



**2024
PRODUCT
INTRODUCTION**

Plug-in Ultrasonic Flowmeter



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Company Profile

Weifang AOBO Instrument Technology Development Co., Ltd., founded in 2002, with registration capital of 10 million RMB, is a "High-Tech" and "Double-Software Certification" enterprise specialized in "flow measurement and intelligent measurement & control" industry, integrating R&D, production, sales and service.

The company has a core R&D team for computer software and technology, automatic intelligent control, HVAC engineering design and flow measurement. It has the ability to provide customers with specific solutions and complete sets of products according to their different needs, based on years of practical experience. Especially in the heating industry, by the customer's recognition, has a high reputation in the industry.

The products are mainly used in the measurement and control of "steam, liquid, gas, sewage and tap water"; and especially suitable for energy monitoring and energy-saving control in many industries, such as thermal power plants, thermal companies, residential heating, petroleum, chemical industry, papermaking, food, coating, printing & dyeing and HVAC.

Since its foundation, based on self-developed and leading technology, reliable quality, high-quality service and good reputation, our company has been warmly accepted by customers, and become a designated supplier for many central enterprises and listed companies.

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I. Product Overview

The ultrasonic flowmeter main board is suitable for any kinds of transducers, including clamp-on type, insertion type, portable and the same kinds of transducers from other manufacturers. The pipe parameters and calibration parameters of water meter and in-line pipe are input by manufacturer, users do not need to input any parameter, only need to connect with flowmeter to work.



Applied to on-line measure and system monitor for nearly all liquids from petrol chemical, metallurgy, electric power plant, irrigation, city water company, energy monitor fields, realize the functions of measuring and checking of flow velocity, flow rate, accumulation and heat quantity of different liquids, and flow rate on/off, liquids distinguish.

II. Operational Principle

When the ultrasonic beam is transmitted through the flowing liquid, there will be a difference between the upstream and downstream transit time (travel time or time of flight), which is proportional to flow velocity, when fluid is flowing, counterflow transit time is more than direct flow transit time. the formula as below.

$$V = \frac{MD}{\sin 2\theta} \times \frac{\Delta T}{T_{up} + T_{down}}$$

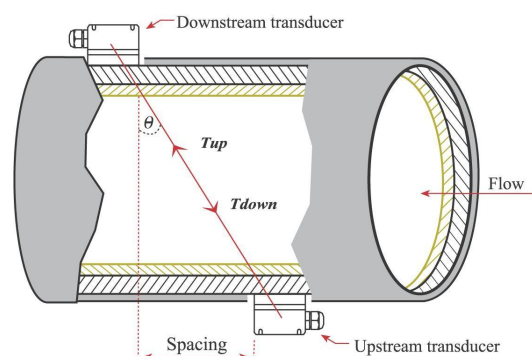
Remarks:

θ The angle between the ultrasonic beam and the flow

M Transit times of the ultrasonic beam

D The internal diameter of the pipe

T_{up} Transit time in the forward direction



T_{down} Transit time in the reverse direction

$$\Delta T = T_{up} - T_{down}$$

$$F = 900 \times \pi \times D^2 \times V$$

F is instant flow rate(unit:m³/hour)

D is inside pipe diameter(unit:m)

V is flow velocity(unit:m/s)

III. Technical Parameter(s)

- Power supply:AC(85~264)V or isolation DC(8-36)V

- Repeatability:better than 0.2%.

- Accuracy:better than 1%

- Signal output :

 - One channel standard isolation RS485 output;

 - One channel isolation 4-20mA or 0-20mA active output;

 - One channel OCT output (programmed between the pulse width(6-1000ms),default before leaving factory (200ms);

 - One channel isolation relay output,with positive, negative, net accumulation pulses and different alarm signals.

- Signal input:

 - Two channel three wire system PT100 platinum resistor input loop,to make heat meter has the function of displaying heat quantity.

 - Three channel 4-20mA input optional,accuracy:0.1%,has the ability to input the signals of pressure, liquid level, temperature and so on.

- Display:2*20 backlight LCD(Chinese and English optional)

- Operating:4*4 tactile keypad

- Other functions:automatic memory the positive,negative,net cumulative flow rate and heat quantity of the last 512 days,128 months,10years.

Automatic memory the time of power on/off and flow rate of the last 30 times, realize to

replenish by hand or automatically, read the data through Modbus communication protocol.

- Protection level: mainframe IP65, Transducer: IP68;
- Transducer: Insertion type.

IV. Installation Condition

The following steps are generally followed for installing the flow sensor:

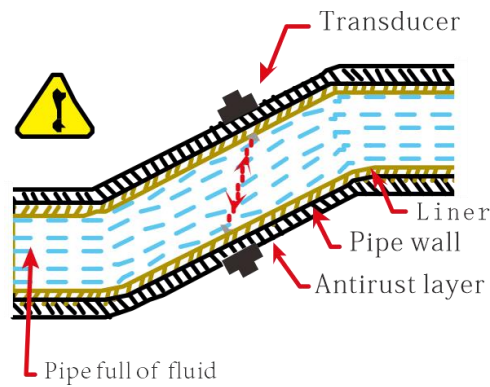
1. choosing measurement point;
2. Select the appropriate installation method according to the site conditions or the type of sensor purchased;
 - Type selection of insertion type flow sensor: insertion type B; Installation method: Z method
 - External clamp flow sensor: the sensor type has been set before delivery, and other parameters such as "outer diameter, wall thickness and installation mode" are set according to the site conditions.
3. Enter the pipe parameters and calculate the installation distance between the two flow sensors;
4. Field mounted sensors;
5. Signal check.

Choosing measurement point:

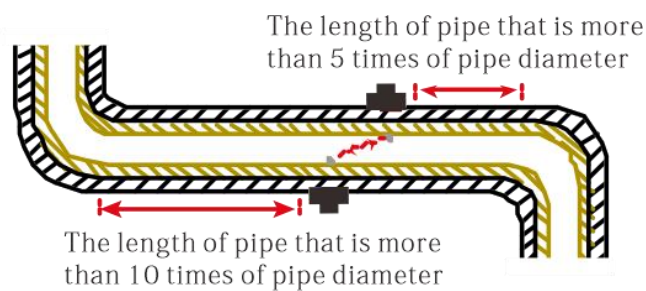
To ensure measurement accuracy and stability, the installation point of transducers should be on the straight pipe full of well distributed fluid (when installing, the pipe must be full of liquid).

Following principle:

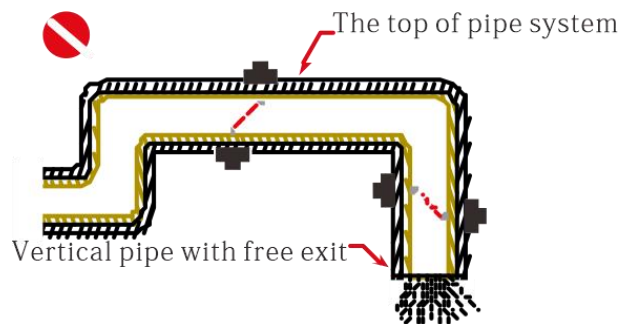
1. Pipe must be full of liquid that is uniform and easy to travel the ultrasonic beam (vertical pipe or horizontal pipe)



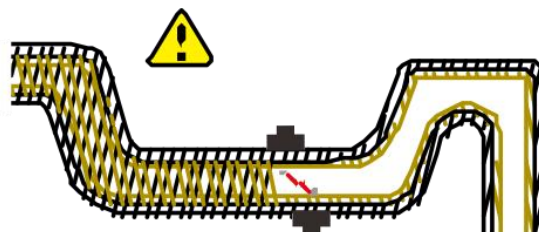
2. Upstream transducer should be installed at the place where the upstream length of the straight pipe is at least $10D$ and the downstream length is at least $5D$ where install the downstream transducer, so the pipe length should be straight without any valve, pump, angle head, D stands for pipe outside diameter. The installation point should stay away from valves, pump, high pressure current, transformers interference source etc.



3. Avoid to install on the highest point of pipe system or vertical pipe with free exit (flow down)



4. For the opened pipe or half full pipe, the transducers should be installed on U type pipe.



5. The two transducers must be installed in horizontal direction to pipe axis plane, within $\pm 45^\circ$ of axis line horizontal plane, to prevent bubbles or not full in upper pipe or sediment in

down side of pipe to influence transducer measurement normally. if there is space limit of installation that could not install horizontal symmetry, then install the transducers vertically or dip angle under the condition of no bubbles in upper parts of pipe.

Insertion type transducer installation method

Installation method: Z method, applicable to above DN80

Sensor type: insert type B

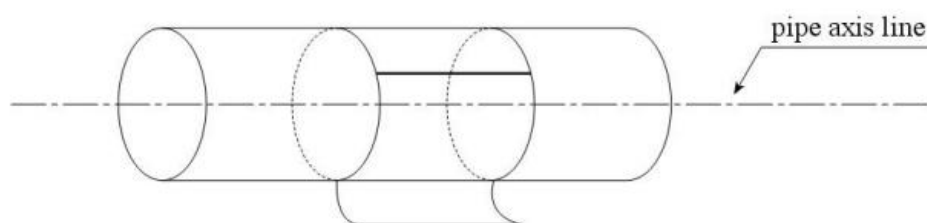
Installation tools: special opening tools provided by the company, 400W electric hand drill (preferably adjustable speed), wrench, etc.

Installation distance L: the distance of the sensor along the pipe axis (see M25), or $L = \text{inner diameter} - 9.113\text{mm}$

1. Locate the installation point

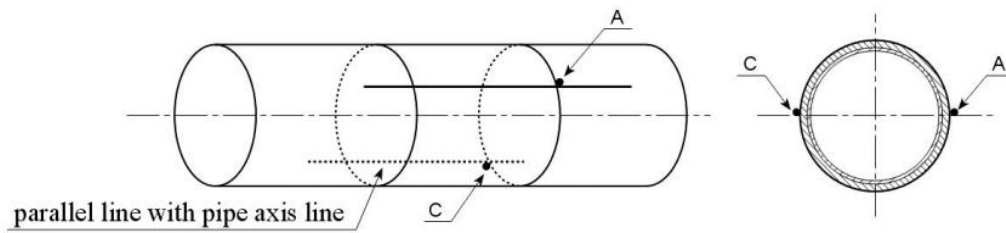
Input the pipe parameters on the mainframe, the installation space L ($L = \text{inside diameter} - 9.113\text{mm}$) will be calculated. (the two sensors must be located in the same axis plane), the installing space L should be the distance between the centers of the two sensors horizontally.

A. Making a fixed position paper: take a $4D$ (D refers to the pipe inner diameter) long and 200mm (or D) wide rectangular paper (according to actual situation on spot, the paper tape can also be replaced by moisture-and-corrosion resistant materials), and draw a line about 100mm from the edge; Wrap the fixed position paper on the cleaned surface of the pipe, making sure that the two paper sides are overlapping and aligned and thus the line drawn may be parallel with the pipe axis.

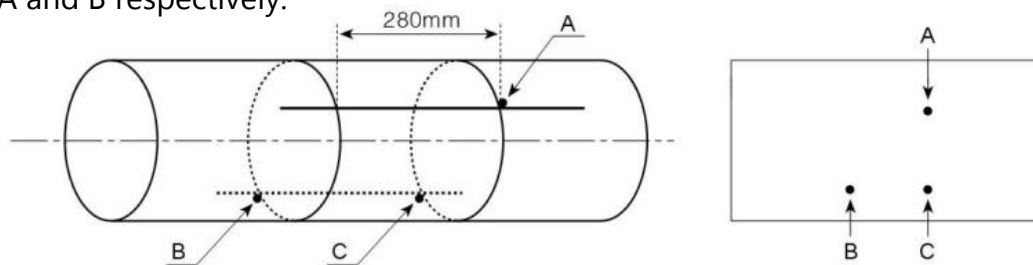


B. Extend the straight line on the fixed position paper, draw a straight line on the pipe, and the intersection point between the drawn straight line and an edge of the positioning paper is A; Starting from point A, measure $1/2$ of the circumference of the pipe along the edge of the positioning paper. The parallel intersection is C. draw a straight line parallel to

the pipe axis at point C (that is, parallel to the straight line on the positioning paper).



C. Removing the fixed position paper and starting from C, the installation space L should be measured along the line, draw on the pipe, the point is B. Thus, A and B are the points where the transducers are to be installed. For example, $L=280\text{mm}$. Then two bases of ball valves should be welded respectively on A and B, making sure the centers of bases overlap A and B respectively.

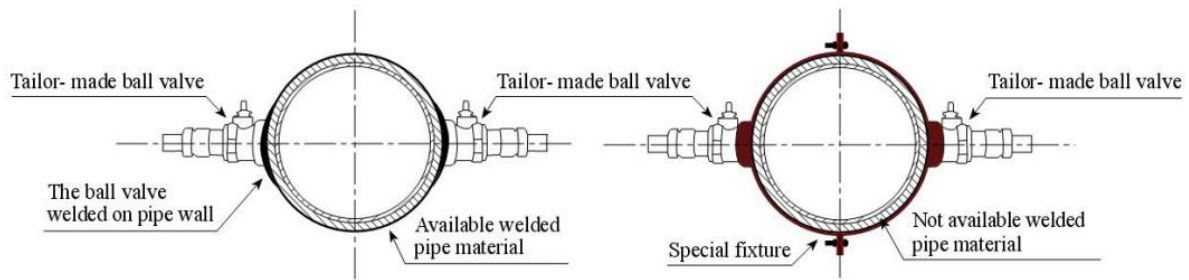


2. Welding the base of the ball valves

For pipes that can be welded (such as steel and stainless steel, etc.), just weld the base on the pipe (Stainless steel pipe should be welded to stainless base, please indicate in your order). Before welding, the rust and paint on the section where the sensors are to be installed shall be cleaned up by using an angle grinder, and the oil dirty and dust should be cleaned by using acetone or alcohol. to prevent water leakage, so the work of welding is very important, making sure the centers of bases overlap A and B respectively, no air bubbles.

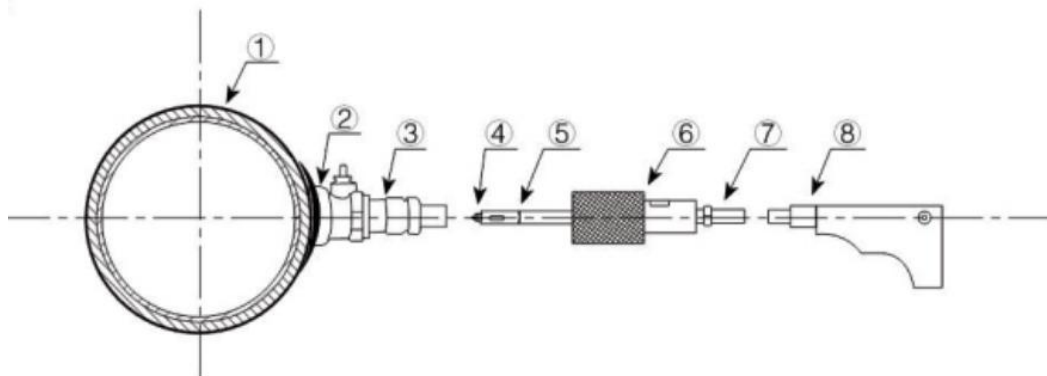
For pipes which material cannot be welded directly (such as cast iron and cement, etc.), special hoops (with airproof rubber pads) should be used. The bases of the ball valves have been welded on the hoops.

These hoops are directly fixed on the pipe and make sure that the centers of the ball valves overlap A and B respectively. Finally, the ball valves should be closely fixed on the bases welded on the hoops to prevent water leakage.



3.Hole-drilling

Connect the sealed sheath of the hole-drilling machine and the outer screw thread of the tailor-made ball valves,screw tightly,open the ball valves,push the drill pipe to touch the outer surface of pipe; then the drill pipe shall be locked to the handle rotary drill before the drill is switched on. During drilling, the drill machine should work in a low speed to avoid sticking or even drill bit breaking.after drilling through pipe wall,pull back the drill pipe until the head of drill bit reach the ball valves spool,turn off the ball valves,take down hole-drilling machine.



- ①Pipe
- ②Ball valve base
- ③Tailor-made ball valve
- ④Locating drill pipe bit
- ⑤19 super hole cutter
- ⑥Seal gland
- ⑦Drill pipe
- ⑧Hole-drilling machine

4. Inserting the transducers

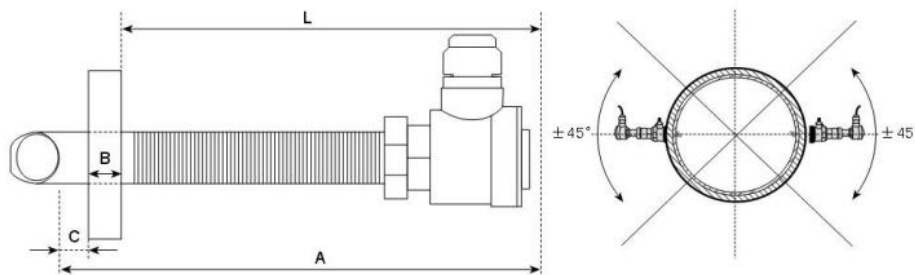
Screw the screw nut to a position under the bottom of the transducer and screw the transducer through the ball valve to ball valve spool. Open the ball valve and continue to screw the transducer until the head of transducer passes the inner wall of the pipe. Before

the wires are connected, the angle of the transducer should be adjusted to make sure that the head of two transducers can be in face to face position so as to send and receive the signals properly(the hole for line of two transducers should be upward or downward at same time).and then fix the screw nut,connect the wires,use silicon rubber to seal the connection place.

5. Length calculation of the part of transducer into the pipe inner wall

Insertion style transducer is made of stainless steel by casting. As the transducer's length A and the pipe wall's thickness B are known,and the length part of transducer left outside the pipe can be measured, the length of the inner part of the transducer can be calculated through the formula: $L=A-B$, $C=0$

Note:the length A of different types of transducers are:Standard insertion type B:A=170mm;Standard insertion type C:A=220mm,and Cement insertion type B:A=310mm.



6. Signal quality(Q value)

Signal quality is indicated as the Q value(display on M90) that represent the receiving signal is good or not,TDS-100F series use 00-99 digits to represent signal quality.00 represent the worst signal,99 represent the best signal,normally the signal quality should be above 60. the reason of poor signal quality could be big interference,or worse installation of transducers,or using bad quality,not professional signal cable.normally ,to adjust transducers repeatly,check the couplant that is enough or not,until the signal is better.

7. Transit time ratio

Transit-time ratio (visit on M91)is usually used to check whether the transducer installation space is good .If the pipe parameters are correct and the transducers are installed properly,the transit time ratio should be in the range of $100\pm3\%$.when the ratio is over the range,you should check,

- a) If the entered pipe parameters are correct?
- b) If the actual space of the transducers is the same as or close to what shown on window M25.
- c) If the transducers are installed properly in the same axis plane of pipe?
- d) If the mounting location is good, if the pipe has changed shape, or if the pipe is too old (i.e., too much corrosion or liner inside the pipe)?
- e) If there is any interference source around the flow meter?

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