

Electromagnetic Flow Meter

Insertion Flow Meter Installation Manual



Installation Manual

Electromagnetic Flowmeter Insertion type

1. Brief Introduction

1.1. Storage precautions

After the shipment arrival, if the instrument is planned to store for a certain time, the followings should be paid attention to:

- A. It should be packed by its original package and kept same as the shipment package.
- B. The storage place should take the following reference:
 - a. Avoid rain and wind.
 - b. Avoid impact
 - c. Don't open the wire box for sensors connection to keep it dry in order not to affect future normal operation
 - d. Atmosphere temperature, humidity and air pressure:

Atmosphere temperature: $-20^{\circ}\text{C}\sim+60^{\circ}\text{C}$

Relative humidity: 5%~90%

Air pressure: 86-106KPa

1.2 Installation location precautions

The installation location is chosen according to the following requirements, ensuring the stable and continuous operation of instruments.

Atmosphere temperature: avoid large temperature change and sunshine, if some thermal radiation in the installation location, the thermal insulation and ventilation should be applied.

Air condition: avoid strongly corrosion and explosive gas in the installation location (non-explode-resistant instrument).

1.3 Change adapter direction

It is not recommended to change the adapter direction by users, if it is necessary to change, please contact service center.

1.4 Product application scope

The insert-type electromagnetic flow-meter is composed of **sensors and adapter**, using for measuring conductive liquid. During measurement, conductivity is required to be more than $5\ \mu\text{s/cm}$, and water, sewage, acid and alkali and so on could be measured.

1.5 Product Component

One set of insert-type electromagnetic flow-meter is composed of sensors and adapter. Two different types are designed, according to safety class and parameter configuration, which are

sensor and adapter in one unit type and sensor and adapter separate type.

The sensor and adapter connection by shield cable is adopted in the separate type installation, to make one set of electromagnetic flow-meter, illustrated as follow. The parameters could be fixed according to user requirement and production value after manufacturing, which is suitable to inner water occasion.



1.6 The main technical parameter of magnetic flowmeter

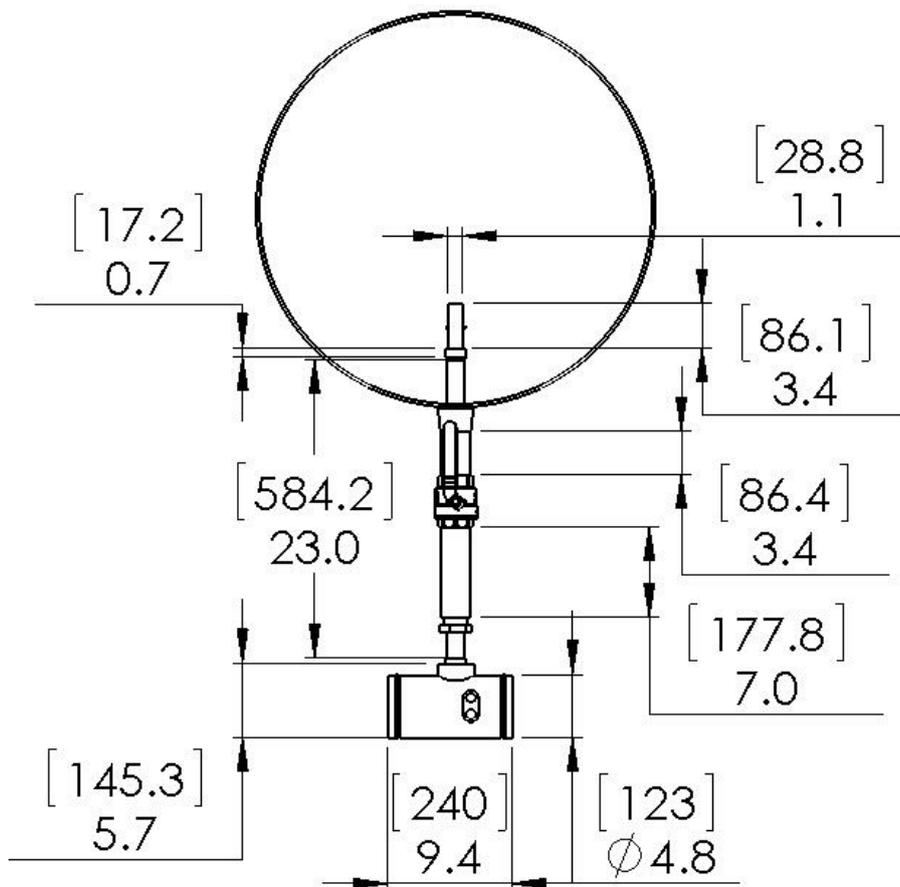
Type		
	One-unit type	Separate type
Accuracy	± 2.5% (according to different situation)	
Diameter (mm)	DN200-DN3000	DN200-DN3000
Flange	Meet GB9119 standard, stainless steel	
Pressure class	1.6MPa	
Adapter cover material	Die-casting aluminum alloy	
Sensor cover material	Stainless steel	
Sensor frame material	Stainless steel/PVDF	
Weight	Depending on type (See datasheet)	
Conductivity	≥ 5 μ s/cm (if less than 5 μ s/cm, please contact us for special order)	
Electrode	316L, Hastelloy alloy, titanium, tantalum, platinum	
Safety class	IP65	IP65/IP67 (sensor could be IP68)
Medium temperature	-25°C ~ 80°C	-25°C ~ 120°C
Atmosphere temperature	25°C ~ 60°C	
Atmosphere temperature influence	< ± 0.1%/10°C or < ± 0.25%/10°C	
Repeatability	≤ ± 0.01% or ≤ ± 0.25%	
Analog output error	≤ ± 0.02mA	
Measurement flowing speed range	≤ 10ms	
Maximum embedded length	-	≤ 5m (Only for IP68)
Cable connection	M20*1.5 sealing sleeve、G1/2、NPT1/2	
Sensor cable	< 30m	

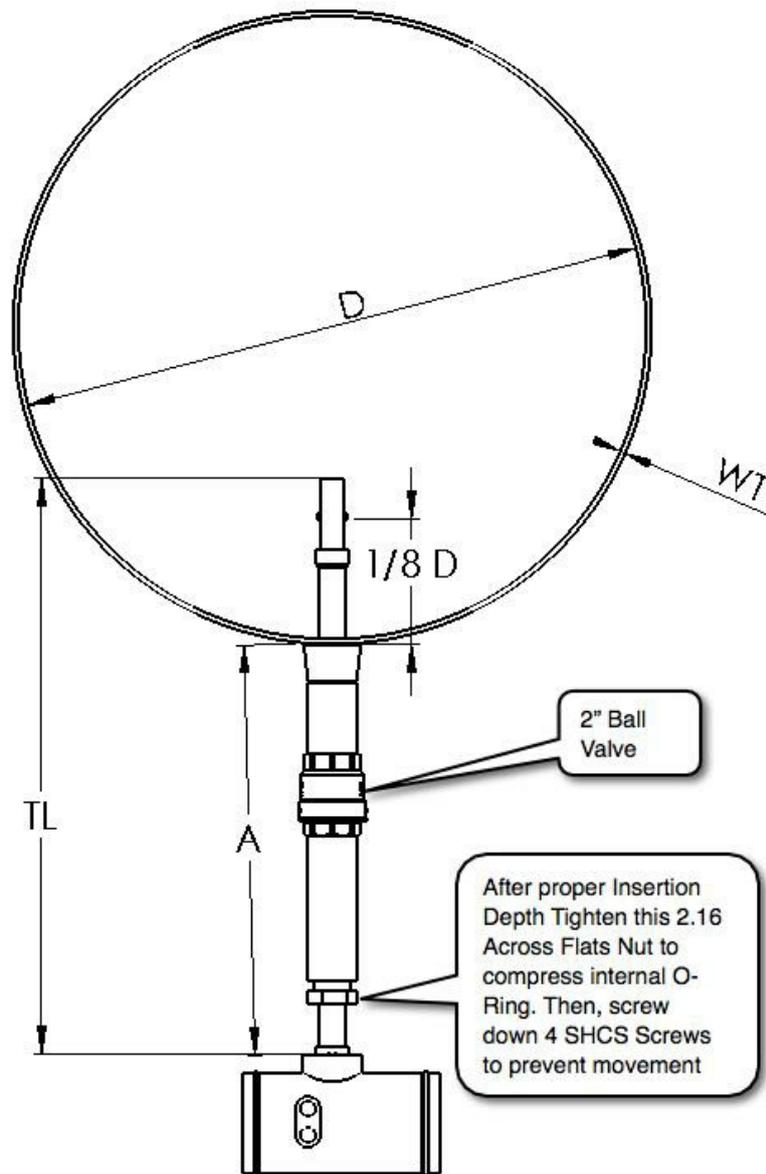
2. Installation

2.1 Dimension

2.1.1 Sensor dimension

The connection is adopted as the sensor's fixation. First, the connection pipes length of base could be calculated according to pipe diameter, and then holes could be opened in the pipe, after that the base will be welded on holes in the pipes; during welding the correct direction of base flange screw hole and insert depth should be paid attention to make the sensor pole vertical to flow direction. The base connection pipe is not allowed to be exceeding the inner surface of measurement pipe to keep its inner surface of the pipe smooth. The exact size and material specification are illustrated as the following drawing.





Installation illustration

Installation principle: The insert pipe of sensor should be exceeding the inner surface 10%, that means the depth $H = (d - 2s) \times 10\%$, adjust expansion joint to make $X = L - 4 - S - H$ (mm).

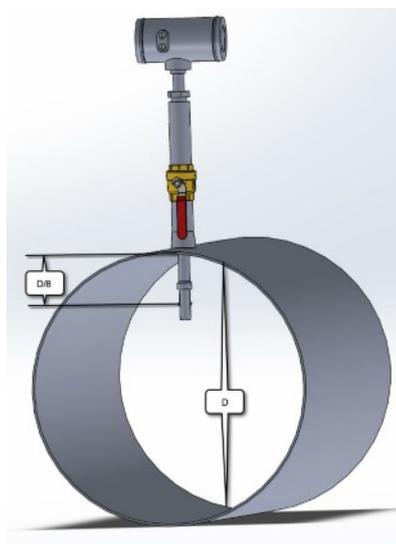
Here L: sensor length, 4: the washer and convex thickness, S: pipe thickness, d: pipe outer diameter

Example: DN500 pipe D=530X8, PMF-ST-450 flow-meter

$H = (530 - 2 \times 8) \times 10\% = 51.4 \text{ mm}$

$X = 450 - 4 - 8 - 5.1 - 4 = 386.6 \text{ mm}$

The insert-type electromagnetic flow-meter installation illustration



DN500mm~DN1200

Name\ DN	DN500 mm	DN600 mm	DN700 mm	DN800 mm	DN900 mm	DN1000 mm	DN1200 mm
Sensor (LX D)	450X Ø 38						
Sealant (included into product)	Ø 45 x 3						
Connection flange	DN40 1.6Mpa						
Spherical valve	DN50						
Connection pipe	Ø 50						
Pipe	Ø dXs						

2.2 Structure and Installation

2.2.1 Adapter structure

The instrument is a kind of intelligent system. The flow signal is magnified before the calculation by signal-chip computer, and then the flow and accumulation value are indicated as well the output of impulse and analog item, which is used for liquid flow calculation and control. The small-type one-unit optimization design is adopted in the adapter, which is installed inside aluminum cover with safety class Ip65.

2.2.2 Sensor structure

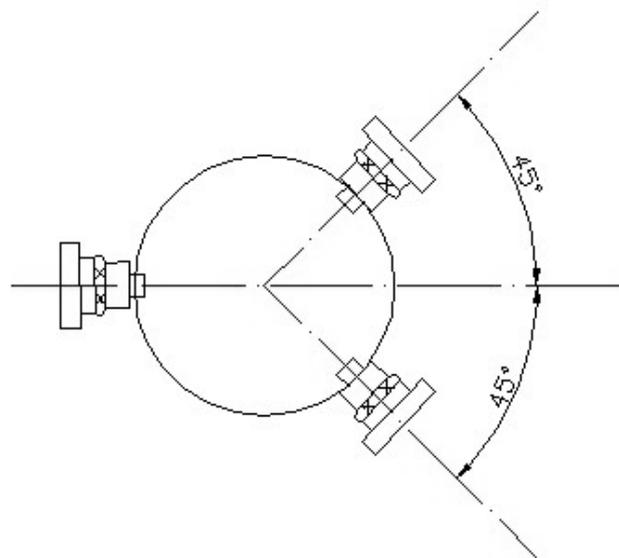
The sensor is composed of measurement detector, installation flange and wire box (separate type)

and so on. The sensor outline is in cylinder shape with installation flange, inside which the excitation winding used for exciting, magnet-conductive winding and two electrodes of magnet-conductive core, contacting liquid, are installed.

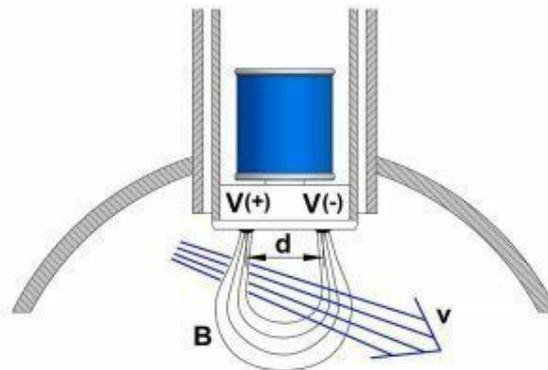


2.2.3 The design of sensor installation location

The sensors could be erected at any position, however, the method illustrated as the drawing below is recommended to make sure that the electrode could be in the liquid all the times.



Right position



The sensors should be installed on the pipes inside which there are liquid all along, and it is always risky to bear whirlpool if the pipe is half-full, as well as to be installed behind valve, elbow, tee-joint as they are also the stem of whirlpool. In this case, the length of straight pipe before sensors should be at least $>10D$ and straight pipe $>5D$ after sensor, by which the whirlpool could be avoided and measurement accuracy improved. If the accuracy is required at $\pm 0.5\%$, the length of straight pipe before sensors should be at least $>30D$ and straight pipe $>10D$ after sensor.

2.3 Installation Requirements

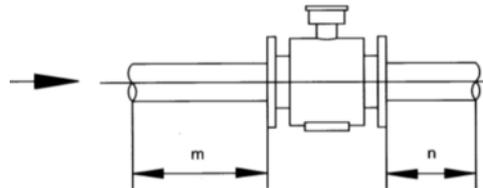
2.3.1 The requirements of straight pipes

The requirements of straight pipes are listed as follows:

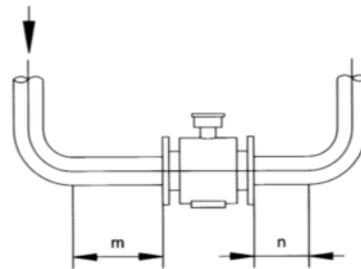
The pipes installation type	Illustration No.	Forward straight pipe	Backward straight pipe
Straight pipe	1	10D	5D
Elbow pipe	2	20D	5D
Increasing pipe	3	20D	10D
Downstream of valve	4	20D	5D
Decreasing pipe	5	10D	10D
Downstream of pump	6	30D	10D

The forward and backward straight pipe of flow-meter illustration

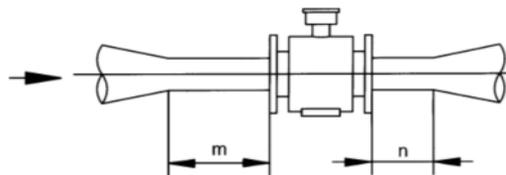
1. Straight pipe installation



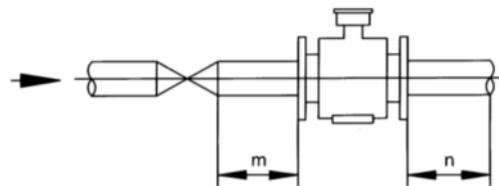
2. Elbow pipe installation



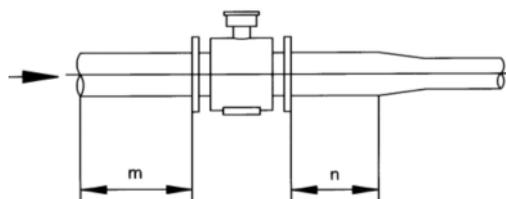
3. Increasing pipe installation



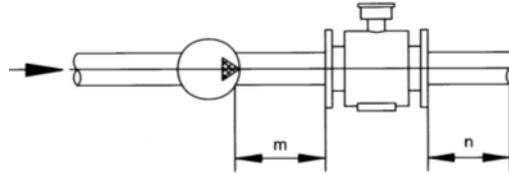
4. Downstream of valve installation



5. Decreasing pipe installation

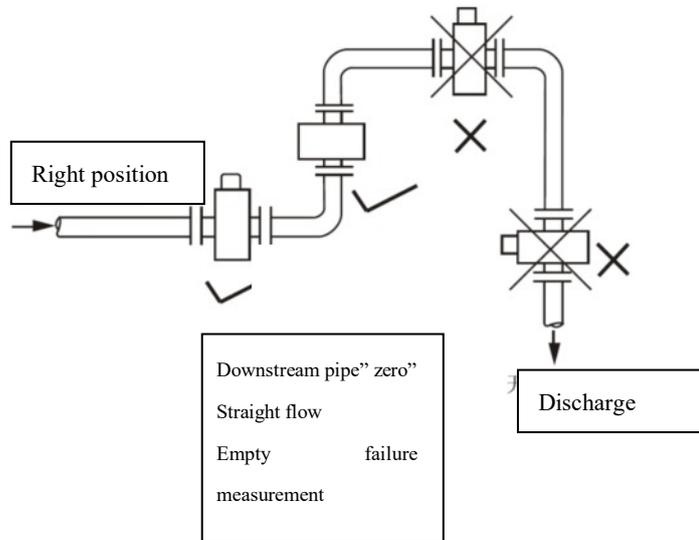


6. Downstream of pump installation

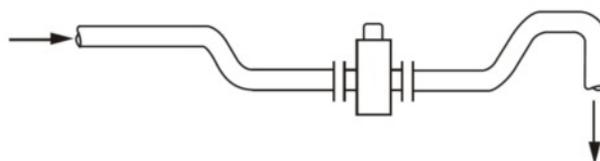


2.3.2 Pipeline design requirement

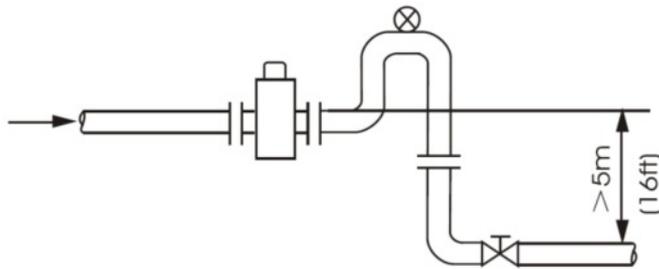
a. To avoid the measurement accuracy caused by mixed air



b. The flow-meter should be installed in the lower section of discharge pipe



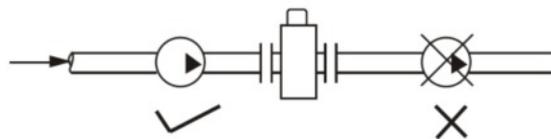
- c. When it comes to the pipe with water head over 5m, the air valve should be installed in the downstream side of flow-meter (vacuum)



- d. When it comes to long straight pipe, the control valve should be installed in the downstream side of flow-meter.



- e. The flow-meter is forbidden to install in sucking side of pump side



- g. It is forbidden to be installed on the pipes inclined to free oscillation...

2.3.3 Operation environment requirement

The outer environment requirements of flow-meter

- a. It is forbidden to install in the environment with great temperature change and high-temperature thermal radiation. If it has to be, the thermal insulation and ventilation solution should be applied.

- b. It had better install the flowmeter inner house, if it has to be outside house, the rain, flood and sun radiation should be avoided.
- c. In order for avoiding corrosion air in the environment, the ventilation solution should be applied.
- d. In order for erection, reparation or maintenance, enough space should be prepared.
- e. The magnetic field and strong vibration should be avoided in the installation location, if strong vibration occurs, the support for fixing pipes should be installed at both sides of flowmeter.

2.4 The distance between sensor and adapter

The shorter distance between sensor and adapter is, the better it is, which makes the adapter more close to sensor. The distance between sensor and adapter depends on measured liquid conductivity and signal capacitance, and the measured medium must be conductive liquid with minimum conductivity $5 \mu \text{ s/cm}$, equaling to conductivity of delonized water. Generally speaking, the conductivity of common purified water and natural water is between 15 and $500 \mu \text{ s/cm}$

2.5 System grounding

Since the flow signal received by the detecting electrode of magnetic flowmeter is at MV class, so the outer interference influences it greatly. In this case, the measurement accuracy repetition depends on good grounding greatly. The measured medium is a kind of electrolytic conductor, so the extra electromagnetic interference must be excluded. Usually the flowmeter is erected on the metal pipes grounded with connecting sensor.



2.6 Electrical Connection

2.6.1 Wire connection

All the wires, meeting the load current requirements, are prepared by the users. The sealing structure should be applied on the outlet holes for wires. In order for its reliability, the round-section cable should be adopted. After the wire connection achieved, the sealing cushion should be pressed tightly as well as screw connector to prevent the eroding by wet air and corrosion gas. The wire for anti-explosive type adapter should be packed by anti-explosive conduit.

All the wire connection should be after the power off

a. After the cable specification is confirmed, the connection could be conducted and the correct and reliable wiring should be done.

b. When the coating of wire is cut off, the insulation layer should be kept without any damage.

When it comes to the flow signal cable, no shielding layer should be cut if the wiring could be conducted.

c. The cable length between sensor and adapter is related to liquid conductivity and outer electromagnetic interference and so on, and its length could be calculated according to the following formula approximately:

$$L = \delta \times 4$$

Here L stands for cable length δ stands for liquid conductivity(μ s/cm)

However, the cable length commonly is not more than 60m to ensure the measurement accuracy and little interference, and to make adapter more close to sensor is recommended.

d. The excitation and flow signal cables are supplied by instrument supplier.

2.6.2 The wiring between sensor and adapter

The cable between flowmeter sensor and adapter is included into instrument scope. If the sensor is installed in the water or in the location inclined to suffer from water, the silica gel should be filled inside wire box following the silica gel operation instruction. If the sensor installation is in vertical method, the wire connection in wire box and silica gel filling should be before installation.

3. Instrument check & maintenance

3.1 Instrument failure diagnose

The electromagnetic flowmeter is a kind of highly-accurate instrument, so maintenance on some parts at a regular time by user is recommended, such as checking wire connection and conduit, electrode cleaning and so on. The unknown technical requirements of flowmeter or related to performance, please take reference from this manual; and the usual maintenance could be conducted on the base of understanding those information. If further maintenance or parts replacement required, please contact with our customer service center, good service and support will be supplied.

If failure occurs in the usual operation, the following information in the list could be adopted as the diagnose reference.

Failure	Possible reasons	Diagnose
Liquid flowing but without indication or signal output	1.Power cable is not connected or power circuit failure	Check power or power circuit by multimeter
	2.Signal or excitation cable wrongly connected	Change signal cable connection(A and B terminal) and excitation cable connection (X and Y terminal)
	3. The sensor is damp-wet or signal cable damaged, causing to grounding short-circuited	Check the insulation of signal cable by multimeter
	4.Output signal cable not well connected or inner wiring connection loosen	Check signal circuit closed by multimeter
	5.Excitation circuit open	Check sensor circuit closed by multimeter
	6. Grounding sound or not	Keep flowmeter, measurement pipe and medium connected and reliable grounding
	7.Medium is not connected or not full of pipe	Medium connected and liquid full of pipes
	8. The electrode is oxidated or dirt on	Dismantle flowmeter and clean electrodes
	9.Failure in adapter	Fuse failure or other reasons
Flow signal indication but beyond limit	1. One signal cable to grounding short circuit or open circuit	Check resistance from cable to grounding (while full liquid, the resistance from electrode to ground is between 1-10 thousand ohm)
	2.Liquid not full of sensor	Check signal cable circuit

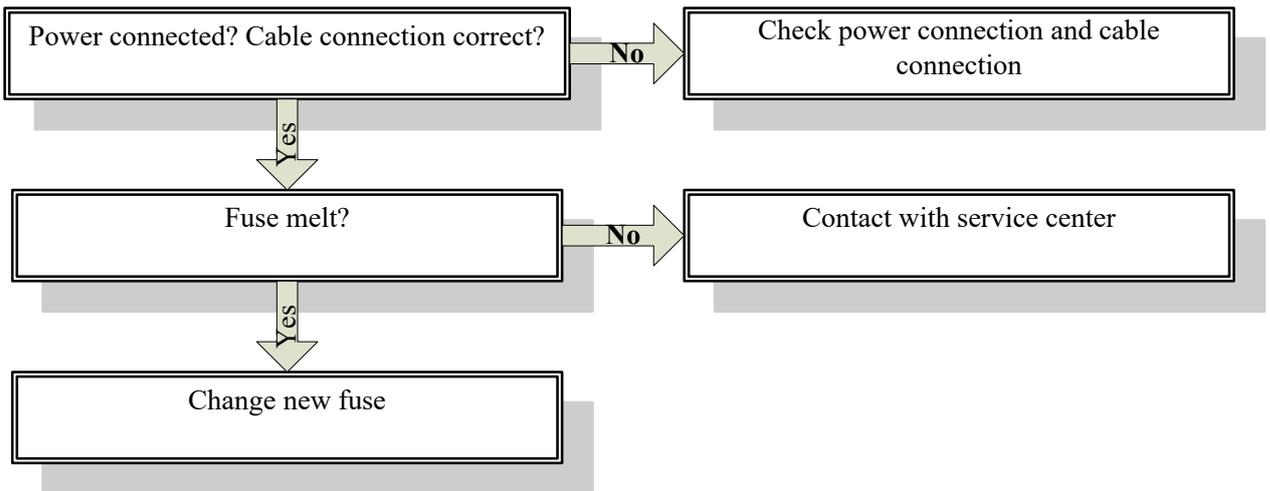
	measurement pipes	closed or not, or improve installation
	3. Not sound grounding	Check signal shielding layer or grounding point resistance, to reinstall grounding device
Instrument indication not conformity with actual flow value	1.Measurement errors caused by zero point change	Not sound grounding or electrode dirt on, and reset zero point after improvement
	2. Calibration factor of adapter not correct	Reset calibration factor following correct calibration value
	3. Sensor installation position not good, or measurement medium not full of pipe or bubbles in the measurement medium	Improve installation following instruction
	4. Dirt on the electrode or inner wall	Clear dirt
	5. The forward or backward sensor straight pipe length is not enough or valve not fully opened.	
	6. Unknown branch pipes in the measurement system	
	7. Errors existing in the measurement reference for electromagnetic flowmeter measurement	Calibrated by standard flowmeter measurement

Other possible failure diagnose

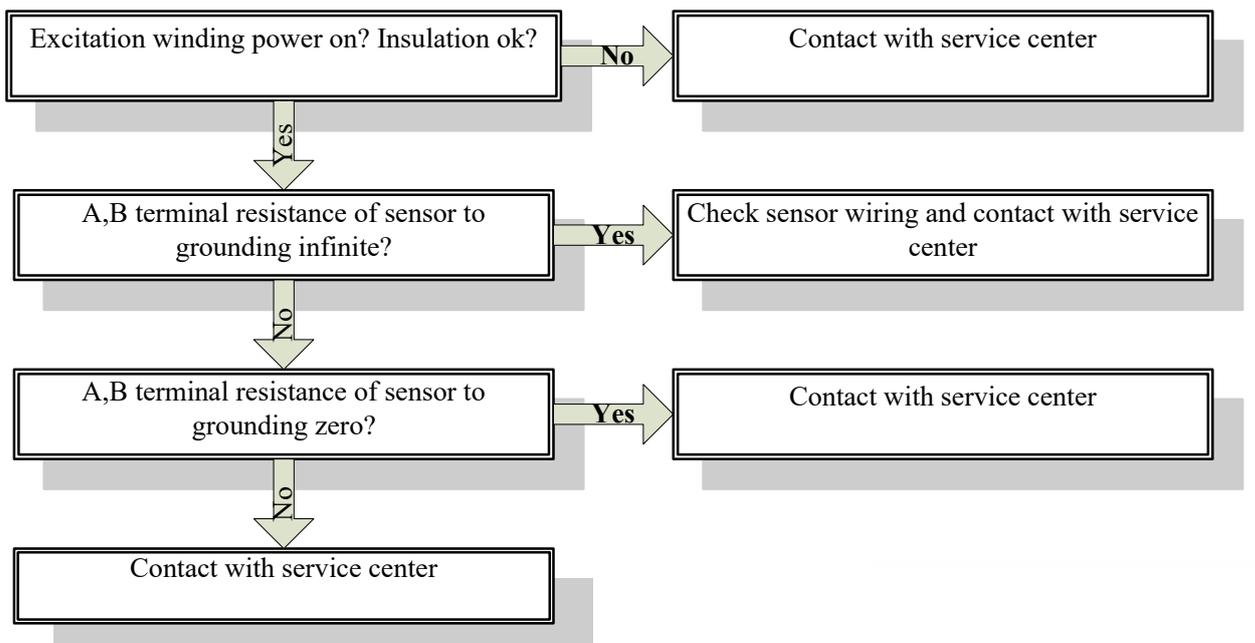
Failure	Failure diagnose
Output shaking	The measured medium flow is in shaking or pulse, in this case, this is not flowmeter failure but exact flow reflection. If straight pipe is not long enough, the short distance from flow meter to pump may also cause shaking
	Liquid not full of pipe or bubbles in the liquid
	Electrical or magnetic interference included such as electrical current
	Conductivity of liquid not equal or too low, maybe many grain of fiber included
	The electrode material doesn't fit to liquid, causing electrode polluted or rusted
	Grounding not sound, the flowmeter, measurement pipe and measured medium are connected with good grounding, zero point not stable.
Zero point not stable	Liquid not full of pipes or bubbles in the liquid
	Grounding nor reliable or electrical or magnetic interference included such as electrical current.
	Small flow inside pipes but thought without flowing, so it is actual indication not flowmeter failure
	Conductivity of liquid not equal or too low, or the electrode material doesn't fit to liquid, causing electrode polluted or rusted
	Insulation in the signal circuit descends

4.2 FAQ Solution

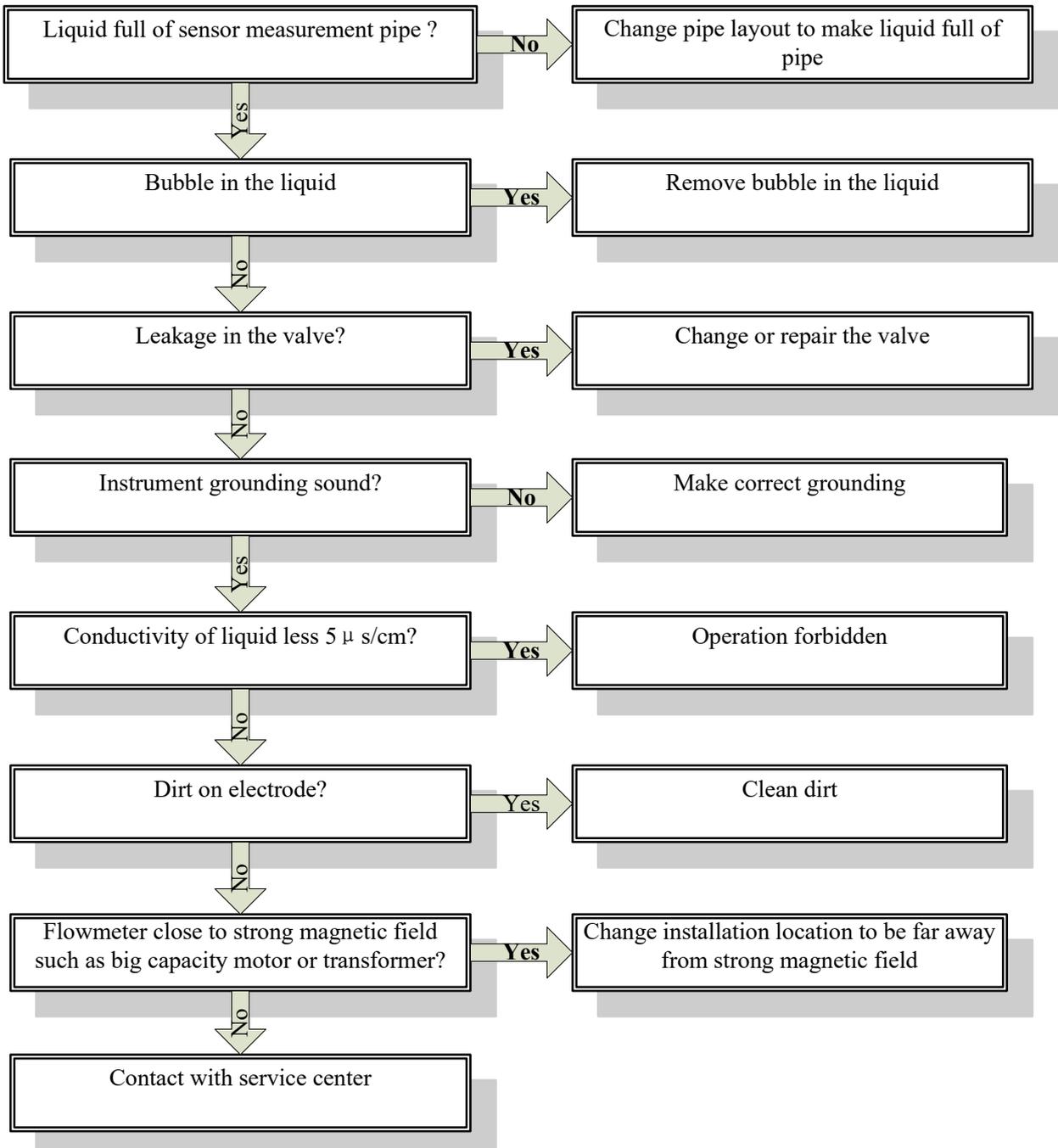
A. No Indicate



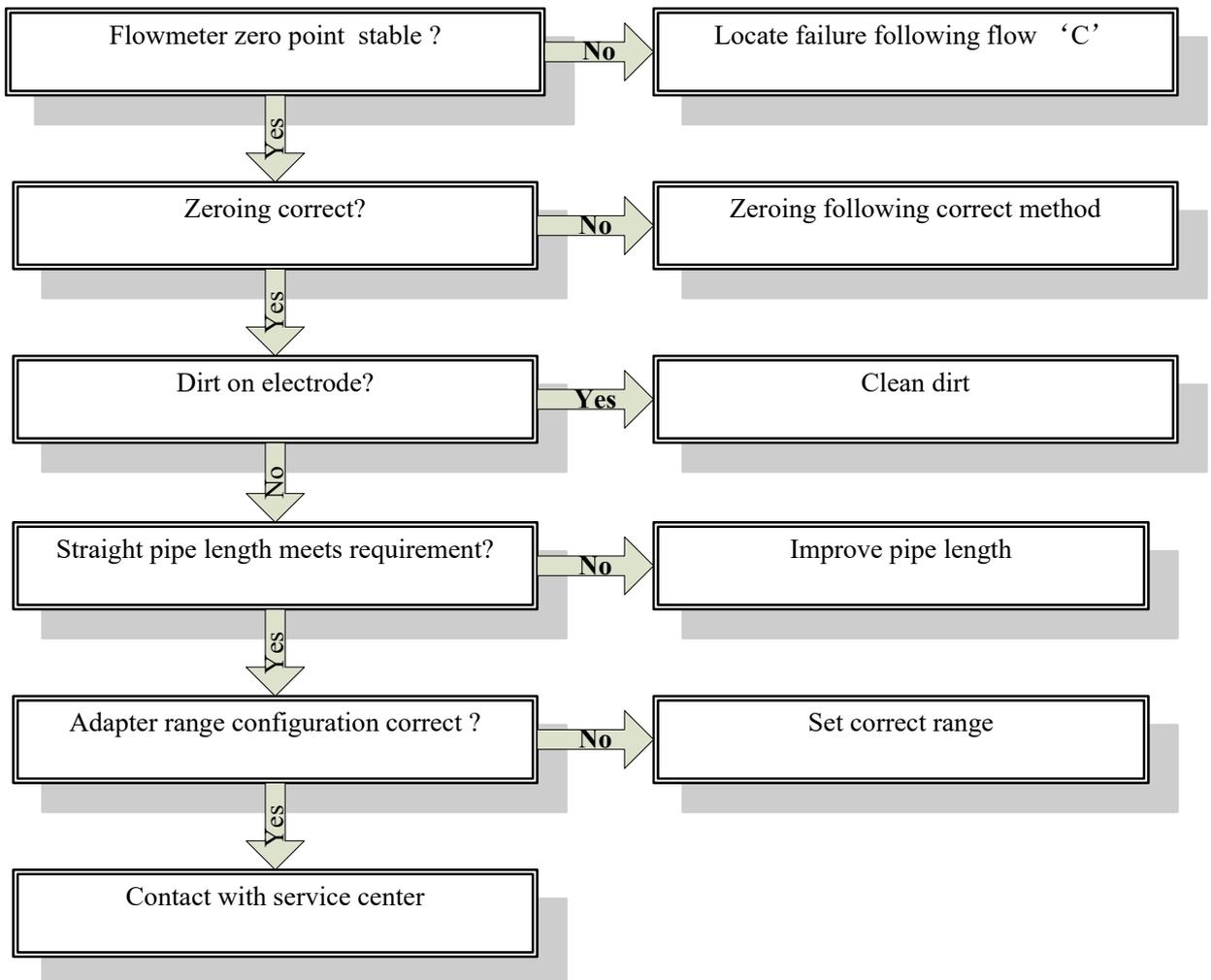
B. Transient flow indicating zero



C. Zero point not stable



D. Measured value not conformity with actual value



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