GFO
GAS FLOW ONLINE

Creators in flow

Turbine Gas Meter

The Statement

Creators in Flow.

GFO Europe with a passion for gas metering technology through the Spiral of Creation. This spiral of creation is the natural path from wish to reality. The GFO logo itself represents the Flower of Live, being the sacred geometry and to been seen in many cultures around the globe. The Flower of Life holds a secret symbol created by drawing 13 circles out of the Flower of Life. By doing this, one can discover the most important and sacred pattern in the universe. This is the source of all that exists; it's called the Fruit of Life. It contains 13 informational systems. Each one explains another aspect of reality. Thus these systems are able to give us access to everything ranging from the human body to gas meters to....the galaxies.

Connecting tomorrow with today

GFO Europe finds its roots firmly embedded in the Netherlands. A country with a longstanding and prominent history of producing and exporting Natural Gas. Supporting technologies such as industrial gas meters, were then developed and consequently, ever since, have conquered the world. Based on their elaborate past and extensive track record in designing innovative gas meters, the GFO team NL works on the next generation of gas meter technologies by following regional and global market requirements while constantly setting gas meter technology trends for years to come. Gas Measurement is a science being in principle an intelligent technology mix of sophisticated R&D, advanced CNC machining and practical experience. Based on this principle and pursuing knowledge itself, long term Product reliability has been achieved. The GFO team NL of engineers continues fine-tuning their proven technologies for innovative gas meters. GFO Europe connects in full focus tomorrow's requirements with today's technologies.

Operating Principle

The operating principle of the Turbine Gas Meter is well known. It is based on the measurement of the gas velocity. The flowing gas is narrowed, accelerated and conditioned by the meter upstream straightening section. The dynamic forces of the fluid causes the turbine rotor to rotate. The turbine rotor is mounted onto an axial shaft with high precision low friction stainless steel ball bearings.

The turbine rotor has helical blades which causes the turbine rotor angular velocity to be proportional to the gas velocity. The rotating movement of the turbine rotor and its primary gear train, all fitted in a pressurized body, drive an externally fitted gearbox. This 100% sealed gearbox allows for the initial error adjustment by adjustable roller counters. The output of this model Turbine Gas Meter is a special designed magnetic coupling where one part is fitted inside the meter body (gas area) and the associated part is placed in the read-out unit. The read-out unit can either be a mechanical index or an electronic index, with or without volume conversion and communication functions. Conversion takes place against normal or standard conditions.

The GFO-TM Features:

"RMC" Replaceable Meter Cartridge

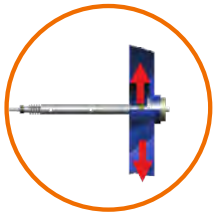
GFO has developed a series of turbine gas meters, ranging from 2" G40 up till 8" G 2500 for pressures up till 16 bar (PN 16/ANSI 150). These meters are based on the concept of the **R**eplaceable **M**eter **C**artridge **(RMC)**. A unique feature enabling the owner/ operator to change the characteristics of the meter on-site to offer ***maximum modular flexibility*** in terms of minimum and maximum capacity, pressure loss and G-ratings. These cartridges can be pre-calibrated, under both low and high pressure conditions, then exchanged on-site, stored and hence allow for fast delivery. The weight of such a **RMC** is significantly lower than a complete meter, which results in a considerable reduced transportation cost by courier service.

Low Weight Aluminum Meter Body

Aluminum meter bodies are already used in many countries. The low weight of the Aluminum bodies results in reduced cost of transportation. In terms of strength, the aluminum bodies are equivalent to the iron GGG40 meter bodies and are being certified being suitable for all classes up to ANSI 150 or DIN PN16. The hard-anodized coating will give the meter body a superior protection against corrosion.

Optimized Bearing Construction & Axial Load Compensation

To reduce the acting forces on the main bearings, the front main bearing is positioned exactly in the vertical centre line of the turbine wheel, resulting in applied forces on the tiny rear bearing being eliminated. As the forces on the turbine wheel and thus the axial load on the bearings are proportional to the density of the gas measured, the axial load on the bearings is notably higher when the meter is operated at higher pressures. The GFO-TM series meters are designed to compensate for density related additional axial loads. This so called Axial Load Compensation (**ALC**) will compensate for the density related axial load on the turbine wheel by causing a slightly over pressure downstream the turbine wheel. This overpressure will push the wheel backwards against the direction of the gas flow and thus restricting the axial load acting on the main front bearing.

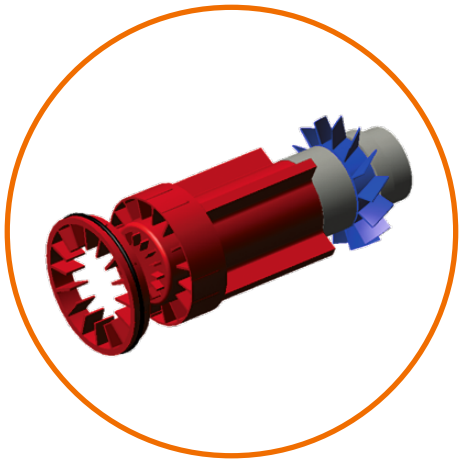


Dirt Protection & Full Flushing Oil System

In order to keep the bearings in proper condition, it is essential to flush out the dirt and refresh the oil on a regular time interval. The GFO-TM series meters are equipped with an ongoing refreshing and flushing oil system whereby the oil is pumped into a reservoir fitted into the bearing block. A splash vane running at proportional speeds splashes the oil through the bearing block, flushing, cleaning and wetting all the parts and surfaces, leading to a significant improvement of the meter's lifetime. To improve the resistance against dirty gas even further, the GFO-TM series meters have its bearings mounted deep inside the bearing block, by the flowing gas only accessible through a labyrinth, hence basically impossible for dirt particles to get into the bearings.

Multistage Flow Conditioner

To guarantee superior meter accuracy even in non-ideal metering installations, the GFO turbine wheel is positioned at the very rear end of the RMC. This creates twice the length for straightening and conditioning the incoming flow profile compared to conventional turbine meters. Where conventional turbine meters have just four active stages for straightening, the GFO-TM has six. This will allow for a minimal straight inlet pipe of only 2 D with Low level and High Level perturbations according to OIML standards.



Multifunctional Coupling and Index

To eliminate limitations to future upgrades both the GFO-RM series and the GFO-TM series are equipped with a hybrid magnetic coupling. Using a special designed magnet inside the meter, the reading of the meter can be changed from "mechanical index" to "electronic index" (magnetic field orientation is used to activate pulse wires for detecting the rotation direction and position of the impellers). The index and its functions can be exchanged with just "one twist and a click". The mechanical index contains a BOX that can hold different types of LF pick-ups and different connectors or fraud detection devices, to generate maximum flexibility. The ability to change sensors quickly and easily via this BOX, gives the meter maximum flexibility.

HF Sensor combined with Isolated Thermo-well

The GFO-TM meters can be fitted with one High Frequency sensor, if required. This sensor can also be fitted into the meter at a later stage, without removing the meter or the cartridge from the installation. The sensor is designed and approved in accordance with ATEX, FM and CSA. The generated output signal complies with EN 60947-5-6 / NAMUR. The housing of this High Frequency sensor is also suitable to be fitted with a Thermo-well in order to provide accurate temperature measurement.

HF Sensor on Aluminum Rotor

The GFO-TM meters above 3" can also be fitted with one or two High Frequency proximity sensors scanning the Aluminum rotor. These HF sensors allow the determination of the gas flow as a HF pulse often used as input into Flow Computers.

Approvals

The GFO-TM series is designed in accordance with all relevant and international published and accepted standards such as: **EC Directives, DIN 33800, EN 12261(MID 2004/22/EC** issued by NMi, **ISO 9951, OIML R137-1&2 (2012)** issued by NMi, ATEX issued by Dekra. Accredited according to Pressure Equipment Directive **PED (PED 97/23/EC)**. Conformity Assessment **EN 10204 3.1 certification issued by Lloyds and HPi**.

Verification & Calibration

The GFO-TM turbine meters or the RMC's are each supplied complete with a calibration certificate. The initial verification and the calibration are done at the GFO factory or a NMi and/or PTB approved calibration bench. When a "pre-calibrated meter internal only" is supplied as replacement such as a G-rating upgrade, the final verification and calibration can be done at the premises of the local gas company, using a similar approved calibration bench. High-pressure calibrations at certified installations can be done as well on customer's request.

Installation

Recommendations for installation: The integrated multi stage flow straightener of the GFO-TM turbine meter eliminates effects of flow disturbances, so called perturbations as defined in the ISO 9951 and consequently complies with the European and major International Directives and guidelines such as the OIML, ISO and DVGW. The design permits very compact M&R stations without sacrificing the meter's accuracy. Although the axial compensation protects for sudden flow variations, it is recommended to pressurize the meter slowly to prevent over-speeding and consequently damaging the meter internal.

Technical Data

Applications:
Medium: natural gas, town gas, propane, inert gases.
Industry: Gas supply, heating manufacturers, chemical industries.

Pressure ratings:
- Pressure ratings for PN10/16 and ANSI 150.
- Various flanges are available on request. (DIN Flanges, ANSI Flanges, JIS Flanges and others)

Nominal diameters:
50 mm (2") to 200 mm (8"). Larger sizes on request.

Measuring range:
20 : 1 minimum or better at atmospheric conditions up to 50 : 1 at higher densities.

Meter index:
100% sealed against possible humidity build-up. Counter eight-digits mechanical rollers.
Standard synthetic material Polycarbonate.
Environmental protection class IP65 (Dekra Certified nr 2177492.01A0)

Pulse Output:
2 LF Reed switch RI27A NO, 1 (Anti Fraud) Reed switch RI90 NC.
1 HF sensor to be fitted into the meter taking pulses from the main shaft.
1 or 2 HF sensors optional, to be fitted onto the main body taking pulses from the aluminum rotor, size 100/4" or larger
Reading: Metric (imperial on request)

Pressure and Temperature connections:
1 Pr. Connection EO-6 S connection / M12 x 1,5 Cable gland (6mm feedtrough)
1 thermowell

Flow rates:
5 m3/h up to 4000 m3/h
Repeatability: better than 0,1 %

Measuring accuracy:
0,2 Qmax to Qmax: ± 1 % or better
Qmin to 0,2Q max: ± 2 % or better

Temperature range:
Standard: -25 °C to + 60 °C (-13 °F to + 140 °F)
On request: -40 °C to + 80 °C (-13 °F to + 140 °F)

Standard Features

The standard mechanical meter index is fitted with a LF output. Additional LF, HF outputs or smart electronics can be fitted. The meters are also fitted with a pressure point and thermowell suitable for easy connection of electronic gas volume conversion devices. The lifetime of the GFO-TM is very stable, a meter concept over many years as proven technology, also by the use of specific precision ball bearings of "made in Germany" quality. The GFO Turbine Meters are designed and manufactured by a team of R&D engineers with over 30 years of gas meter experience. The standard calibrated measurement range is 1:20 under atmospheric conditions, while extended measurement ranges such as 1:30 are optionally available. Larger measurement ranges are under R&D but care should be taken that to achieve such, low friction, small bearings are to be used, resulting in a possibly reduced life time. The GFO turbine meters can be installed horizontally and with some additional provisions also vertically.

Pipe Size mm (inch)	G-rating	Measurement Range (m3/h) Qmin-Qmax	High Frequency (Hz)	2 x Low Frequency (pulse/m3)	Overall Length (mm)	Pressure Rating	Body material
50 (2") 	G 65 G 100 	(p>4bar) 5 –100 8 –160	200 – 400	10 1 	150	ANSI 150 DIN PN10/16	Aluminium GGG40 Carbon Steel
80 (3") 	G 100 G 160 G 250	8 – 160 12,5 - 250 20 - 400	200 - 300	1 1 	240	ANSI 150 DIN PN10/16	Aluminium GGG40 Carbon Steel
100 (4") 	G 160 G 250 G 400	12,5 - 250 20 - 400 32 - 650	200 - 300	1 1 1	300	ANSI 150 DIN PN10/16	Aluminium GGG40 Carbon Steel
150 (6") 	G 400 G 650 G 1000	32 - 650 50 - 1000 80 - 1600	100 - 200	1 1 0,1	450	ANSI 150 DIN PN10/16	Aluminium GGG40 Carbon Steel
200 (8") 	G 650 G 1000 G 1600	50 - 1000 80 - 1600 125 - 2500	75 - 150	0,1 0,1 0,1	600	ANSI 150 DIN PN10/16	Aluminium GGG40 Carbon Steel

GFO has agents and representatives worldwide.
GFO has a continuing program of product research and development.
Technical specifications and construction may change due to improvements.
This publication serves as general information only, and all specifications are subject to confirmation by GFO

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