# LWQ GAS TURBINE FLOW METER

## Summary

LWQ series gas turbine flowmeter integrates gas turbine flow sensor and flow converter. The main performance index reaches the international advanced level, and it is an ideal instrument for gas measurement of petroleum, chemical, electric power, metallurgy industry and civil boiler, city gas, gas pressure station measurement and gas trade measurement.

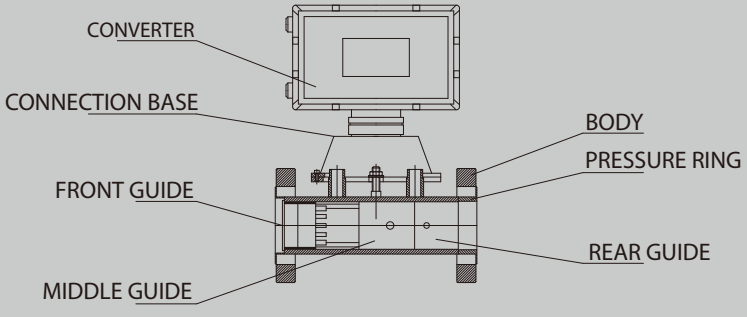
## Product Features

- Use a new type of sensor, low starting flow, low pressure loss, good anti-vibration and anti-pulse fluidity, not easy to corrode, good reliability, and long service life.
- Adopt new micro-processing and high-performance integrated chips, with high calculation accuracy, powerful functions and superior performance.
- Use advanced micro-power high-tech, and the whole machine has low power consumption. It can not only run with internal battery for long-term power supply, but also can run with external power supply.
- According to the flow frequency signal, the instrument series can be divided into eight segments to automatically perform linear correction, and the calculation accuracy of the instrument can be improved according to user needs.
- Adopt EEPROM data storage technology. It has storage and query functions of historical data. There are three historical data recording methods for users to choose.
- The meter transmitter part can be rotated at 180°C, which is easy to install and use.
- High accuracy, generally up to ±1.5%R, ±1.0%R
- Good repeatability. Short-term repeatability can reach 0.05%R~0.2%R. Because of its good repeatability, it is the preferred flowmeter in trade settlement.
- It can detect the temperature, pressure and flow rate of the measured gas, automatically track and compensate the flow rate, and display the gas flow rate under the standard condition (pn=101.325kpa,Tn=293.15k), and query the data of temperature, pressure, time and date in real time.

## Operating Principle

**Flow meter structure**

The basic structure of the temperature and pressure compensated type gas turbine flowmeter is shown in the figure, which mainly consists of the meter body, movement (front guide, middle guide, rear guide), connection base and converter.




Gas Turbine Flow Meter Structure

**Operating principle**

When the airflow enters the flowmeter, it will first pass through the leading fluid of the independent movement and accelerate. The turbine blades are at a certain angle with the flow direction of the fluid. Under the action of the fluid, the turbine generates a rotational torque at this time. After the turbine overcomes the resistance torque and the friction torque, it starts to rotate. When the forces are balanced, the speed is stable, and the turbine rotation speed is linear with the flow rate. The magnet on the rotating transmitter plate periodically changes the sensor's magnetic resistance. Pulse signals proportional to the volume flow of the fluid are induced at both ends. The signal is amplified and reshaped by the preamplifier, and the pressure and temperature signals detected by the pressure and temperature sensor are simultaneously output to the flow totalizer for processing, which directly displays the standard volume flow rate and the standard volume total.

**Working principle of flow totalizer**

The flow totalizer is composed of a temperature and pressure detection analog channel, a flow sensor and a micro-processing unit, and is equipped with an external output interface to output various signals. The microprocessor in the flowmeter performs temperature compensation according to the gaseous equation and automatically corrects the compressibility factor. The gaseous equation is as follows:

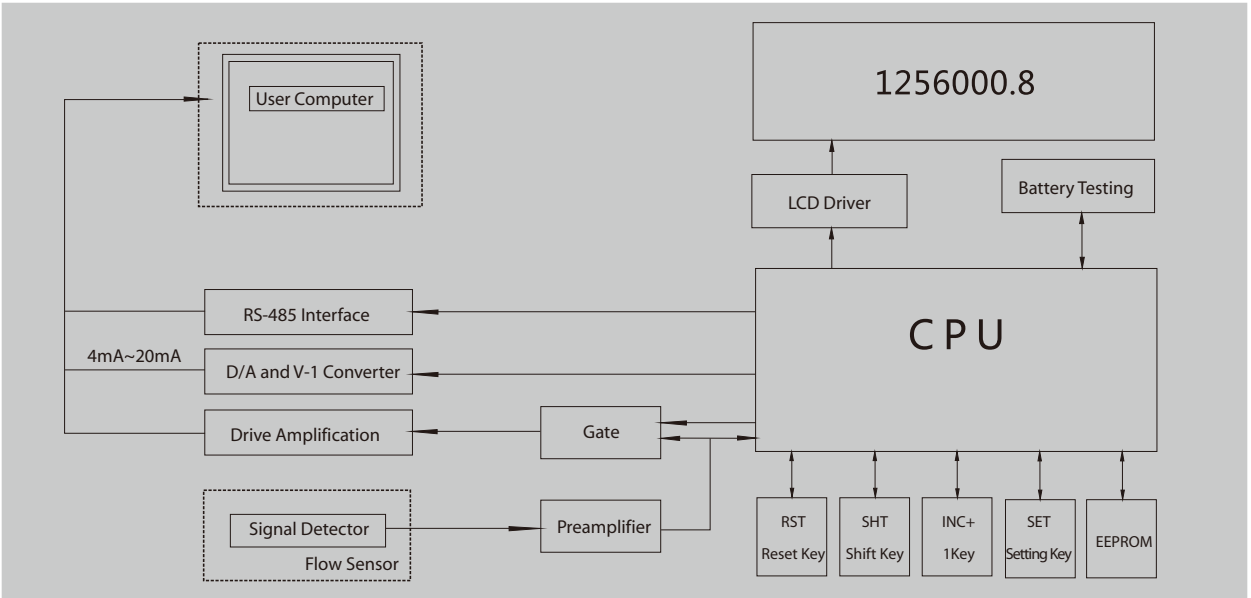
**Qn = Zn/Zg （Pg + Pa） /P n · Tn/Tg · Qg**

In the formula:

- Qn —Volume flow in standard state($m^3$ /h )
- Qg —Uncorrected volume flow($m^3$ /h )
- Pg —Gauge pressure at the pressure detection point of the flowmeter(KPa )
- Pa —Local atmospheric pressure(KPa )
- Tg —Absolute temperature of the medium(273.15 + t) k
- t —Temperature of the measured medium(℃ )
- Zn—Compression coefficient in standard conditions
- Zg —Coefficients for operating conditions
- Tn—Absolute temperature in standard conditions(293.15k)
- Pn—Standard atmospheric pressure(101.325KPa)

***Note:***

For natural gas Zn/Zg=(Fz)2, Fz is called the super-compression factor and is calculated according to the formula in China National Petroleum Corporation's standard SY/T6143-4996.



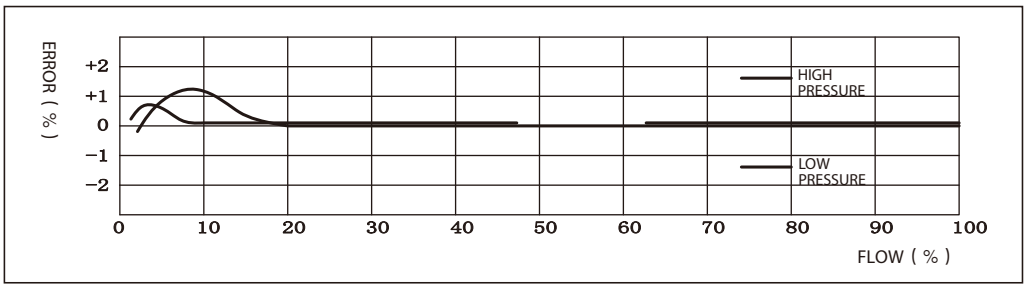

Working Principle of Flow Totalizer

## Technical Parameters

### 1. Basic Parameters

| | | | |
|---|---|---|---|
| Executive standard | Measurement of gas flow in closed pipelines- turbine flow sensor (GB/T8940-2003) | | |
| Instrument size (mm) and connection type | Flange connection type | Stainless steel | DN25-DN300 |
| | | Carbon steel | DN350, DN400 |
| | Thread connection type | Carbon steel | DN25, DN40, DN50 |
| Accuracy | ±1.5%R (±1%R needs to be customized) | | |
| Range ability | 1:10 ; 1:20 ; 1:30 | | |
| Material construction | Body: SS304(DN25-DN300 ), CS(DN350 , DN400 )<br>Blade: Anti-corrosion ABS or high-quality aluminum alloy<br>Conditioning plate: DN25-DN150 is ABS, DN200 is cast aluminum alloy<br>Converter: Die-cast aluminum alloy | | |
| Working condition | Ambient temperature:-20°C~+60°C | Relative humidity: 5%~90% | |
| | Medium temperature: -30°C~+80°C | Atmospheric pressure: 86kPa~106kPa | |
| Power supply | A. External power supply: +24VDC±15%, ripple＜±5%,applicable to 4-20mA output, pulse output, RS485,etc.<br>B. Internal power supply: 1 set of 3.6V 10AH lithium battery, the battery voltage is 3.0V-3.6V for normal operation.Under voltage indication appears when the voltage is below 3.0. | | |
| Overall power consumption | A. External power supply: ＜2W<br>B. Internal power supply: average power consumption＜800uA. | | |
| Flange standard | Normal standard | GB/T 9113-2000 | |
| | Other standards | International standard | DIN, ANSI, JIS |
| | | China standard | HG, GB |
| Thread standard | Normal standard | BSP thread (male) (refer to GB/T7307-2001) | |
| | Other standards | Female thread, NPT thread, etc. | |
| Signal output | Pulse signal, 4-20mA current signal, Control signal | | |
| Communication output | RS485 communication, Optional HART, GPRS | | |
| Real-time recording | Start-stop record, daily record, fixed time interval record | | |
| Signal line interface | Female M20X1.5 or other | | |
| Ingress protection | IP65 | | |
| Explosion-proof | ExdIICT6 Gb | | |
| Electrical Interface | M20*1.5 female thread (NPT thread on request) | | |

**Typical error curve of flowmeter**




**① Pulse output mode (select one of the following three by setting)**

A. Working condition pulse signal. Directly amplify and output the working condition pulse signal detected by the flow sensor through optocoupler isolation, high electrical level ⩾20V, low electrical level ⩽1V.
B. The frequency signal proportional to the standard volume flow is isolated and amplified by the optocoupler. The high electrical level is greater than or equal to 20V, and the low electrical level is less than or equal to 1V.
C. Calibration pulse signal is matched with IC valve controller. High electrical level ⩾2.8V, low electrical level⩽0.2V. The unit pulse represents the volume settable range: 0.01m³~10.00m³. But when selecting the value must be noted: the calibration pulse signal frequency should be ⩽ 200Hz.

**② 4-20mA current signal (using optically isolated current module)**

Proportional to the standard volume flow rate, 4mA for 0m³/h, 20mA for the maximum standard volume flow rate (this value can be set).

**③ Control signal**

A. Lower limit alarm signal (LP): Photoelectric isolation collector (OC) output, normal state OC gate cut-off, alarm state OC gate conduction, maximum load 50mA current, power supply +12VDC ~ +24VDC.
B. Upper limit alarm signal (UP): Photoelectric isolation collector (OC) output, OC gate is cut off in normal state, OC gate is on in alarm state, maximum load current 50mA, operating pressure is +12VDC~+24VDC.
C. Turn off the alarm output (BC terminal, used for IC card controller): logic gate circuit output, normal output low electrical level, amplitude ⩽0.2V; alarm output high electrical level, amplitude ⩾2.8V, load resistance ⩾100KΩ.
D. Battery under voltage alarm output (for BL, IC card controller): logic gate circuit output, normal output low electrical level, amplitude ⩽0.2V; alarm output high electrical level, amplitude ⩾2.8V, load resistance ⩾100KΩ.

**④ RS485 Communication**

Using RS485 interface, it can be directly connected to the host computer or secondary instrument, remotely display the temperature, pressure of the medium, and the standard volume flow and total standard volume after temperature and pressure compensation.

**⑤ Real-time Recording Function**

In order to meet the needs of data management, the flowmeter adds a real-time numerical control storage function, which can be set by one of the following three:
a: Start/Stop record: The last 1200 start/stop times, total volume and net flow records. Factory default items.
b: Daily records: Date record of the last 920 days. Temperature, pressure, standard volume and total volume record at zero time.
c: Fixed time interval records: 1200 records of date and time, temperature, pressure standard volume and total flow rate at fixed time intervals. The above-mentioned stored data can be read through a laptop computer to form data reports and graphs for analysis.

***2. Measuring Range and Working Pressure***

| Instrument Size ( mm ) | Model | Standard Range ($m^3/h$) | Model | Extended Range ($m^3/h$) | Normal Pressure Rating & Special High Pressure Rating (Mpa) | (Mpa) | Mounting Type | Maximum Pressure Loss(KPa ) |
|---|---|---|---|---|---|---|---|---|
| DN25 | S | 2.5-25 | W | 4-40 | 1.6 | 6.3, 4.0 | Flange, Thread | 1.5 |
| DN40 | S | 5-50 | W | 6-60 | 1.6 | 6.3, 4.0 | Flange, Thread | 1.5 |
| DN50 | S1 | 6-65 | W1 | 5-70 | 1.6 | 6.3, 4.0 | Flange, Thread | 0.5 |
| | S2 | 10-100 | W2 | 8-100 | 1.6 | 6.3, 4.0 | Flange, Thread | 1 |
| DN80 | S1 | 13-250 | W | 10-160 | 1.6 | 6.3 | Flange | 1 |
| | S2 | 20-400 | | | 1.6 | 6.3 | Flange | 2.5 |
| DN100 | S1 | 20-400 | W | 13-250 | 1.6 | 6.3 | Flange | 1 |
| | S2 | 32-650 | | | 1.6 | 6.3 | Flange | 1.5 |
| DN150 | S1 | 32-650 | W | 80-1600 | 1.6 | 4 | Flange | 1 |
| | S2 | 50-1000 | | | 1.6 | 4 | Flange | 2 |
| DN200 | S1 | 80-1600 | W | 50-1000 | 1.6 | 4 | Flange | 0.5 |
| | S2 | 130-2500 | | | 1.6 | 4 | Flange | 1 |
| DN250 | S1 | 130-2500 | W | 80-1600 | 1.6 | 2.5 | Flange | 0.5 |
| | S2 | 200-4000 | | | 1.6 | 2.5 | Flange | 1.5 |
| DN300 | S | 200-4000 | W | 13-2500 | 1.6 | 2.5 | Flange | 1 |
| DN350 | S | 400-8000 | W | 320-6500 | 1.6 | - | Flange | 1.5 |
| DN400 | S | 650-13000 | W | 650-13000 | 1.6 | - | Flange | 2 |

***Notes:***
1. DN20, DN32, DN65, DN125 are non-national standard products and need to be customized.
2. The maximum pressure loss is the pressure loss value of the flowmeter working at the maximum flow point, the medium is air, and it is at ambient temperature.

### 3. Instrument Classification

According to the function of the instrument, the LWQ series gas turbine flowmeter can be divided into 3 categories:
① Gas turbine flowmeter sensor/transmitter
② Intelligent display gas turbine flowmeter
③ Intelligent temperature and pressure compensation gas turbine flowmeter

### 4. Function Description

#### ① Gas turbine flowmeter N/A type sensor/transmitter

The gas turbine flow sensor/transmitter product itself does not have the local display function, and only transmits the working condition flow signal remotely. The instrument is cheap, flexible and convenient, and small in size. It is especially suitable for use with secondary display, PLC, DCS and other computer control systems. This type turbine flowmeters are all explosion-proof products with an explosion-proof grade of ExdIICT6 Gb.

| | |
|---|---|
| **Display Type** | No local display |
| **Power Supply** | DC24V, Ripple <±5% |
| **Signal Output** | Pulse output' 4-20mA output |
| **Explosion-proof** | ExdIICT6 Gb |

**Application:**
It can be used as a collection instrument of working condition flow signal, which can remotely transmit flow signal to the host computer.

#### ② Intelligent display G type gas turbine flowmeter

The intelligent display G-type gas turbine flowmeter integrates a gas turbine flow sensor and a flow totalizer. Its main performance indicators have reached the domestic advanced level. It is used for gas metering in petroleum, chemical, electric power, metallurgical industry and boilers and urban natural gas pressure regulation. It is a ideal instrument for station metering and gas trade metering.

| | |
|---|---|
| **Display Type** | Local display |
| **Power Supply** | DC24V, 3.6V lithium battery, 220V |
| **Signal Output** | Pulse output' 4-20mA output' RS485 output |
| **Explosion-proof** | ExdIICT6 Gb |

**Application:**
It can be used for industrial control instrumentation in the field of stable pressure and temperature.

### ③ *Intelligent display E-type gas turbine flowmeter*

The intelligent display E-type gas turbine flowmeter integrates a gas turbine flow sensor and a flow totalizer. It has the characteristics of compact structure, high reliability, and no external power supply interference.

This type of turbine flowmeter has pulse output, 4-20mA current output, and RS-485 communication output mode can also be selected, which is suitable for use with secondary instrumentation, PLC, DCS and other computer control systems.

| | |
|---|---|
| **Display Type** | Local display |
| **Power Supply** | DC24V, 3.6V lithium battery |
| **Signal Output** | Pulse output' 4-20mA output' RS485 output, HART |
| **Explosion-proof** | ExdIICT6 Gb |

**Application:**
It can be used for industrial control instruments in the field of stable pressure and temperature.

### ④ *Intelligent temperature and pressure compensation D2/D4 gas turbine flowmeter*

The temperature and pressure compensation gas turbine flowmeter has built-in temperature and pressure sensors and an intelligent flow totalizer. Through the micro-processing unit, the real-time collected flow, temperature, and pressure signals are compensated for temperature and pressure according to the gas equation, and the compression factor is automatically corrected, and then the volume flow in the standard state is displayed intuitively.

※ Standard state flow rate: the gas volume flow rate under a standard atmospheric pressure at 20°C.

| | |
|---|---|
| **Display Type** | Local display |
| **Power Supply** | DC24V, 3.6V lithium battery |
| **Signal Output** | Pulse output, 4-20mA output, RS485 output, IC card signal output, GPRS signal output |
| **Explosion-proof** | ExdIICT6 Gb |

**Application:**
It can be used for industrial control instruments in the field of stable pressure and temperature.

## *Model Selection Table*

### *1. Selection Instructions*

When selecting the model, the user should reasonably select the model and specification of the flowmeter according to the nominal pressure of the pipeline, the highest pressure of the medium, the temperature of the medium, the condition of the medium composition, the flow range and the signal output requirements.

In order to maximize the performance of the flowmeter, the flow rate range of the flowmeter should be within the range of (20%~80%) Qmax. The signal output mode of the flowmeter when it leaves the factory: working condition pulse signal output (three-wire system), standard flow signal (IC card) output or RS-485 communication output. If other output functions are required, please specify when ordering.

## 2. Model Selection Table

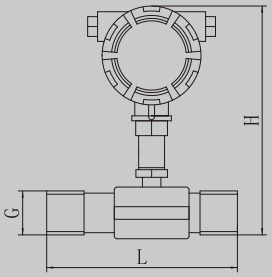
| Model | | | | | | | | | | Contents |
|---|---|---|---|---|---|---|---|---|---|---|
| LWQ- | □ | -□ | -□ | -□ | -□ | -□ | -□ | -□ | -□ | |
| Instrument Type | N | | | | | | | | | 24V power supply, no local display, pulse output |
| | A | | | | | | | | | 24V power supply, no local display, 4-20mA output |
| | G1 | | | | | | | | | Local display, battery powered, no output |
| | GX | | | | | | | | | Local display, external power supply, current output/RS485 output/pulse output |
| | E1 | | | | | | | | | Local display, battery powered, no output |
| | EX | | | | | | | | | Local display, external power supply, current output/RS485/pulse output |
| | D2 | | | | | | | | | Temperature and pressure compensation type, dual power supply, RS485/current output/pulse output |
| | D4 | | | | | | | | | Temperature and pressure compensation type, dual power supply, current output/RS485 output/pulse output |
| Nominal diameter | | 25 | | | | | | | | DN25 |
| | | 40 | | | | | | | | DN40 |
| | | 50 | | | | | | | | DN50 |
| | | 80 | | | | | | | | DN80 |
| | | 100 | | | | | | | | DN100 |
| | | 150 | | | | | | | | DN150 |
| | | 200 | | | | | | | | DN200 |
| | | 250 | | | | | | | | DN250 |
| | | 300 | | | | | | | | DN300 |
| | | 350 | | | | | | | | DN350 |
| | | 400 | | | | | | | | DN400 |
| Connection Type | | | FL | | | | | | | Flange connection |
| | | | LW | | | | | | | Threaded connection |
| | | | Z | | | | | | | Special specification |
| Measuring Range | | | | S | | | | | | Standard range, please refer to Table 1 on page 2 for selection |
| | | | | W | | | | | | Extended range, please refer to Table 1 on page 2 for selection |
| | | | | Z | | | | | | Special range |
| Body Material | | | | | S | | | | | Stainless steel |
| | | | | | C | | | | | Carbon steel |
| Rotor Material | | | | | | S | | | | Anticorrosive ABS |
| | | | | | | L | | | | Aluminum alloy |
| Explosion-proof | | | | | | | N | | | Non explosion-proof |
| | | | | | | | E | | | ExdIICT6 Gb |
| Pressure Rating | | | | | | | | N | | 1.6MPa |
| | | | | | | | | H(x) | | 4-2High pressure refer to table 4-2 |
| Accuracy | | | | | | | | | 10 | 1%R |
| | | | | | | | | | 15 | 1.5%R |
| | | | | | | | | | Z | Special accuracy requirement |

**Note:**

DN20, DN32, DN65, and DN125 are non-national standard products and need to be customized.
X is a number, representing different functions, please consult the sales.

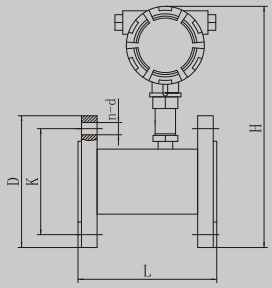
## Outline Drawing and Installation Size

### Intelligent Display Type Installation Size



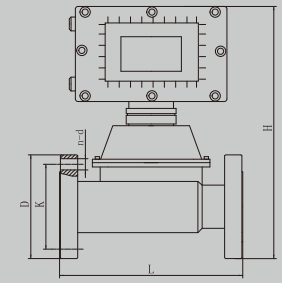

Threaded connection diagram

| Instrument Size(mm) | L(mm) | H(mm) | G (Male Thread) |
|---|---|---|---|
| 25 | 170 | 225 | G2 |
| 40 | 200 | 225 | G2 |
| 50 | 220 | 235 | G 2 1/2 |



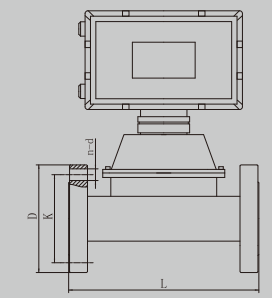

Flange connection diagram

| Instrument Size (mm) | L (mm) | D (mm) | K (mm) | H (mm) | d (mm) | n (Number of Holes) | Pressure Rating |
|---|---|---|---|---|---|---|---|
| 25 | 200 | 115 | 85 | 255 | 14 | 4 | 1.6 MPa |
| 40 | 200 | 150 | 110 | 275 | 18 | 4 | |
| 50 | 200 | 165 | 125 | 285 | 18 | 4 | |
| 80 | 240 | 200 | 160 | 320 | 18 | 8 | |
| 100 | 300 | 220 | 180 | 340 | 18 | 8 | |
| 150 | 450 | 285 | 240 | 400 | 22 | 8 | |
| 200 | 500 | 340 | 295 | 465 | 22 | 12 | |
| 250 | 500 | 405 | 355 | 525 | 26 | 12 | |
| 300 | 300 | 460 | 410 | 585 | 26 | 12 | |
| 350 | 350 | 520 | 470 | 640 | 26 | 16 | |
| 400 | 400 | 580 | 525 | 705 | 30 | 16 | |




D4 type diagram

| Instrument Size (mm) | L (mm) | D (mm) | K (mm) | H (mm) | d (mm) | n (Number of Holes) |
|---|---|---|---|---|---|---|
| 25 | 200 | 115 | 85 | 349 | 14 | 4 |
| 50 | 200 | 165 | 125 | 405 | 18 | 4 |
| 80 | 240 | 200 | 160 | 425 | 18 | 8 |
| 100 | 300 | 220 | 180 | 455 | 18 | 8 |
| 150 | 450 | 285 | 240 | 530 | 22 | 8 |



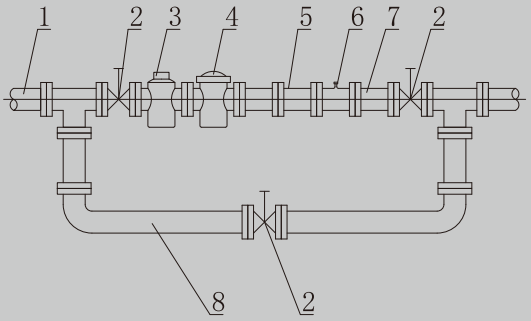

D2 type diagram

| Instrument Size (mm) | L (mm) | D (mm) | K (mm) | H (mm) | d (mm) | n (Number of Holes) | Pressure Rating |
|---|---|---|---|---|---|---|---|
| 25 | 200 | 115 | 85 | 330 | 14 | 4 | 1.6 MPa |
| 40 | 200 | 150 | 110 | 355 | 18 | 4 | |
| 50 | 200 | 165 | 125 | 370 | 18 | 4 | |
| 80 | 240 | 200 | 160 | 400 | 18 | 8 | |
| 100 | 300 | 220 | 180 | 455 | 18 | 8 | |
| 150 | 450 | 285 | 240 | 485 | 22 | 8 | |
| 200 | 500 | 340 | 295 | 545 | 22 | 12 | |
| 250 | 500 | 405 | 355 | 605 | 26 | 12 | |
| 300 | 300 | 460 | 410 | 670 | 26 | 12 | |
| 350 | 350 | 520 | 470 | 730 | 26 | 16 | |
| 400 | 400 | 580 | 525 | 790 | 30 | 16 | |

## External Installation Type

1. Installation of Flow Meter

The flowmeter should be installed horizontally. The flowmeter with a nominal diameter of 15～25mm and the pipe are connected by thread, and the flowmeter with a nominal diameter of 40～200 is connected with the pipe by a flange. The upstream straight pipe section of the flowmeter should be ⩾10DN, and the downstream straight pipe section should be ⩾ 5DN, (DN is the inner diameter of the pipe). When the fluid has particles and dirt, a filter should be installed on the upstream side of the flowmeter. When there is gas in the liquid fluid, a deaerator should be installed on the upstream side of the flowmeter. When the length of the straight pipe on the upstream side cannot be guaranteed, a direct-flow device should be installed. . During installation, a bypass pipeline should be laid for easy cleaning and replacement, see the figure below.




| | | | |
|---|---|---|---|
| 1. Entrance | 2. Valve | 3. Filter | 4.Deaerator |
| 5. Front Straight Pipe | 6. Sensor | 7. Rear Straight Pipe | 8. Bypass |

2. During installation, the liquid flow direction should be consistent with the direction of the arrow indicating the flow direction on the flowmeter housing.
3. The flowmeter should be far away from the external electromagnetic field. If it cannot be avoided, the necessary shielding measures should be taken.
4. The liquid flowing in the pipeline must not contain magnetically conductive substances.

## Ordering Information

When ordering, please read this selection sample first, and select the appropriate flowmeter according to the fluid medium condition and site requirements, and then provide the manufacturer with the following information.

- The model of the gas turbine flowmeter
- The name of the fluid medium and its physical parameters
- Maximum working pressure | Maximum working temperature | Minimum working temperature
- Common flow rate | Maximum flow rate | Minimum flow rate