specification.

Il est certifié qu'un brevet européen a été délivré pour l'invention décrite dans le fascicule de brevet, pour les Etats contractants désignés dans le fascicule de brevet.

Europäisches Patent Nr. / European patent No. / Brevet européen n°
2787329

Patentinhaber / Proprietor of the patent / Titulaire du brevet

Nanjing Youyang Control Technology Co. Ltd
Qingshuiting West Road 2
Nanjing 211102/CN

PIVTEC-GmbH
Stauffenbergring 21
37075 Göttingen/DE

München, den / Munich, / Fait à Munich, le 15.02.17

Benoît Battistelli
Président des Europäischen Patentamts
President of the European Patent Office
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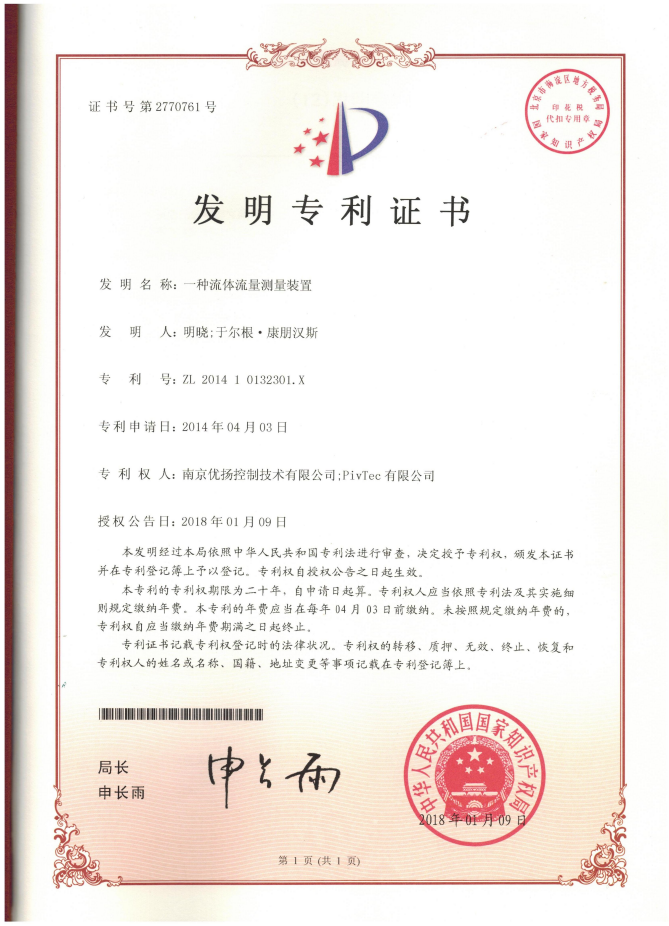

证书号第2770761号

发明专利证书

发明名称：一种流体流量测量装置

发　明　人：明晓;于尔根·康朋汉斯

专　利　号：ZL 2014 1 0132301.X

专利申请日：2014年04月03日

专利权人：南京优扬控制技术有限公司;PivTec有限公司

授权公告日：2018年01月09日

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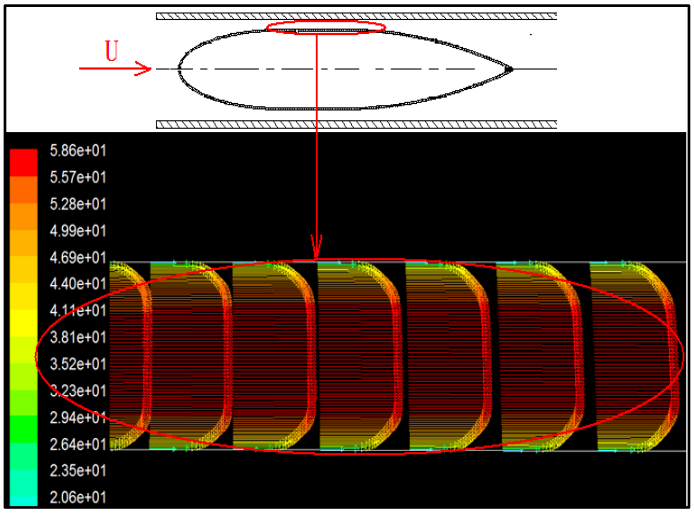
2018年01月09日

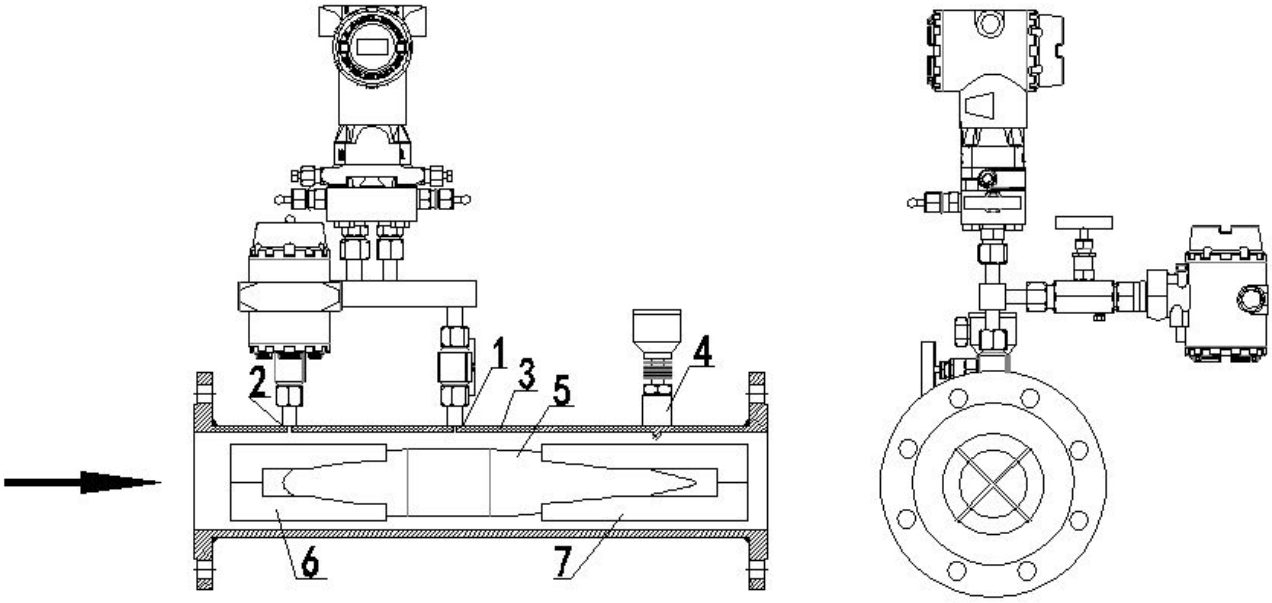
第 1 页 (共 1 页)

Theoretical Advantage of the Design



- • Basic principles of fluid mechanics: the similarity between the flow field of calibration and that of application.
- Standardization of the fluid flow in pipeline.
- As the Reynolds number (flow rate) increases, the boundary layer becomes thinner and the effect of viscosity decreases, and a constant flow coefficient is obtained.
- Designed with Computational Fluid Dynamics
- Design optimized with genetic algorithm

CLJ Series SPINDLE Flowmeter



1. Low pressure tap
2. High pressure tap
3. Measuring tube
4. Temperature tap
5. Throttling spindle
6. Front fins
7. Rear fins

CLJ 型

Applied with a flow totalizer, it can:

- Communicate remotely
- Totalize remotely
- Calculate the peak value
- Upload the data

For more information, contact the supplier.

Specification

Features

- Accuracy：Better than 0.15% for liquid; Better than 0.3% for gas
- Repeatability: Better than 0.1%
- Turndown Ratio：13:1（expandable to 150:1，500:1 depending on pressure sensors ）

Preparation

- Contact local representative and complete the CDS form in appendix to confirm the applicability.
- There is no requirement for the straight run upstream and downstream.

Application

- Applicable for liquid, gas or steam in pipelines where Reynolds number is greater than 2,000。
- 1/4" to 160" (DN8 to DN4000 mm). As for other pipe size, contact local representative。

Operating Temperature Range

- -200 to 850 °C

Maximum Operating Pressure

- Maximum PN 400 by GB standard; Maximum Class 2500 by ASME standard.

Calibration

- The meter is calibrated by flow rate before delivery. A unique calibration co-efficient is stored in electronic components such as flow totalizer. When replacing

flow totalizer, there is no need to re-calibrate the meter and its performance will not be affected.

Table 1. Typical Turndown（8 mm to 4000 mm / ¼ Inch to 160 Inch）

DN mm（ Inch）	Operating Pressure MPa	Flow Rate（Gas） Nm^3/h (1)	Flow Rate（Liquid） m^3/h
8 (¼)	0.1 ~ 40	0.57 ~ $5.7x10^3$	0.01 ~ 2.0
15 (½)	0.1 ~ 40	1.27 ~ $1.3x10^4$	0.03 ~ 4.5
25 (1)	0.1 ~ 40	3.53 ~ $3.5x10^4$	0.08 ~ 12
32 (1 ¼)	0.1 ~ 40	5.79 ~ $5.8x10^4$	0.14 ~ 20
40 (1 ½)	0.1 ~ 40	9.05 ~ $9.0x10^4$	0.22 ~ 32
50 (2)	0.1 ~ 40	14.1 ~ $1.4x10^5$	0.34 ~ 49
65 (2 ½)	0.1 ~ 40	23.9 ~ $2.4x10^5$	0.57 ~ 84
80 (3)	0.1 ~ 40	36.2 ~ $3.6x10^5$	0.87 ~ 130
100 (4)	0.1 ~ 40	56.6 ~ $5.7x10^5$	1.36 ~ 200
125 (5)	0.1 ~ 40	88.4 ~ $8.8x10^5$	2.12 ~ 310
150 (6)	0.1 ~ 40	127 ~ $1.3x10^6$	3.06 ~ 450
200 (8)	0.1 ~ 40	226 ~ $2.3x10^6$	5.44 ~ 790
250 (10)	0.1 ~ 40	353 ~ $3.5x10^6$	8.50 ~ $1.2x10^3$
300 (12)	0.1 ~ 40	509 ~ $5.1x10^6$	12.2 ~ $1.8x10^3$
350 (14)	0.1 ~ 40	693 ~ $6.9x10^6$	16.6 ~ $2.4x10^3$
400 (16)	0.1 ~ 40	905 ~ $9.0x10^6$	21.7 ~ $3.2x10^3$
450 (18)	0.1 ~ 40	$1.2x10^3$ ~ $1.1x10^7$	27.5 ~ $4.0x10^3$
500 (20)	0.1 ~ 40	$1.4x10^3$ ~ $1.4x10^7$	33.9 ~ $4.9x10^3$
600 (24)	0.1 ~ 40	$2.0x10^3$ ~ $2.0x10^7$	48.9 ~ $7.1x10^3$
700 (28)	0.1 ~ 40	$2.8x10^3$ ~ $2.8x10^7$	66.6 ~ $9.7x10^3$
800 (32)	0.1 ~ 40	$3.6x10^3$ ~ $3.6x10^7$	87.0 ~ $1.3x10^4$
1000 (40)	0.1 ~ 40	$5.7x10^3$ ~ $5.7x10^7$	135 ~ $2.0x10^4$
1200 (48)	0.1 ~ 40	$8.1x10^3$ ~ $8.1x10^7$	196 ~ $2.9x10^4$
1400 (56)	0.1 ~ 40	$1.1x10^4$ ~ $1.1x10^8$	267 ~ $3.9x10^4$
1600 (64)	0.1 ~ 40	$1.5x10^4$ ~ $1.4x10^8$	348 ~ $5.1x10^4$
1800 (72)	0.1 ~ 40	$1.8x10^4$ ~ $1.8x10^8$	440 ~ $6.4x10^4$
2000 (80)	0.1 ~ 40	$2.3x10^4$ ~ $2.3x10^8$	544 ~ $7.9x10^4$
2200 (88)	0.1 ~ 40	$2.7x10^4$ ~ $2.7x10^8$	658 ~ $9.6x10^4$
2400 (96)	0.1 ~ 40	$3.3x10^4$ ~ $3.3x10^8$	783 ~ $1.1x10^5$
2600 (104)	0.1 ~ 40	$3.8x10^4$ ~ $3.8x10^8$	919 ~ $1.3x10^5$
2800 (112)	0.1 ~ 40	$4.4x10^4$ ~ $4.4x10^8$	$1.1x10^3$ ~ $1.6x10^5$
3000 (120)	0.1 ~ 40	$5.1x10^4$ ~ $5.1x10^8$	$1.2x10^3$ ~ $1.8x10^5$
3200 (128)	0.1 ~ 40	$5.8x10^4$ ~ $5.8x10^8$	$1.4x10^3$ ~ $2.0x10^5$
3400 (136)	0.1 ~ 40	$6.5x10^4$ ~ $6.5x10^8$	$1.6x10^3$ ~ $2.3x10^5$
3600 (144)	0.1 ~ 40	$7.3x10^4$ ~ $7.3x10^8$	$1.8x10^3$ ~ $2.6x10^5$
3800 (152)	0.1 ~ 40	$8.2x10^4$ ~ $8.2x10^8$	$2.0x10^3$ ~ $2.9x10^5$

(1) Nm^3/h under the condition of 1.013 bar and 0℃

4000 (160)	0.1 ~ 40	$9.1x10^4$ ~ $9.0x10^8$	$2.2x10^3$ ~ $3.2x10^5$

Dimensions

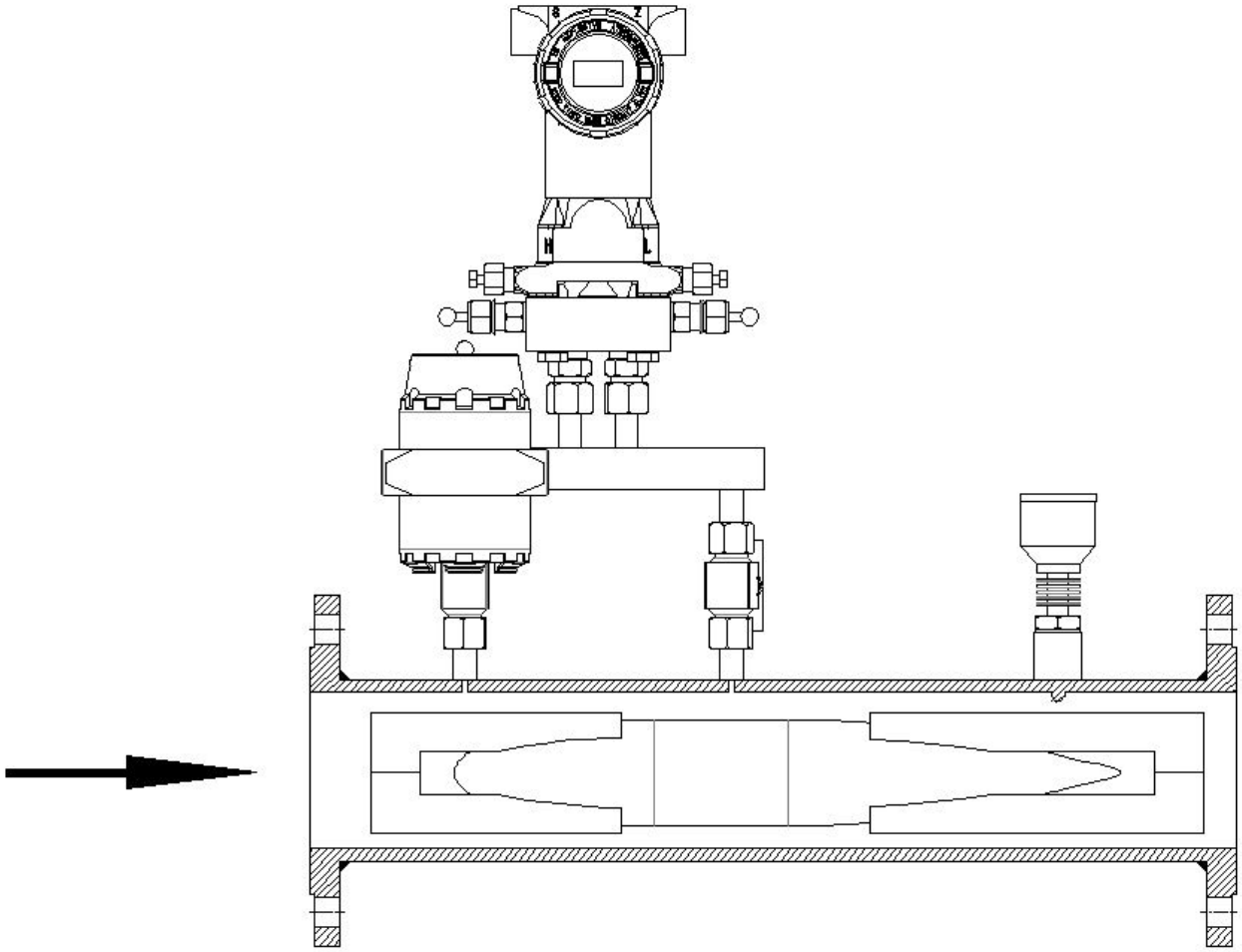


Figure 1. Connection of PL Flange

Flange Standard：GB/T9119-2010
Connection Type：PL
Facing Type：FF/RF
Pressure Rating (MPa)： 0.25、0.6、1.0、1.6、2.5、4.0、6.3、10
（note：PL- plate slip-on welding, FF – flat face, RF - raised face）

Table 2. GB/T9119-2010 Flange Class（10 mm to 600 mm / ⅜ Inch to 24 Inch）

DN mm（ Inch）	Flange Class MPa / Outer Daimeter mm		GB/T9119-2010							
			0.25	0.6	1.0	1.6	2.5	4.0	6.3	10.0
			FF/RF						RF	
	I	II	L							
10 (⅜)	17.2	14	144	144	148	148	148	148	160	160
15 (½)	21.3	18	164	164	168	168	168	168	180	180
20 (¾)	26.9	25	188	188	192	192	192	192	204	204
25 (1)	33.7	32	208	208	212	212	212	212	228	228
32 (1 ¼)	42.4	38	240	240	244	244	244	244	256	256
40 (1 ½)	48.3	45	272	272	276	276	276	276	292	292
50 (2)	60.3	57	332	332	340	340	340	340	352	356
65 (2 ½)	76.1	76	392	392	400	400	404	404	412	420
80 (3)	88.9	89	456	456	460	460	468	468	480	488
100 (4)	114.3	108	556	556	564	564	572	572	584	592
125 (5)	139.7	133	660	660	664	664	676	676	688	704
150 (6)	168.3	159	760	760	768	768	780	780	792	816
200 (8)	219.1	219	964	964	968	972	984	992	1016	1040
250 (10)	273	273	978	978	982	988	1000	1014	1040	1074
300 (12)	323.9	325	1128	1128	1132	1144	1156	1184	1210	1248
350 (14)	355.6	377	1302	1302	1310	1320	1334	1366	1394	1440
400 (16)	406.4	426	1456	1456	1464	1476	1496	1530	1560	-
450 (18)	457	480	1660	1660	1672	1684	1708	1732	-	-
500 (20)	508	530	1810	1810	1846	1842	1866	1894	-	-
600 (24)	610	630	2164	2164	2184	2210	2236	2268	-	-

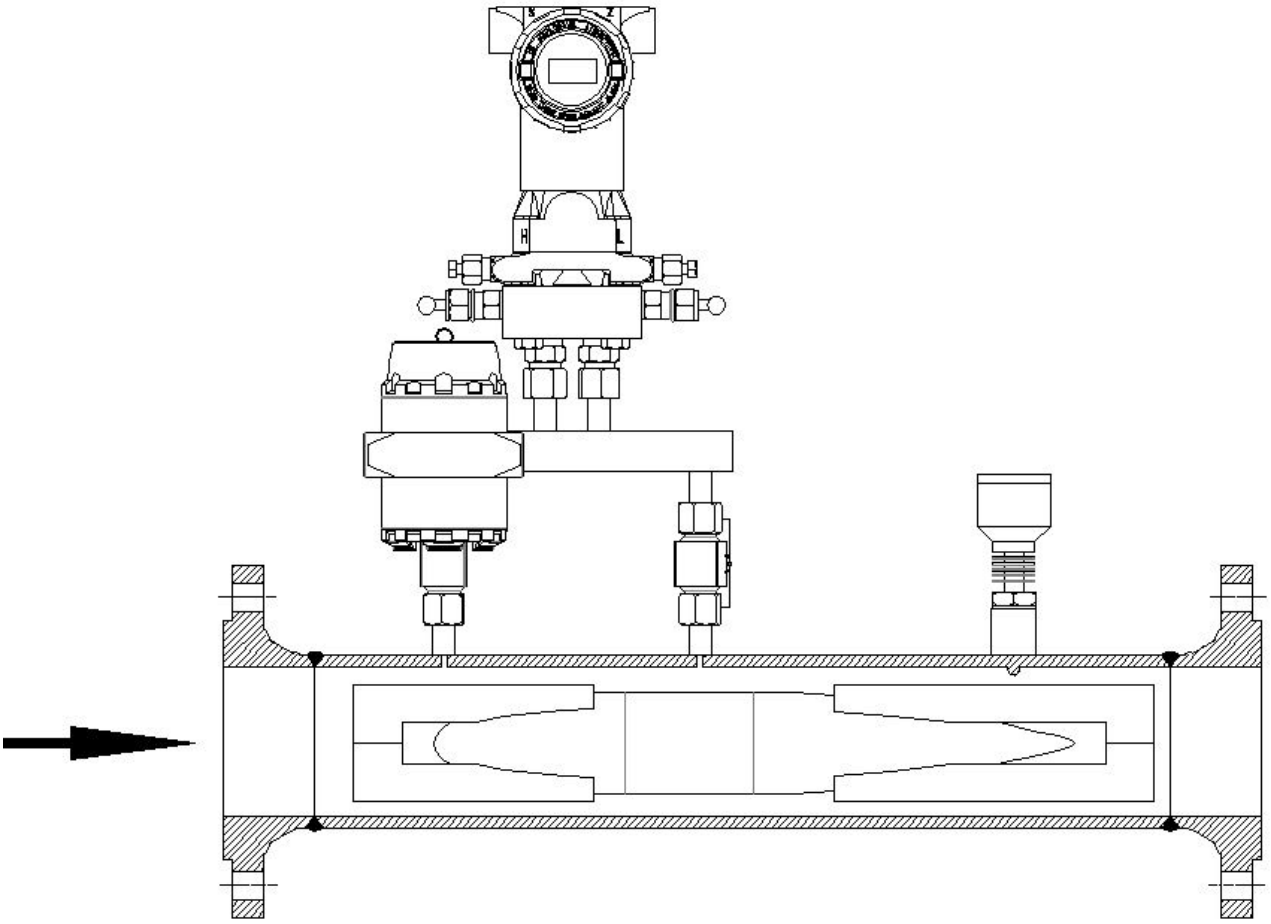


Figure 2. Connection of WN Flange

Flange Standard：ASMEB16.5-2009;
Connection Type：WN;
Facing Type：FF/RF/MF/RJ;
Pressure Rating (CLASS/MPa)：300/5.0、600/11.0、900/15.0、1500/26.0、2500/42.0

Flange Standard：GB/T9115-2010;
Connection Type：WN;
Facing Type：RF/MF/RJ;
Pressure Rating (MPa)：4.0、6.3、10.0、16.0、25.0、32.0、40
（note：WN - welding with neck、FF - flat face、RF- raised face、MF – male&female face、RJ – ring joint）

Table 3. ASMEB16.5-2009 Flange Size（15 mm to 600 mm / ½ Inch to 24 Inch）

DN mm （ Inch）	Flange Class / Outer Diameter mm	ASMEB16.5-2009					
		Class150	Class300	Class600	Class900	Class1500	Class2500
		FF/RF/RJ	RF/MF/RJ				
	I	L					
15 (½)	21.3	232	242	244	260	260	286
20 (¾)	26.9	262	272	274	300	300	318
25 (1)	33.7	288	300	304	326	326	358
32 (1 ¼)	42.4	320	336	342	354	354	398
40 (1 ½)	48.3	360	374	380	406	406	462
50 (2)	60.3	424	436	446	504	504	554
65 (2 ½)	76.1	496	510	518	570	570	646
80 (3)	88.9	556	576	586	644	654	756
100 (4)	114.3	670	688	724	748	768	900
125 (5)	139.7	794	814	848	874	932	1078
150 (6)	168.3	894	914	954	1000	1062	1266
200 (8)	219.1	1120	1140	1186	1244	1346	1556
250 (10)	273	1130	1162	1234	1298	1438	1768
300 (12)	323.9	1306	1338	1392	1480	1646	2008
350 (14)	355.6	1500	1532	1580	1676	1846	-
400 (16)	406.4	1650	1688	1756	1832	2022	-
450 (18)	457	1876	1914	1968	2058	2254	-
500 (20)	508	2036	2070	2130	2246	2462	-
600 (24)	610	2402	2434	2506	2684	2912	-

Table 4. GB/T9115-2010Flange Size（8 mm to 600 mm / ¼ Inch to 24 Inch）

DN mm （Inch）	Flange Class MPa / Outer Diameter mm		GB/T9115-2010											
			0.25	0.6	1.0	1.6	2.5	4.0	6.3	10.0	16.0	25.0	32.0	40.0
			RF		RF/MF				RF/MF/RJ					
	I	II	L											
8 (¼)	17.2	14	176	176	190	190	190	190	210	210	210	236	236	250
15 (½)	21.3	18	200	200	216	216	216	216	230	230	230	260	260	276
20 (¾)	26.9	25	224	224	240	240	240	240	256	256	264	284	300	320
25 (1)	33.7	32	250	250	260	260	260	260	296	296	296	310	336	360
32 (1 ¼)	42.4	38	278	278	292	292	292	292	328	328	328	348	374	408
40 (1 ½)	48.3	45	316	316	330	330	330	330	364	364	368	400	416	460
50 (2)	60.3	57	376	376	390	390	396	396	424	436	450	470	500	540
65 (2 ½)	76.1	76	436	436	450	450	464	464	496	512	524	550	600	630
80 (3)	88.9	89	504	504	520	520	536	536	564	576	592	624	680	720
100 (4)	114.3	108	610	610	624	624	650	650	676	700	720	760	810	870
125 (5)	139.7	133	716	716	730	730	756	756	796	830	850	900	970	1020
150 (6)	168.3	159	816	816	830	830	870	870	910	950	976	1040	1110	1170
200 (8)	219.1	219	1030	1030	1044	1044	1080	1096	1140	1180	1200	1300	1390	1480
250 (10)	273	273	1050	1050	1066	1070	1106	1140	1180	1244	1240	1360	1530	-
300 (12)	323.9	325	1204	1204	1216	1236	1264	1310	1360	1420	1430	-	-	-
350 (14)	355.6	377	1374	1374	1386	1414	1450	1500	1550	1628	-	-	-	-
400 (16)	406.4	426	1530	1530	1544	1570	1620	1670	1720	-	-	-	-	-
450 (18)	457	480	1730	1730	1744	1766	1820	1870	-	-	-	-	-	-
500 (20)	508	530	1886	1886	1900	1918	2000	2030	-	-	-	-	-	-
600 (24)	610	630	2240	2240	2264	2276	2350	2400	-	-	-	-	-	-

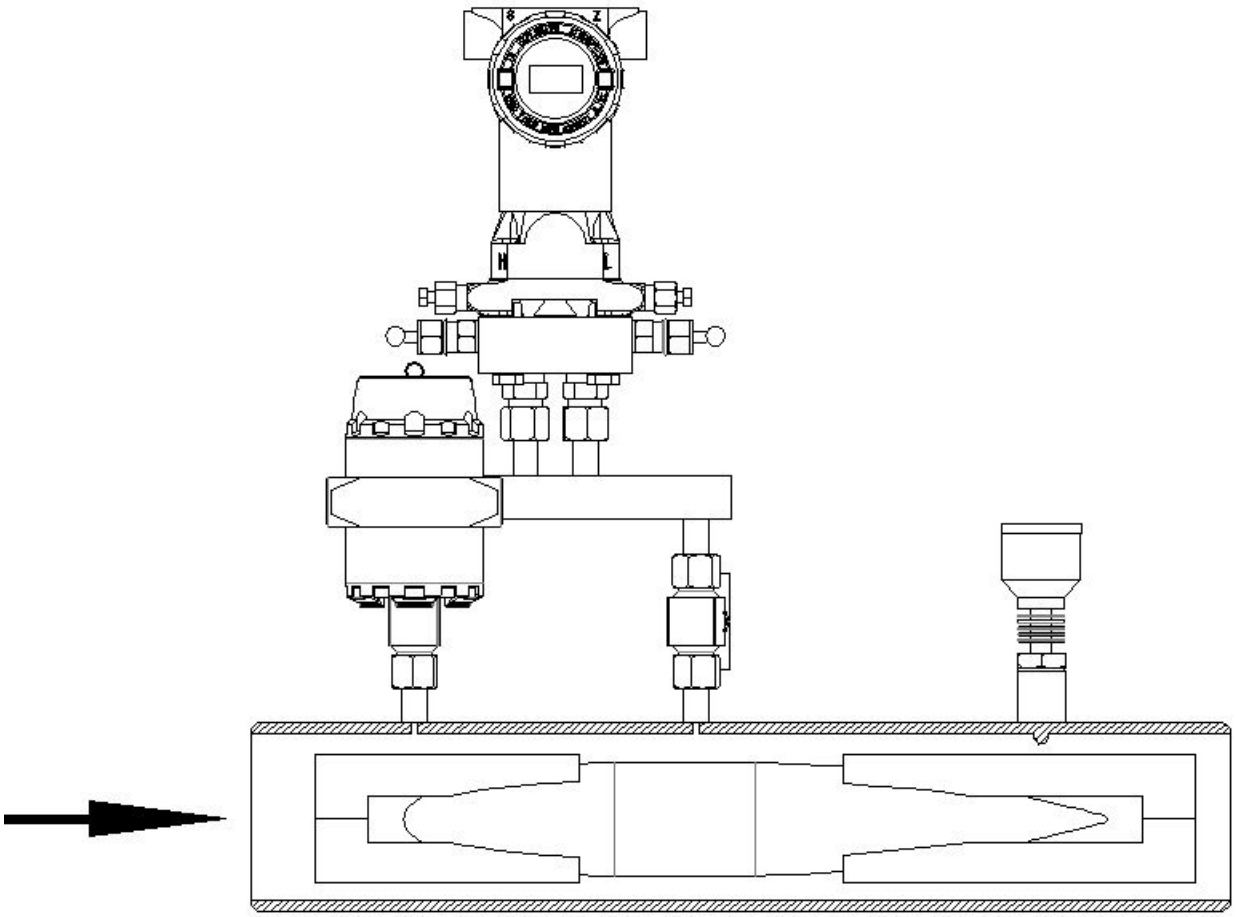


Figure 3. Welding Connection

Table 5. Connecting Pipe Size（10 mm to 450 mm / ⅜ Inch to 18 Inch）

DN mm（ Inch）	Outer Diameter mm		Length mm
	I	II	L
10 (⅜)	17.2	14	120
15 (½)	21.3	15	140
20 (¾)	26.9	20	160
25 (1)	33.7	25	180
32 (1 ¼)	42.4	32	208
40 (1 ½)	48.3	40	240
50 (2)	60.3	50	300
65 (2 ½)	76.1	65	360
80 (3)	88.9	80	420
100 (4)	114.3	100	520
125 (5)	139.7	125	620
150 (6)	168.3	150	720
200 (8)	219.1	200	920

250 (10)	273.0	250	930
300 (12)	323.9	325	1080
350 (14)	355.6	377	1250
400 (16)	406.4	426	1400
450 (18)	457.0	480	1600

To be continued on next page

Table 6. Connecting Pipe Size（500 mm to 4000 mm / **20** Inch to 160 Inch）

DN mm（ Inch）	Outer Diameter mm		Length mm
	I	II	L
500 (20)	508	530	1750
600 (24)	610	630	2100
700 (28)	711	720	2400
800 (32)	813	820	2800
900 (36)	914	920	3100
1000 (40)	1016	1020	3500
1200 (48)	1219	1220	4100
1400 (56)	1422	1420	4800
1600 (64)	1626	1620	5400
1800 (72)	1829	1820	6100
2000 (80)	2032	2020	6700
2200 (88)	2235	2220	7300
2400 (96)	2438	2420	8000
2600 (104)	Customized		8600
2800 (112)			9200
3000 (120)			9900
3200 (128)			10500
3400 (136)			11100
3600 (144)			11800
3800 (152)			12400
4000 (160)			13000

Information for Purchase Order

Model	Product
CLJ	SPINDLE Flowmeter
Code	Inner Diameter of Measuring Tube
0008	8 mm（¼ Inch）
0015	15 mm（½ Inch）
0025	25 mm（1 Inch）
0032	32 mm（1¼ Inch）
0040	40 mm（1½ Inch）
0050	50 mm（2 Inch）
0065	65 mm（2½ Inch）
0080	80 mm（3 Inch）
0100	100 mm（4 Inch）
0125	125 mm（5 Inch）
0150	150 mm（6 Inch）
0200	200 mm（8 Inch）
0250	250 mm（10 Inch）
0300	300 mm（12 Inch）
0350	350 mm（14 Inch）
0400	400 mm（16 Inch）
0450	450 mm（18 Inch）
0500	500 mm（20 Inch）
0600	600 mm（24 Inch）
0700	700 mm（28 Inch）
0800	800 mm（32 Inch）
0900	900 mm（36 Inch）
1000	1000 mm（40 Inch）
1200	1200 mm（48 Inch）
1400	1400 mm（56 Inch）
1600	1600 mm（64 Inch）
1800	1800 mm（72 Inch）
2000	2000 mm（80 Inch）
2200	2200 mm（88 Inch）
2400	2400 mm（96 Inch）
2600	2600 mm（104 Inch）
2800	2800 mm（112 Inch）

To be continued on next page

Code	**Inner Diameter of Measuring Tube**
3000	3000 mm（120 Inch）
3200	3200 mm（128 Inch）
3400	3400 mm（136 Inch）
3600	3600 mm（144 Inch）
3800	3800 mm（152 Inch）
4000	4000 mm（160 Inch）
Code	Flange Class
A1	ANSI150　RF, MF, RJ
A3	ANSI 300 RF, MF, RJ
A6	ANSI 600 RF, MF, RJ
A9	ANSI 900 RF, MF, RJ
AF	ANSI 1500 RF, MF, RJ
AT	ANSI 2500 RF, MF, RJ
D1	DIN PN 10
D2	DIN PN 16
D3	DIN PN 25
D4	DIN PN40
D5	DIN PN 64
D6	DIN PN 100
R3	ANSI 300 RJ
R6	ANSI 600 RJ
R9	ANSI 900 RJ
RF	ANSI 1500 RJ
RT	ANSI 2500 RJ
YY (1)	Customized（to be confirmed with local representative before order）
Code	Material
CS	Carbon Steel
AS	304 Stainless Steel
BS	316 Stainless Steel
YY	Other
Code	Fluid
Y	Liquid
Q	Gas
Z1	Saturated Vapor（＜300℃）
Z2	Superheated Steam（≥300℃）
Code	Mounting
01	Vertical
02	Horizontal

To be continued on next page

Code	Item
	Flow Calibration
WC	Flow co-efficient Calibration（5 points）
WD	Flow co-efficient Calibration（10 points）
	Special Cleansing
P2	Special Degreasing
	Special Inspection
QC1	Inspection of outlook and size，providing quality control documents
QC7	Non-destructive test report
	Traceability of Material
Q8	Material documents In accordance with ISO 10474-3.1B 和 EN 10204-3.1B

Typical Model：CLJ - 200 - D5 - AS - Q - 02

CLJ Series SPINDLE Flowmeter

Configuration Data Sheet (CDS)

Complete this form to define a Custom Flow Configuration for SPINDLE Flowmeter.
Unless specified, SPINDLE Flowmeter will be configured with the default values identified by the ★ symbol.
For technical assistance in filling out this CDS, contact our local representative.

* = compulsory ★ = default

Customer Information

*End-user Name： *Phone：

*Buyer Name： *E-mail：

*Contact Person： Fax：

Application and Configuration

Tag： Model：

*Fluid Type： ☐**Liquid★** ☐Gas ☐Steam

*Fluid Name：

Pipeline Information for SPINDLE Flowmeter Mounting

*Orientation / Direction: ☐ Vertical Upward ☐Vertical Downward ☐**Horizontal★**

*Pipe Size / Thickness：_____ Pipeline ID：_____

Materials of SPINDLE Flowmeter

*Measuring Tube Material ☐**Carbon Steel★** ☐ 304SS ☐ 316SS ☐Hastelloy ☐Other_____

*Spindle Material ☐**Carbon Steel★** ☐ 304SS ☐ 316SS ☐Hastelloy ☐Other_____

***现场工况**

	4mA	Minimum	Normal	Maximum	20mA
Flow rate					
Pressure（P）					
Temperature（T）					

CLJ 型

Filled by：

Data：

Fluid Data Sheet (FDS)

If need any help when filling in the FDS，Please contact the local technical representative。

Fill in this sheet to specify a fluid. Sign★ as the label of default data.

* = compulsory ★ = default

Customer Information

*End-user Name：

*Phone：

*Buyer Name：

*E-mail：

*Contact Person：

Fax：

Fluid Type

☐Customized Liquid

☐Liquid

☐Customized Gas

☐Gas

☐Customized Natural Gas

☐Natural Gas

Customized Specification Sheet for Liquid

Mass Compressibility and Viscosity Information

1. Fill in the following operating temperatures.

a) _____Minimum

b) _____ [⅓ (Max. - Min.)] + Min.

c) _____ [⅔ (Max. – Min.)] + Min.

d) _____Maximum

2. Transfer the values from the above section to the lettered lines below.

3. Check one Density box, then enter values for each temperature and the standard density.

4. Check one Viscosity box, then enter values for each temperature. (At least one viscosity value is required.)

Density

☐ Density in Kg/CuM

☐ Density in Lbs/CuFt

Temperature

a) _____Minimum

b) _____ [⅓ (Max. - Min.)] + Min.

c) _____ [⅔ (Max. – Min.)] + Min.

d) _____Maximum

Viscosity

☐ Viscosity in Centipoise

☐ Viscosity in Lbs/Ft Sec

☐ Viscosity in Pascal Sec

Temperature

a) _____Minimum

b) _____ [⅓ (Max. - Min.)] + Min.

c) _____ [⅔ (Max. – Min.)] + Min.

d) _____Maximum

Standard density/compressibility____(at standard reference conditions as specified)

Volumetric Compressibility and Viscosity Information

***Fluid Density**：_____ Unit：☐ Lbs/CuFt ☐Kg/m^3 ☐Other：_____

or

Fluid Molecular Weight：_____

* **Fluid Viscosity**：_____ Unit：☐Centipoise ☐Other：_____

Customized Specification Sheet for Gas

Mass Compressibility and Viscosity Information

1. Operating Pressure and Temperature

Operating Pressure	Operating Temperature
1) _____Minimum	5) _____Minimum
2) _____ [⅓ (Max. - Min.)] + Min.	6) _____ [½(Max. - Min.)] + Min.
3) _____ [⅔ (Max. – Min.)] + Min.	7) _____Maximum
4) _____Maximum	8) _____ [⅓(Max. - Min.)] + Min.
	9) _____ [⅔(Max. - Min.)] + Min.

2. Transfer the values from the above section to the numbered lines below
3. Check one Density/Compressibility box, then enter the 12 values for each pressure/temperature range.
4. Check one Viscosity box, then enter values for each temperature. (At least one viscosity value is required.)
5. Enter values for molecular weight, isentropic exponent, and standard density (or standard compressibility).

Density

☐ Density in Kg/CuM
☐ Density in Lbs/CuFt
☐ Compressibility

Pressure	**Temperature**
1) _____	5) _____
2) _____	5) _____
3) _____	5) _____
4) _____	5) _____
1) _____	6) _____
2) _____	6) _____
3) _____	6) _____
4) _____	6) _____
1) _____	7) _____
2) _____	7) _____
3) _____	7) _____
4) _____	7) _____

Viscosity

☐ Viscosity in Centipoise
☐ Viscosity in Lbs/Ft Sec
☐ Viscosity in Pascal Sec

Temperature
5) _____
8) _____
9) _____
7) _____

Molecular Weight： _____

Isentropic Exponent (K)：
_____ 1.4★

Standard density/compressibility： _____

Volumetric Compressibility and Viscosity Information

***Fluid Density：** _____ Unit：☐ Lbs/CuFt ☐Kg/m^3 ☐Other：_____

or

Fluid Molecular Weight： _____

Fluid Compressibility：

Compressibilty under basic conditions：

***Fluid Viscosity：**_____ Unit：☐Centipoise ☐Other：_____

Isentropic Exponent (K)：_____ 1.4★

Compressibility Factor Information

Choose desired characterization method, and only enter values for that method

☐ **Detail Characterization Method (AGA8 1992)**

		Mole Percent	Valid Range
CH4	Methane	_____ %	0 - 100%
N2	Nitrogen	_____ %	0 - 100%
CO2	Carbon Dioxide	_____ %	0 - 100%
C2H6	Ethane	_____ %	0 - 100%
C3H8	Propane	_____ %	0 - 12%
H2O	Water	_____ %	0 – Dew Point
H2S	Hydrogen Sulfide	_____ %	0 - 100%
H2	Hydrogen	_____ %	0 - 100%
CO	Carbon Monoxide	_____ %	0 - 3.0%
O2	Oxygen	_____ %	0 - 21%
C4H10	i - Butane	_____ %	0 - 6% (1)
C4H10	n - Butane	_____ %	0 - 6% (1)
C5H12	i - Pentane	_____ %	0 - 4% (2)
C5H12	n – Pentane	_____ %	0 - 4%
C6H14	n - Hexane	_____ %	0 - Dew Point
C7H18	n - Heptane	_____ %	0 - Dew Point
C8H18	n - Octane	_____ %	0 - Dew Point
C9H2O	n - Nonane	_____ %	0 - Dew Point
C10H22	n - Decane	_____ %	0 - Dew Point
He	Helium	_____ %	0 - 3.0%
Ar	Argon	_____ %	0 - 1.0%

☐ **Gross Characterization Method, Option 1 (AGA8 Gr-Hv-CO_2)**

Specific gravity at 14.73 psia and 60 °F	_____		0.554 - 0.87
Volumetric Gross Heating Value at Base Conditions	_____	BTU/SCF	477 - 1150 BTU/SCF
Carbon Dioxide	_____	%	0 - 30%
Hydrogen	_____	%	0 - 10%
Carbon Monoxide	_____	%	0 - 3.0%

☐ **Gross Characterization Method, Option 2 (AGA8 Gr-CO_2-N_2)**

Specific gravity at 14.73 psia and 60 °F	_____		0.554 - 0.87
Carbon Dioxide	_____	%	0 - 30%
Nitrogen	_____	%	0 - 50%
Hydrogen	_____	%	0 - 10%
Carbon Monoxide	_____	%	0 - 3.0%

(1) *The summation of i-Butane and n-Butane cannot exceed 6 percent.*

(2) *The summation of i-Pentane and n-Pentane cannot exceed 4 percent.*

北京史宾德科技发展有限公司

北京市朝阳区安华里五区 18 号楼 710
电话：010-53394026
传真：010-64484120
邮编：100011
邮箱：Spindle.flow@foxmail.com

南京优扬控制技术有限公司

南京市江宁区百家湖科技产业园 21 栋 1 层
电话：025-52720062
传真：025-52729806
邮编：211102
邮箱：niyouyang@126.com