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CATALOGUE

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TMS KOREA

FLOWMETER

VALVE

CONTROLLER

VISION ANALYSIS SYSTEM

Enterprise measuring the flow of up-to-date science

MECHATRONICS SYSTEM

1. SUMMARY

TGFE(Turbine Gas Flowmeter Electronic), which is produced by TMS Korea, is a gas turbine flowmeter. The flowmeter has a rotational wing which is installed in tube. The rotational wing is consisted of several blades attached to the wing. When the gas is passed through the tube, the rotational wing begins rotating in proportion to the gas flow velocity. If magnet is installed at the rotational wing and flow sensor is installed at the outside of the tube, electric pulse is generated as the rotational wing is being rotated. The principle is to measure the flow rate of the gas which is passing through the tube by counting the frequency of the signal.



◆ Design Standard

(ISO 9951:1993, EN 12261:2002, OIML R6, 32, KS B 8300, AGA Report No. 7, 8, SGERG-88)





TMS KOREA GAS TURBINE METER

◆ Features

The purpose of the TGFE type turbine meter is to measure the flow rate of gas. Therefore, temperature and pressure correction are required since the volume of gas is changed in accordance with the change of the pressure and temperature of the gas. As the compensation of the TGFE type turbine meter is performed by the semiconductor sensor measuring the real time temperature and pressure change, the flow rate under the operation situation is changed to the flow rate under the standard situation directly. The highest performance and the finest accuracy are demonstrated by the turbine meter because the flow obstacles are minimized since micromini semiconductor sensors applied to the up-to-date industrial fields are mounted to all the sensors which are attached to this TGFE type turbine meter.

- High accuracy ($\pm 1\%$) and durability.
($\pm 1\%$ Accuracy of Volume correction for Pressure and temperature)
- No damage on cable due to built-in type of temperature and pressure sensor.
- Temperature, Pressure, Instantaneous flow rate, Accumulated flow rate, Correction Factor.
- Possible to modify the function by online user or administrator mode.
- Simple Structure and easy maintenance.
- Excellent durability and insulation.
- Easy process control due to the installation of the highly efficient totalizer.

◆ Applicable gases

The standard design of TGFE is apply to the measurement of gases without corrosive characteristic.

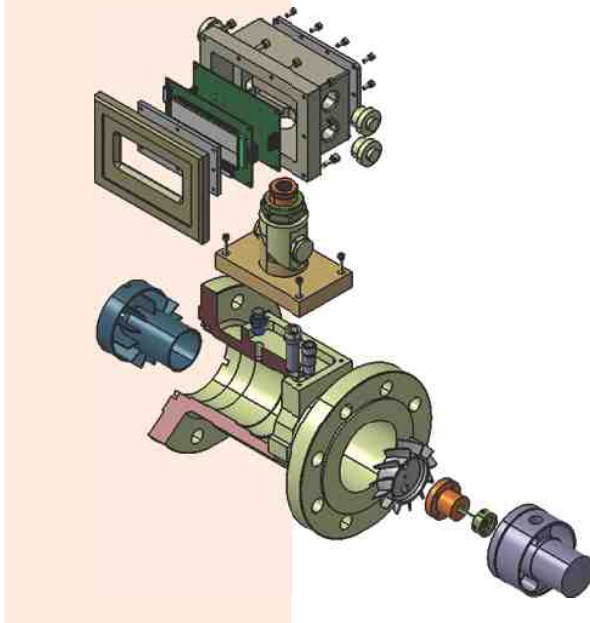
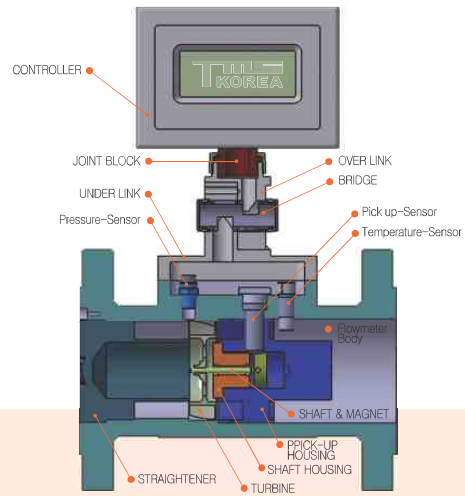
Natural gas
Air
Town gas
Acetylene
Methane
Helium
Ethane)
Carbon dioxide(Dry)
Propane
Nitrogen
Butane
Hydrogen

Particularly, in the case of the natural gas, it is used in wide range for the custody transfer application and it can be applied to the measurement of various industrial primary gases and gas station etc.

2. MAIN FEATURES

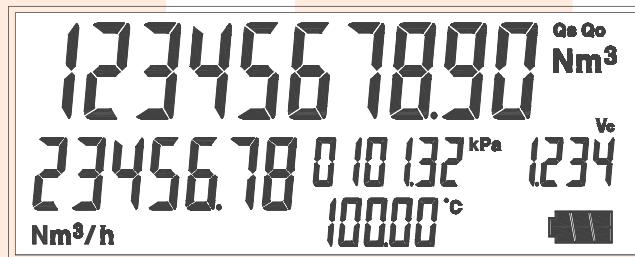
◆ Structure features

- Minimization for durability, different pressure and swirl through the three-dimensional fluid flow analysis.
- Not necessary to inject the lubricating oil as using the high durability bearing.
- Rangeability (30:1) : the wider measuring range with the high accuracy.
- Excellent durability, strength and chemical resistance of materials because Materials and Body of Meter are extrusion, not casting. No corrosion due to coating of electrical fusion.
- Covering corrosion and keeping electrical safety due to built-in type of temperature and pressure sensor.
- Controller can be rotated to up and down(60°), left and right(180°) direction from user's eyesight.



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◆ Electrical · Electronic Characteristic



Q_s : Corrected Accumulated Volume(m^3)
 Corrected Instantaneous Volume(m^3/h)
 Q_o : Uncorrected Accumulated Volume(Nm^3)
 Uncorrected Instantaneous Volume(Nm^3/h)
 kPa : Absolute Pressure
 $^{\circ}\text{C}$: Relative temperature
 V_c : PTZ Correction Factor

- Possible to apply to various compressibility calculations.(SGERG 88, AGA 8, Fixed Value)
- Data logging : Temperature, Pressure, Instantaneous flow rate, Accumulated flow rate, Correction Factor)
 Basic(16Mbit) : 1 year storage(hour, day, month, year)
 Option(512Mbit) : 10 years storage(minute, hour, day, month, year)[but 2 years for logging minute]
- Possible to control the process through the central monitoring system like SCADA as using various communication protocols.
- Using micro processor and high capacity memory.
- Possible to use the electric power continuously without power cutoff as using two batteries.
- Battery discharge alarm function.
- Possible to use the electrical power stably as immediately, automatically converted inside lithium battery in case of the electric power interruption by using DC power.
- No damage on cable due to built-in type of temperature and pressure sensor.
- No inferior sensor by causing outside noises.

3. SPECIFICATIONS

◆ General

- Power : Inside power supply 3.6Volt Lithium battery (power consumption : average 0.3mA, continuous 0.7mA)
[international standard specification: ER32L615, standby usage 12 years, continuous usage 6 years
(Dual Battery)]
- Display update rate : 2sec
- Operating temperature : -40~+60°C
- LCD display temperature : -40~+60°C

◆ Frequency input

- Frequency range : 0Hz to 5KHz

◆ Output signal

- Flow pulse signal output (output distance less than 50m)
- 4~20mA signal output (output distance less than 200m)
- RS-485/232 communication connection signal (long distance data transmission)

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◆ **Environmental class**

- Environmental temperature : $-40^{\circ}\text{C} \sim +60^{\circ}\text{C}$
- Medium temperature : $-40^{\circ}\text{C} \sim +60^{\circ}\text{C}$
- Absolute pressure : 0.3~6bar(standard), 0.3~20bar(Option), 0.3~40bar(Option)
- Relative humidity : 5%~95%

◆ **Hazardous area class**

- Internal pressure explosion-proof : Ex d IIB T5(IEC 60079-0, 1)
- Weather proof class : IP 65

◆ **Accuracy**

- Pressure sensor : $\leq \pm 0.2\%$
- Temperature sensor(PT 1,000 A Class) : $\leq \pm 0.15\%$
- Temperature and pressure correction : $\leq \pm 0.3\%$
- Reproducibility : $\pm 0.2\%$
- Accuracy : $\pm 1\%$ (above 0.15 Qmax)



4. MEASURING ACCURACY

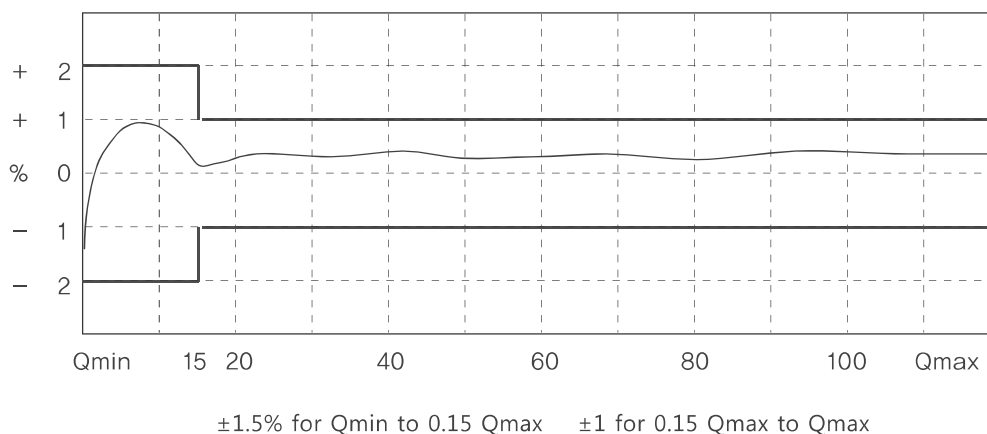
The following error limit shall apply to the measuring accuracy for pressure and temperature correction in the permissible measuring range.

Measuring Range	Qmin to 0.15 Qmax	0.15 Qmax to Qmax
Legal accuracy limit	± 2	± 1
Calibration accuracy	± 1	± 0.5
TGFE Series accuracy	$\leq \pm 1.5$	$\leq \pm 1$

Reproducibility : $\leq \pm 0.2\%$

※ Reproducibility : is one of the main principles of the scientific method, and refers to the ability of a test or experiment to be accurately reproduced, or replicated, by someone else working independently.

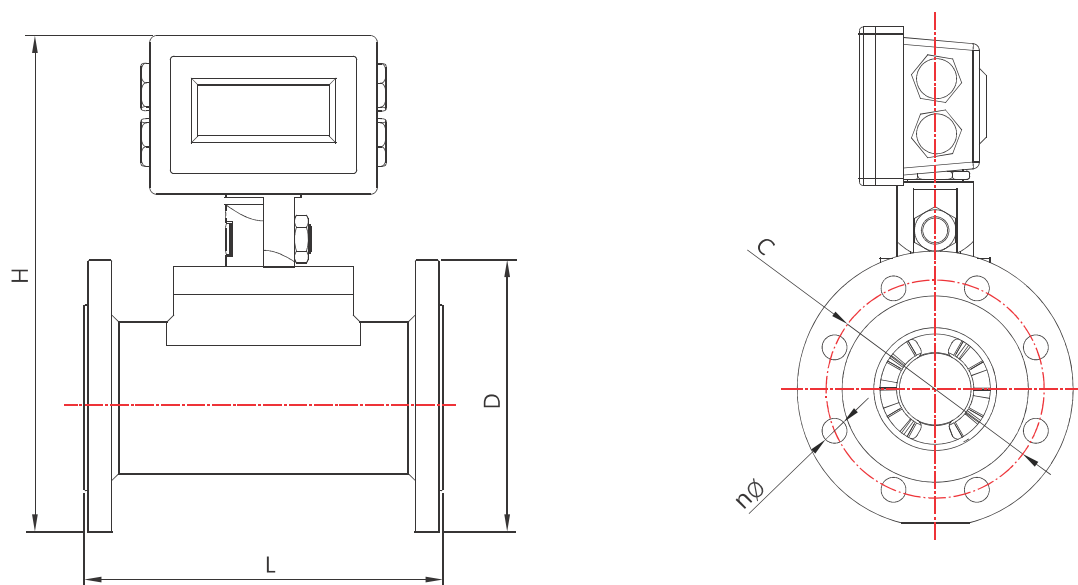
◆ Calibration Curve of TGFE



※ Accuracy for Pressure sensor and Temperature sensor

Measuring Range	Pressure	Temperature
Legal accuracy limit	± 1	± 1
Calibration accuracy	± 0.2	± 0.15
TGFE Series accuracy	$\leq \pm 0.3$	$\leq \pm 0.3$

5. DIMENSION



Model specification	Standard specification	1.6 Mpa(mm)				
	mm(in)	L	H	D	C	nØ
TGFE-A050	50(2)	150	353	Ø165	Ø125	4-Ø18
TGFE-A080	80(3)	240	381	Ø200	Ø160	8-Ø18
TGFE-A100	100(4)	300	402	Ø220	Ø180	8-Ø18
TGFE-A150	150(6)	450	415	Ø285	Ø240	8-Ø23
TGFE-A200	200(8)	600	425	Ø340	Ø295	12-Ø23

- Manufacturing of higher grade flow meter is possible in accordance with the 1.6MPa of steel design and the need of customers.
- Installation condition : The flowmeter and tube is connected by flange and the flange is manufactured in accordance with the DIN, ANSI, JIS standard.
- Flowmeter upstream and downstream pipe length : Upstream $\geq 1DN$; Downstream $\geq 2DN$

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6. RANGEABILITY

- Maximum flowrate is the standard flowrate under the uncorrected volume for pressure and temperature.
- Minimum flowrate can be calculated by the ratio between maximum flowrate and rangeability.
- Pressure loss indicates the value under the maximum standard flowrate (specified condition).
- Rangeability from Minimum to Maximum is 30:1.

Model specification	Standard specification mm(in)	Flow rate (m ³ /h)	Accuracy (%)	Pressure loss (ΔP (mbar))	Case material
TGFE-A050-G65	50(2)	3~100	±1.5% for Qmin to 0.15 Qmax	6	1.6MPa Aluminum alloy (Option : 4Mpa Carbon steal)
TGFE-A080-G100	80(3)	5~160		5	
TGFE-A080-G160	80(3)	8~250		8	
TGFE-A080-G250	80(3)	13~400		12	
TGFE-A100-G250	100(4)	13~400	±1.0% for 0.15 Qmin to Qmax	5	
TGFE-A100-G400	100(4)	20~650		12	
TGFE-A150-G650	150(6)	32~1000		8	
TGFE-A150-G1000	150(6)	50~1600		14	
TGFE-A200-G1000	200(8)	50~1600		5	
TGFE-A200-G1600	200(8)	80~2500		8	

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7. PRESSURE LOSS UNDER THE MEASURING CONDITION

• Pressure loss is caused by friction loss by flow resistance of fluid, granular loss with air density and gross loss of piping parts. Also, it is proportioned to gas gravity, piping length, and flow rate and is in inverse proportion to internal diameter of piping. According to that, the equation is applied.

※ Standard Density of Gas

Natural gas : $\rho = 0.83\text{kg/m}^3$, City gas : $\rho = 0.9\text{kg/m}^3$, Air : $\rho = 1.29\text{kg/m}^3$

$$\Delta P_m = \Delta P_s \times \frac{\rho_m}{\rho_s} \times P_{ab} \times \left[\frac{Q_m}{Q_{\max}} \right]^2$$

ΔP_m Pressure loss under the measuring condition (mbar)

ΔP_s Pressure loss under the specified condition (mbar)

P_{ab} Absolute Pressure (mbar)

ρ_m Standard air density under the measuring condition (kg/m³)

ρ_s Density of fluid under the specified condition (kg/m³)

Q_m Instantaneous flowrate under the measuring condition (m³/h)

Q_{\max} Maximum flowrate under the specified condition (m³/h)

Example :

Flow rate(Q_m)=150m³/h, Meter size=G160, Q_{\max} =250m³/h, Air density(ρ_m)=1.29kg/m³,
NG density(ρ_s)=0.83kg/m³ ΔP_s =8mbar(See the table), P_{ab} =1.25bar

$$\Delta P_m = 8 \times \frac{1.29}{0.83} \times 1.25 \times \left[\frac{150}{250} \right]^2 = 5.59\text{mbar}$$

8. PRECAUTIONS FOR ORDERING

◆ Selection of flowmeter within the rational flow rate measuring range

All the flow rate ranges are based on the operating condition volume. When selecting the model, the user shall select the meter in accordance with the intermediary variables based on the gas volume for the operating condition. When the standard condition (101.325kPa, 20°C) volumetric flow rate is known, the instrument shall be selected again in accordance with the intermediary variables after converted it to the operating condition volumetric flow rate by the following equation.

$$Q_s = Q_o \times \frac{P_a + P_g}{P_N} \times \frac{T_N}{T_g} \times \frac{Z_N}{Z_g}$$

$$Q_s = Q_o \times \frac{P_a + P_g}{101.325} \times \frac{T_N}{273.15 + t} \times \frac{Z_N}{Z_g}$$

Qo : PTZ Uncorrected Volume

Qs : PTZ Corrected Volume

PN : Standard atmospheric pressure (101.325kPa)

Pa : Atmospheric pressure(kPa)

Pg : Gauge pressure(kPa)

Tg : Absolute temperature of the flowmeter inspection point (273.15+t)K

TN : Absolute temperature under the standard condition
(273.15K+National standard temperature°C)

t : Gauge temperature(°C)

Zg : Compressibility factor under the operating condition

ZN : Compressibility factor under the standard condition

◆ Intermediary variables data cooperation at the time of ordering

- 1) 1) Pipe diameter
- 2) Minimum, maximum flow rate (Conditions Specified)
- 3) Minimum, maximum pressure
- 4) Minimum, maximum temperature
- 5) Environmental temperature
- 6) Gas type
- 7) Signal output transmission distance
- 8) Others (required documents and conditions for user)

9. OTHER PRECAUTIONS & GUARANTEE PERIOD

- 1) Do not disassemble or assemble the flowmeter.
- 2) Those handling precautions described above shall be observed without fail as violating these can be resulted in the failure of the product.
- 3) Unless otherwise specified, the product guarantee of this item is as follows.

☐ **Guarantee period** : During the shorter period of either 18 months after the delivery or the 12 months after the usage, when it is clear that the failure is caused by the manufacturing problem of this company, the product will be repaired or replaced with free of charge.

☐ **A/S will be provided rapidly when it is informed to the purchasing shop or to the nearest agent.**

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