

CATALOG



STLUVCF
V-cone Flow Transducer

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General Features of STLUVCF V-cone Flow Transducer Advantage

- Accuracy: $\pm 0.5\%$
- Repeatability: $\pm 0.1\%$
- Wide size range: DN15~DN2000
- It can measure high temperature and high pressure media: $-40\sim 700^{\circ}\text{C}$, $0\sim 42\text{MPa}$
- Wide measuring range: generally 10:1
- Wide range of the β value: the unique geometrical shape of V-cone flow transducer allows wide range of the β value.
- Low requirements on straight pipe length: straight pipe 0-3D upstream and 0-1D downstream
- Small pressure loss: pressure loss is $1/3\sim 1/5$ that of the orifice plate when the β value remains the same.
- Strong resistance against wear, no demand for repeated calibration: after throttled by the streamline V-cone, the vacuum layer effect will be generated on the surface of V-cone to keep the V-cone from being worn easily so that stability is good and service life is long, and V-cone flow transducer doesn't need repeated calibration.
- Being free from blockage and adhesion: the complete purging design of V-cone avoids the deposition of residue, coagulation or particle.
- Long-term favorable stability: the β value can remain the same for long and the measuring accuracy can be ensured for a long period.
- Stable signal: signal fluctuation is $1/10$ of that of orifice plate.
- A complete range of specifications, flexible installation: pipe flanged type, directly welded type, square pipe type
- It can measure successfully flowrate of many media which can not be measured by other flowmeter, such as dirty medium (coke oven gas, blast furnace gas, feed stock and residual oil, etc.), gas and liquid two-phase medium (moisture and condensed water).

Coal gas: blast furnace gas, coke oven gas, city gas	Water: raw water, drinking water, production water, sewage water, etc.
Natural gas: including gas containing 5% of moisture	Organic chemicals: methanol, glycol, xylene, raw methanol, etc.
Flue gas: flue gases emitted by various kinds of boilers, heating furnaces	Various kinds of water solutions: acid, alkaline and salt solution
Air: compressed air containing water and dusts	Corrosive gas: wet chloride gas
Steam: saturated steam, overheated steam	Gas of hydrocarbon: alkanes, alkene, etc.
Oil: raw oil, fuel oil, diesel oil, gasoline, heavy oil, etc.	Winds with low static pressure: such as primary winds and secondary winds of circulating sulfuration bed, etc.

General Features of STLWCF V-cone Flow Transducer

Limitation

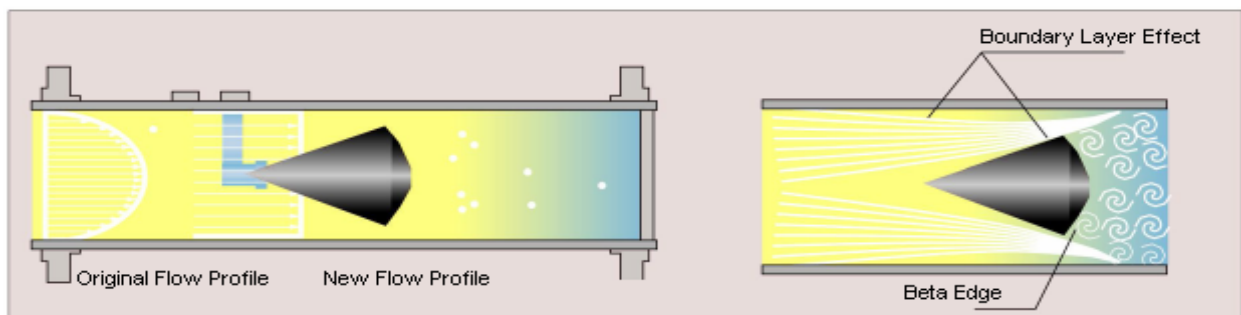
- When higher than 0.5% of accuracy is required, every flow transducer must be calibrated actually on the calibrating equipment which approaches to practical working condition, i.e. calibrating needs actual fluid calibrating.
- Owing to its structure, a set of V-cone flow transducer can not measure bidirectional flowrate.
- As though a throttling device accompanying the quality differential pressure transmitter and the second meter could obtain whole excellent system performance, matching differential pressure transmitter with superior quality is a must for the purpose of higher accuracy. So re-calibrate the differential pressure transmitter and the second meter at regular intervals according to the manufacturer's manual.

STLUWCF V-cone Flow Transducer

Main Features

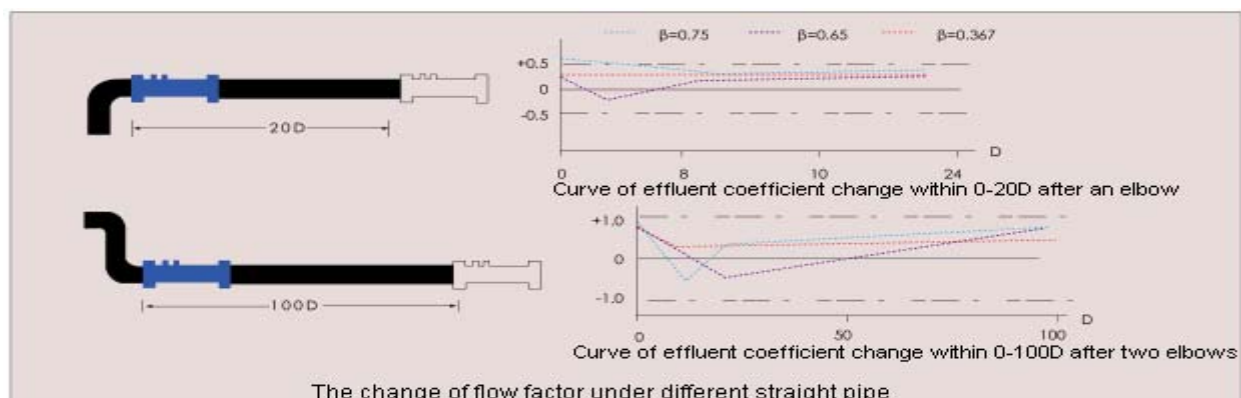
- Homogenizing flow velocity

When fluid in the pipe flows fully without any block and disturbance, its velocity distribution is as follows: the closer to the pipeline center, the higher flow velocity, so flow velocity reaches its peak in the center; the closer to the pipe wall, the lower flow velocity, so flow velocity is close to zero. Because most velocity type flowmeters can not change uneven velocity, they can only ignore the actual distinction of flow velocity in the pipeline and suppose the flow velocity was even. While V-cone of V-cone flow transducer installed in the pipeline center separates directly the fluid in the center where fluid flows at speed, it makes high velocity fluid approach to surrounding low velocity fluid and mix with them, then difference of flow velocity disappears and flow velocity is really homogenized. The advantage of homogenizing flow velocity is that measuring signal really reflects actual value of measured flow velocity and accurate differential pressure in the front and rear of transducer can be measured even at low flow velocity. With the decrease of flow velocity, above advantage is more obvious, which is the greatest strength for low flowrate which the traditional differential pressure type flowmeter can not measure.



- Short straight pipe needed in installation: only 0~3D upstream and 0~1D downstream

V-cone flow transducer adopting the throttling pattern of internal wall gradually shrinkage can force the regions with high flow velocity to be shrinkage and close to the pipe wall when fluid flow through the spaces between V-cone and internal wall of the pipe, so that the flow velocity is homogenized smoothly. Because V-cone has such a function of self commuting function of homogenizing flow velocity it only needs very short straight pipe upstream and downstream when V-cone flow transducer is adopted to measure flowrate. The experimental results showed that only maximum 3D (upstream) and 1D (downstream) of straight pipe are needed. This solves the defect of conventional differential pressure flowmeters such as orifice plate flowmeter which needs very long straight pipe upstream and downstream, and flow factor is unstable, etc.

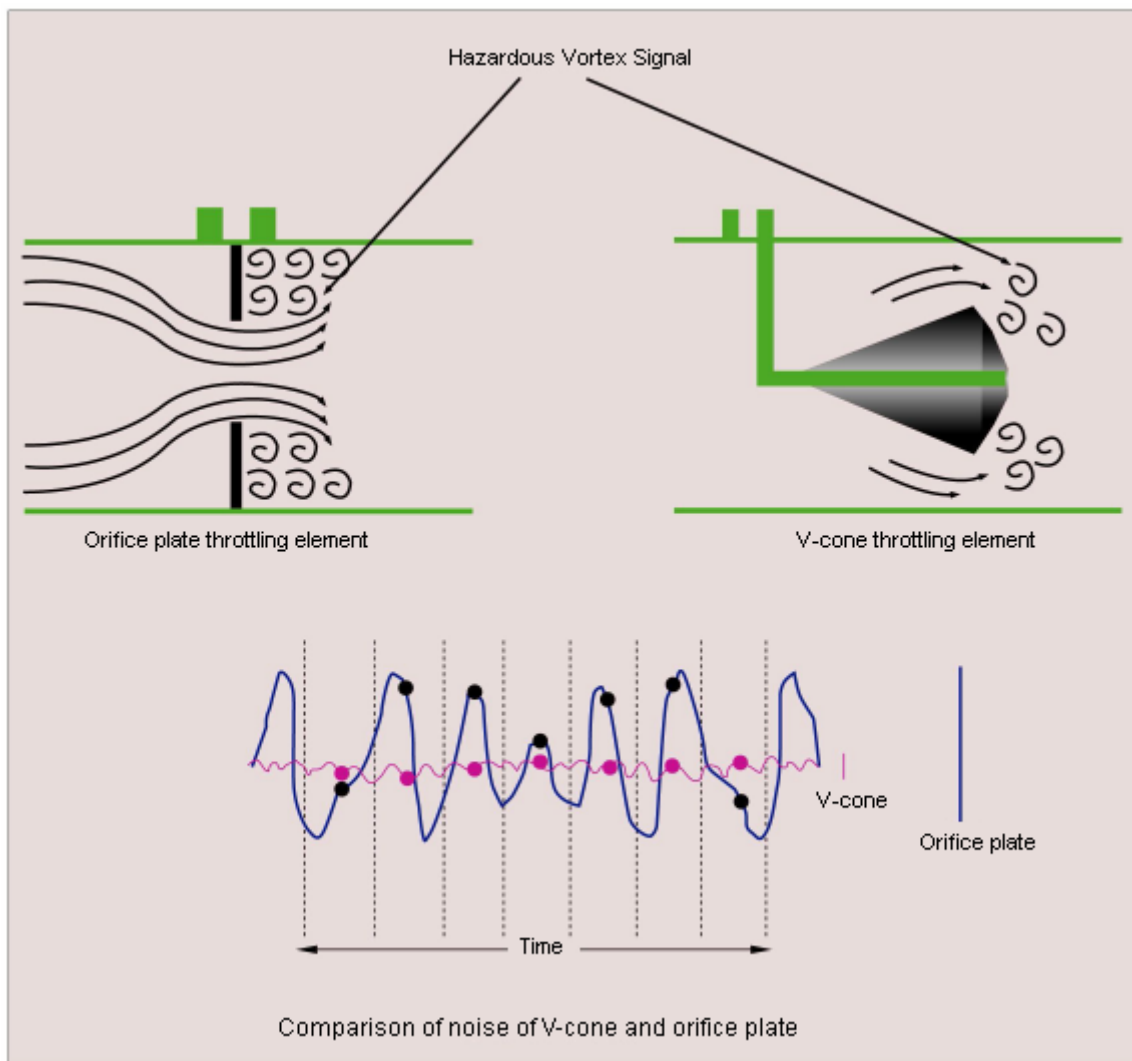


STLUWCF V-cone Flow Transducer

Main Features

- High accuracy $\pm 0.5\%$, good repeatability $\pm 0.1\%$, wide turndown ratio 10:1

As V-cone flow transducer adopts the throttling pattern of internal wall gradually shrinkage, the static pressure generated at the downstream is signal with high frequency and low amplitude (turbulence), but not signal with low frequency and high amplitude generated by conventional differential pressure type flowmeter such as orifice plate, as is shown in the following diagram. This makes that differential pressure measured by differential pressure transmitter is very stable signal with low noise. At the low pressure side, the differential pressure transmitter can measure pressure which resolution is better than 2.5mm water column, so that very large turndown ratio and good repeatability can be obtained when only one differential pressure transmitter is used. The shape and angle of V-cone which are designed and fabricated precisely can make flow velocity to be “homogenized” possibly, and it can make the accuracy of V-cone flowmeter (a differential transmitter with accuracy 0.2% is equipped) is better than 0.5%, repeatability is better than 0.1% and turndown ratio reaches up to 10:1.



STLUWCF V-cone Flow Transducer

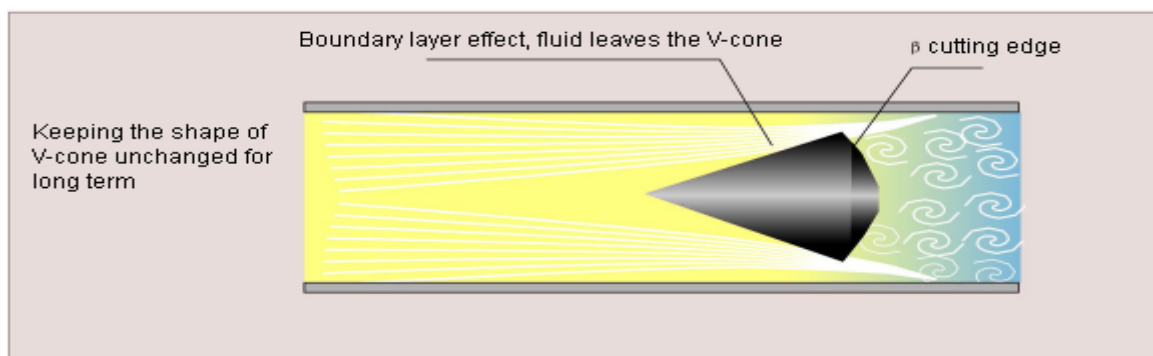
Main Features

- Small permanent pressure loss, applicable to measuring fluid with low static pressure and low flow velocity

Large permanent pressure loss is one of the largest defects of conventional differential pressure type flowmeter. But V-cone flow transducer adopting the throttling pattern of internal wall gradually shrinkage realizes gradual shrinkage and diffusion of fluid to internal wall of pipes and there is no impact on smooth surface of V-cone when fluid flows through the V-cone, so the permanent pressure loss of V-cone is far lower than that of orifice plate. Due to the characteristics of low noise signal with high frequency and low amplitude at low pressure side, V-cone flow transducer is particularly suited for measuring fluid with low static pressure and low flow velocity.

- Wear resistance and long term stability, no demand for repeated calibration

As the throttling pattern of internal wall gradual shrinkage is adopted, fluid will shrink gradually when they flow through V-cone, so that it will not cause abrasion by dirty fluid caused by impact on β side in conventional throttling patterns such as orifice plate. It is shown as the following figure. Wear resistance is the outstanding feature of V-cone flow transducer, so β keeps unchanged, V-cone flow transducer has long term stability and long service life and it doesn't need repeated calibration.



- No blockage, no adhesion and it can measure flowrate of dirty fluid

Except for the tapping, there is no any “detaining dead region” and “dead angle” in the structure of V-cone flow transducer.

When fluid flows through the V-cone, solid particles, droplets or bubbles carried in the fluid will be cleared up and blown to the downstream side, especially fluid will be accelerated constantly when it pass through circular space which decreases gradually, so the dirty resistance ability is very strong and it is impossible for existence of depositions such as particles, residuals and coagulations of fluid in the pipe. This makes V-cone flowmeter to be suitable to measure flowrate of dirty fluid, such as coke oven gas, blast furnace gas, crude oil, residual oil, etc. It can also measure flowrate of solid-liquid phase media or gas-liquid phase media.

- Wide range of the β value

The unique geometrical shape of V-cone flow transducer allows wide range of the β value. The standard β value is 0.45, 0.50, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80, 0.85.

- It can measure flowrate of high temperature and high pressure media

Different structure materials and installation patterns are adopted for V-cone flowmeter, so it can measure flowrate of fluid which temperature reaches up to 700°C and also measure fluid which temperature reaches up to 42MPa.

STLUWCF V-cone Flow Transducer

Technical Parameter

Measured Fluid	Steam, Gas, Liquid
Nominal Diameter	DN15~DN2000
Precision	±0.5% (the accuracy of differential pressure flow transmitter shall be no less than 0.2%)
Repeatability	±0.1%
Rated Pressure	≤16MPa, Maximum ≤42MPa
Working Temperature	-40~700℃
Ambient Temperature	-40~65℃
Wide Turndown Ratio	Generally 10:1
Low Pressure Loss	Pressure loss is 1/3~1/5 that of the orifice plate when the β value remains the same
Requirement of Straight Pipe	Straight pipe 0-3D upstream and 0-1D downstream, no straight tube is needed for square pipe V-cone flow transducer
Structural Materials	
Name of Parts	Materials
Measuring Pipe and Flange	304 Stainless Steel, 20# Carbon Steel, Others
V-cone and Connecting Accessories	304 Stainless Steel
Tapping	304 Stainless Steel
Three-valve Manifold (accessory, optional)	304 Stainless Steel
Induced Pressure Pipe (accessory, optional)	304 Stainless Steel
Condensation Tank (accessory, optional)	304 Stainless Steel
Drainage Valve (accessory, optional)	304 Stainless Steel
Coat on the External Surface	
Materials of the Measuring Pipe of Transducer	Coat on the External Surface
Full Stainless Steel 304	Sprayed by Stainless Steel Sands
The Material of Measuring Pipe is Carbon Steel	Silver Gray Epoxy Reins Paintings

Permanent pressure loss

Permanent pressure loss is the power loss. For V-cone flowmeter, the major reason of fluid pressure loss is the forming vortex behind the V-cone and fluid friction along the pipe, which make a part of fluid mechanical energy change into the heat energy irreversibly and disappear in the fluid. If differential pressure transmitter can not identify correct signal of too small differential pressure, measuring accuracy must be affected. Increasing differential pressure will increase permanent pressure loss. For the customers, the increase of permanent pressure loss is to waste too much energy, which is not accepted.

Reynolds number

The range of Reynolds number of V-cone flowmeter must be $8 \times 10^3 \sim 5 \times 10^6$. Flowrate within this range is proportional to square root of differential pressure.



Application below Reynolds' Number should be limited.

Medium property

Two points should be considered. Firstly, physical property: select pressure taking pattern of differential pressure according to dirt level of fluid; secondly, chemical property: select structural materials according to corrosiveness.

Pressure tapping pattern and equipped differential pressure transmitter

There are three pressure tapping patterns as following table:

- Socket welded pressure tapping: applicable to high pressure media. Selection of differential pressure transmitter as per requirements. Welded induced pressure pipe. No other special requirements.
- Taper pipe tread pressure tapping: applicable to clean media, low pressure media, etc. Selection of differential pressure transmitter as per requirements. Taper pipe tread pressure tapping is the induced pressure pattern of induced pressure pipe (NPT1/2 or NPT1/4 selected according to pipe diameter). No other special requirements.
- Flange pressure tapping: applicable to media with strong corrosion, low temperature, big viscosity, easily fouling, crystallization, etc. When differential pressure $\geq 6\text{kPa}$, equipped with remote double flange differential pressure transmitter; when differential pressure $< 6\text{kPa}$ (e.g. blast furnace gas), equipped with differential pressure transmitter which induced pressure pipe needs special design. No other special requirements.

1. Detailed and correct process parameters or flowmeter selection specification of Design Institute are required for the selection of STLUVCF V-cone flow transducer.
2. Select meter model according to the physical and chemical property of medium, working condition, accuracy, installation requirements, etc.
3. According to the medium type, temperature, pressure, corrosivity, etc., select the materials of pipe, flange, V-cone, connecting fittings, etc.
4. Select the nominal diameter, pressure grade of flange and structural type according to the temperature, flowrate and pressure of medium.
5. Select pressure tapping pattern and materials of connecting fittings according to medium temperature, pressure, viscosity, dirt level, etc.
6. According to the selection above, the type of V-cone flow transducer will be got. Its structural dimension can be found in the dimension table. Indicate whether accessories needed or not, such as companion flange, bolts and nuts and gaskets, valve manifold, etc. Install the straight pipe according to the straight pipe requirements.
7. Ideal differential pressure value, turndown ratio and pressure loss are got through software calculation as per all process parameters and suitable β value selection.
8. For conveniently matching differential pressure transmitter, recommended scale differential pressure value is within 10~30kPa; for the low flowrate, selected differential pressure is above 0.5kPa as much as possible; for double flange pressure tapping, select more than 6kPa of differential pressure as much as possible.

The first step: find out measured fluid and relevant process parameter in detail

The following parameter must be known in detail:

1	Fluid name, ingredients, state, viscosity	Confirm whether V-cone flow transducer can be used or not
2	Fluid temperature, pressure	Confirm whether within the range of temperature and pressure or not
3	Fluid measuring range	Confirm whether differential pressure is within measuring range of V-cone flow transducer
4	Corrosivity	Confirm materials
5	Installing environment	Confirm whether differential pressure transmitter needs explosion proof or not
6	Output signal, communication	Confirm selection of differential pressure transmitter
7	Power supply	Confirm selection of differential pressure transmitter
8	Synthesize the conditions above	Confirm temperature and pressure compensation needed or not

The second step: after customer provides process parameters, the ratio of equivalent diameter β is calculated in detail by using software in combination with process parameters such as medium temperature (involving thermal expansion coefficient of metal materials), pressure, state, etc. Consider comprehensively the correlation between differential pressure and structural dimension of V-cone flow transducer and temperature, pressure, state and flowrate range of measured fluid, then select the most suitable equivalent diameter β and differential pressure value, so that V-cone structural dimension is confirmed.

The third step: confirm meter type according to the selection table

According to the procedure above, take an example as follows:

Superheated steam of the chemical plant's boiler, density is 2.468kg/m^3 , operating pressure is 0.5MPa , operating temperature is 265°C , maximum flowrate is 37000kg/h , normal flowrate is 32500kg/h , minimum flowrate is 14000kg/h , pipe flange type installation, no companion flange. Select the proper flow transducer according to the condition above.

- Input the parameters above into the software, then get suitable equivalent diameter β and differential pressure value.
- From the calculation above, the medium conforms to the process parameters (1), (2) and (3) shown in the table above.
- Owing to the steam medium, the materials of pipe and body flange is 20# carbon steel, and V-cone and connecting fittings is stain steel 304. Select code C in the selection table.
- According to operating pressure and the maximum non-shock pressure of flange, 1.6MPa of pressure grade can be confirmed. Select code G3 in the selection table.
- According to the pressure and density of medium, pressure tapping port should select taper pipe thread (NPT 1/2). Select code N in the selection table.
- According to the parameters above, code /6 of accessory in the selection table can be confirmed.
- So the model of the V-cone flow transducer is STLUCFF350CG3N/6.

Note: differential pressure transmitter should be selected separately as per the customer's requirements.

STLUWCF V-cone Flow Transducer

Selection Table

Item	Code	Description
Factory Mark	STLU	Silver Automation Instruments
Working Principle	VC	V-cone
Meter Type	F	Flowmeter
Structural Type	F	Pipe Flanged
	W	Directly Welded
	S	Square Pipe
	O	Others
Nominal Diameter	15	DN15
	20	DN20
	25	DN25

	1800	DN1800
	1900	DN1900
Structural Material	A	Materials of pipes, flanges of meter body, V-cone and connecting fittings are 304 stainless steel
	B	Materials of pipes, flanges of meter body, V-cone and connecting fittings are 316L stainless steel
	C	Materials of pipes, flanges of meter body are 20# carbon steels, V-cone and materials of connecting fittings are 304 stainless steel
	O	Other Materials
Rated Pressure	-G1	GB 0.6MPa
	G2	GB 1.0MPa
	G3	GB 1.6MPa
	G4	GB 4.0MPa
	D1	DIN PIN16
	D2	DIN PIN25
	D3	DIN PIN40
	J1	JIS 10K
	J2	JIS 20K
	J3	JIS 40K
	A1	ANSI Class150
	A2	ANSI Class300
	A3	ANSI Class600
Type of Pressure Tapping Port	S	Socket Welded
	N	Taper Pipe Thread (NPT 1/4 or NPT 1/2)
	F	Flange Pressure Tapping
	O	Others
Scheme of Accessories Equipment	/1	Applicable to measuring clean liquid with $t \leq 85^{\circ}\text{C}$ (please refer to page 29)
	2	Applicable to measuring clean gas with $t \leq 85^{\circ}\text{C}$ (please refer to page 30)
	3	Applicable to measuring clean liquid and gas with $t \geq 85^{\circ}\text{C}$ (please refer to page 31)
	4	Applicable to measuring dirty media with $t \leq 320^{\circ}\text{C}$ (please refer to page 32)
	5	Applicable to measuring dirty media with $t \leq 320^{\circ}\text{C}$ and differential pressure $\Delta P \leq 6\text{KPa}$ (please refer to page 33)
	6	Applicable to measuring clean steam with high temperature (please refer to page 34)
	7	Applicable to measuring clean liquid, vertical installation (please refer to page 35)
	8	Applicable to measuring clean gas, vertical installation (please refer to page 36)
Other Accessories	L	Equipped with customer's flange, bolt and gasket

Note: flange dimension refers to GB/T9115, 9119, DIN 2631~2637, JIS B220, ANSI B16.5.

- (1) Fluid name
- (2) Outer & Inner diameter of pipeline (mm)
- (3) Selected type of V-cone flow transducer
- (4) Scale flowrate unit (kg/ h, t/h, m³/ h, Nm³/ h)
 - a) Under operating condition
 - b) Under standard condition
- (5) Normal flowrate, minimum flowrate, maximum flowrate
 - a) Under operating condition
 - b) Under standard condition (specify the state of flowrate for gas medium)
- (6) Operating pressure (MPa)
 - a) Absolute pressure
 - b) Gauge pressure
- (7) Fluid temperature (°C) : Max, Min, Normal
- (8) Fluid density (kg/ m³)
 - a) Under operating condition
 - b) Under standard condition (specify the state of flowrate for gas medium)
- (9) Viscosity (Pa · s)
- (10) Relative humidity
- (11) Gas component
Volume percentage (for more than two kinds of mixed gas)
- (12) Pipe installation
 - a) Horizontal installation
 - b) Vertical installation
- (13) Pipe flange
 - a) According to standard specifications of flange
 - b) Flange drawing provided by customers



Notice:

- (1), (2), (4), (5), (6), (7), (11), (12) must be provided for water & steam measurement.
- (1)~ (13) are provided for common gas
- (1), (2), (4), (5), (6), (7), (8), (9), (12), (13) are provided for common solution & oil.
- Please provide detailed value for parameters. Range value does not work.

Precaution of Handling & Transportation

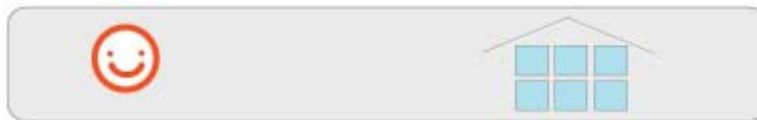
In order not to be damaged, do not open the package before meter received by customer. Handle with care during the transportation, do not crash, drench, impact and vibrate.



Precaution of Storage

Flow transducer should be installed in time once it arrives at the using place to avoid reducing metal parts being corroded etc. Pay special attention to the following things:

(1) Try not to open the package to store in any condition;



(2) Storage place should be:

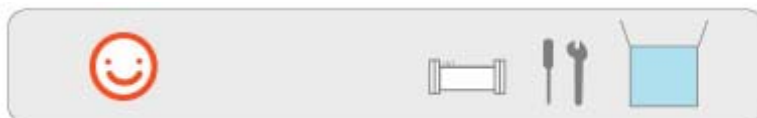
- a. Damp proof and rain-proof
- b. Little mechanical vibration
- c. Temperature between $-35\sim 60^{\circ}\text{C}$, ideal temperature is about 25°C



(3) Should clean meter body totally before store used V-cone flow transducer.



(4) The flow transducer performance will be affected if outdoor storage for a long time. Therefore, please install it immediately once it is carried to the installing site.



Precaution of Installing Location Selection

Although we have considered bad working conditions during design, in order to ensure good accuracy and stability, should pay attention to the following things when select installing location:

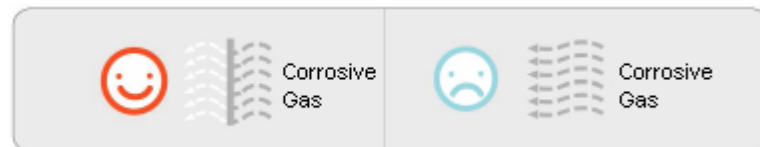
(1) Ambient temperature

Avoid installing in the location with large temperature change. If the meter will be affected by heat radiation, please take measures of heat insulation and ventilation.



(2) Ambient air

Avoid installing flow transducer at the ambient with strong corrosive gas. If must be installed in corrosive ambient, should take measures of ventilation.



(3) Adjustable valve

When measuring liquid, adjustable valve should be installed downstream 3D away from transducer (when measuring gas, it is 5D). If must be installed at upstream, straight pipe for upstream of transducer should be no less than 3D (when measuring gas, it is 10D).



(4) Water hammer

When measuring steam flow on horizontal pipe, location of flow transducer must not be on low point of pipe, because this is the location where condensate liquid deposited and cause water hammer easily. For discontinuous delivering gas pipe, water hammer will happen much easier when open-close which will affect flow transducer normal measuring, what's worse, it will damage the probe. Flow transducer should be installed in high point of pipe and install steam trap at low point of front pipe.



(5) For V-cone flow transducer with large diameter, when measuring humid gas and steam, flow direction must be up to down for vertical installation. When flow direction is down to up, effusion in the negative induced pressure pipe cannot run back into the pipe and will cause pressure signal of negative induced pressure pipe higher than normal pressure, additionally liquid density is much larger than gas, which will bring great measurement error.

Precaution of Installing Location Selection



(6) Others

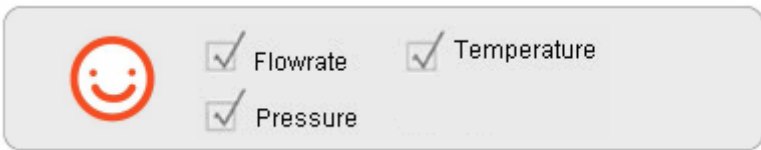
There should be enough space around V-cone flow transducer to:

- a. Regular maintenance, meter reading
- b. Wiring, pipe installation

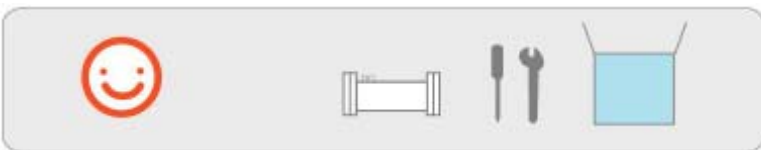


Precaution of Installation & Application

V-cone flow transducer must be used under certain condition. Please confirm whether the meter is suitable to the operating condition (flowrate, pressure, temperature, explosion proof etc.) or not before installation.



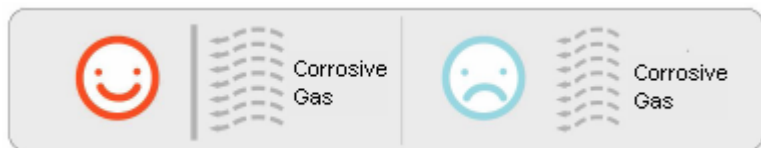
After open the package, please install as soon as possible to avoid being corroded by corrosive material or damped by raining. Avoid foreign body entering into measuring pipe or winding the cone.



Avoid transducer being installed in place where temperature changes greatly or heat radiation occurs.



Avoid transducer being installed in place where corrosive atmospheres surrounding. If it is necessary, take some measures of prevention of corrosion.

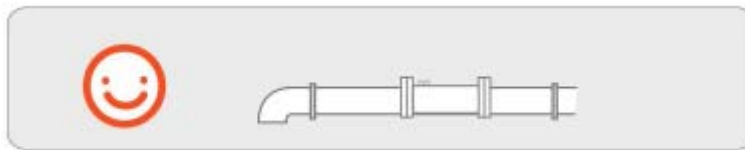


Precaution of Installation & Application

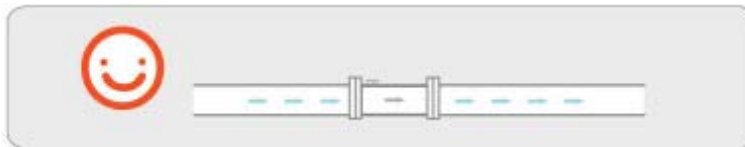
Avoid transducer being installed in place with strong mechanical vibration and impact. If it is necessary to install on pipe with strong vibration, it needs to fasten pipe around transducer.



Straight pipe at up & down stream should be as manual requirement, or it will affect measuring accuracy of transducer.



Flow direction must conform to the arrow on the transducer.



When open shutoff valve at up & down stream of transducer, it should be very slowly, and opening time should be no less than 2min.



Avoid transducer installed on long overhead pipe, otherwise leakage will happen between transducer and flange. If can not avoid, fitting device for pipe must be used.



Transducer can be installed on vertical or horizontal pipe. For vertical pipe installation, flow direction should be down to up when measure liquid.



Avoid transducer installed around valve exit, or open-close of valve will affect the measuring accuracy and meter service life, even damage transducer.

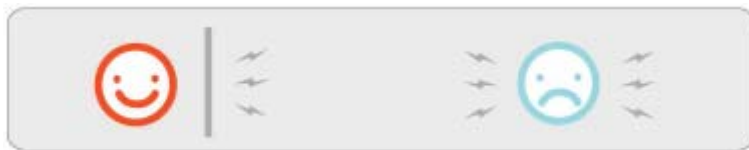


Precaution of Installation & Application

There should be enough space around transducer to ensure installation and wiring and regular maintenance.



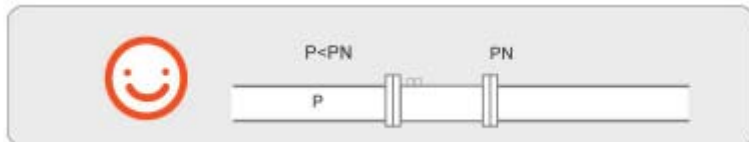
Wiring location of differential pressure transmitter should be far away from electrical noise, such as large power transformer, electromotor, welding machine and strong power supply etc.



Radio interference should not be around installing location, otherwise, radio interference will affect normal operation of differential pressure transmitter.



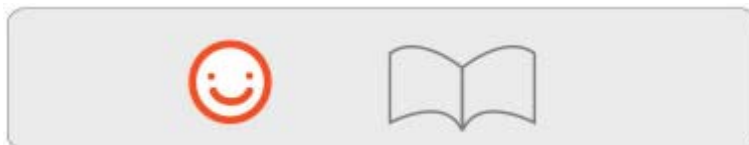
Pressure of installing pipe should not exceed maximum rated pressure of transducer.



When transducer parts are pressed, can not tighten or loosen installing bolts of flange.



User must comply with instructions and warnings of this manual to guarantee correct and safe application. Improper application may damage the meter.



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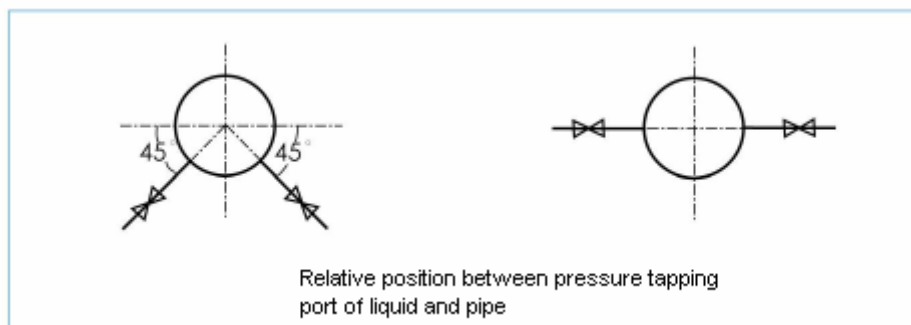
Installation Requirements

The installation of pipe flanged V-cone flow transducer is rather convenient and simple. Firstly, weld the companion flanges on the process pipe according to requirements, then install the transducer body between the two flanges according to the marked flow direction, place the selected gaskets, connect the flanges by bolts and fasten bolts evenly with a torque spanner.

1. Flow direction mark of V-cone transducer must be consistent with the fluid direction in the process pipe.
2. When a V-cone transducer is installed in the pipe, front-end surface must be perpendicular to the pipe axis, i.e. process flanges on both sides of transducer must keep parallel and the permissible maximum nonperpendicularity should not exceed $\pm 1^\circ$.
3. When a V-cone transducer is installed in the pipe, the measuring pipe must be kept homocentric with the pipe.
4. When gaskets are installed, any gaskets can not extrude from the inner wall of the pipe, or else very large measurement error may be caused.
5. Control valves which are used to adjust flowrate are preferably installed beyond minimum straight pipe after the throttling fitting.
6. Installation of a V-cone transducer on the process pipe should be carried out after cleaning and flushing of the pipe.
7. When a transducer which is installed on process pipe should be dismantled together with the process pipe, do not use the transducer as the support for hoisting to hoist pipe together. It should be dismantled from the process pipe and be hoisted separately.
8. All connections for positive and negative induced pressure pipes of the V-cone transducer must be tightened without leakage.
9. If drainage port and purging pipeline are installed, the valves of the drainage port and the purging pipeline should not leak.
10. For V-cone transducer installed on the horizontal or declining pipe, its pressure tapping port is divided into three types according to different measured fluids as follows:

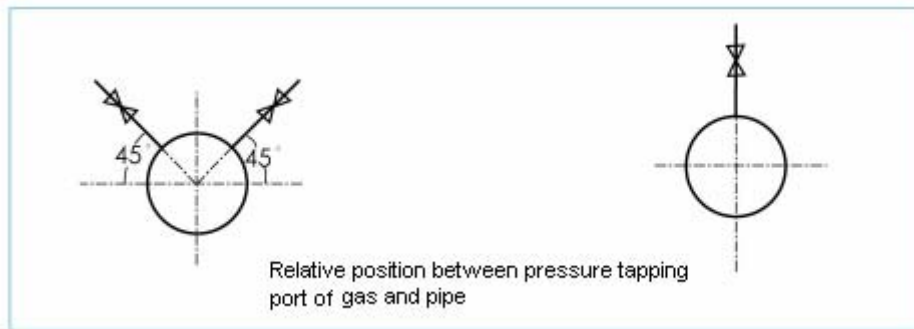
- **Measuring liquid**

When measuring liquid, the position of pressure tapping port should be declining downward in the angle of 45° or be horizontal so as to avoid the gas in the liquid entering into and depositing in the induced pressure pipe or the measuring chamber of differential pressure transmitter.



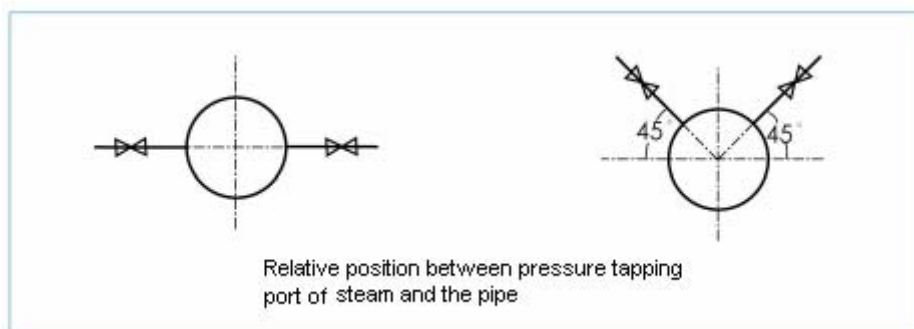
- Measuring gas

On the contrary, when measuring gas, the position of pressure tapping port should be declining upward in the angle of 45° or be vertical upward so as to avoid the liquid and dirt in the gas entering into and depositing in the induced pressure pipe or the measuring chamber of differential pressure transmitter.



- Measuring steam

When measuring steam, pressure tapping port must be in the horizontal position when the differential pressure transmitter is installed under the flowmeter, so that it can ensure normal operation of the flow transducer under process conditions of continuous or intermittent use of steam. When process pipe is under the ground or close to ground, the position of pressure tapping port should be declining upward in the angle of 45° because differential pressure transmitter is installed above the flowmeter.



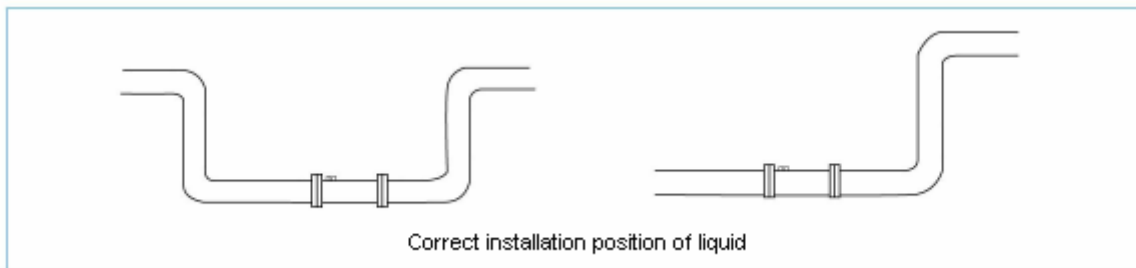
STLUWCF V-cone Flow Transducer

Installation Type

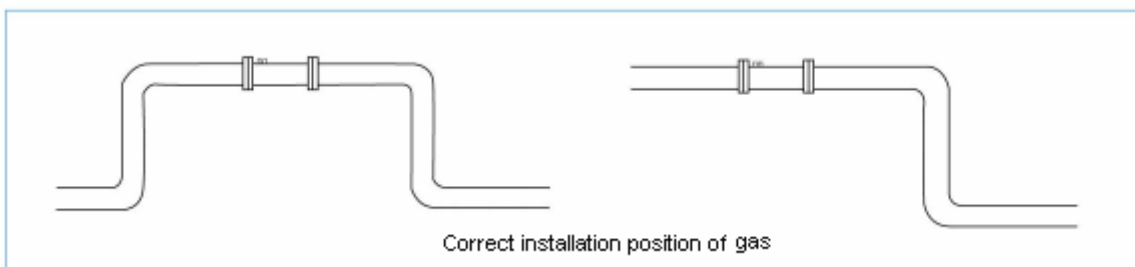
According to the different measured media, the flow transducer should choose the correct installation place. Please notice that the flow transducer shall not be installed near the pump and at the outlet of reciprocating pump.

1. Installation on the horizontal pipe

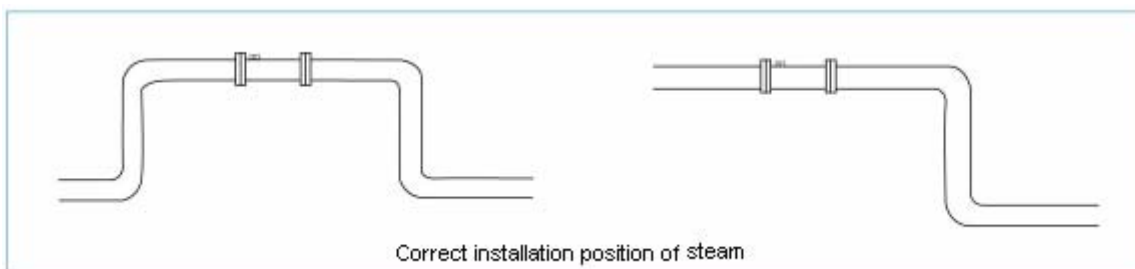
A. When measuring liquid, the flow transducer should be installed on the lower pipe to ensure the measuring pipe full of the measured liquid. Please do not install on the higher pipe, or the measuring pipe is not completely full of the liquid and air bubbles accumulate easily in the upper part of measuring pipe.



B. When measuring gas, the flow transducer should be installed on the higher pipe to ensure the measuring pipe full of the measured gas. Please do not install on the lower pipe, or the measuring pipe is not completely full of the gas and liquids accumulate at the bottom of the measuring pipe.



C. When measuring steam, the flow transducer should not be installed on the lower pipe where the condensed fluid accumulates and water hammer easily takes place. For the discontinuous delivering steam pipe, water hammer will happen much easily when open-close which will badly affect normal measurement of the flow transducer and even damage the transducer.

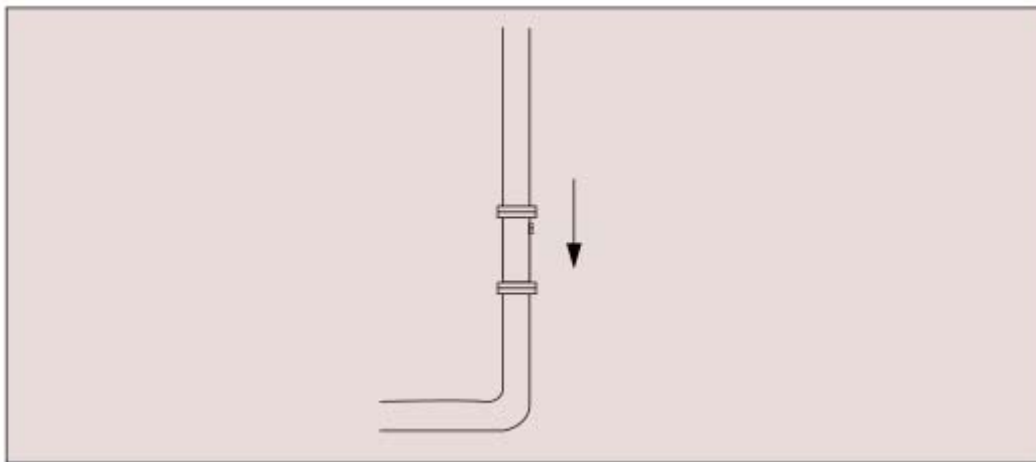


2. Installation on the vertical pipe

A. When measuring liquid, the flow transducer can be installed on the vertical pipe, flow direction had better be down to up, which can ensure the pipe full of fluid. If the pipe full of fluid can be guaranteed, the flow transducer can be installed on the pipe where the flow direction is up to down.

B. When measuring dry gas, the flow transducer can be installed on the vertical pipe. Flow direction is not strictly required.

When measuring humid gas, vertical installation can be adopted, but there are requirements on installation. For negative pressure tapping in the center, the flow direction should be up to down as following figure, because when the flow direction is down to up, effusion in the negative induced pressure pipe cannot run back into the pipe and will cause pressure signal of negative induced pressure pipe higher than normal pressure, additionally liquid density is much larger than gas, which will bring great measurement error.



C. When measuring steam, vertical installation can be adopted, but there are requirements on installation. For negative pressure tapping in the center, the flow direction should be up to down, for which reasons are same as the humid gas measurement above.

STLUWCF V-cone Flow Transducer

Straight Pipe Requirements

1. Pipe flanged type

The V-cone flow transducer is just the straight pipe with flanges. V-cone is in the pipe. Same flanges are welded on process pipe and assembled with transducer.

2. Directly welded type

Due to excellent abrasive resistance and self-clean function, V-cone flow transducer can be welded permanently in the pipeline.

3. Square pipe type

No requirements on straight pipe for square pipe type V-cone flow transducer.

Straight pipe requirements upstream and downstream

Measuring gas, Reynolds number range $Re > 2 \times 10^5$, β value ≥ 0.65

Size	Choke Parts	Upstream	Downstream
For all	1 elbow	1D	1D
	2 elbows	1D	1D
	T connection pipe	1D	1D
	Butterfly valve (Control valve)	10D for unfavorable position	5D for downstream of valve
	Butterfly Valve (Cut-off Valve)	5D	3D
	Ball valve (Cut-off)	1D	1D
	Heat exchanger (According to type)	1D	0D
	Diverging duct (0.67D-D) length 2.5D	2D	2D
	Converging duct (3D-1D) length 3.5D	1D	1D

Measuring liquid, Reynolds number range $Re < 2 \times 10^5$, β value ≥ 0.65

Size	Resistance Parts	Upstream	Downstream
For all	1 elbow	0D	0D
	2 elbows	0D	0D
	T connection pipe	0D	0D
	Butterfly valve (Control valve)	3D for unfavorable position	3D for downstream of valve
	Butterfly valve (Cut-off valve)	3D	3D
	Ball valve (Cut-off)	0D	0D
	Heat exchanger (According to type)	0D	0D
	Diverging duct (0.67D-D) length 2.5D	1D	1D
	Converging duct (3D-1D) length 3.5D	1D	1D

Extraction type of differential pressure pipe

If the three-valve set and differential pressure transmitter are not installed on the transducer body, induced pressure pipeline of V-cone flow transducer is extracted by induced pressure pipe, pay attention to following points:

1. Induced pressure pipe: material of differential pressure pipe and inner diameter should be the same as the induced pressure pipe, however, its best length is $\leq 16\text{m}$, shown as table below:

Measured fluid	Length of Induced Pressure pipe	
	Pipe DN < 16000(mm)	16000~45000(mm)
Water, steam, dry gas	7~ 9	10
Humid Gas	13	13
Oil with low/ middle viscosity	13	19
Dirty liquid/gas	25	25

2. Induced pressure pipe should be vertical or sloppy, with slope no less than 1:12; for high viscosity fluid, slope can be increased. When transmission distance of differential pressure is more than 30m, induced pressure pipe should be sloppy by subsection, and install gas collector (exhaust valve) at the highest point and settling vessel (drain valve) at the lowest point. To avoid distortion of differential pressure signal transmission, positive and negative induced pressure pipeline should be paved closely at most;
3. In extremely cold area need antifreezing equipment, should take the same measures as the process pipe; when use electricity or steam to heat and tracing, should avoid overheat. For low boiling point and easily vaporizable fluid, also should take the same measures as process pipe, to prevent liquid vaporizing in induced pressure pipe to cause fake differential pressure;
4. Connecting type

If the measured fluid is clear liquid and process pipe is installed horizontally, when differential pressure transmitter is under pipe, except tapping port downward $\leq 45^\circ$, induced pressure pipe may not need other accessories; when differential pressure transmitter is above pipe, except tapping port downward $\leq 45^\circ$ then upward induced pressure pipeline, should install gas collector or exhaust valve at the highest point of induced pressure tube.

If the measured fluid is clear gas and process pipe is installed horizontally, when differential pressure transmitter is under of pipe, except tapping port downward $\leq 45^\circ$, induced pressure pipe may not need other accessories; when differential pressure transmitter is above pipe, induced pressure pipe may not need other accessories.

When measured fluid is steam, except tapping port meeting above requirements, no matter differential pressure transmitter is above or under pipe, measures of heat preservation should be taken on induced pressure pipe between condenser and tapping port.

When measured fluid is clear humid gas, no matter pipe is installed horizontally or vertically, differential pressure transmitter above or under pipe, except tapping port location conforming to above requirements for gas, should make a position on induced pressure tube lower than differential pressure transmitter, and set settling vessel or drain valve on this position.

Extraction type of differential pressure pipe

When measured fluid is high viscosity, corrosive, easily frozen, easily separating out solid particles, kinds of fluid connecting except according to above type, isolator must be installed between differential pressure transmitter and V-cone transducer and the isolator installed on the positive and negative induced pressure pipe should be at the same level, and fill isolator to differential pressure transmitter with seal liquid to make measured fluid not contact differential pressure transmitter, to avoid damaging normal operation of differential pressure transmitter. Selection of seal liquid should accord to character and density of measured fluid.

STLUCFF Pipe Flanged V-cone Flow Transducer Common Structure Type

STUVCFF pipe flanged V-cone flow transducer (DN15~DN2000)

Nominal diameter: DN15~DN50

Positive and negative pressure tapping pattern: pipe wall multipoint pressure tapping

Common pressure tapping port: NPT 1/4



Nominal diameter: DN65~DN250

Positive pressure taking pattern: pipe wall pressure tapping

Negative pressure taking pattern: center pressure tapping

Common pressure tapping port: NPT 1/2

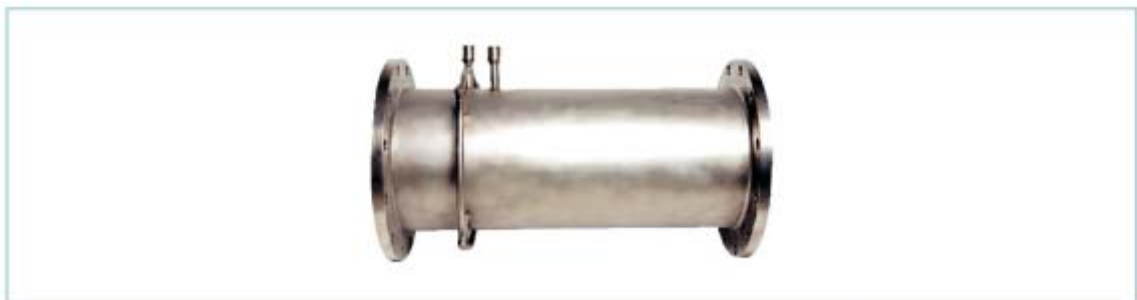


Nominal diameter: DN300~DN2000

Positive pressure tapping pattern: pipe wall multipoint circular pressure tapping

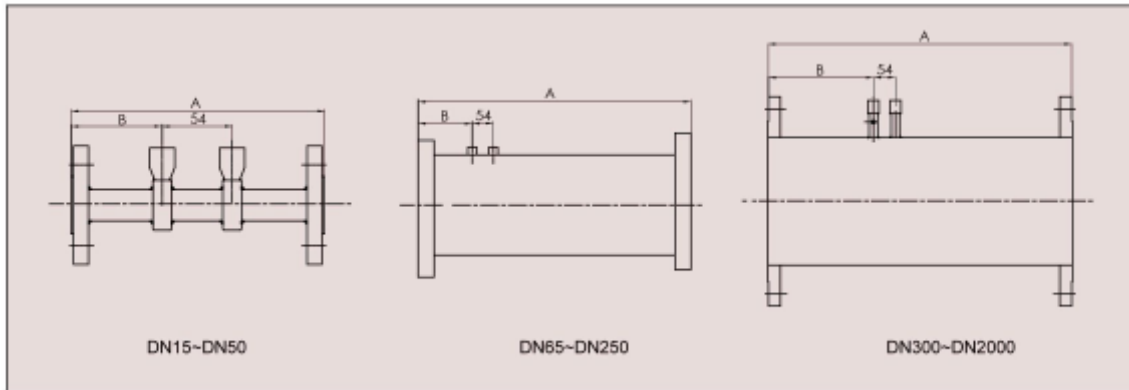
Negative pressure tapping pattern: center pressure taking

Common pressure tapping port: NPT 1/2



STLWCFF Pipe Flanged V-cone Flow Transducer

Outline Dimension



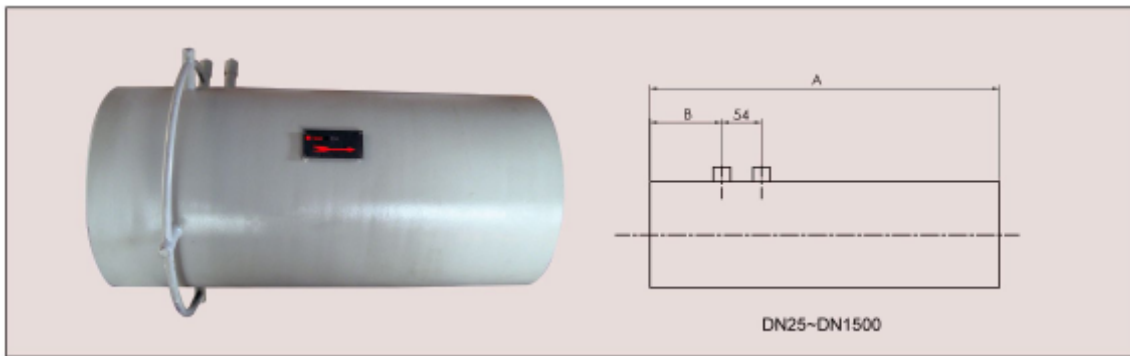
DN (mm)	Rated Pressure (MPa)	A (mm)	B (mm)	C (NPT inch)	
15	4.0	203	70	1/4	
20		203	70	1/4	
25		203	70	1/4	
40		265	95	1/4	
50		305	95	1/4	
65		330	111	1/2	
80		382	113	1/2	
100	1.6	425	118	1/2	
125		570	121	1/2	
150		578	125	1/2	
200		666	130	1/2	
250		733	148	1/2	
300		772	125	1/2	
350		787	145	1/2	
400	1.0	805	125	1/2	
450		874	155	1/2	
500		990	125	1/2	
600		1241	125	1/2	
700		1540	125	1/2	
800		1540	125	1/2	
900		1540	135	1/2	
1000		1850	125	1/2	
1200		0.6	1850	125	1/2
1400			2155	125	1/2
1600	2155		125	1/2	
1800	2460		155	1/2	
2000	3050		340	1/2	

Allowable error range: DN15~25: $\pm 4\text{mm}$; DN40~250: $\pm 6\text{mm}$; DN300~600: $\pm 7\text{mm}$; $\geq \text{DN}700$: $\pm 8\text{mm}$

STLVCFW Directly Welded Type V-cone Transducer Outline Dimension

DN range: DN25~DN1500

As is shown in the following figure, this V-cone flow transducer is especially applicable to measuring media with high pressure, such as high pressure steam of power plant, high pressure polymerizing and schizolysis of petrochemical enterprise, etc. Directly welded type can reduce leakage points on process pipe.



DN (mm)	A (mm)	B (mm)	C (NPT nich)
25	197	67	1/4
40	259	92	1/4
50	299	92	1/4
65	324	108	1/2
80	376	110	1/2
100	419	115	1/2
125	560	116	1/2
150	568	120	1/2
200	656	125	1/2
250	723	143	1/2
300	762	120	1/2
350	777	140	1/2
400	795	120	1/2
450	864	150	1/2
500	980	120	1/2
600	1231	120	1/2
700	1530	120	1/2
800	1530	120	1/2
900	1530	130	1/2
1000	1840	120	1/2
1200	1840	120	1/2
1400	2145	120	1/2
1500	2145	120	1/2

Allowable error range: DN15~25: $\pm 4\text{mm}$; DN40~250: $\pm 6\text{mm}$; DN300~600: $\pm 7\text{mm}$; $\geq \text{DN700}$: $\pm 8\text{mm}$

STLUVCF5 Square Pipe Type V-cone Flow Transducer

Outline

STLUVCF5 square pipe type V-cone flow transducer is to measuring the media in the square pipe and applicable to measuring air volume such as boiler burning system of power plant and heating furnace of petrochemical,enterprise.No straight pipe required,high accuracy,stable measurement. Media with low velocity and static pressure can be measured. Outline dimension is according to customer's requirements. Convenient installation and V-cone is changeable.

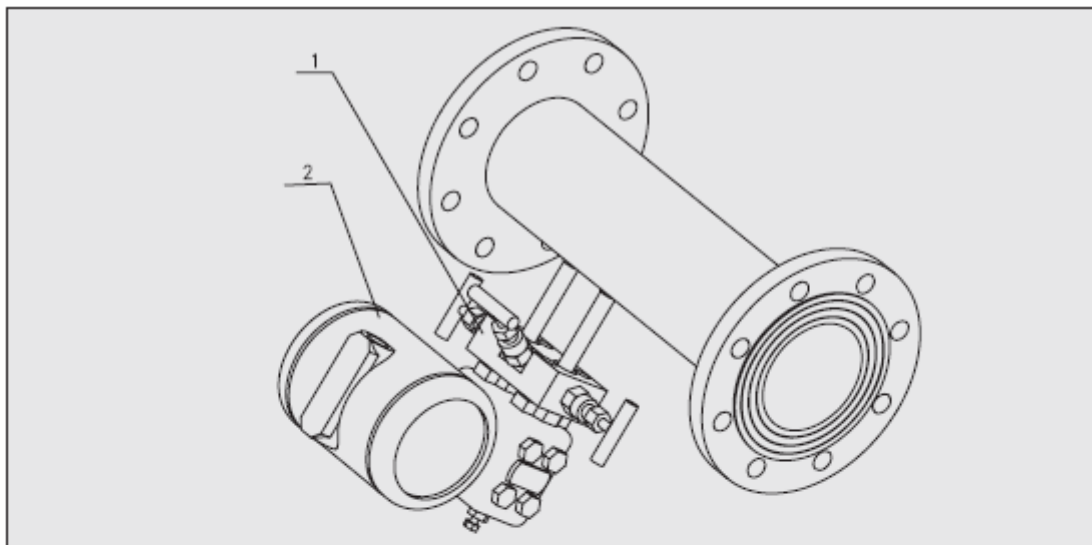


Typical V-cone Flowmeter Accessory and Installation

The V-cone flowmeter is generally composed of V-cone flow transducer, differential pressure transmitter, valve, valve manifold, induced pressure pipe, condenser, etc. A set of V-cone flowmeter also includes flow calculator which is used to measure volumetric flowrate under the working condition. For the compressible media such as gas, steam, etc., the differential pressure transmitter and temperature transmitter should be equipped for temperature and pressure compensation to measure gas volumetric flowrate under the standard condition and steam mass flowrate. Following are some V-cone flowmeter configuration and installation method.

Proposal 1: to measure $t \leq 85^{\circ}\text{C}$ clean liquid, compact installation on the horizontal pipe

Compact installation is to install V-cone flow transducer and differential pressure transmitter together by tri-valve set, which not only reduces requirements on long induced pressure pipe and other accessories, but also reduces the manpower and gas accumulation in the transmitter. So the maintenance is easier and meter more stable and reliable. As is shown in the installation diagram below, the pressure tapping port could be declining downward in the angle of 45° or horizontal.



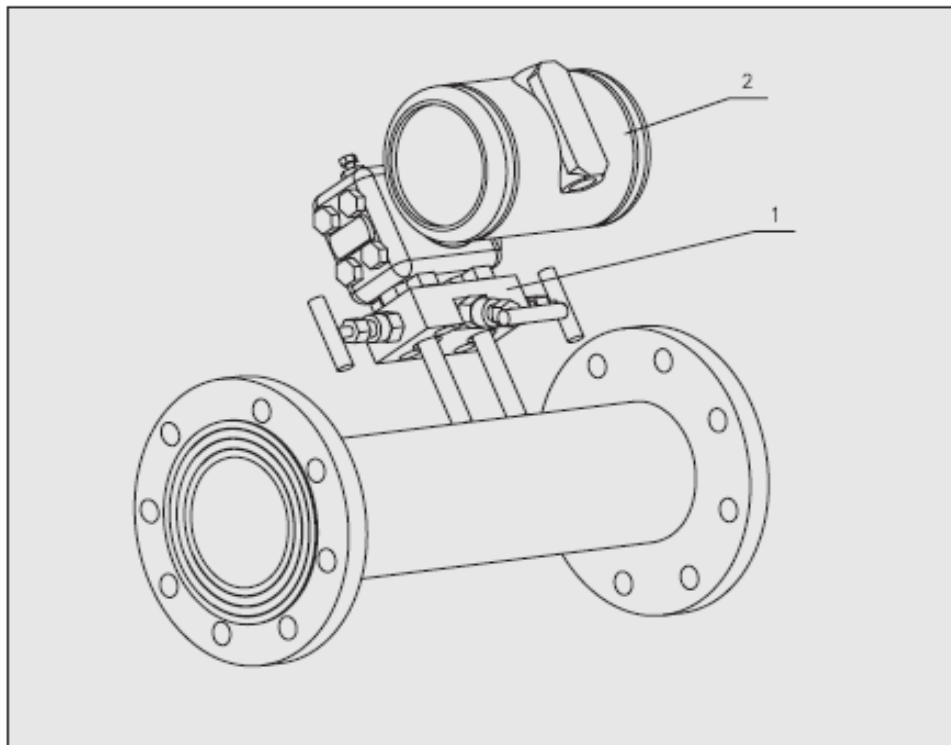
Accessoris table 1

Serial Number	1	2
Name	Tri-valve Set	Differential Pressure Transmitter
Model	Integrated YSF	Customer's Order
Quantity	1	1
Materials	0Cr18Ni9	
Pressure Grade	20MPa	
Remark	Standard	Extra Order

Typical V-cone Flowmeter **Accessory and Installation**

Proposal 2: to measure $t \leq 85^{\circ}\text{C}$ clean gas, compact installation on the horizontal pipe

When measuring gas, the differential pressure transmitter should be installed above the pipe (above the V-cone flow transducer) because it can make accumulated liquid in the induced pressure pipe and transmitter flow automatically downward to the process pipe to avoid measurement error. Installation pattern is as below, the pressure tapping port could be declining upward in the angle of 45° or vertical.



Accessoris table 2

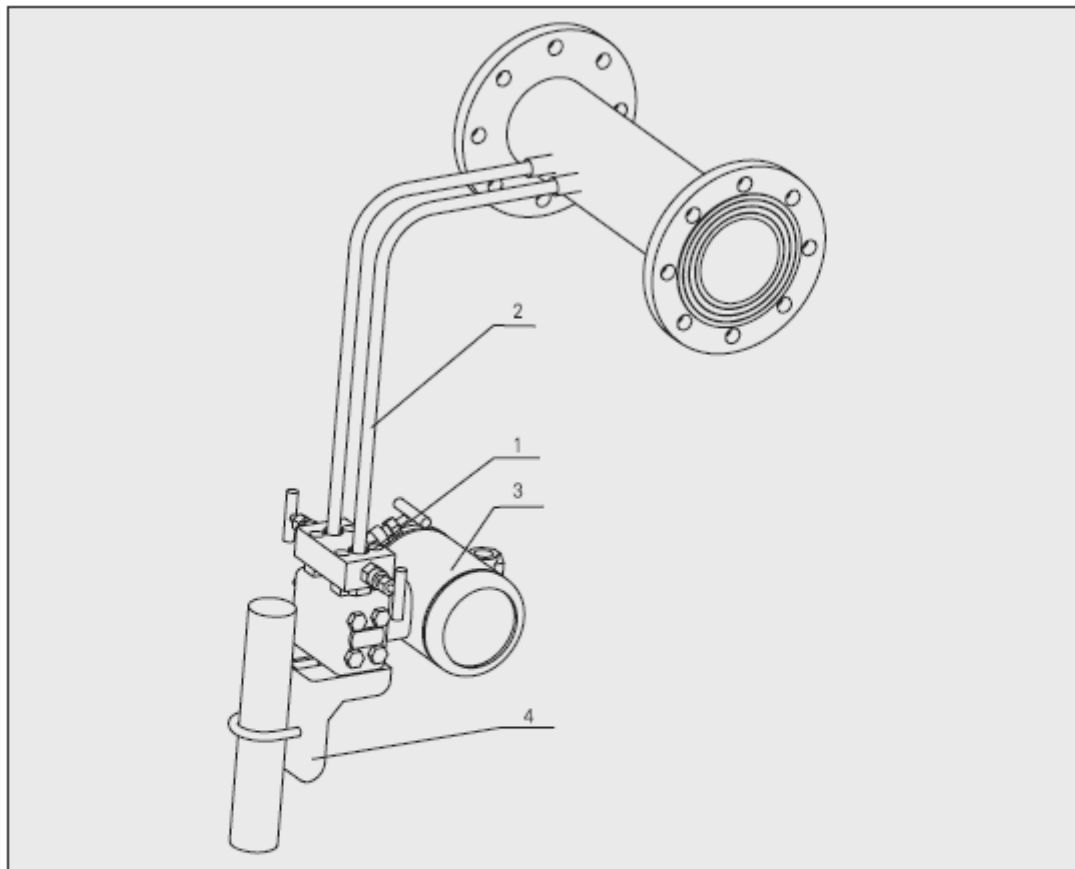
Serial Number	1	2
Name	Tri-valve Set	Differential Pressure Transmitter
Model	Integrated YSF	Customer's Order
Quantity	1	1
Materials	0Cr18Ni9	
Pressure Grade	20MPa	
Remark	Standard	Extra Order

Typical V-cone Flowmeter

Accessory and Installation

Proposal 3: to measure $t \geq 85^{\circ}\text{C}$ clean gas and liquid, remote installation on the horizontal pipe

Remote installation is to separate V-cone flow transducer and differential pressure transmitter both of which are connected by the induced pressure pipe. When media $t \geq 85^{\circ}\text{C}$, when the on-the-spot installation position is confined, or when the differential pressure transmitter cannot be installed on the V-cone flow transducer with large diameter, please adopt the following installation pattern:



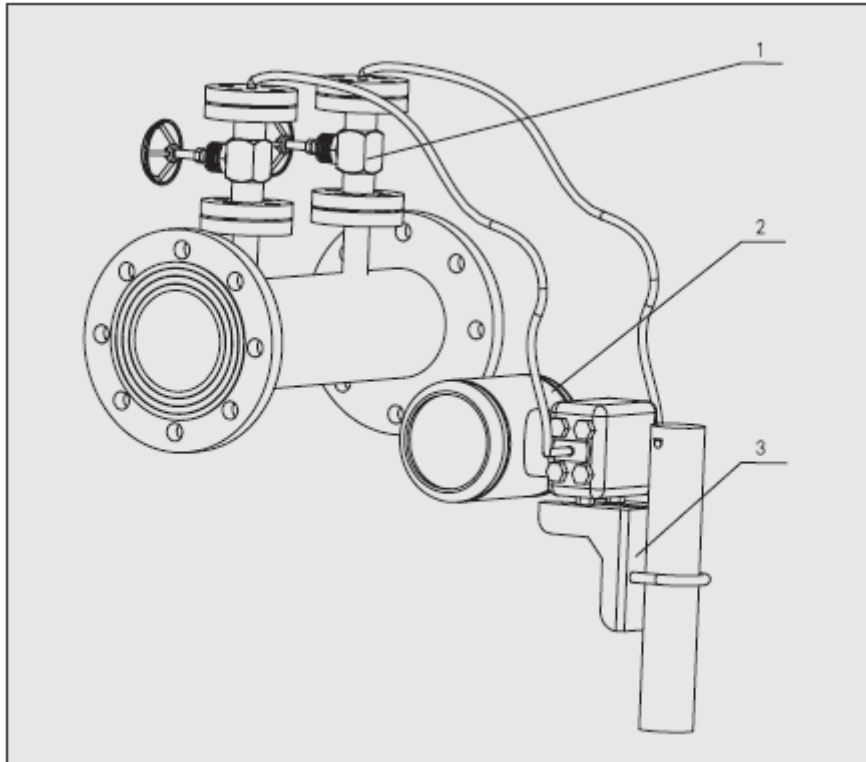
Accessoris table 3

Serial Number	1	2	3	4
Name	Tri-valve Set	Syphon	Differential Pressure Transmitter	Bracket
Model	Integrated YSF	$\Phi 14 \times 2$	Customer's Order	
Quantity	1	2	1	1
Materials	0Cr18Ni9	0Cr18Ni9		
Pressure Grade	20MPa	16MPa		
Remark	Standard	Standard	Extra Order	Enclosed

Typical V-cone Flowmeter **Accessory and Installation**

Proposal 4: to measure $t \leq 320^{\circ}\text{C}$ dirty media, adopt remote flanged differential pressure transmitter

When measuring dirty media with strong corrosivity, easy crystallization and easy block, remote differential pressure transmitter is generally adopted to isolate measured media from transmitter to protect differential pressure transmitter and normal measurement.



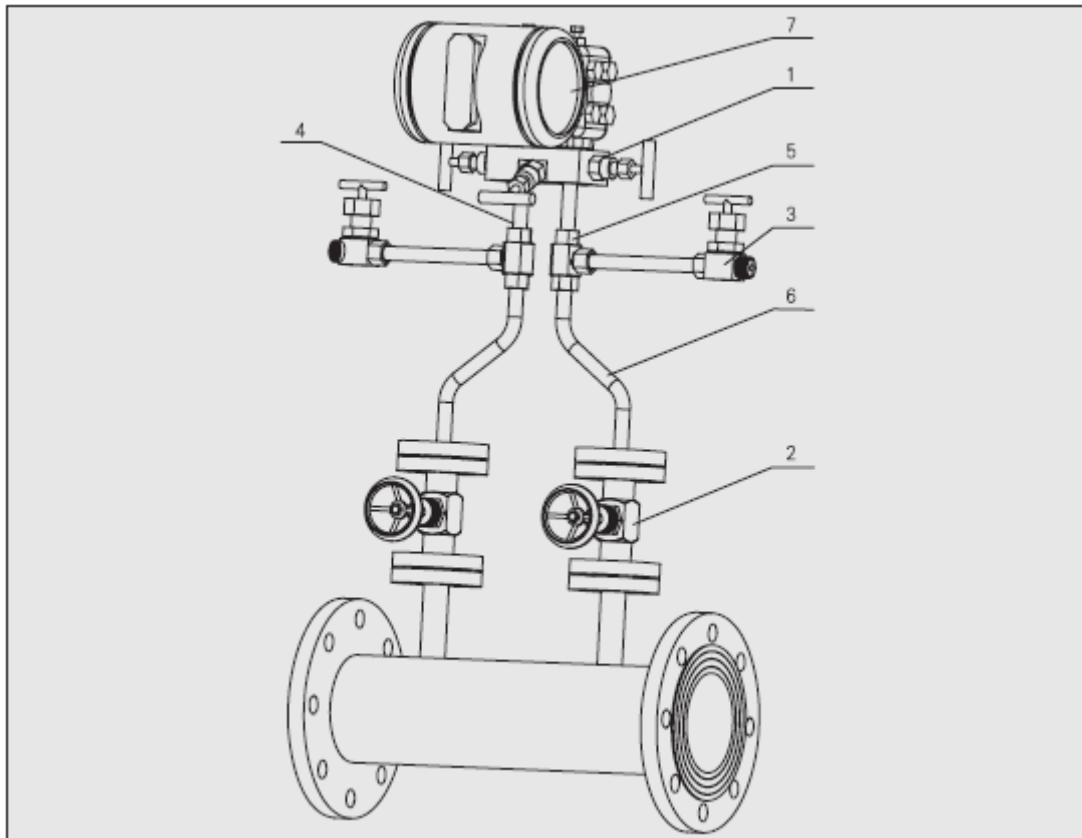
Accessoris table 4

Serial Number	1	2	3
Name	Stop Valve	Remote Flanged Differential Pressure Transmitter	Bracket
Model	YZL-12BJ41H High Temperature and High Pressure Stop Valve	Customer's Order	
Quantity	2	1	1
Materials	0Cr18Ni9		
Pressure Grade	16MPa		
Remark	Standard	Extra Order	Enclosed

Typical V-cone Flowmeter **Accessory and Installation**

Proposal 5: to measure $t \leq 320^{\circ}\text{C}$ dirty media, micro differential pressure $\Delta P \leq 6\text{kPa}$

Because media is very dirty under the conditions above, flange pressure tapping pattern is adopted. When differential pressure is minor, remote flange type differential pressure transmitter is not suitable because its differential pressure range of lower limit is higher. So the following figure of installation pattern is adopted.



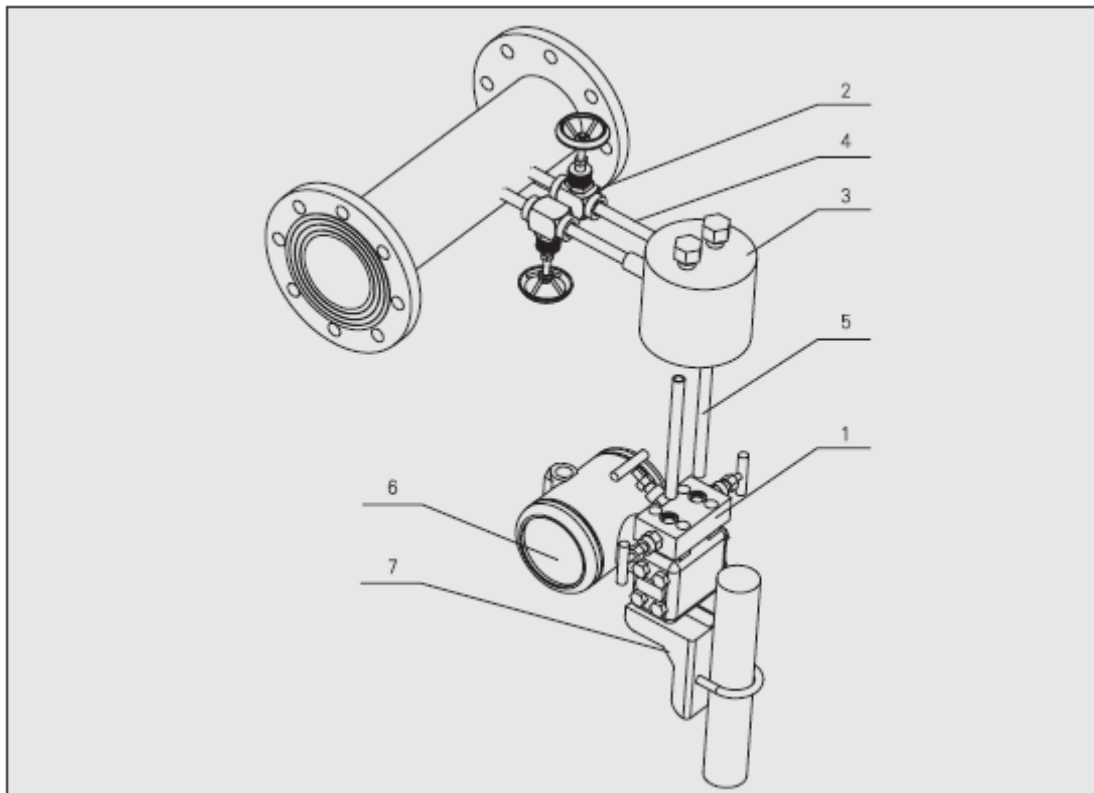
Accessoris table 5

Serial Number	1	2	3	4	5	6	7
Name	Tri-valve Set	Stop Valve	Needle Valve	Induced Pressure Pipe	Three-way Pipe	Syphon	Differential Pressure Transmitter
Model	YSF Integrated	YZL-12BJ41H High Pressure and Temperature	M20 × 1.5	$\Phi 14 \times 2$ L=75	M20 × 1.5	$\Phi 14 \times 2$	Customer's Order
Quantity	1	2	2	4	2	2	1
Materials	0Cr18Ni9	0Cr18Ni9	0Cr18Ni9	0Cr18Ni9	0Cr18Ni9	0Cr18Ni9	
Pressure Grade	20MPa	16MPa	16MPa	16MPa	16MPa	16MPa	
Remark	Standard	Standard	Standard	Standard	Standard	Standard	Extra Order

Typical V-cone Flowmeter Accessory and Installation

Proposal 6: to measure clean steam with high temperature, remote installation on the horizontal pipe

When measuring clean steam with high temperature, remote installation is adopted and differential pressure transmitter is installed under the V-cone flow transducer. So the induced pressure pipe between flow transducer and condenser is shorter, which can ensure steam-phase state of this pipeline and condensed fluid reflowing to the pipe, and can make accumulated steam in the induced pressure pipe flow automatically upward to the pipe to ensure the induced pressure pipe and transmitter full of the condensed fluid.



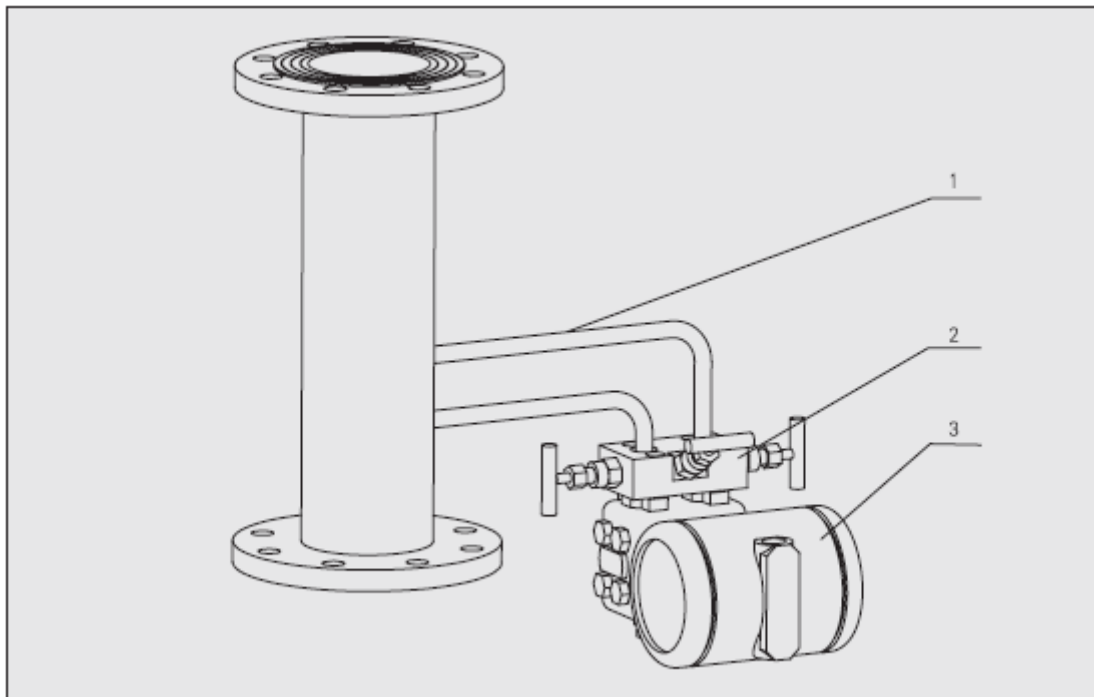
Accessoris table 6

Serial Number	1	2	3	4	5	6	7
Name	Tri-valve Set	Stop Valve	Double Condenser	Induced Pressure Pipe	Lengthened Induced Pressure Pipe	Differential Pressure Transmitter	Bracket
Model	YSF Integrated	YZL-12BJ41H High Pressure and Temperature	Φ133×3	Φ14×2 L=75	Φ14×2	Customer's Order	1
Quantity	1	2	1	4	2	1	
Materials	0Cr18Ni9	0Cr18Ni9	0Cr18Ni9	0Cr18Ni9	0Cr18Ni9		
Pressure Grade	20MPa	16MPa	16MPa	16MPa	16MPa		
Remark	Standard	Standard	Standard	Standard	Equipped by Customer	Extra Order	Enclosed

Typical V-cone Flowmeter **Accessory and Installation**

Proposal 7: to measure clean liquid, remote installation on the vertical pipe

Remote installation on the vertical pipe can prevent gas that liquid contains entering and depositing in the induced pressure pipe or transmitter to bring the measurement error.



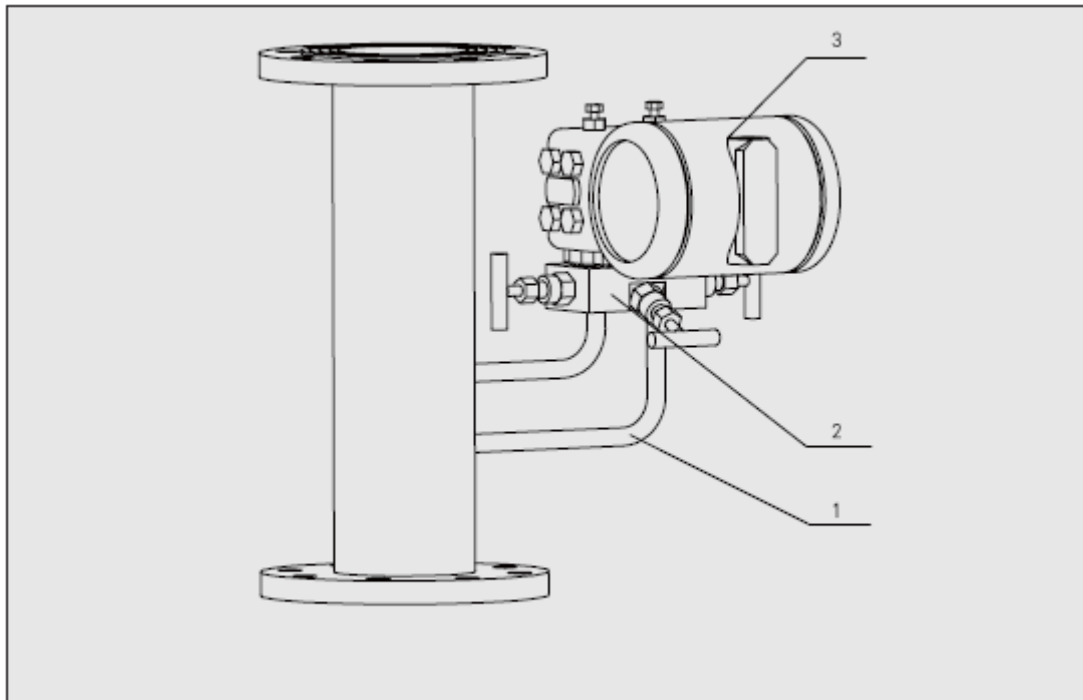
Accessoris table 7

Serial Number	1	2	3
Name	Syphon	Tri-valve Set	Differential Pressure Transmitter
Model	Φ14 × 2	Integrated YSF	Customer's Order
Quantity	2	1	1
Materials	0Cr18Ni9	0Cr18Ni9	
Pressure Grade	16MPa	20MPa	
Remark	Standard	Standard	Extra Order

Typical V-cone Flowmeter **Accessory and Installation**

Proposal 8: to measure clean gas, remote installation on the vertical pipe

Remote installation on the vertical pipe can prevent liquid that gas contains entering and depositing in the induced pressure pipe and transmitter to bring the measurement error.



Accessoris table 8

Serial Number	1	2	3
Name	Syphon	Tri-valve Set	Differential Pressure Transmitter
Model	Φ14 × 2	Integrated YSF	Customer's Order
Quantity	2	1	1
Materials	0Cr18Ni9	0Cr18Ni9	
Pressure Grade	16MPa	20MPa	
Remark	Standard	Standard	Extra Order

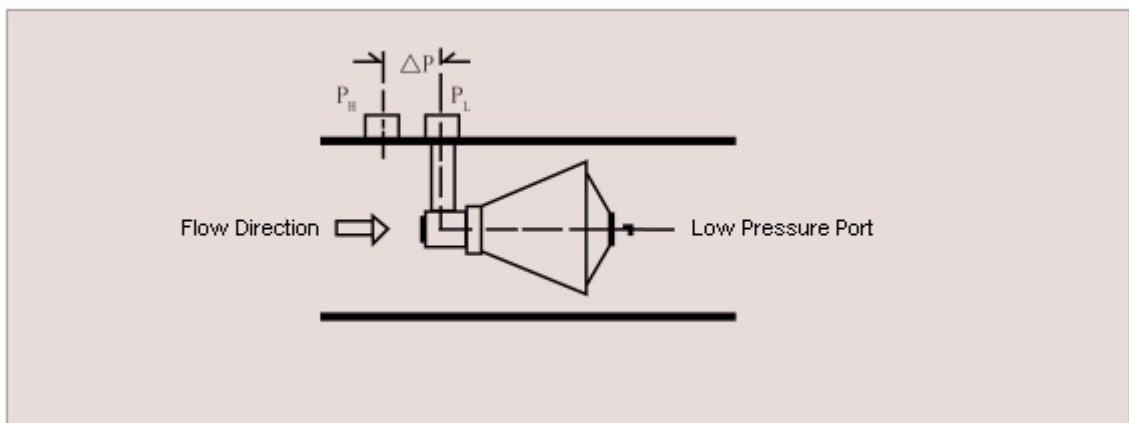
Appendix 1 V-cone Flow Transducer Measuring Principle



The V-cone is a new kind of differential pressure flowmeter, can be used to measure the various fluid under different flowing condition within wide Reynolds number range ($8 \times 10^3 \leq Re \leq 5 \times 10^6$). With the same theory of other differential pressure flowmeter, it is based on Bernoulli's theorem of energy conservation for the continuous flowing fluid in a closed pipe. For ideal fluid, fluid velocity is directly proportional to quadratic root of differential pressure.

V-cone flow transducer has not only unique V-cone throttling contour to extend measuring range of flowrate, but also special structure of fluid conditioner. Therefore, requirement of straight pipe is very low, totally different from other differential pressure flowmeter which needs long straight pipe for fluid flowing. V-cone flow transducer inherits advantages of good stability and strong universality, while avoids limitations of traditional differential pressure flowmeter.

Basic principle of V-cone flow transducer is V-cone and tapping ports coaxially installed in measuring pipe. Measuring tube and V-cone is designed and machined precisely. When fluid passes V-cone, flowing fluid will interact with cone and reshape the velocity profile before V-cone, fluid velocity increasing and static pressure decreasing with local contraction. Differential pressure ΔP will be produced before & behind V-cone. High pressure (positive pressure) P_H is the static pressure obtained at the pressure tapping port in front of upstream fluid contraction, while low pressure (negative pressure) P_L is pressure at downstream obtained from tapping port at V-cone central axis.



Appendix 1 V-cone Flow Transducer

Measuring Principle

Flow Formula	$\Delta P = P_H - P_L$ $\beta = \sqrt{1 - \frac{d^2}{D^2}}$ $q_v = K \cdot \varepsilon \sqrt{\frac{\Delta P}{\rho}}$
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- Thereinto: β ----- Equivalent diameter ratio
 D ----- Inside diameter of pipe
 d ----- Diameter of the largest cross section of cone
 q_v ----- Volumetric flowrate
 ρ ----- Fluid density under operating condition
 K ----- K factor
 ε ----- Expansion factor of measured medium

Appendix 2 Manufacture Standard of V-cone Flow Transducer

V-cone Flow Transducer	Standard of Shanghai Enterprise Q/SVE A04-2007
GB/T 2624-2006	Measurement of fluid flow by means of differential pressure devices inserted in circular cross-section conduit running full
GB/T 15464-1995	General Technical Specifications of Instruments Packing
GB/T 9329-1999	Basic Environmental Conditions and Testing Methods for Instruments Transportation and Storage in the Transportation

Appendix 3 International Standard of Pipe Flange and Standard of Foreign Countries

International Standard of Pipe Flange and Standard of Foreign Countries		
Standard of Pipe Flange	General Situation	Pipe Series
International standard ISO7005-1 (1992)	Series 1: PN10, 16, 20, 50, 110, 150, 260, 420bar (ANSI system) Series 2: PN2.5, 6, 25, 40bar (DIN system) DN10~4000mm	British system pipe
Germany DIN (series standard)	PN1, 2.5, 6, 10, 16, 25, 40, 64, 100, 160, 250, 320, 400bar, DN16~4000mm	British system pipe
USA ANSI B 16.5 (1988)	PN Class 150, 300, 400, 600, 900, 1500, 2500 lb, the corresponding relation with SI system pressure grade as below: 150 lb--2.0MPa 600 lb--10.0MPa (11.0MPa revised by ISO) 300 lb--5.0MPa 900 lb--15.0MPa 400 lb--6.8MPa 1500 lb--25.0MPa (26.0MPa revised by ISO) DN15~600mm 2500 lb--42.0MPa	British system pipe
Former USSR (series standard)	PN0.1, 0.25, 0.6, 1.0, 1.6, 2.5, 4.0, 6.4, 10.0, 16.0, 20.0MPa, DIN system (except 20.0MPa, connecting dimensions can be exchanged with German Flange) DN10~3000mm	Metric pipe
England BS4504	DIN system: nominal pressure and connecting dimensions conform to German standard	British system pipe
England BS1560	ANSI system: nominal pressure and connecting dimensions conform to American standard	British system pipe
France NF E29	DIN system: nominal pressure and connecting dimensions conform to German standard	British system pipe
France NF M87	ANSI system: nominal pressure and connecting dimensions conform to American standard	British system pipe
Japan JPI TS-15	ANSI system: nominal pressure and connecting dimensions conform to American standard	British system pipe
Japan JIS B 2201~2217	Rated pressure: 2, 5, 10, 16, 20, 30, 40, 63kgf/cm ² (mark by 2K, 5K, 10K...) DN10~1500mm	British system pipe

Appendix 4 Steel Grade Table of Common SS & Refractory Steel

China GB1220 GB1221	ISO ISO683/13 ISO683/16	USA AISI, ASTM UNS	Japan JIS	Former USSR ГОСТ5632	England BS970Part4 BS1449Part2	France NFA35-572 NFA35-576~582 NFA35-584	Germany DIN17440 DIN17224
0Cr18	1	410S S41000	SUS410	08KH13		Z6C13	X7Cr13
0Cr13Al	2	405 S40500	SUS405		405S17	Z6CA113	X7CrAl13
1Cr13	3	410	SUS410	12KH13	410S21	Z12C13	X10Cr13
2Cr13	4	420 S42000	SUS420J ₁	20KH13	420S37	Z20C13	X20Cr13
3Cr13	5		SUS420J ₂	30KH13	420S45		
1Cr17	8	430 S43000	SUS430	12KH17	430S15	Z8C17	X8Cr17
1Cr17Ni2	9	431 S43100	SUS431	14KH17H2	431S29	Z15CN16-02	X22CrNi17
00Cr19Ni11 (00Cr18Ni10)	10	304L S30403	SUS304L	03KH18H11	304S12	Z2CN18.09	X2CrNi189
0Cr19Ni9 (0Cr18Ni9)	11	304 S30400	SUS304	08KH18H10	304S15	Z6CN18.09	X5CrNi189
1Cr18Ni9	12	302 S30200	SUS302	12KH18H9	302S25	Z10CN18.09	X12CrNi188
1Cr18Ni12 (1Cr18Ni12Ti)	13	305 S30500	SUS305	12KH18H12T	305S19	Z8CN18.12	X5CrNi1911
0Cr18Ni11Ti (0Cr18Ni9Ti)	15	321 S32100	SUS321	08KH18H10T	321S12 321S20	Z6CNT18.10	X10CrNiTi189
0Cr8Ni11Nb (1Cr18Ni11Nb)	16	347 S34700	SUS347	08KH18H12T	347S17	Z6CNNb18.10	X10CrNiNb189
00Cr17Ni14Mo2	19, 19a	316L S31603	SUS316L	03KH17H13M2	316S12	Z2CN17.12	X2CrNiMo1810
0Cr17Ni12Mo2 (0Cr18Ni12Mo2Ti)	20, 20a	316 S31600	SUS316	08KH17H13M2T	316S16	Z6CND17.13	X5CrNiMo1810
00Cr19Ni13Mo3 (00Cr17Ni14Mo3)	24	317L S31703	SUS317L	03KH16H15M3	317S12	Z2CND19.15	X2CrNiMo1816
0Cr19Ni13Mo3 (0Cr18Ni12Mo3Ti)	25	317 S31700	SUS317	08KH16H15M3	317S16		
1Cr18Ni9Ti				12KH18H10T			XCrNiTi189
00Cr18Ni14Mo2Cu2			SUS316JIL				
00Cr30Mo2			SUS447J1				
2Cr23Ni13 (1Cr23Ni13)		309 S30900	SUH309	20KH23H12	309S24	Z15CN24.13	
2Cr25Ni20 (1Cr25Ni20Si2)		310 S31000	SUH310	20KH25H20C2	310S24	Z12CN25.20	CrNi2520



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