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Handbook

ABDT-1206A Portable Velocity Meter

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CONTENTS

ABDT-1206A Propeller Portable Velocity Meter

I. Overview

ABDT-1206A propeller-type velocity meter is a versatile, general-purpose instrument commonly used for flow velocity measurements in hydrologic studies. It is suitable for measuring average flow velocity at predetermined points in rivers, lakes, reservoirs, and canals, as well as for pipeline and scientific experiment

ABDT-1206A propeller-type velocity meter is commonly utilized in a variety of applications, including hydrologic research, water resource surveys, irrigation management, and river runoff experiments. It is also suitable for monitoring water velocity and water flow in industries such as hydro-power, environmental protection, mining, transportation, geology, research institutes, municipal administration, and more.

II. Main Technical Parameters

1) Rotary diameter of rotary propeller: Φ70mm.

2) Hydraulic thread pitch for propeller: 120mm (theoretical value).

3) Starting velocity V_0: 0.05 m/s.

4) Critical velocity V_k: about 0.13 m/s.

(The actual verification value shall prevail. According to statistical analysis, V_k is much smaller than the above value.)

5) Velocity measurement range: 0.06 m/s ~ 8 m/s.

6) Output signal: on-off signal of magnetic excitation switch contact.

7) Signal number/rotor revolution number: 2/1 (2 signals per revolution).

8) Switch contact capacity: DC U $\leqslant$ 24V

I $\leqslant$ 120mA

9) Contact work times: 1×10^7

10) Full line relative mean square deviation m: | m | $\leqslant$ 1.5% (used when V$\geqslant V_k$)

11) Relative error δ : | Δ | $\leqslant$5%(for V<V_k)

12) Working water environment: water temperature 0℃ ~ + 40℃

Water depth: 0.1m ~ 30m

Suspended Sediment Concentration ⩽ 20kg/m^3

13) Storage environment: Temperature: 25℃ ~ + 55℃

Humidity ⩽ 90%

III. Structural Features and Working Principles

ABDT-1206A propeller-type velocity meter consists of a rotary paddle, rotating parts, support, tail parts (or fixed rod screws), trunk Reed parts, and more(See Fig.1).

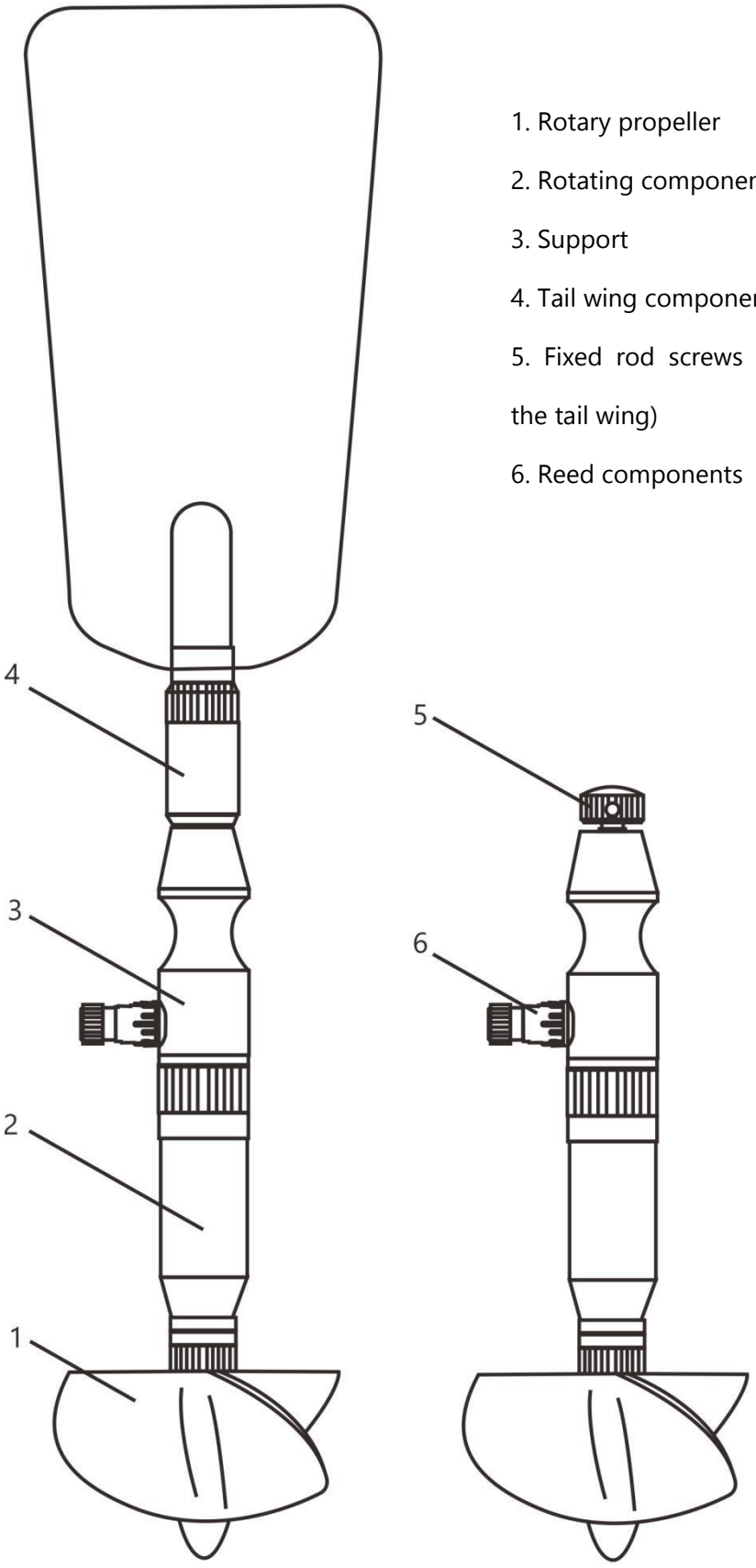
The rotating paddle passively feels the water flow and rotates around a horizontal support shaft due to the force of the water flow. Its' diameter is 70mm, and its' theoretical hydraulic pitch is 120mm.

The rotating parts(see fig. 2) , which include a shell, internal rotor system(rotating branch parts, see fig.3),moving sleeve branch parts and pressing cap, etc., are used to generate angular velocity under the force of the rotating paddle. This triggers the dry Reed to produce on-off signals.

The support is for installing and fixing the velocity meter during operation, with an installation aperture of 16mm.

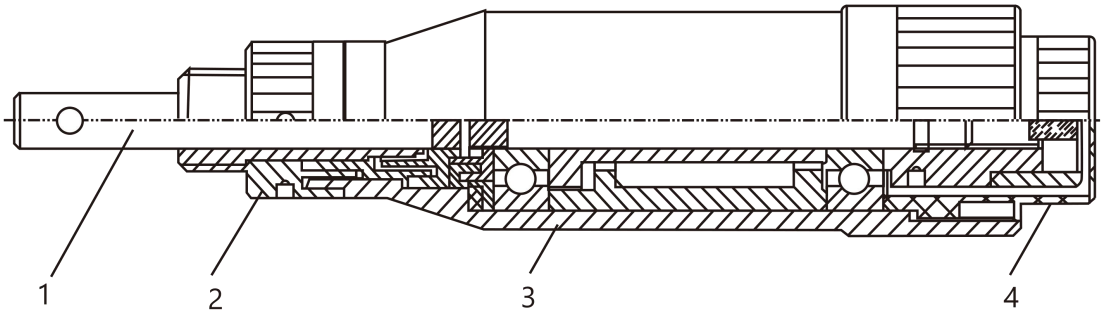
The empennage parts are for directional control when the velocity meter is in use. The clarinet component receives magnetic excitation from the rotor system and provides an external tachometer signal.

When the velocity meter operates, the rotating paddle is driven by water flow to rotate, which synchronously drives the rotor part of the rotating parts to rotate. This activates the magnetic steel installed on the rotor, triggering the reed to generate on-off signals.



1. Rotary propeller
2. Rotating components
3. Support
4. Tail wing components
5. Fixed rod screws (when not using the tail wing)
6. Reed components

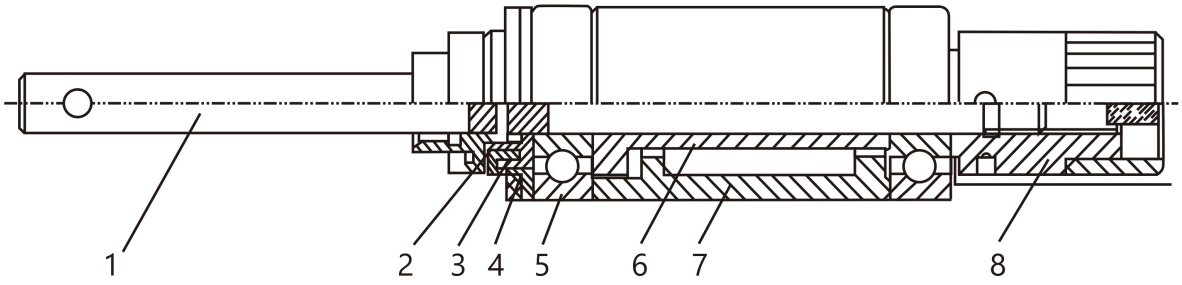
Figure 1 Rotating components



1. Rotating support component 2. Moving sleeve support component

3. Shell support component 4. Pressure cap

Figure 2 Rotating components



1. Propeller shaft components 2. Bearing inner cover

3. Bearing outer cover 4. Sealing gasket 5. Bearing 625

6. Inner spacer sleeve 7. Outer spacer sleeve

8. Union cap component

Figure 3 Rotating branch components

IV. Installation

(1) Installation of measuring rod

For shallow water flow measurement, CG16-1 type measuring rod (product selection accessories) can be selected for installation (see figure 4). The total length of the measuring rod is 1.6m, and each section is 0.4m; There is a line on the measuring rod every 2cm, and there is a digital mark every 10cm which is used as the mark of the installation position of the depth measurement and the tachometer. There is a pointer (direction mark) above the

measuring rod to align the flow direction of the tachometer (the position of the direction mark on the measuring rod should be higher than the water surface to facilitate identification and observation).

Notes: When confirming that the direction mark is consistent with the direction of the velocity meter and can be visually aligned with the flow direction, the tail parts may not be installed.

(2) Installation of suspension rod and suspension cable

When the measuring point is relatively deep, the suspension method is generally used to measure the velocity, and the velocity meter is installed on the suspension rod, suspension cable or lead fish. In this case, whether to install the tail can be determined according to actual needs.

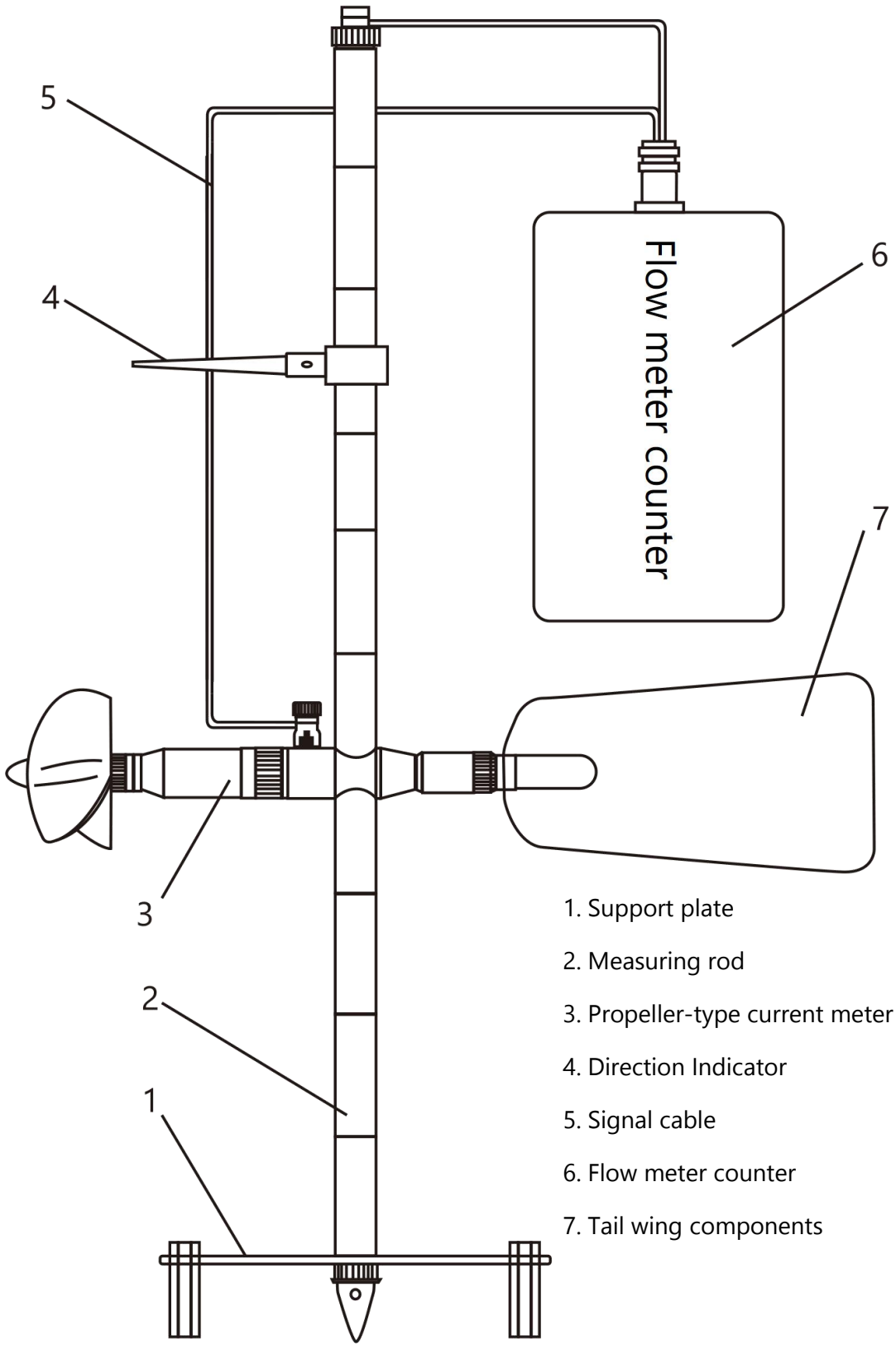


Figure 4. Installation of flow meter on measuring rod

V. Use, Operation and Maintenance

The use of velocity meter should be carried out in strict accordance with the relevant provisions of SL443-2009《hydrologic cable test specification》, GB50179-93《River flow test specification 》and other relevant hydrologic test specifications.

5.1 Preparation before use

Before using the velocity meter, the following simple tests should be carried out:

(1) Sensitivity test

1) Aim at the paddle to blow gently and evenly against the water surface, and the paddle should be able to rotate easily without freezing;

Notes: This test depends on the actual experience of users at a large extent and should be tested repeatedly and mastered skillfully so as to make a comparison in the future.

2) Rotate the paddle quickly by hand, and there should be no emergency stop.

(2) Signal testing

Test with counter or loudspeaker, Multi-meter, etc. The signal should be accurate and reliable.

5.2 Relationship between velocity and rotor velocity

Above the critical velocity V_k, there is a relatively stable linear relationship between the flow velocity (usually refers to the average flow velocity at a measuring point) and the rotor velocity of the portable velocity meter. On the premise of ensuring the accuracy, ABDT-1206A propeller velocity meter provides the following unified relationship within its measuring velocity range:

$$V=a + b*n \qquad (1)$$

Where: V- velocity (average flow rate in a time period), m/s

a-velocity meter constant, m/s

b- rotary paddle hydraulic pitch, m

n- velocity meter rotor rate, s^{-1}

$$n= R/T \qquad (2)$$

In the formula:

R: the total number of the velocity meter rotor

T-speed measurement duration, s

In order to eliminate the influence of water flow pulsation on measurement accuracy, according to the requirements of hydrologic test specifications, generally T≥100s.

For ABDT-1206A propeller type velocity meter, the velocity meter generates two signals when the rotor rotates for one circle,, so the formula (1) has the following statement:

$$v = a + b\frac{N}{2T} \quad (3)$$

In the formula:

N-the total number of signals in the velocity measurement duration

The determination of a and b values in formula (3) is given by a special velocity meter verification institution after passing the sink verification (see GB/T 21699-2008 "verification/calibration method of rotor type tachometer in straight Groove"), and the verification certificate is issued. For different velocity meter, their values are different. Before the velocity meter leaves the factory, the verification certificate will be issued randomly. Before using the velocity meter, users can find out the corresponding a and b values of the velocity meter from the verification certificate.

From the above, it can be seen that users only need to measure the total number of signals and the corresponding velocity measurement duration to calculate the average velocity of a measuring point in this period.

5.3 Use, operation and precautions

The velocity meter is generally used with a suitable counter. According to the ratio of signal number to rotor revolution number, manual counting can also be used for low-speed measurement (for example, the sound device and stopwatch can be used together).

Notes: Using the velocity meter counter can automatically measure the velocity, which is convenient and fast.

Pay attention to the following items during use:

(1) Before entering the water, the exposed signal wiring should be wrapped tightly with

insulating tape or adhesive tape to prevent the water body from becoming the signal medium;

(2) See Figure 4 for the wiring method of signal line;

(3) Before entering the water,check whether the installation of the velocity meter is stable;

(4) When the velocity meter puts forward the water surface, in order to prevent the possible loosening phenomenon of the rotating paddle, the rotating paddle should not deviate from the flow direction facing the water surface (pay special attention when the flow rate is large).

5.4 Maintenance, maintenance and precautions

The internal structure of ABDT-1206A propeller flow meter is precise, and the maintenance and maintenance work needs to be done more carefully. The following points should be done:

(1) After each use, use clean soft cloth (or towel) to wipe the remaining water drops and dirt on the surface of the velocity meter clean and put them back into the instrument box according to the original state.

(2) Avoid the collision of the velocity meter, especially when the propeller is subjected to inappropriate external force, it may deform or even break, thus affecting its normal use.

(3) Before the flood season, a comprehensive inspection should be carried out on the velocity meter:

1) The dry reed components (see figure 1) are vulnerable parts (based on the total flow measuring duration of 200h per year and the average flow rate of 0.5 m/s, then the annual working times of the dry reed is 6×10^6. In order to ensure the normal operation of the velocity meter, check whether the signal is reliable and replace the dry reed components if necessary.

The replacement of clarinet components is extremely simple, and it only needs to be directly rotated from the support (see figure 1); This work can even be carried out below the water surface without the need to put the velocity meter on the water surface.

2) According to relevant standards, the velocity meter of ball bearing structure should

be checked and refueled every 6 months. ABDT-1206A propeller type velocity meter has good sealing performance of oil chamber and strong ability of preventing water (sand). It can increase or decrease the frequency of cleaning and refueling according to local hydrologic characteristics and usage. The following are the cleaning and refueling operations for reference:

a. Disassembling the velocity meter: the parts to be cleaned are mainly bearings and sealing parts (see figure 3, rotating branch parts). Rotate the rotating parts from the support, and observe the oil quality of the internal instrument from the pressure cap. If the oil is clear, the water content is very small, and the rotation is flexible, it can not be disassembled to wash; Otherwise, it should be disassembled to clean. First, screw down the pressure cap from the rotating parts (see figure 2); Then, with the help of hook wrench and small change needle (product accessories), screw down the supporting part of the moving sleeve (the small change needle penetrates into the radial hole of the front end of the supporting shaft, and the small nail at the front end of the hook wrench is inserted into one of the radial holes of the supporting part of the moving sleeve, which can be operated by.

Notes: Part of velocity meter may have a very small compensation washer between the moving sleeve branch part and the rotating branch part (set to compensate the processing error, its size is: out diameter Φ6.2mm, inner diameter Φ5mm, thickness about 0.3mm). After removing the branch parts of the moving sleeve, you should pay great attention and be careful to lose them. When reassembling after cleaning, the compensation washer should be put in from the front end of the supporting shaft first, and then the moving sleeve branch parts should be assembled.

b. Prepare a certain amount of high-grade clean gasoline (recommend 120# aviation gasoline is used) and pour it into a container.

Notes:

1. The volume of the container should be suitable for horizontal placement of rotating branch parts;

2. In order to avoid secondary contamination of parts by impurities deposited in gasoline as much as possible, it is better to set a net leakage compartment in the container

during cleaning.

c. Put the shell and rotating branch parts etc. into gasoline for washing. The washing of the bearing should make the inner and outer rings rotate at a relatively high speed.

d. If the rotation flexibility of the bearing is not good enough, the rotating branch part (see figure 3) should be split (unscrew the cap part), and then clean the bearing separately (in gasoline, pinch the inner ring of the bearing and then quickly turn its outer ring).

Notes:Replace new bearings when necessary. It is recommended to use bearings with D-level accuracy and without dust ring.

e. After cleaning and draining, reassemble each piece in sequence. Before rotating into the pressure cap, fill the pressure cap with instrument oil (product accessories, the standard configuration before leaving the factory is about 30ml).

Notes:

1. Please choose instrument oil with low kinematic viscosity (about 6~10 mm^2/s at 50℃), no moisture and mechanical impurities, good antioxidant capacity, good chemical stability and light stability;

2. After the instrument oil is used, cover the bottle cap tightly to prevent dust and impurities from invading.

f. Check the rotating performance of rotating parts.

g. Wipe it clean with a clean soft cloth and put it in the instrument box for later use.

(4) According to relevant regulations, under the normal use conditions of the velocity meter, the stable validity period of formula (1) is 1 year. After one year of use, or less than one year but the accumulated working time has reached 300h, it shall be sent to the velocity meter verification institution for re-verification, and the values of a and b shall be approved.

Notes: ABDT-1206A type propeller type velocity meter has good sealing performance; The propeller material has excellent anti-aging performance, corrosion resistance, impact resistance and so on, and also has excellent dimensional stability. Therefore, if the velocity meter is properly maintained and cleaned and refueled according to regulations, the service life of the formula (1) can be appropriately extended under the condition that conditions permit (for example, comparing with other velocity meter on site, and the error is within the

specified range). However, according to the regulations, the maximum stable validity period of formula (1) cannot exceed 2 years.

VI. Fault Analysis and Troubleshooting

Fault	Cause	Method
The rotating paddle is not flexible	1. Wrong assembly, loose structure or improper assembly gap 2. Bearing wear and failure 3. After disassembly, the compensation washer is lost (existing in some of velocity meter products)	1. First clean and refuel, then reassemble 2. Replace 3. Seek manufacturer's support or if you use it urgently,please process it according to the above specifications and sizes
Signal instability or large error	1. The deviation of the contact parameters of the clarinet 2. The rotating paddle is not flexible 3. The survey is not conducted according to the requirements of the river flow test specification, and the survey data are not representative. 4. Magnetic steel parameter deviation 5. Surrounding strong magnetic field interference 6. When used with the counter, the counter fails or the parameter settings are incorrect.	1. Replace the clarinet components 2. See the previous column. 3. Install and compare according to the specification requirements (but do not rule out the possibility of malfunction of the tachometer) 4. Replace and cap parts 5. Change measuring points 6. Repair the counter or check the relevant parameters

VII. Product List

Please carefully check the products you have received according to the following list. If you have any questions, please consult us.

(1) Standard configuration

1) Velocity meter host (including spinning paddle) 1 set

2) Fixed screw 1piece

3) Instrument oil (about 30ml) 1box

4) Tool accessories

a. Hook wrench 1 piece

b. Small change needle 2 pieces

5) Spare parts and components

Trunk Reed components 2 sets

6) Product instructions 1 copy

7) Product certificate 1 copy

8) Instrument box 1 piece

(2) Selectable accessories

Empennage parts 1 set

(3) Flow measurement supporting equipment (optional accessories)

1) CG16-1 type measuring rod

2) XZ series velocity meter counter

3) LY series sound device

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