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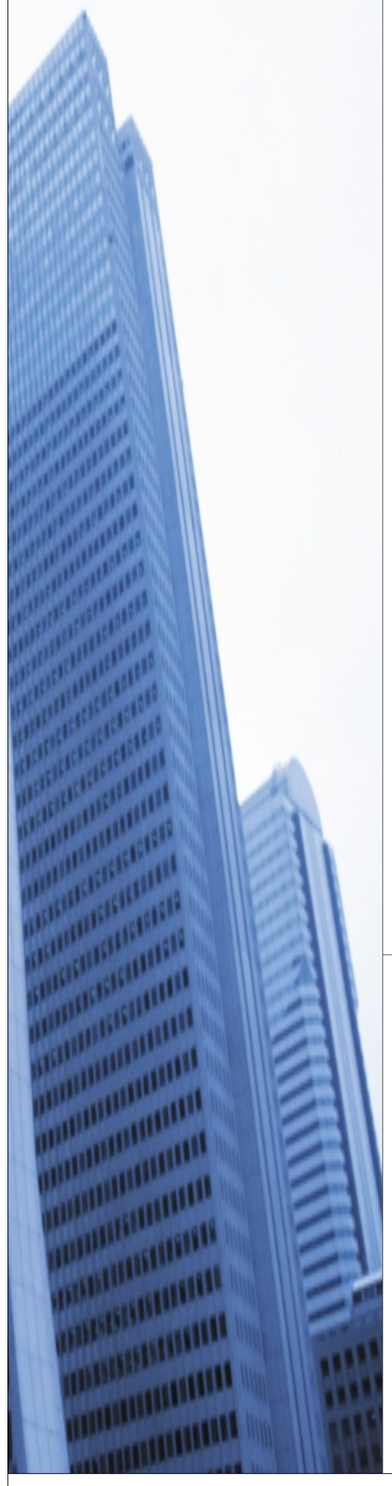
Energy Integrato KHC2K/93 for
Industrial, Commercial and Residential
Applications

KUMHO HEAT METER

Metertech **KumHo Metertech Inc.**



Improvements for a more pleasant living environment are being made at a fast speed in our steadily developing industrial society; and, as one of the methods to solve every worsening pollution problems, a large complex of community dwelling houses, such as apartments and terrace houses, using centralized or district heating systems are being constructed.

Accordingly, in order to contribute to more effective and rational management of heating energy and to maximize the effects of energy saving, Kumho Electric, Inc., has been manufacturing and selling integrating calorimeters since the 70's ; and has now succeeded in acquiring the KS mark for integrating calorimeters, manufactured on the basis of the technologies and experience accumulated over the past twenty plus years. Kumho is not satisfied with this achievement, however, and intends to make ever more strenuous efforts to develop advanced calorimetric systems, opening a window to the future, as a faithful partner in energy management projects.

Operating Principles

This is measuring instrument used to measure the heat consumed within a specified heating range, whose basic principle of operation is to indicate integrated values using the following formula by measuring the heating media (water or other liquid) passing over a specified period of time; the temperature difference (⊿T) between supply temperature and return temperature, measured by a pair of temperature sensors; and applying the corresponding specific constant-heat conversation factor (K-factor/Heat coefficient).

$$Q = K \cdot P \cdot I \cdot \Delta T = K \cdot V \cdot \Delta T$$

Q : Amount of Heat
P : Pulse
I : 1 Pulse Value
K : Heat conversion factor = Specific Heat / Specific Volume
V : Amount of heating media passed
⊿T : Temperature difference between supply and return sides.

"K" value when integrating calorimeter is installed on return side.

Return temperature ℃

Forward temperature ℃ ↓	10	20	30	40	50	60	70	80	90	100	110	120	130	140
20	1,162													
30	1,160	1,157												
40	1,160	1,157	1,154											
50	1,160	1,157	1,154	1,150										
60	1,159	1,157	1,154	1,150	1,145									
70	1,160	1,158	1,156	1,152	1,148	1.145								
80	1,161	1,159	1,156	1.153	1.149	1,145	1,139							
90	1.161	1,160	1,157	1,153	1,149	1,145	1,139	1.132						
100	1,162	1,161	1,158	1,155	1,151	1,146	1,140	1,134	1,129					
110	1,163	1,162	1,159	1,156	1,152	1,148	1,142	1,136	1,131	1,124				
120	1,164	1,163	1,161	1,157	1,154	1,149	1,144	1,138	1,132	1,125	1,118			
130	1,166	1,165	1,162	1,159	1,155	1,151	1,145	1,140	1,134	1,127	1,120	1,114		
140	1,167	1,166	1,164	1,161	1,157	1,153	1,148	1,142	1,136	1,130	1,123	1,116	1,109	
150	1,169	1,168	1,166	1,163	1,159	1,155	1,150	1,144	1,139	1,132	1,126	1,119	1,112	1,104

Structure and Construction

The Kumho integrating calorimeter is composed of a flow sensor, which measures the passing volume of the supplied water; a temperature sensor and flow sensor which measure the temperature difference between supply side and return side; and an operating unit which calculates the amount of heat present, based on the measurements taken by the temperature sensors.

1. Flow Sensor

The revolution rate of the rotor, which is in proportion to passing volume, is decelerated by the operation of the gear, and the result relayed to the flow indicating unit which, in turn, operates the flow signal generator, transmitting an electrical signal to the operating unit for each specified volume.

2. Temperature Detector (Temperature Sensor)

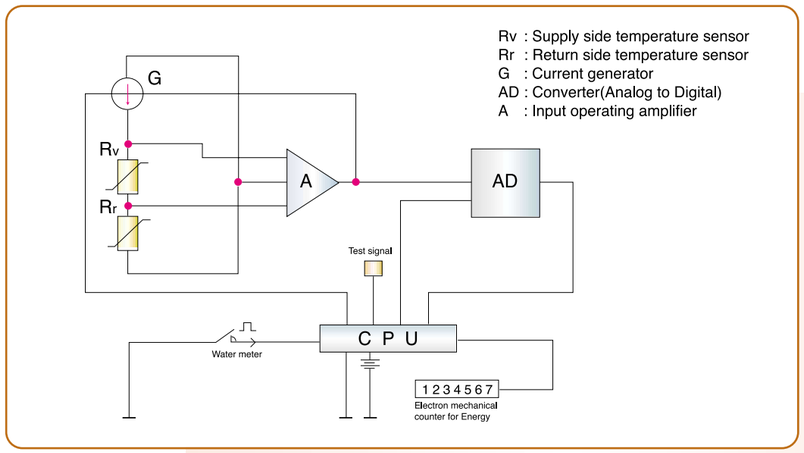
This unit measures the temperature of supply side (Rv) and that of return side (Rr) by using platinum (Pt) temperature measuring resistors (Pt 100§ , Pt 500§) of minimal electric resistance, and applying a large and accurate temperature factor, derived according to resistance and temperature.

Resistance value in relation to temperature variation of platinum(Pt) temperature measuring resistor.

℃	0	5	10	15	20	25	30	35	40	45	50	55
Pt 100	100.00	101.95	103.90	105.85	107.79	109.73	111.67	113.61	115.54	117.47	119.40	121.32
Pt 500	500.00	509.75	519.50	529.25	538.95	548.65	558.35	568.05	577.70	587.35	597.00	606.60

60	65	70	75	80	85	90	95	100	105	110	115	120
123.24	125.61	127.07	128.98	130.89	132.80	134.70	136.60	138.50	140.39	142.29	144.17	146.06
616.20	625.80	635.35	644.90	654.45	664.00	673.50	683.00	692.50	701.95	711.45	720.85	730.30

Block Diagram



3. Operating Unit

The operating unit is where the electrical flow signal generated by the flow sensor; temperature difference detected by the temperature sensor; and corresponding heat conversion factor, are collected and calculated to display the consumed heat to the indicator as an integrated value.
Constructed with highly accurate constant current circuity, the operating unit minimizes errors in temperature detection, and any temperature difference detected is compared and amplified through an operating amplifier and input into a CPU via an analog to digital converter for calculation purposes; and, since at this time the operation is being carried out by the built-in microprocessor, its accuracy is superior, while measurement error is minimized by the continuous correction of the heat conversion factor according to temperature distribution.

Features

Kumho KHC-2K, Electronic Integrating Calorimeter has flow sensors, temperature sensors and calculator installed in the one body; and can be installed and used easily in apartments, shopping centers or offices which use centralized of district heating systems.

- Flow sensor has durability and superior sensitivity and calculator can calculate delicate temperature difference and provide accurate calculation with low power-consumed built-in micom.
- Indicator

Easy Installation

Because the unit is compact in size and cable connection is simple, it is easily handled and installed, requiring only a small space. Because one of two temperature sensor is mounted inside the flow sensor, only one sensor is installed on the pipe (supply side), making installation simple and inexpensive.

Negligible Power Consumption

The unit is equipped with a built-in lithium battery and no external power supply in needed; and because power consumption per pulse is extremely low, the unit can be used for longer 5 years after the battery has been replaced with a new one. Battery replacement is simple.

The machine is Extremely durable and Long-Lived

Constructed from high-precision electronic parts such as its microprocessor, the operating unit contains no parts producing mechanical friction or subject to material fatigue. The life of the unit is more or less permanent and the unit exhibits superior durability because the flow sensor adapt industrial diamond bearings offering superior wear-resistance.

Wide Selection Range

Indicators are available in diversified models such as straight reading type, pulse type, remote-reading type or centralized type, while diameter and flow sensor are also available in a variety of models.

Superior Measurement Accuracy

Since the unit is microprocessor-based, measuring stability is ensured, coupled with outstanding precision even under conditions of minor temperature difference. Temperature is measured at each pulse, thus consecutively correcting the theoretical heat conversation factor (K-factor) on the basis of carrier density and enthalpy.

Superior Sensitivity

Because the unit has outstanding sensing capability it to detect micro-flows, the possibility of error is extremely low, even I situations of minor flow.

Specifications

Operating Unit

Category		KHC2K
Temperature range	℃	0~120
Maximum temperature difference	℃	50
Minimum temperature difference	℃	3
Input flow per pulse	L	10(100)
Unit of measurement		Mwh
Maximum indication Value	Mwh	999.999
Minimum indication Value	Kwh(Mwh)	1,10(0.01,0.001)
Length of indicator cable	m	5(Length can be changed upon request)

Category		KHC2K
Power supply	℃	3.6V Lithium battery
Ambient temperature of operating unit	℃	0~40
Ambient temperature of indicator		-30~50
Maximum temperature difference error	20~50℃	±1%
	10~20℃	±2%
	10~5℃	±5%
	2~5℃	±4%
Temperature sensor	Resistance element	Pt. 500
	Length of cable	1.5m(Supply cable)

※ Pulse type and telemetry type can also be manufactured upon request.

Flow Sensor

Category	Model	KDH		NDH		
Diameter of meter	mm	13	20	25	32	40
Maximum flow	m3/h	2.0	2.5	3.5	5.0	8.0
Minimum flow	m3/h	0.15	0.25	0.3	0.4	0.5
Starting flow(Sensitivity)	L/h	Max.20	Max.30	Max.35	Max.40	Max.70
Maximum pressure	kgf/cm2	10	10	10	10	10
Temperature range	℃	0~120	0~120	0~120	0~120	0~120
Size Distance between panels mm	110	130	225	230	245	
Size Connectors		PF20(3/4″)	PF25(1″)	PF32(11/4″)	PF40(11/2″)	PF50(2″)

Indicator Unit

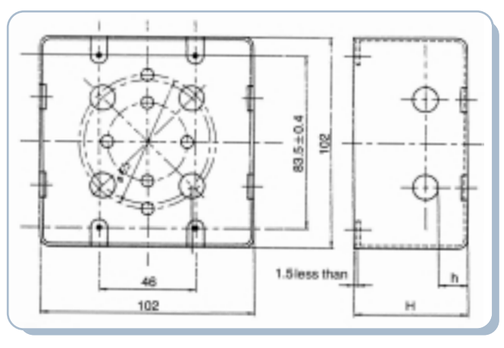
Dimensions	Width	70mm
	Lenght	70mm
	Depth	35mm

Centralized Indicator

Centralized indicators are installed at the entrance or in the security offices, facilitate gauge examination and analysis.

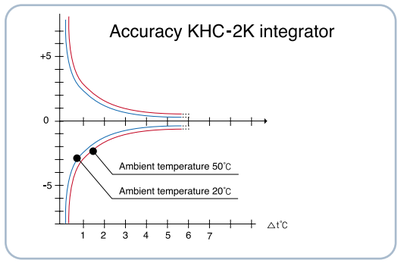
- To be made to order.
- Size is variable depending on the number of households. (Refer to following standards)

Dimensions of built-in box

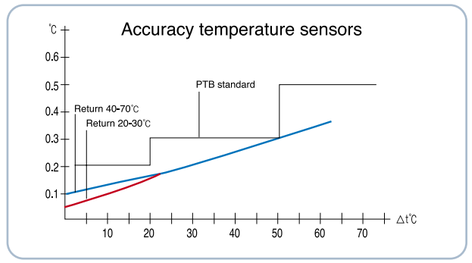


Performance

Error Distribution Chart Created by Differences in Ambient Temperature of Operating Unit

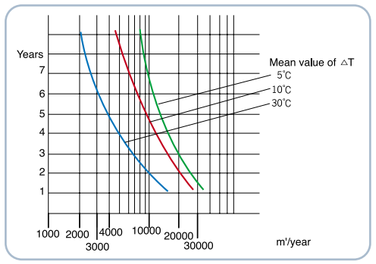


Error Distribution Chart for Temperature Sensor



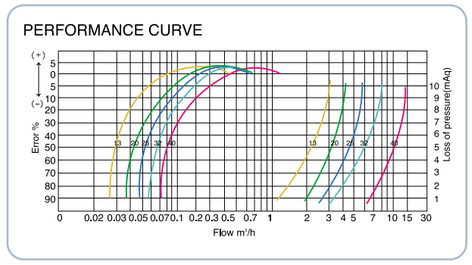
Battery Life-Time

1.2Ah battery, water meter pulse value : 10L



Flow Sensor Performance Curve

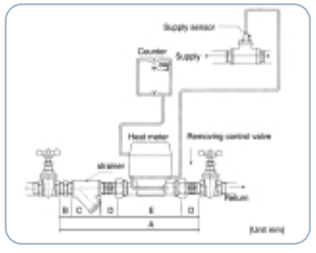
A : KDH/B : NDH



(Unit :mm)

Category	KDH		NDH		
	13	20	25	32	40
A	287	325	447	478	511
B	21	22	24	26	28
C	74	85	100	120	130
D	41	44	49	51	54
E	110	130	225	230	245

Standard Piping Layout



Precautioms when installing meter

Precautions to be taken when selecting installation location and when installing meter.

1) Must be installed inside building in a space of sufficient area to permit easy examination of the meter.
2) Avoid places exposed to direct sunlight; high humidity; severe vibration, or to heavy concentrations of dust.
3) Install calculator (Indicator in the case of remote-reading type) in a place facilitating easy reading of the meter) - Conceal built-in box.
4) Install cable tubing to protect cable connecting indicator to calculator
   - Make cable tubing as short as possible and install in such a way as to minimize number of bends.
   - After the cable tubing has been installed, put protective covers on both ends of the tube to prevent any foreign material from entering.
5) Calorimeter must be installed to return side and a strainer installed in front of the meter to protect flow sensor (Strainer to be minimum 40 mesh).
6) Make sure to install valves at both ends (including strainer) of meter.

Performance

Preparations to be made prior to installation:

1) Install all accessory parts first, prior to installing main body of calorimeter. (Union, nut, sensor pocket, strainer)
2) Prepare a temporary pipe, whose diameter and length are the same as those of the main body of calorimeter and install in flow sensor location to pass water.
3) Open all valves and remove thoroughly all foreign material inside pipe. (Minimum 5 flushing required.) Make sure, at this time, to remove air from the pipe, and flush out of the pipe after passing heating medium through it.
4) Change water as required according to quality of heating water and check water for impurity
5) Clean strainer simultaneously at this time.

Precautions to be taken when installing

1) Upon completion of the work described in preceding paragraphs, remove the temporary pipe and install calorimeter. (Verify, at this time, the flow direction (arrow park) of flow sensor).
2) Insert sensor at supply side (temperature sensor) correctly into sensor poket and tighten fixed anchor slightly.
3) In the case of the telemetry type; after cable has been inserted, apply caulking to the end of transmission tube located towards the operating unit side and put busing on the end of transmission tube located towards the indicator side, to prevent breakdown resulting flow dew formation.
4) When the calculator and indicator unit have been connected by cable, make sure that the cable color match each other.
   . Connect cable tightly so that no insulation will be caught in the terminal block.
   . In case of 3-wire meter; starting from left rear of indicator:
   #1: Shield (-) #2: White #3: Blue #4: Brown

Precautions when moving and handing

1) A calorimeter is precise instrument and therefore care must be taken to prevent severe vibration or external impact from being applied to any part.
2) When it is required to transport the meter, transport in its packing box.
3) Take care not to damage cable insulation o not apply excessive force when installing pipe.

Others

1) In order to ensure smooth operation of the meter, make sure to flush out the system each year prior to switching on heating, in accordance with the procedures described under the title "Preparations prior to installation"
2) Replace heating water regularly (More than 2 times per month)
3) Upon completion of trial operation, it is advisable to put your company seal on the temperature sensor (supply side sensor)

Application

The Applications Kumho KHC 93 Industrial Integrating Calorimeter is used to measure heat supplied by district heating systems, or by other systems which use circulating water.
Because the unit is microprocessor based, performance is superior.
Measured values are expressed is Mwh, Gcal and in other units which are applied in calculating charges for heat supplied. In addition, this Kumho Integrating Calorimeter is used in wide range of applications, such as the following:

Technical Specifications

Operating Unit KHC 93 Type

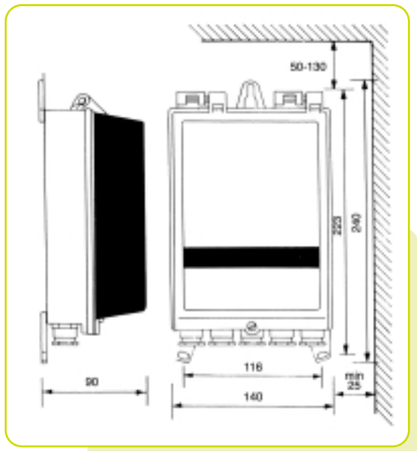
Features

- This is an operating unit capable of measuring both heating and cooling amounts.
- The front cover can be opened or closed easily; making power supply and other terminal (Test, flow sensor and temperature sensor) connections easy. However, the front cover is sealed at time of delivery.
- Temperature difference is measured for each pulse and the theoretical temperature conversion factor corrected continuously based on carrier density and enthalpy.
- Because the meter is composed of automatic electronic measuring circuits, precision is superior even in circumstances of minor temperature differences, ensuring stable measuring conditions.
- The unit has a built-in, 6-unit electronic integrating instrument indicating heat and flow, and LED pulse lights.
- Heating output pulses are possible and the unit can also be computer connected.
- The flow pulse unit has been subdivided and flow meters of different pulse characteristics can be used.
- Meets German PTB (Physikalish-Technische Bundesanstalt) and Swedish SP (Statens Proringsanstalt) Standards.
- All cables are perfectly connected and no separate connection is required.
- Wide range of power sources can be selected (AC 220V and DC 6V used concurrently, plus backup function). (Backup battery replacement is simple.)

Performance

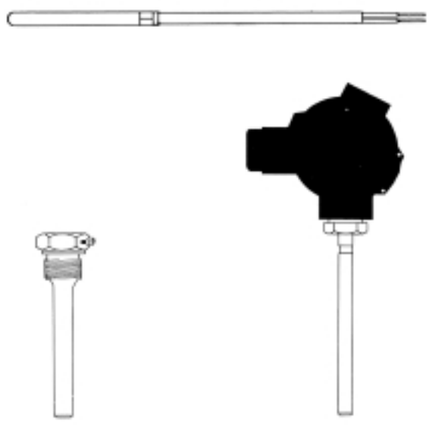
	KHC93
Maximum temperature difference	50℃ 80℃
Minimum temperature sensing capability	0.01℃
Maximum ambient temperature	50℃
Unit of measurement	Mwh Gcal
Maximum indicated value	9.999Mwh
Minimum indicated value	0.01Mwh
Power Supply	6V/DC 220V/AC
Power consumption	Max.3W
Temperature sensor	PT 100
Cooling meter Temperature range Maximum temperature difference	 0~15℃ 15℃
Line resistance Temperature sensor Flow sensor	 10Ω Max. 200Ω Max.

Installation location and size



- Select a wall Location close to flow sensor and temperature sensor, where meter reading is easy. Mount the meter and connect flow sensor and temperature sensor.
- The standard cable used for the flow sensor and temperature sensor is 0.75mm² .
- Length of cable connecting the operating unit, flow sensor and temperature sensor should not exceed.

Temperature Sensor KHT-210

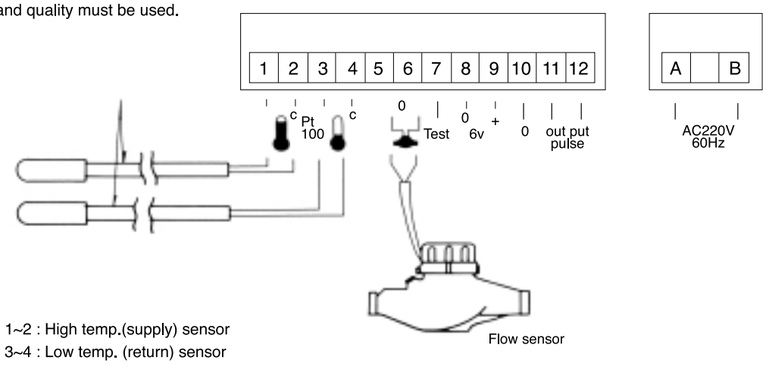


- This unit can be used for all types of operating unit used to measure heating or cooling amounts.
- The temperature sensor uses PT100 inside a brass tube, and different types of sensor pocket are available, depending on installation location conditions.
- Reaction time, under normal installation conditions, is 10 seconds.
- The temperature sensor KHT-210 is composed of a set of two units, each unit capable of detecting temperature differences of less than ±0.05℃, and the sensor's accuracy is ±0.4%. (DIN 43760)
- Measurable temperature range is, -30℃ to + 180℃.
- The unit does not require a separate well, and installation is simple due to its simplified structure.

- Be careful not to confuse the supply sensor with the return sensor.
- If the length of supply cable differs from that of return cable, measurement error may result. Therefore, do not cut the cable on either side.

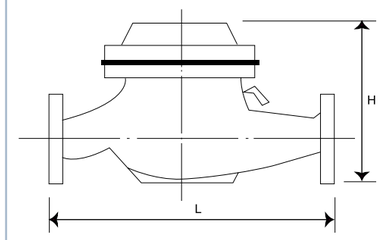
Connecting Flow Sensor and Temperature Sensor (Products are delivered after connections have been made.)

For temperature sensors, cables of same length and quality must be used.

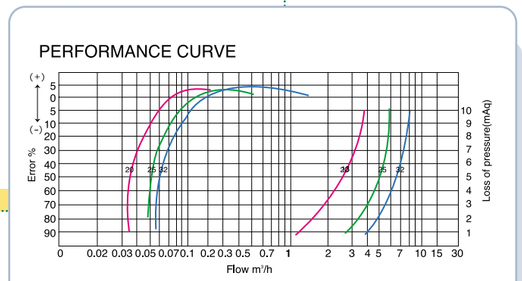


1~2 : High temp.(supply) sensor
3~4 : Low temp. (return) sensor
5~6 : Water meter flow sensor
7~8 : Test signal
8~9 : Power supply ; 6V/DC
11~12 : Heat output pulse (Contact point pulse)

Flow Sensor NDH-F



PERFORMANCE CURVE

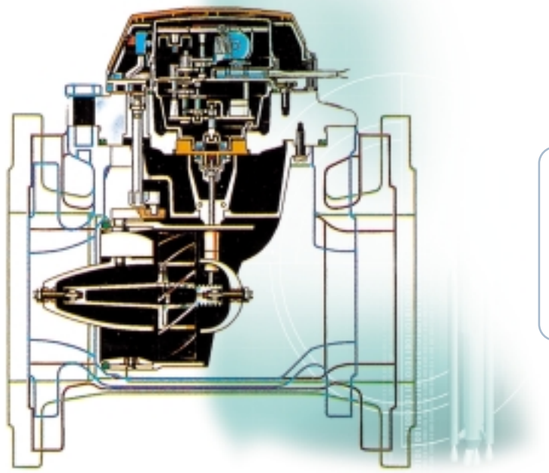


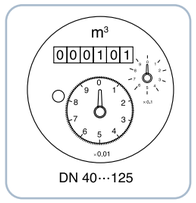
Precautions in installing flow sensor

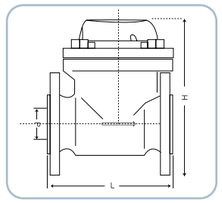
- Ensure to provide straight pipe measuring not less than 5 x d on the inlet side, and not less than 3 x d at the outlet side, of flow sensor.
- Make sure to install strainer in front of flow sensor to protect the sensor from foreign object ingress.
- Check operating unit panel without fail, to check the location of flow sensor, and install the flow sensor at the designated position,paying attention to the arrow direction (Example: "Install at supply side", or " install at return side").

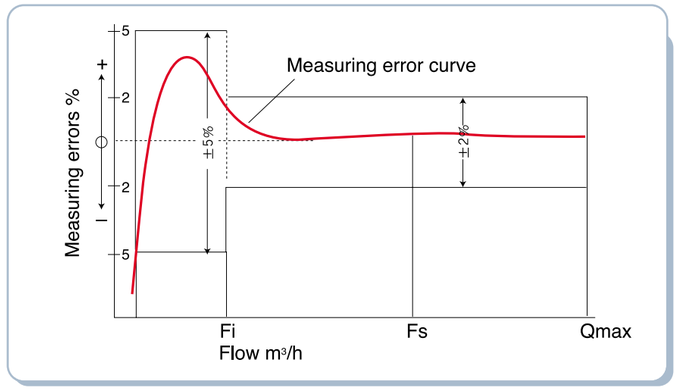
Diameter Meter(d)	mm	20	25	32(25B)
MaximnMeter(Fs)	m3h	1.5	3.5	6
Minmum flow(Fi)	m3h	0.15	0.3	0.4
Pulse sife	ℓ/pulse	10	10	10
Dimensions	Length(L)mm	190	260	260
	Heigth(H)mm	165	170	170
Weight	kg	4.2	5.8	6.4
Temperature range	℃	0~120	0~120	0~120
Maximum pressure	kgf/cm2	16	16	16

Flow Sensor Cosmos WP

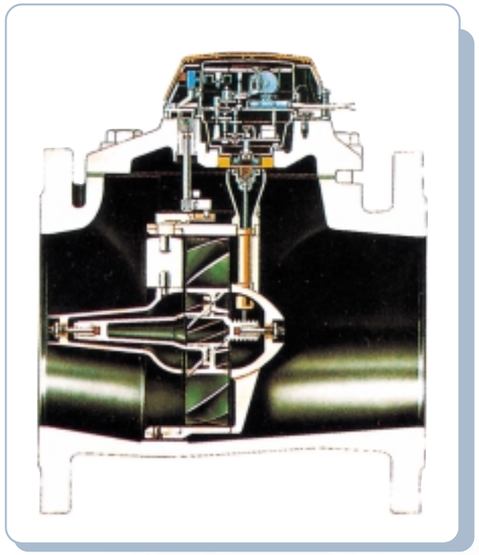


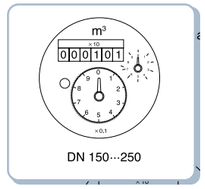


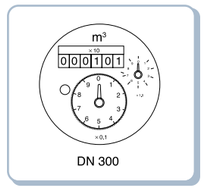


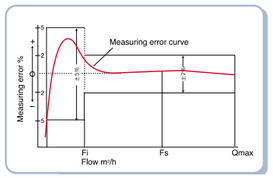


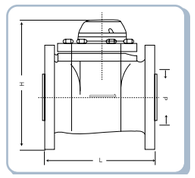
		Cosmos WP					
Diameter Meter	mm	40	50	65	80	100	125
Maximn flow(Fs)	m3/h	10	15	25	45	70	100
Minmum flow(Fi)	m3/h	1.0	1.5	2.0	3.2	4.8	8.0
Pulse sife	ℓ /pulse	10	100	100	100	100	100
Dimensions	Length(L)mm	300	200	200	225	250	250
	Heigth(H)mm	235	257	268	275	285	300
Weight	kg	13	14	17	18	21	28
Temperature range	℃	0~120	0~120	0~120	0~120	0~120	0~120
Maximum pressure	kgf/cm2	16	16	16	16	16	16











		Cosmos WP			
Diameter Meter	mm	150	200	250	300
Maximn flow(Fs)	m3/h	150	250	500	600
Minmum flow(Fi)	m3/h	12	20	30	50
Pulse sife	ℓ /pulse	1000	1000	1000	10,000
Dimensions	Length(L)mm	300	350	450	500
	Heigth(H)mm	368	395	515	540
Weight	kg	40	53	103	118
Temperature range	℃	0~120	0~120	0~120	0~120
Maximum pressure	kgf/cm2	16	16	16	16

Installation Example (Return side)