

LGV

V-CONE FLOW METER

Operation Manual

LGV - DT - JS - 1028 - 2018(A)



Preface

Thank you for choosing the products of Dandong Top Electronics Instrument (Group) Co., Ltd.

This operation manual provides you with important information about installation, connection and commissioning as well as maintenance, troubleshooting and storage. Please read it carefully before installation and commissioning and save it as an integral part of the product near the instrument for reading at any time.

This manual can be downloaded from www.ddtop.com.

If you do not follow this manual, the protection provided by this instrument may be damaged.

Trademarks, Copyrights and Restrictions Instructions

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The performance specifications of this instrument are effective from the date of release, and are subject to change without notice. Dandong Top Electronics Instrument (Group) Co., Ltd reserves the right to modify the products described in this manual at any time without prior notice.

Quality Assurance

Dandong Top Electronics Instrument (Group) Co., Ltd guarantees that all products will be free from defects in materials and manufacturing processes within one year from the date of leaving the factory.

During the warranty period, if the product is returned due to quality problems, and the claim is determined to fall within the scope of the warranty after inspection by the manufacturer, Dandong Top Electronics Instrument (Group) Co., Ltd is responsible for repairing or replacing it for the buyer (or owner) free of charge.

Dandong Top Electronics Instrument (Group) Co., Ltd is not responsible for the costs caused by improper use of equipment, labor claims, direct or subsequent damage, and installation and use of equipment. Except for the special written warranty certificate for certain products, Dandong Top Electronics Instrument (Group) Co., Ltd does not provide any express or implied quality guarantee.

Quality

Dandong Top Electronics Instrument (Group) Co., Ltd has passed the ISO9001 quality system certification. The entire production process is strictly implemented in accordance with the scope of the quality system, providing the strongest guarantee for the quality of products and services.

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1 Safety Tips

For safety reasons, it is expressly prohibited to modify or change the product without authorization. Repair or replacement is only allowed to use the accessories specified by the manufacturer.

1.1 An explosion may cause death or serious injury.

When installing the device in an explosive environment, be sure to comply with applicable local, national, and international standards, codes, and regulations. Ensure that the equipment is installed in accordance with intrinsically safe or non-flammable site operating procedures.

1.2 Process leaks can cause serious injury or death.

If the process seal is damaged, the medium may leak at the connection.

1.3 Failure to follow the safety installation guidelines may result in death or serious injury.

The operations described in this manual need to be completed by professionals who have received professional training and obtained corresponding qualifications or special end-users.

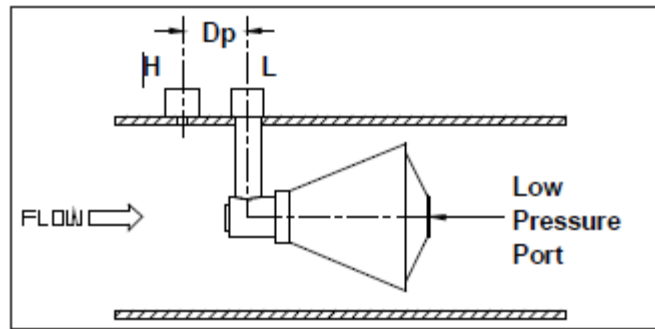
2 Summary

2.1 Production

The V-cone flow meter is a high-performance differential pressure flow measuring instrument. The unique support body and cone angle design make it suitable for various gases, liquids and vapor in metallurgy, chemical industry, fertilizer, chemical fiber, petroleum, natural gas, electric power, hydraulic and other industrial enterprises under the condition of a short straight pipe section. Flow measurement of the medium. It has the characteristics of firm cone, short straight pipe section, high measurement accuracy, wide range ratio, small pressure loss, and low installation cost. It is a major breakthrough in the field of flow sensor technology in recent years. It compensates for the structural defects of standard flow elements such as orifice plate, nozzle and venturi tube, and has broad market prospects.

2.2 Operating Principle

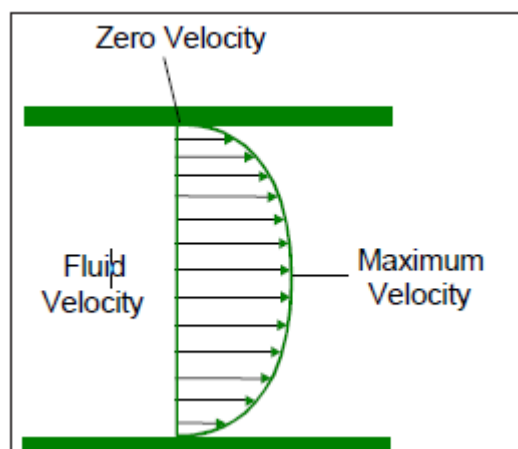
V cone is a differential pressure type flow meter. The main theory is Bernoulli's law of conservation of energy in closed pipes. This shows that for a constant flow, the pressure in the pipe is inversely proportional to the square of the velocity in the pipe. Simply speaking, the pressure decreases as the velocity increases. For example, when the fluid approaches a V-cone flow meter, its pressure is P_1 . When the fluid velocity increases in the contraction area of the V cone, the pressure drops to P_2 .



Both P1 and P2 are measured using various differential pressure sensors at the V-cone taper joint. The pressure difference produced by the V cone increases and decreases exponentially with the flow rate. When the contraction occupies more of the cross-sectional area of the pipe, there will be more pressure differential at the same flow rate. The β ratio is equal to the flow area at the largest cross section of the cone (converted to the equivalent diameter) divided by the inner diameter of the flow meter.

2.3 Remolded Velocity Profile

The V cone is similar to other differential pressure meters in the flow equation it uses. However, the geometry of the V cone is very different from the traditional differential pressure meter. The V cone reduces the flow rate by placing a cone in the center of the pipe.



This will force the fluid in the center of the pipe to flow around the cone. This geometric structure has many advantages over traditional concentric differential pressure gauges. The actual shape of the cone has undergone extensive testing and years of verification to provide the best performance in different situations.

3 Features

3.1 High Accuracy

The primary element accuracy of the V cone sensor is $\pm 0.5\%$. The accuracy of the flow measurement system depends on the accuracy level of the V cone sensor and the accuracy level of the differential

pressure transmitter and the secondary instrument.

The accuracy specification of the actual flow percentage means that the measurement uncertainty is within the given percentage value range, and the percentage value is within the specified range of the flow meter.

3.2 Repeatability

The V cone has a repeatability of up to or better than $\pm 0.1\%$.

Repeatability refers to the ability of the flow meter to repeat accuracy at a given flow rate.

3.3 Range

The range of the V cone far exceeds the traditional differential pressure gauge. The typical range of V cone is 10:1. Larger ranges are achievable. A fluid with a Reynolds number as low as 8000 will produce a linear signal. The lower Reynolds number range is measurable and repeatable. The pressure difference is measured by applying curve fitting, which is calibrated to a specific Reynolds number range.

3.4 Installation Requirements

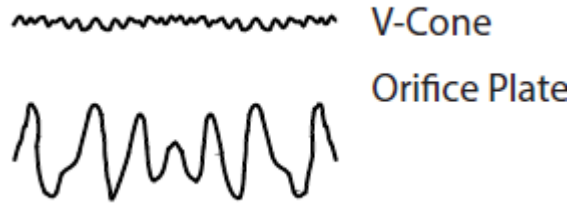
Because the V-cone can flatten the velocity profile, it can still work normally when it is closer to the interference upstream than other differential pressure gauges. The recommended installation of the V cone is 3 times the diameter upstream and 2 times the diameter downstream. This is the biggest benefit for users with larger pipelines and higher costs or users with smaller running lengths.

3.5 Long-Term Performance

The contour shape of the cone shrinks the flow without hitting the steep surface. A boundary layer is formed along the cone to draw fluid away from the β edge. This means that the beta edge is not subject to the usual abrasion of dirty liquid like the orifice plate. The beta rate will remain the same, and the calibration of the meter will remain accurate for a longer period of time.

3.6 Stable Signal

Each pressure gauge has a "signal jump". This means that the signal generated by the main device will fluctuate even in a stable flow. In a typical orifice plate, the vortex formed behind the orifice plate is very long. The long vortex produces a high-amplitude low-frequency signal from the orifice plate. This may interfere with the differential pressure reading from the gauge. When the fluid passes through the cone, the V cone forms a short vortex. These short vortices produce a low-amplitude high-frequency signal. This translates into a high stability signal of a V cone. Representative signal of V cone and typical orifice plate.



3.7 Low Permanent Pressure Loss

Without being impacted by a steep surface, its permanent pressure loss is lower than that of a typical orifice gauge. In addition, the stability of the V-cone signal allows the recommended full-scale differential pressure signal of the V-cone to be lower than other differential pressure meters. This will reduce permanent pressure loss.

3.8 Range

The unique geometric structure of the V cone allows a wider range of β ratios. The standard beta ratio ranges are 0.45, 0.55, 0.65, 0.75 and 0.80.

3.9 No Stagnation Area

The "sweeping" design of the cone does not allow stagnant areas where debris, condensate or particles in the fluid may accumulate.

3.10 Structure Support

In order to prevent the flow meter from being impacted and causing the cone to fall off during use, the V-cone flow meter adopts a supported cone fixing method, which will make the cone fixed very firmly and reliably, while reducing the impact of cone vibration on the measurement. At the same time, the influence of the support on the flow field is fully considered to ensure the measurement accuracy.

4 V Cone Flow Measurement System

4.1 Application Data

The customer must provide the application parameters in order to select the appropriate V-cone flow meter. Dandong Top Electronics Instrument (Group) Co., Ltd has an extensive flow meter performance database that can be used to measure dimensions.

4.2 Flow Calculation

$$q_m = \frac{C}{\sqrt{1 - \beta_v^4}} \cdot \varepsilon \cdot \frac{\pi}{4} \cdot D^2 \cdot \beta_v^2 \cdot \sqrt{2\Delta P \rho}$$

$$q_v = \frac{q_m}{\rho} \quad \beta_v = \sqrt{1 - \frac{d_v^2}{D^2}}$$

其中: q_m : Mass Flow

q_v : Volume Flow

C: Outflow Coefficient

β_v : Equivalent Diameter Ratio

ρ : Fluid Working Density

ΔP : Pressure Difference

D: Pipe Inner Diameter

d_v : Maximum Cross-Sectional Diameter of Cone

ε : Gas Expansion Coefficient (Liquid is 1)

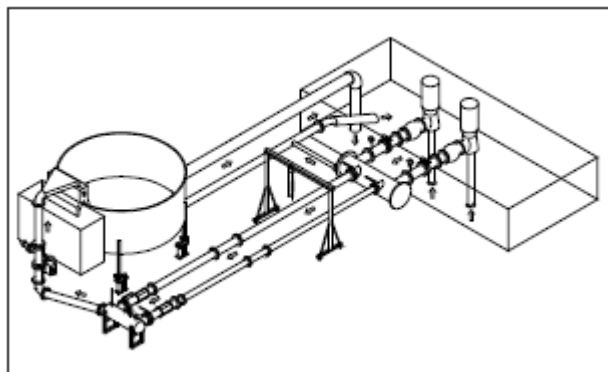
4.3 Applications Dimensions

Each V cone is customized according to its specific application. Before manufacturing, each V cone will determine a cone diameter according to the physical parameters of the application. The full-scale pressure difference, accuracy and pressure loss are determined by the calculation of the determined cone diameter.

4.4 Calibration

The water flow verification device can be used to calibrate the V cone flow meter with high precision.

It is recommended to calibrate every V-cone flow meter. The best accuracy can be obtained when calibrating the full flow range. In the case that the flow meter cannot be calibrated, DDTOP can estimate flow meter C based on years of data.



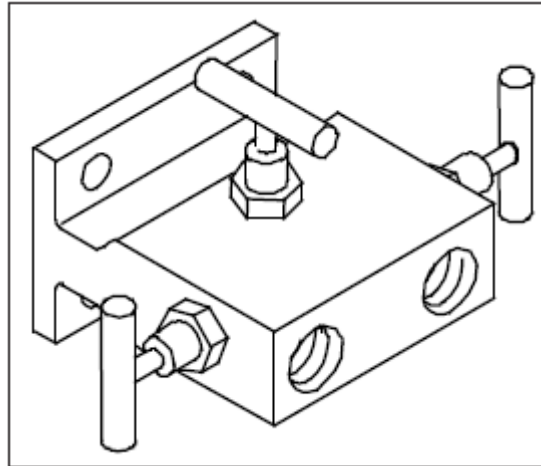
4.5 Structure Materials

All materials for V-cone flow meters are certified. The materials provided to DDTOP include the certified material test reports of the raw material manufacturers. The test report includes material composition and applicable material grade. If required, a copy of the material test report can be

provided to the customer.

4.6 Manifold

DDTOP recommends three-way valve or five-way manifold as part of the V cone flow measurement system. The manifold allows online transmitter calibration, the isolation of the transmitter and the transmission line, without the need to depressurize the pipeline and online purification of the transmission line.



4.7 Secondary and Tertiary Instruments

The differential pressure transmitter measures the differential pressure signal from the V cone. Once the signal is measured, the transmitter generates an electronic signal, which is then transmitted to a flow computer or other control system. For compressible fluids, pipeline pressure and temperature measurement are usually required for accurate flow measurement. DDTOP provides the following fluid measuring instruments: differential pressure transmitters, flow computers, pressure and temperature sensors for a wide range of flow measurement.

4.8 Flow Meter Nameplate

Each V-cone meter has a nameplate fixed on the tube. The following is an example of the standard nameplate and display.

		V Cone Flow Meter					
FA 10F213-21		Medium flow direction					
Model	<input type="text"/>	Tag NO.	<input type="text"/>	β value	<input type="text"/>	Accuracy	<input type="text"/>
Nominal Size	<input type="text"/>	Flowmeter Scale	<input type="text"/>	Cone Material	<input type="text"/>	Date	<input type="text"/>
Pressure Rating	<input type="text"/>	Full Scale Diff. Press	<input type="text"/>	Material Flanges	<input type="text"/>	Serial NO.	<input type="text"/>
Dandong Top Electronics Instrument (Group) Co., Ltd							

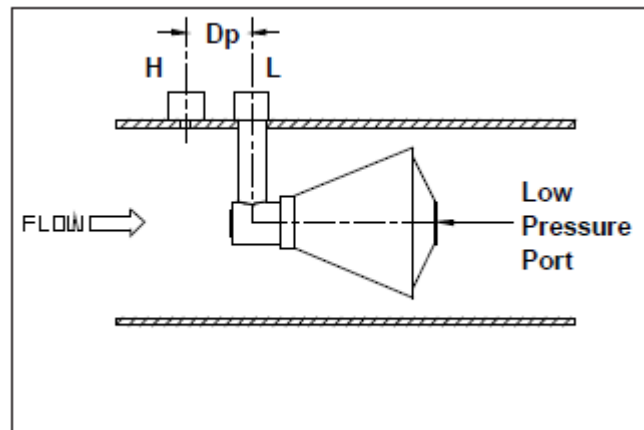
5 Installation

5.1 Unpack

DDTOP tests and inspects all products during production and before shipment. However, checking the instrument and accessories found that the damage may be caused during transportation. If you have questions about documentation or flow meters, please contact your DDTOP sales representative.

5.2 Direction

Each V cone has a flow direction label that shows the direction of flow through the meter. The high pressure port is upstream. The low pressure port is downstream.



5.3 Pipeline Requirements

It is recommended that the straight, unobstructed pipe section upstream of the V cone is 0-3 times the diameter. The recommended downstream of the V cone is 0-2 times the diameter. The "diameter" here means the nominal pipe size of the pipeline.

5.4 Installation

The preferred design is to minimize the distance between the main equipment and the auxiliary equipment. At the same time, in applications such as vapor, the auxiliary equipment must be continuously provided with cooling protection.

The installation design of the flow meter should consider the troubleshooting of the instrument.

Divide and calibrate. To connect to the pulse pipeline, valves, manifold and auxiliary equipment are necessary. The installation that provides these accesses must not destroy the measurement accuracy by adding an excessively longtapping pipeline and a large number of accessories.

Remarks: The shorter the tapping pipeline, the greater the measurement accuracy. Longer and complex pipelines will increase uncertainty and provide more opportunities for closure. The blocked pipeline leads to loss of control and creates a dangerous situation. Good design

specifications allow liquid and gas to be naturally discharged from the tapping pipeline.

5.5 Tapping Pipeline: Common Use

The required diameter of the tapping pipeline depends on the conditions of use. The hole should not be smaller than 1/4" (6 mm), preferably at least 3/8" (10 mm). The inner diameter should preferably not exceed 1" (25 mm). For vapor applications, 3/8" (10 mm) to 1" (25 mm) should be used. Most instrument pipeline is 316 stainless steel, but for offshore applications, duplex steel may be the material of choice to avoid salt spray corrosion of pipelines.

5.6 Tapping Pipeline: Process Industry

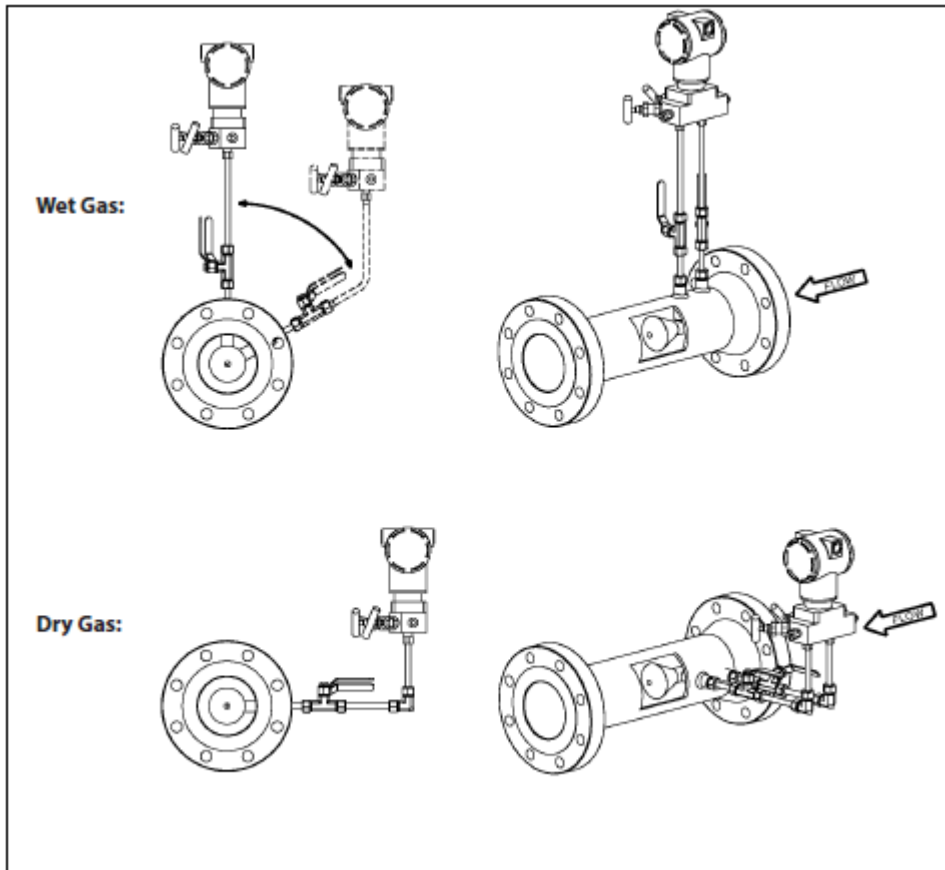
In most process control applications, reliability is the first consideration. If the pressure tap or pulse tube is blocked, the differential pressure signal will be lost. This can lead to dangerous or expensive out of control. Flow signals in process safety management require high reliability. The recommended minimum inner diameter for industrial applications is 5/8" (16 mm). Some users even specify a minimum inner diameter of 3/4" (18 mm). For high temperatures in condensed vapor applications, it is specified as 1" (25 mm). Allow the condensate to flow freely. In small pipelines and cleaning liquids, appropriately smaller sizes can be used. In all configurations, stainless steel pipelines are recommended.

5.7 Tapping Pipeline: Vapor Application

The vapor temperature can be as high as 1500 degrees Fahrenheit (815 degrees Celsius), which is much higher than the temperature that a standard differential pressure transmitter can withstand. Standard differential pressure sensors can only tolerate temperatures of approximately 200 degrees Fahrenheit (93°C). In order to isolate the sensor from very high temperatures, the usual technique is to install a condensate tank or a pipe section with a long enough differential pressure in the pipeline to cool the sensing pipe section before the transmitter. In all configurations, it is recommended to use stainless steel tapping pipelines.

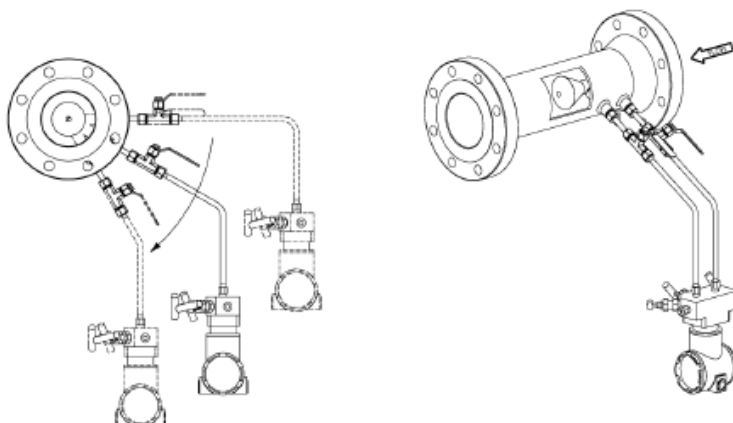
5.8 Horizontal Pipeline Installation: Gas

The pressure tap on the main equipment should be located between the horizontal centerline and the top of the pipe (3 point to 12 point or 9 point to 12 point), unless the measured fluid is vapor that is intended to condense in the auxiliary system. However, if the liquid is "wet gas", that is, a gas containing a small amount of liquid, the measuring port should be as vertical as possible to allow the liquid to drain from the auxiliary equipment. The connecting line from the main equipment to the auxiliary equipment should be inclined upward for gas use. The recommended self-draining slope is at least 30°.



5.9 Horizontal Pipeline Installation: Liquid

The pressure tap should be located between the horizontal centerline and 60° below the centerline (3 point to 5 point or 7 point to 9 point). If solids are present in the liquid, the measurement port located at the bottom dead center may accumulate solids; the measurement port located above the center line may accumulate air or non-condensable gas. In either case, the angle between the measuring port and the horizontal plane should exceed 60°.



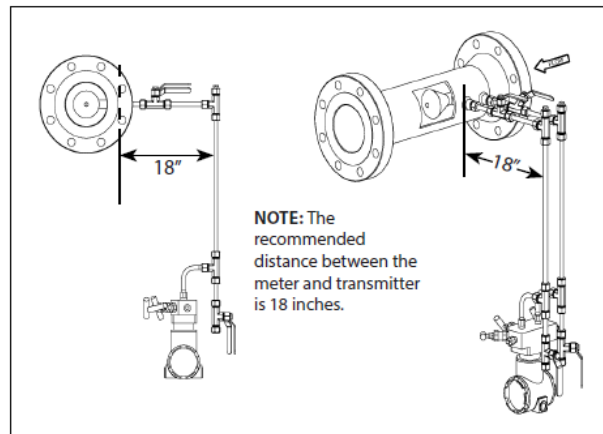
5.10 Horizontal Pipeline Installation: Condensing Vapor

This is the most difficult application of DP pipelines and requires careful consideration during installation. The vapor may be at a very high temperature, which can damage the transmitter; in

addition, depending on the temperature and pressure, the vapor may be in the liquid or gas phase. Therefore, the direction of the DP piping system must enable it to operate in the presence of gas or liquid.

The pressure tap should be located on the horizontal center line of the main equipment (3 point or 9 point). In condensing hot vapor facilities, such as vapor, the fluid in the pulse pipeline is a liquid condensed from vapor. In this case, the pressure tap should be level, and the tapping pipeline should face the differential pressure transmitter, as shown in the figure.

There is a problem, during startup, auxiliary equipment may be exposed to vapor temperature before the pipelines are filled with condensate and cooled. In this case, it is prudent to install a socket-type tee joint in the tapping pipeline so that the tapping pipeline and auxiliary equipment are filled with liquid (vapor water) before starting.

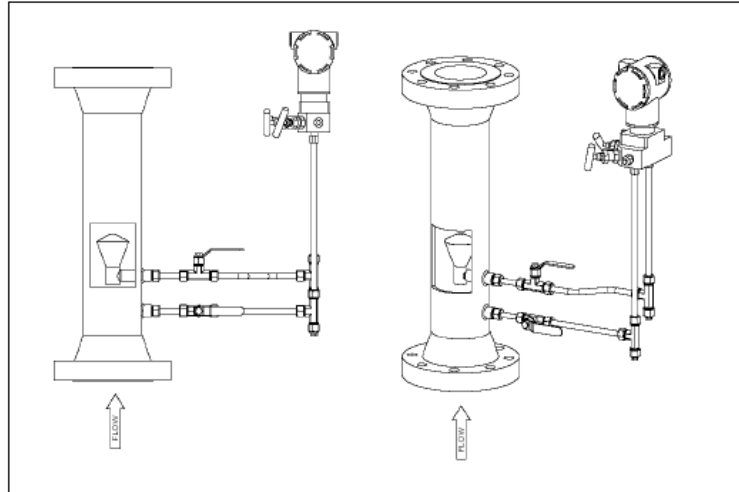


5.11 Vertical Pipeline Installation: Common Use

In the case of vertical pipelines, the radial position of the pressure tap is usually not a problem. Attention must be paid to the V-cone in the vertical upward flow and vertical downward flow piping arrangements. In this section, vertical downward flow and vertical upward flow are separated.

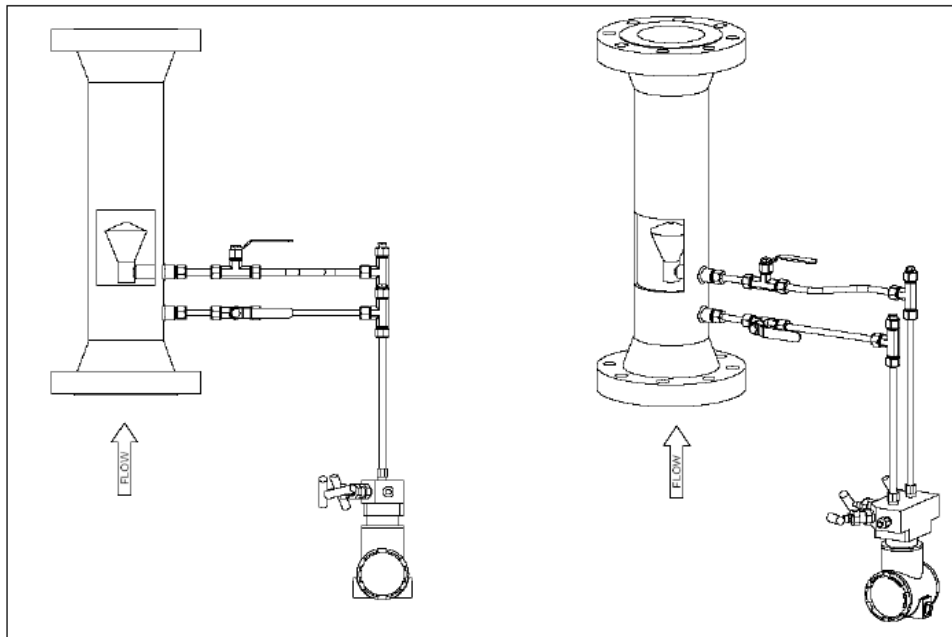
5.12 Vertical Pipeline Installation: Gas

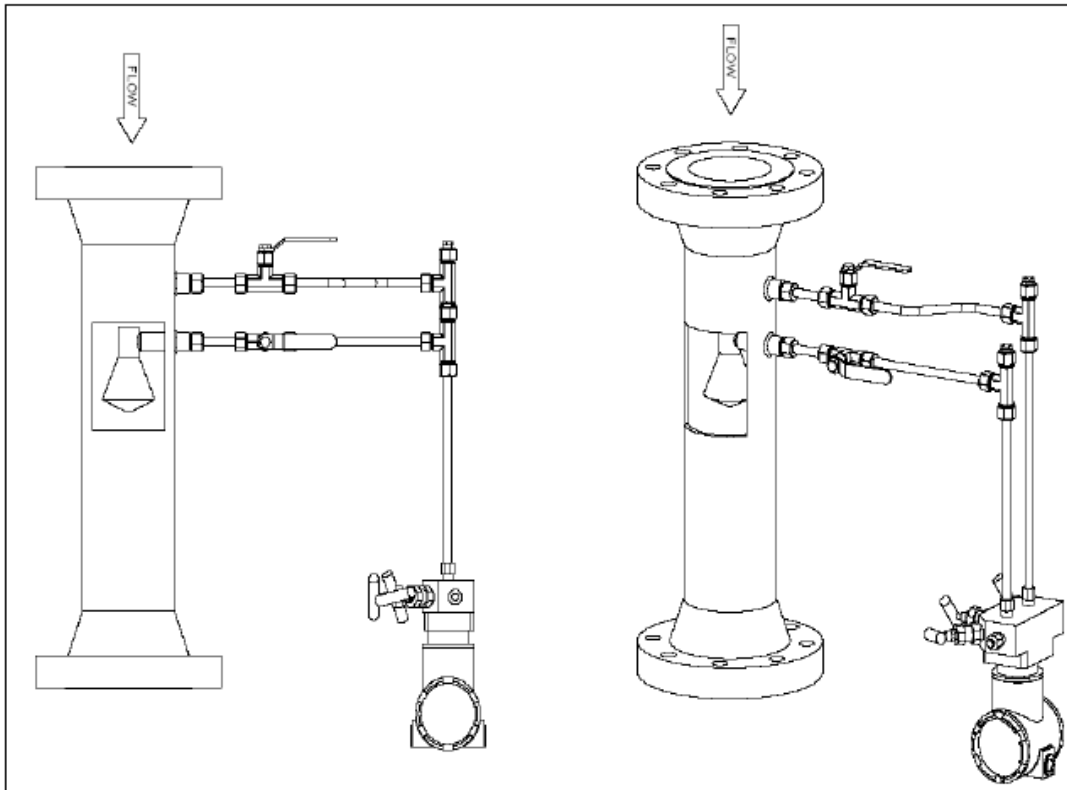
In a clean, dry, non-condensing gas, if you ensure that no liquid or dirt can fill the cone, you can use a standard pressure tap. The location of the transmitter is not important.



5.13 Vertical Pipeline Installation: Liquid

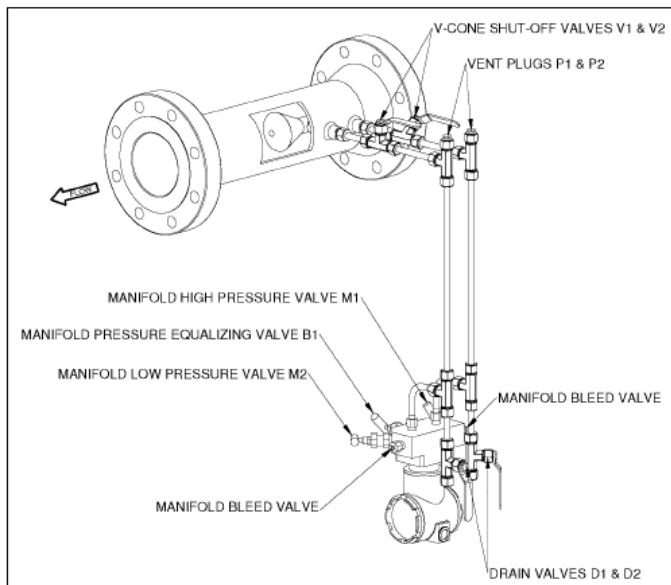
In most process applications, it should be assumed that even if the liquid is water, there may be gas or vapor associated with the liquid. Therefore, the pipeline must allow the gas to rise back into the flowing medium. The DP pipeline should be led horizontally as short as possible, and then down to the transmitter, which should be located below the two measuring ports.





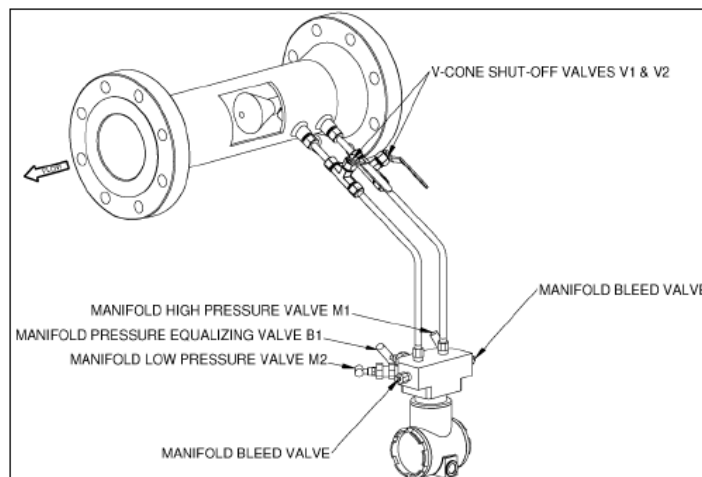
5.14 After installation, the DP pressure transmitter is zeroed for vapor flow applications

1. Close the high and low pressure V- cone stop valve (V1 and V2)
2. Remove the ventilation plugs P1 and P2.
3. Fill the pulse tube with water/glycol solution through P1 and P2.
4. When the pulse line is full, adjust the transmitter gauge pressure until the reading is 0.
5. Adjust the transmitter pressure difference to zero.
6. Replace and tighten the exhaust plugs P1 and P2, and slowly open the high and low pressure V-cone stop valves V1 and V2.
7. Allow time for the excess pulsed liquid to drain back into the V-cone and allow the system to stabilize. This may take a few minutes. Confirm that there are no leaks in the impulse line components and connections.



5.15 After installation, the DP pressure transmitter is zeroed, and it is used in liquid applications at ambient temperature

1. To clear the air in the pipeline, open the vent manifold until the liquid flows steadily and there is no air. Then close the vent valve.
2. Close manifold M1 and M2.
3. Open the balanced valve B1.
4. Zero the DP transmitter.
5. Close the balanced valve B1 and open the manifold M1 and M2.

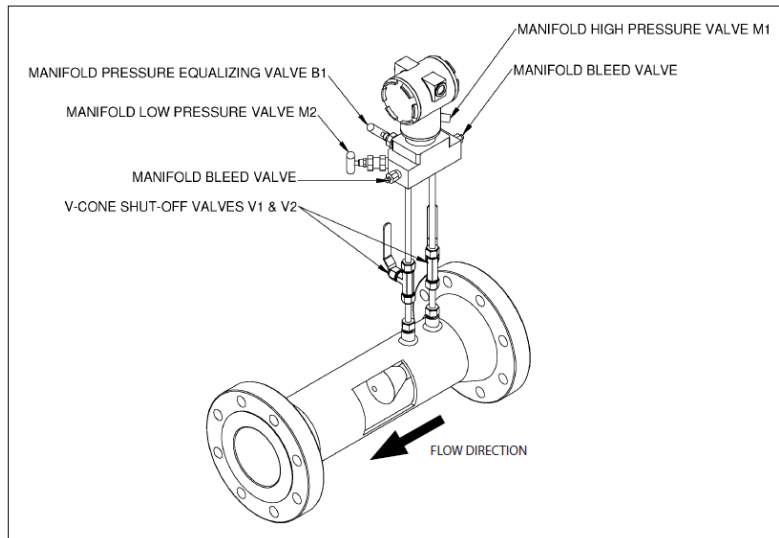


5.16 DP pressure transmitter is zeroed after installation, in gas applications

1. To remove any liquid in the pipeline, open the vent valve until there is a steady air flow and there is no liquid. Then close the vent valve.
2. M1 和 M2。 Close manifold M1 and M2.
3. Open the balanced valve B1.
4. Zero the DP transmitter.

5. Close the balanced valve B1 and open the manifold M1 and M2.

The system is now operating with the DP transmitter zeroed to pipeline pressure.



5.17 Differential Pressure Measurement

In the current technology, the pressure difference is usually measured with a differential pressure transmitter. These transmitters can simply record the pressure difference and provide a 4-20mA signal to the flow computer or DCS system.

6 Maintenance

6.1 Regular Maintenance

If the instrument is installed correctly, there is no need for regular maintenance or recalibration. Under extreme process conditions, regularly check the V cone for any obvious physical damage. Calibrate and maintain the secondary and tertiary instruments according to the manufacturer's instructions.

7 Troubleshooting

7.1 On-Site V-Cone System Troubleshooting

This operation manual is designed to help you troubleshoot the V-cone system. A few things to keep in mind as you proceed:

Most V cones are calibrated devices. There is already fluid flowing through the meter. If the cone is missing or there is a leak in the meter, this will be discovered during the calibration process.

Flow measurement requires a system. Don't assume that there is a problem with the main device,

just because it is called a V-cone system. Most problems occur on the DP transmitter or flow computer.

This operation manual assumes a simple instrument, valve manifold, DP transmitter and flow computer system. The system can be more complex, including pressure and temperature transmitters, and a full range of digital control systems.

In the troubleshooting process, make a preliminary assessment of the symptoms of the failure and refer to the following table:

Phenomenon	Region	Problems/Solutions
No Signal (0mA)	Transmitter	The transmitter has no power.
	Transmitter	The transmitter wiring is incorrect. Check the continuity of the line.
Negative Signal (< 4 mA)	Transmitter	The transmitter wires are reversed.
Low Signal (< 4mA)	V-Cone	Install the V cone backwards, and connect the meter wire according to the mark. In this case, the high pressure tap will sense a lower pressure than the low pressure tap. This negative DP will force the signal to be below 4ma.
	Tapping Pipeline	The instrument line is reversed. The pressure on the low pressure side of the transmitter is greater than that on the high pressure side. Check the "H" and "L" marks on the V cone and the conveyor.
	Transmitter	The transmitter has a fault. When a failure occurs, some transmitters will send a specified mA signal. This can be set to a low value, such as 3.8 mA, or a high value, such as 20.1 mA.
Zero Signal (4 mA)	V-Cone	The meter is damaged. Remove the meter and inspect it visually.
	V-Cone	There is no flow in the pipeline. Check other system locations to verify the flow through the meter. The meter may be under pressure, but there is still no flow.
	Valve Manifold	The pipe group/instrument pipe is closed or blocked. Make sure the valve and pipeline are open. If the liquid is safe, open the vent valve on the transmitter to verify the pressure in the meter line.
Zero Signal (4 mA)	Transmitter	The transmitter is in check mode. Some transmitters allow system checks by forcing the signal to 4 or 20 mA. Ventilate the low pressure side of the transmitter to ensure that the signal responds to pressure changes.

Error Signal-High or Low	V-Cone	The process conditions do not match the actual conditions. Please contact DDTOP or your sales representative to recalculate using the correct process conditions.
	V-Cone	Wrong meter. Confirm the serial number on the meter to ensure that the specifications are correct. Sometimes the two meters are interchanged. Remember that each V cone has a unique flow coefficient.
	Tapping Pipeline	There is a foreign body in the instrument pipeline. Dirt and sediment may settle into the meter pipeline. If the liquid is safe, drain the instrument pipeline and check if there is any solid, gas or liquid ejected (whichever should not appear). If the oil is not safe, open the central pipe valve for several minutes under high pressure. Close the valve and compare the signal level with the previous one. In horizontal liquid applications, install the gauge on the side of the pipe (3 point or 9 point direction). For horizontal gas applications, installed on the top or side of the pipe (12, 3 or 9 point direction).
	Flow Computer	The flow calculation is incorrect. Using a loop calibrator, apply 4, 12, and 20 mA currents to the computer/system. Each of these points should be associated with V-cone size information.
	Flow Computer	The mA signal read error. Apply a known current to the loop and read the original signal in the computer. Most computers allow users to directly see the milliamp signal.
Unstable Signal	V-Cone	Partially full tube (liquid only). Partially full tube cycles will cause unstable readings. See above for details.
	Transmitter	The power supply is insufficient to generate a signal. Check the power supply specifications of the transmitter.
Slow Response Time	Transmitter	Damp
Sudden Reading	V-Cone	There are foreign objects in the meter. This will increase the limit of the meter and increase the differential pressure. Remove the meter and inspect it visually.
	Tapping Pipeline	The leak has already begun.

Signal is Too High	V-Cone	The V cone is installed backwards. Look for the flow direction arrow on the meter body near the pressure tap. If the arrow is not visible and the gauge is larger than 2 inches, the flow direction can be determined by the position of the pressure tap. The pressure tap will be close to the upstream side. For gauges smaller than 2 inches, the gauge wire needs to be removed. Look at the base of the two pressure taps. One pressure tap has a smooth bottom, and the other will be mainly welding material. The smooth pressure tap is located on the upstream side. The meter measures the reverse flow, and the DP signal will be as high as 30%.
	V-Cone	The flow direction is opposite to expectations. The assumption of flow is sometimes wrong. Use other system readings for verification. The meter measures the reverse flow, and the DP signal will be as high as 30%.
	V-Cone	Partially full tube (liquid only). Partially full pipe will cause the meter reading too high. This can happen even in pressurized systems. <ul style="list-style-type: none"> • Horizontal pipe: If the fluid is safe, turn on the pressure at the top of the pipe. Air release will indicate a partially full tube. • Vertical pipeline: Upward flow will ensure the entire pipeline. Down flow is difficult to diagnose whether the pipeline is full.
	V-Cone	There are foreign objects in the meter. This will increase the limit of the meter and increase the differential pressure. Remove the meter and inspect it visually.
	Tapping Pipeline	The low pressure meter pipeline leaks. Perform a leak check from the meter to the transmitter.
	Transmitter	The low pressure vent valve is leaking. Perform a leak check on the valve.
	Transmitter	The zero point moves in the positive direction. This will result in more obvious errors at the lower end of the transmitter range. Verify by closing the manifold side valve and opening the center valve. The reading should be zero (4 mA). Recalibrate if necessary.
Signal is Too High	Transmitter	The DP span is set too low. Use a pressure calibrator or handheld communicator to verify the span point.
	Transmitter/ Flow Computer	Both the transmitter and the flow computer are set to take the square root of the signal. The signal is correct at 20 mA. When the signal decreases from 20 mA, the positive error will increase sharply. Use a loop calibrator to check the 12 mA point.


	Flow Computer	4 mA is set as the minimum flow. Our calculation assumes that 4mA is equal to zero flow. Sometimes 4 mA is set to equal the minimum flow rate on the resize page. This error is zero at the maximum flow rate and increases as the flow rate decreases. The size of the error will depend on the zero offset.
Signal is Too Low	Valve Manifold	Cross ventilation of the valve manifold. The center valve must be closed. To test, close the two side valves and observe the transmitter signal. If the signal becomes zero (4 mA), the center valve will not close completely.
	Tapping Pipeline	Leak in the high-pressure meter pipeline. Perform a leak check from the meter to the transmitter.
	Transmitter	The high pressure vent valve is leaking. Perform a leak check on the valve.
	Transmitter	The zero point has moved negatively. This will result in more obvious errors at the lower end of the transmitter range. Verify by closing the side valve of the valve manifold and opening the center valve. The reading should be zero (4 mA). Recalibrate if necessary.
	Transmitter	The DP span is set too high. Use a pressure calibrator or handheld communicator to verify the span point.
	Transmitter/ Flow Computer	Neither the transmitter nor the flow computer is set to take the square root of the signal. The signal is correct at 20 mA. When the signal decreases from 20 mA, the negative error will increase sharply. Use a loop calibrator to check the 12 mA point.

Recommended equipment for troubleshooting on-site V-cone installation:

1. 4 to 20 mA loop simulator-strongly recommended;
2. Digital multi-meter: with VDC, I and Ω measurement;
3. Pressure calibrator
4. Handheld communicator of smart instrument;
5. Hand tools: screwdriver (+), screwdriver (-), 12 inch angle wrench, 4 inch angle wrench.

8 Product Certificate

Product Certificate

Certificate		Certification No.	Scope and Description
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Approval of Measuring Instrument Form

14F202-21