MFE600E Series Electromagnetic Flowmeter

Features

- The measurement accuracy will not be influenced by the fluid density, viscosity, temperature, pressure and electrical conductivity changes;
- Open flow without moving parts in measuring pipe, no pressure loss;
- Simple structure, easy installation, no high requirements for straight pipe section;
- No mechanical inertia, with good sensitivity, it can measure the transient pulsating flux, and has good linearity;
- Only the lining and electrodes contact with the media, as long as the selection of electrode and lining materials is proper, they can be corrosion resistance and abrasive resistance, and are able to ensure long-term use;
- Multi-electrode structure ensures high accuracy. With the grounding electrode, it doesn't need grounding ring which saves the cost;
- When power off, EEPROM can protect parameter setting and cumulative values.
- The converter uses a low-power consumption single-chip for processing data which ensure the reliable performance, high accuracy, low power consumption and zero stability. Dot matrix LCD can display the integrated flux, transient flux, velocity, flow percentage and other parameters;
- Two-way measuring system can be used for measuring forward flux and reverse flux; low frequency rectangular wave excitation improves the stability of ow, low power loss and superior low velocity characteristic.

Introduction

MFE600E Series Electromagnetic Flowmeter (hereinafter called Electromagnetic Flowmeter) is designed and manufactured with the most advanced domestic and abroad technology, featuring high accuracy, reliability, good stability and long service life.

We pay our attention to every detail in the process of the product structure design, material selection, manufacturing, assembly and factory testing etc. With a water tower up to 37m as pressure stabilizer for actual ow calibration, we have a professional production line for electromagnetic flowmeter, also we design and develop a series of software and hardware for electromagnetic flowmeter for mass production to ensure high quality in long term use. The product has backlight and wide temperature-ranged LCD display. With fully practical function, visual display, easy operation, it saves troubles for on-site installation operation and maintenance. MFE600E can be widely used in industrial fields such as petroleum, chemical, metallurgy, water supply and drainage, steel, coal, paper, food, textile, environmental protection and other municipal administration, water conservancy construction field etc.

Working Principle

The working principle of Electromagnetic Flowmeter is based on Faraday's Law of Electromagnetic Induction, that is, when the conductive liquid flows through the electromagnetic flowmeter, the induced electromotive force will be produced in the liquid conductor, and the induced electromotive force is directly proportional to the velocity of conductive liquid, magnetic flux density and width of conductor (interior diameter of flowmeter). Such induced electromotive force is detected by a pair of electrodes on the tube wall of the flowmeter, and the equation of induced electromotive force is as follows:

U = K×B×V×D

U: Induced electromotive force

K: Instrument Constant

B: Magnetic flux density

V: Velocity

D: Interior diameter of measuring pipe

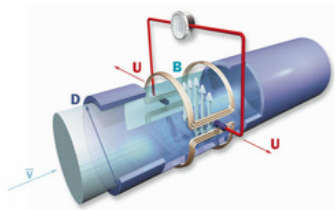

Figure 1 working principle diagram

Specifications

Table 1 Specifications

Diameter	Flange type: DN6~DN1600, ≥ DN20 with built-in grounding electrode
	Sanitary type: DN6~DN50
	Threaded type: DN6~DN50
	Clamping type: DN10~DN300
Measurement accuracy	±0.5%FS
Electrode type	Standard fixed electrode, antifouling electrode
	DN6~DN20: a pair of measuring electrodes, no grounding electrodes
	DN25~DN500: a pair of measuring electrodes and a pair of grounding electrodes
	≥DN600: 2 pairs of measuring electrodes and a pair of grounding electrodes
Structure type	Integrated type, separated type (cable length of separated type≤100m)
Rated pressure	GB: PN2.5, PN6, PN16, PN25, PN40, PN63, PN100, PN160, PN250
	ANSI: CLASS 150, CLASS 300, CLASS 600, CLASS 900
	DIN: PN10, PN16, PN25, PN40, PN63
	JIS: 5K,10K,16K, 20K, 30K, 40K, 63K
	Others: customizable

Electrode material	316L, Ti, HB/HC, Ta, WC, Pt
Lining material	Neoprene (CR), Natural Rubber (NR), Polyurethane Rubber (PU)
	Polytetra fluoroethylene (PTFE), F46, PFA
Measured pipe	Stainless steel
Flange/body ange	Carbon steel (standard), stainless steel (optional)
Converter housing	Aluminum die-casting
Power supply	100 V AC~240V AC
	12V DC, 24V DC
	Battery supply (LCD display, RS485 output, wireless output, frequency/pulse output, and the frequency/pulse output is used only for calibration or calibration purposes.)
	Solar power with storage battery
Output signal	4mA~20mA DC (load resistance 0Ω~750Ω, active output)
	Hart
	Frequency, pulse output (Passive, active output optional)
	Upper and lower limit alarm output
	RS485 (standard Modbus protocol), RS232
	Pro bus-DP, Pro bus-PA
Electrical connection	M20×1.5
IP protection	IP65, IP68: submersible, long-term working in water, suitable for instrument installation in instrument well.
Environmental temp.	Working temp.: -20ºC~60ºC
Storage temp.	-40ºC~60ºC
Relative humidity	5%~90%

Outline Structure

Integrated flange connection dimensions

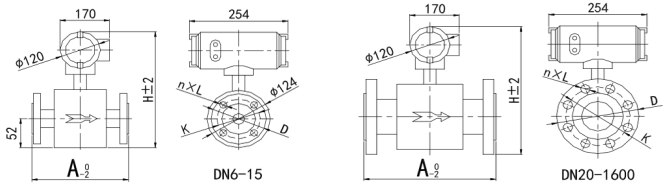

Figure 2 Integrated Outline Dimension

A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Table 2 Integrated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	n×L
6	4.0	150	304	90	60	4×14
10		150	304	90	60	4×14
15		150	304	95	65	4×14
20		150	304	105	75	4×14
25		150	312	115	85	4×14
32		150	330	140	100	4×18
40		150	340	150	110	4×18
50		200	338	165	125	4×18
65		200	358	185	145	8×18
80		200	374	200	160	8×18
100	1.6	250	402	220	180	8×18
125		250	425	250	210	8×18
150		300	458	285	240	8×23
200	1.0	350	522	340	295	8×23
250		400	574	395	350	12×23
300		500	624	445	400	12×23
350		500	678	500	460	16×23
400		600	742	656	515	16×25
450		600	794	615	565	20×25
500		600	862	670	620	20×25
600		600	950	780	725	20×25
700		700	1058	895	840	24×30
800		800	1166	1010	950	24×34
900		900	1272	1110	1050	28×34
1000		1000	1376	1220	1160	28×34
1200	0.6	1200	1578	1405	1340	32×34
1400		1400	1840	1630	1560	36×36
1600		1600	2078	1830	1760	40×36

Separated flange connection dimensions

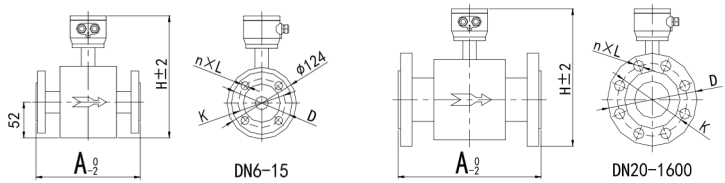

Figure 3 Separated Outline Dimension

A: duct length of flowmeter; H: flowmeter height; N: bolt holes quantity; L: bolt hole diameter; K: center circle diameter of bolt hole; D: flange outside diameter.

Table 3 Separated flowmeter dimensions

DN	Rated Pressure (MPa)	Outline Dimension(mm)		Flange Connection Dimension(mm)		
		A	H	D	K	n×L
6	4.0	150	245	90	60	4×14
10		150	245	90	60	4×14
15		150	245	95	65	4×14
20		150	245	105	75	4×14
25		150	252	115	85	4×14
32		150	270	140	100	4×18
40		150	280	150	110	4×18
50		200	280	165	125	4×18
65		200	300	185	145	8×18
80		200	314	200	160	8×18
100	1.6	250	342	220	180	8×18
125		250	366	250	210	8×18
150		300	400	285	240	8×23
200	1.0	350	464	340	295	8×23
250		400	516	395	350	12×23
300		500	566	445	400	12×23
350		500	618	500	460	16×23
400		600	682	656	515	16×25
450		600	734	615	565	20×25
500		600	802	670	620	20×25
600		600	892	780	725	20×25
700		700	998	895	840	24×30
800		800	1106	1010	950	24×34
900		900	1212	1110	1050	28×34
1000		1000	1316	1220	1160	28×34
1200	0.6	1200	1518	1405	1340	32×34
1400		1400	1780	1630	1560	36×36
1600		1600	2018	1830	1760	40×36

Separated converter dimensions

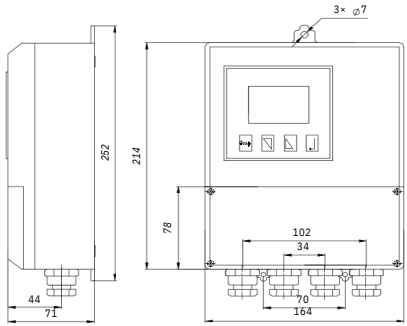

Figure 4 Separated converter dimensions

The separated type is generally used in on-site- maintenanceand debugging reading inconvenient occasions, but also used in more severe applications, such as high-tem-perature fluids and vibration sources. In most occasions, the integrated and separated types can both meet the requirements. For large--diameter flow measurement, when the diameter is ≥ 500mm, the separated type is recommended for easy maintenance; when the meter is installed below the ground, the separated type, IP68 protection level structure must be selected; when the meter is unavoidably installed at the pump outlet, please choose a separated structure meter.

Electrical Connection

The electromagnetic owmeter converter can be divided into integrated converter and separated converter, and the wiring diagram is shown in Figure 5 and Figure 6.

When wiring, please note:

a) RS485 communication cable needs to use two-core twisted pair shielded wire;

b) The same cable shall not be used for the power line and 4mA~20mA DC signal line. Two cables shall be connected separately.

Integrated wiring

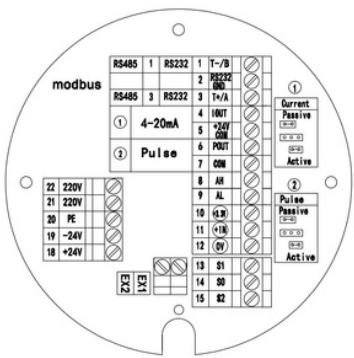

Figure 5 Integrated wiring diagram

When wiring, select the corresponding power terminal to connect to the power line according to the product specifications, and then connect to the signal line according to the required output signal. See Table 4 for the specific meaning of the integrated electromagnetic flowmeter wiring terminals.

Table 4 Terminal de nition of integrated type

Terminal Symbol		Function
1	T-/B	RS485/RS232 communication output
2	RS232 GND	RS232 grounding wire
3	T+/A	RS485/RS232 communication input
4	IOUT	4mA~20mA DC output; 4mA~20mA DC
5	+24V DC COM	output grounding wire; Pulse/frequency
6	POUT	output Pulse/frequency output
7	COM	grounding wire
8	AH	Alarm output for Upper Limit of flow
9	AL	Alarm output for Lower Limit of flow
10	+3.3V	Pressure transmitter +IN
11	+IN	Pressure transmitter output terminal
12	0V	Pressure transmitter GND
13	S1	Electrode wire
14	S0	Signal grounding wire
15	S2	Electrode wire
20	PE	Power grounding wire
21	220V	220V AC power supply access
22	220V	
19	-24V	24V DC(12V DC) power supply access
18	+24V	
	EX1	Exciting current
	EX2	
Short Circuit lugs	Passive	When lugs are connected to Passive, the current① or pulse② will output an active signal.
	Active	When lugs are connected to Active, the current① or pulse② will output a passive signal.

Separated wiring

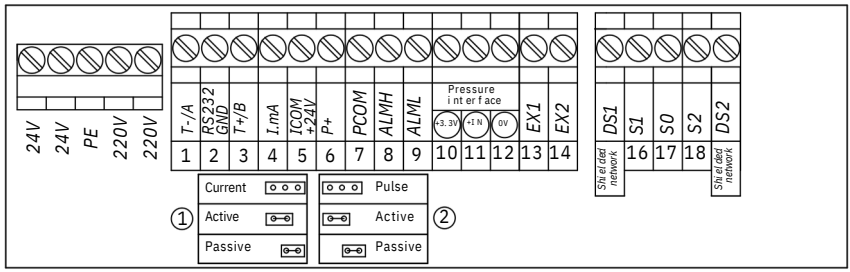

Figure 6 Separated wiring diagram

When wiring, select the corresponding power terminal to connect to the power line according to the product specifications, and then connect to the signal line according to the required output form. See Table 5 for the specific meaning of the integrated electromagnetic flowmeter wiring terminals.

Table 5 Terminal definition of separated type

Terminal Symbol		Function
1	T-/A	RS485/RS232 communication output
2	RS232	RS232 grounding wire
3	T+/B	RS485/RS232 communication input
4	I.mA	4mA~20mA DC output;
5	Icom	Current output grounding wire
6	P+	2-way flow pulse output/frequency output
7	Pcom	Pulse output grounding wire
8	ALMH	Alarm output for Upper Limit of flow
9	ALML	Alarm output for Lower Limit of flow
10	+3.3V	Pressure transmitter +IN
11	+IN	Pressure transmitter output terminal
12	0V	Pressure transmitter GND
13	EX1	Exciting current
14	EX2	
Shielding network	DS1	
16	S1	Electrode wire
17	S0	Signal grounding wire
18	S2	Electrode wire
Shielding network	DS2	
220V	220V	220V AC power supply access
220V	220V	
24V	24V	24V DC power supply access
24V	24V	
Short Circuit lugs	Passive	When lugs are connected to Passive, the current① or pulse② will output an active signal.
	Active	When lugs are connected to Active, the current ① or pulse② will output a passive signal.

Installation

The electromagnetic flowmeter must work under the condition of full pipe, and the flowmeter cannot work normally when the pipe is not full or empty.

The correct installation method of the electromagnetic flowmeter should ensure that the pipe is filled with liquid and should not be installed high on the pipe, as shown in Figure 7.

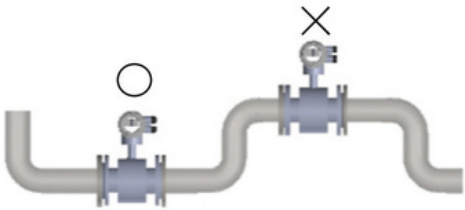

Figure 7

Front and rear straight pipe installation

In order to ensure the upstream piping conditions required for high accuracy measurement of the flowmeter, the piping installation as shown in the figure below is recommended.

When there are valves at the front and rear of the flowmeter, the front and rear straight pipe must meet the front 5D and rear 2D installation methods at least, and the valve must be fully open, as shown in Figure 8.

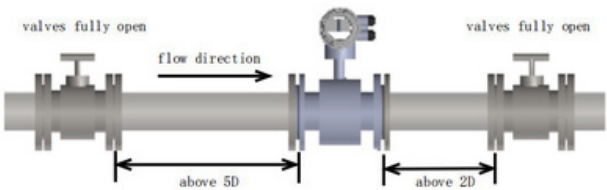

Figure 8

When flowmeter is installed at the back end of T-tube, the flowmeter and T-tube shall have a minimum of 5D straight pipe segments, as shown in Figure 9.

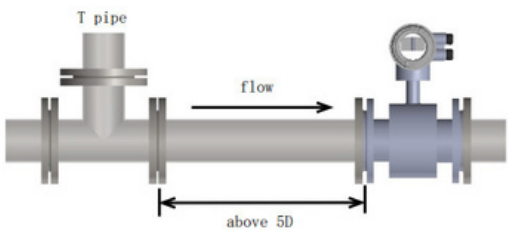

Figure 9

When the flowmeter is installed at the back end of 90。elbow pipe, at least 5D straight pipe are needed between the flowmeter and the tail end of the elbow, as shown in Figure 10.

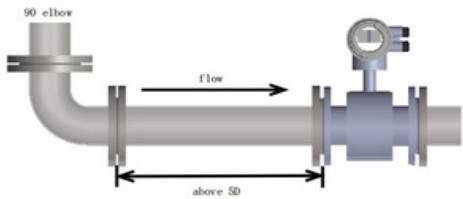

Figure 10

When the flowmeter is installed at the back end of the expanded diameter pipe, the flowmeter and the back end of the expanded diameter pipe need to ensure a minimum of 10D straight pipe, as shown in Figure 11.

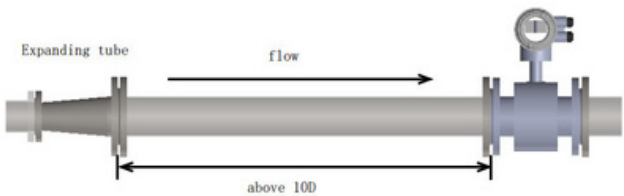

Figure 11

When the flowmeter is installed at the back end of the valve and the valve is not fully open, the flowmeter and the back end of the valve need to ensure a straight pipe section of at least 10D, as shown in Figure 12.

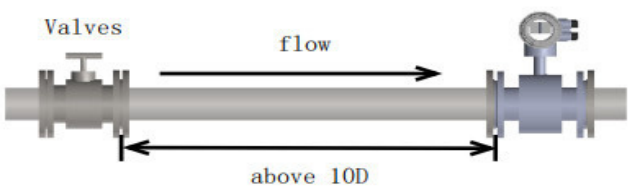

Figure 12

Installation Direction

When installing, the positive direction of liquid flow should generally be the same with the direction of the arrow on the sensor, and there must be suficient space for installation and maintenance near

the flowmeter. During installation, the flowmeter should be equipped with supports on both sides of the pipeline to prevent the flowmeter from being stressed due to pipeline vibration, impact and contraction.

When installing the flowmeter, in general, with horizontal installation, please ensure the axis of the measuring electrode is approximately horizontal; if the axis of the measuring electrode is perpendicular to the ground, bubbles can easily build up near the upper electrode which is easy to block the liquid from contacting the electrode below that is easily covered by mud or impurities. The converter is generally installed above the pipeline to prevent water from entering the converter.

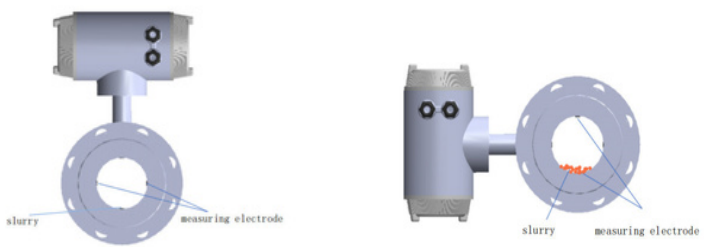

Figure 13 Flowmeter installation direction

When installing the flowmeter, please ensure the axis of the pipeline and the flowmeter measuring tube are in the same straight line. If there is an angle between the two axes, the flange connection will not be sealed well, and even the flange welding part will break.

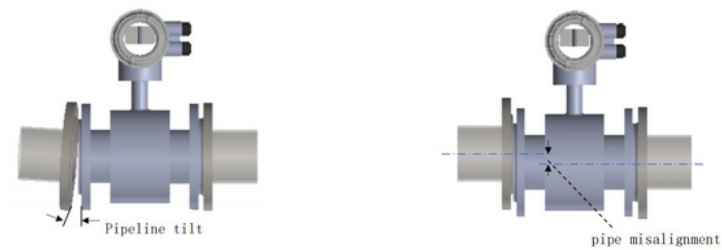

Figure 14 Flowmeter installation symmetrically with the pipe axis

Order Guide

MFE600E	Electromagnetic Flowmeter

Code	Sensor type	Code	Sensor type	Code	Sensor type
AS0	Standard	AS1	With pressure port	AS2	Explosion-proof (CT4)

Code	Pipe diameter
xxx	For example: 100 represents DN100

Code	Electrode Type
1	Standard Mount

Code	Electrode Material	Cod	Electrode	Code	Electrode	Code	Electrode material
0	SS316L	2	Hastelloy	4	Titanium (Ti)	6	wolfram carbide (WC)
1	Platinum (Pt)	3	Tantalum (Ta)	5	HastelloyC		

Code	Lining material	Code	Lining material	Code	Lining material
1	PFA	3	Neoprene	5	Polytetra uoroethylene
2	Natural rubber	4	Polyurethane Rubber	6	F46

Code	Rated pressure	Code	Rated pressure
4.0	4.0MPa, DN10~DN80	1.0	1.0MPa, DN200~DN1000
1.6	1.6MPa, DN100~DN150	0.6	0.6MPa, DN1200~DN1600

Code	Media working temp.	Code	Media working temp.
E	≤60	H	≤120ºC

Code	Ground mode				
*	Without electrode	1	With electrode	2	Ground ring

Code	Protection level		
0	IP65	1	IP68

Code	Converter mode		
0	Integrated	1	Separated

Code	Analog Signal				
*	without	0	4mA~20mA	1	4~20mA+Hart

Code	Digital signal				
0	without	2	Pri bus-DP	4	others
1	RS485	3	Wireless transmission (2G/4G/Lora)		

Code	Sensor material		
0	Carbon Steel	1	Stainless steel

Code	Connection mode		
1	Flange	3	Clamping
2	Thread	4	Clamp

Code	Accessories				
0	Without	3	Pressure transmitter		
1	Carbon steel companion flange	4	Others		
2	Stainless steel companion flange				

Code	Power supply		
0	100V~240VAC		
1	24V DC	3	12V DC
2	BatteryPower supply	4	Others

(×××)	Instrument full range

MFE600E	-	AS1	100	1	0	5	1.6	E	2	0	0	0	1	0	1	1	0	(200)	the whole spec.

WELKO Av. Providencia 2330, Of. 63
+56 9 3174 3870 / +56 9 3427 0017
ventas@welko.cl - www.welko.cl

Example: MFE600E-AS1-100-105-1.6E2-0001-0110(200)

Explanation: MFE600E Electromagnetic flowmeter; DN100 diameter; with pressure measurement interface; fixed stainless steel 316L electrodes; PTFE lining; rated pressure 1.6MPa; media temp. 0~60 ºC; ground electrode and ground ring; IP65 protection, integrated, with 4~20mADC and RS485 digital signal; carbon steel sensor; flange connection; with companion mounting flange (including bolts and nuts), 100~240VAC power supply; full range 200m³/h

The selection of electromagnetic flowmeter should be carried out by technicians who are familiar with the on-site process conditions. The appropriate diameter, lining material, electrode, etc. should be selected according to the order guide, and determined by the end users who are familiar with the on-site process conditions.

Order Notes

According to statistics from authoritative organizations in the world, one-third of the cases of flow meter failure are caused by the quality of the product itself, and two-thirds of the cases are caused by product selection and on-site installation that do not meet the requirements. The selection of electromagnetic flowmeter requires the implementation of the following parameters.

a) Collect process data
   1) The name of the measured fluid, and the composition of the chemical substance contained;
   2) Max. flow, min. flow, common flow;
   3) Max. Working pressure;
   4) Max. Temp., min. Temp.

b) The measured fluid must be conductive, conductivity＞5μS/cm.

c) The maximum flow and the minimum flow must conform to the values of the flow range in table 7.

d) When measuring cleaning media, the economic flow rate is 1.5m/s~3m/s; When measuring easy crystallization solution, the flow rate should be appropriately increased to 3m/s~4m/s to automatically clean and prevent adhesion deposition; for measuring ore slurry, etc. For wear-resistant fluids, the flow rate should be appropriately reduced to 1m/s~2m/s to reduce the wear on the lining and electrodes. In practical applications, there is rarely a flow velocity exceeding 7m/s, and it is even rarer to exceed 10m/s.

e) The actual maximum working pressure must be less than the rated working pressure of the flowmeter.

f) The maximum and minimum working temperature must meet the requirements specified in the flowmeter.

g) Confirm whether there is negative pressure in process pipeline.

Attentions

a) Common pipe diameters and rated pressure

Table 6 Pipeline normal rated pressure

Rated pressure	Diameter
4.0MPa	DN10~DN80
1.6MPa	DN100~DN150
1.0MPa	DN200~DN1000
0.6MPa	DN1200~DN1600
Notes: Other pressures can be customized	

b) Flow range

Table 7 Flow range

Velocitym/s / Flow m³/h / DN mm	0.5	1	2	3	4	5	10
6	0.0509	0.1018	0.2036	0.3054	0.4072	0.5089	1.0179
10	0.1414	0.2827	0.5655	0.8482	1.1310	1.4137	2.8274
15	0.3181	0.6362	1.2723	1.9085	2.5447	3.1809	6.3617
20	0.5655	1.1310	2.2619	3.3929	4.5239	5.6549	11.3097
25	0.8836	1.7671	3.5343	5.3014	7.0686	8.8357	17.6715
32	1.4476	2.8953	5.7906	8.6859	11.5812	14.4765	28.9529
40	2.2619	4.5239	9.0478	13.5717	18.0956	22.6195	45.2389
50	3.5343	7.0686	14.1372	21.2058	28.2743	35.3429	70.6858
65	5.9730	11.9459	23.8918	35.8377	47.7836	59.7295	119.4591
80	9.0478	18.0956	36.1911	54.2867	72.3823	90.4779	180.9557
100	14.1372	28.2743	56.5487	84.8230	113.0973	141.3717	282.7433
125	22.0893	44.1786	88.3573	132.5359	176.7146	220.8932	441.7865
150	31.8086	63.6173	127.2345	190.8518	254.4690	318.0863	636.1725
200	56.5487	113.0973	226.1947	339.2920	452.3893	565.4867	1130.9734
250	88.3573	176.7146	353.4292	530.1438	706.8583	883.5729	1767.1459
300	127.2345	254.4690	508.9380	763.4070	1017.8760	1272.3450	2544.6900
350	173.1803	346.3606	692.7212	1039.0818	1385.4424	1731.8030	3463.6059

400	226.1947	452.3893	904.7787	1357.1680	1809.5574	2261.9467	4523.8934
450	286.2776	572.5553	1145.1105	1717.6658	2290.2210	2862.7763	5725.5526
500	353.4292	706.8583	1413.7167	2120.5750	2827.4334	3534.2917	7068.5835
600	508.9380	1017.8760	2035.7520	3053.6281	4071.5041	5089.3801	10178.7602
700	692.7212	1385.4424	2770.8847	4156.3271	5541.7694	6927.2118	13854.4236
800	904.7787	1809.5574	3619.1147	5428.6721	7238.2295	9047.7868	18095.5737
900	1145.1105	2290.2210	4580.4421	6870.6631	9160.8842	11451.1052	22902.2104
1000	1413.7167	2827.4334	5654.8668	8482.3002	11309.7336	14137.1669	28274.3339
1200	2035.7520	4071.5041	8143.0082	12214.512	16286.0163	20357.5204	40715.0408
1400	2770.8847	5541.7694	11083.538	16625.308	22167.0778	27708.8472	55417.6944
1600	3619.1147	7238.2295	14476.458	21714.459	28952.9179	36191.1474	72382.2947

c) Electrode material

Table 8 Electrode material property

Material	Corrosion resistance	Applicability
316L	Domestic water, industrial water, raw water, groundwater, urban sewage, treated neutral industrial sewage	☑
	Acid, alkali, salt	☒
Hastelloy B(HB)	Weak organic acid	☑
	Reducing acids such as nitric acid, hydrochloric acid, phosphoric acid, and hydrofluoric acid	☒
Hastelloy C(HC)	Oxidizing salts such as Fe3+, sea water	☑
	Reducing acids such as nitric acid, hydrochloric acid, phosphoric acid, and hydrofluoric acid	☒
Titanium (Ti)	Chloride (chloride/magnesium/aluminum/calcium/ammonium/iron, etc.)	☑
	Ammonia, sodium salt, potassium salt, ammonium salt, hypochlorite, sea water	
	Sodium hydroxide, potassium hydroxide, ammonium hydroxide, barium hydroxide and other alkaline solutions with a concentration of less than 50%	
	Nitric acid, hydrochloric acid, sulfuric acid, phosphoric acid, hydro uoric acid and other reducing acids	☒
Tantalum (Ta)	Hydrochloric acid (concentration less than 40%), dilute sulfuric acid and concentrated sulfuric acid	☑
	Chlorine dioxide, ferric chloride, hypochlorous acid, sodium cyanide, lead acetate, etc.	
	Oxidizing acid such as nitric acid, aqua regia with temperature lower than 80	
	Alkali, hydro fluoric acid	☒
Platinum (Pt)	Almost all acid, alkali, salt solutions	☑

	Aqua regia, ammonium salt	☒
Wolfram carbide (WC)	Treated neutral industrial sewage, domestic sewage, can resist the interference of solid particles	☑
	Acid, alkali, salt	☒

d) Lining material

Table 9 Lining material property

Lining Material	Symbol	Property	Working temp.	Applicable liquid	Applicable diameter
Neoprene	CR	Medium abrasion resistance, resistant to corrosion by low-concentration alkali and salt	-10ºC~60ºC	Tap water, domestic sewage	DN50~DN1600
Natural rubber	NR		-10℃ ~60℃		
Polyurethane rubber	PU	Excellent abrasion resistance, poor acid and alkali resistance	-10℃ ~60℃	Pulp, mineral pulp and other slurries	DN25~DN600
Polytetrafluoro ethylene	F4 (PTFE)	The chemical performance is very stable, resistant to the corrosion of boiling hydrochloric acid, sulfuric acid, aqua regia and concentrated alkali	-20℃ ~120℃	Corrosive acid, alkali, salt liquid	DN25~DN1600
Polyperfluoroe thylene propylene	F46 (FEP)	The chemical performance is equivalent to F4, and the compressive and tensile strength is better than F4	-20℃ ~150℃	Corrosive acid, alkali, salt liquid	DN6~DN500
Copolymer of tetrafluoroethyl ene and per fluorinated hydrocarbon vinyl ether	PFA	The chemical properties are equivalent to F46, and the compressive and tensile strength is better than F4	-20℃ ~150℃	Corrosive acid, alkali, salt liquid	DN6~DN500