

iM-TM

Industrial metering



TECHNICAL BROCHURE

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Who we are

We are a global organization specialized in designing and manufacturing technologically advanced solutions for natural gas treatment, transmission and distribution systems.

We are the ideal partner for operators in the Oil & Gas sector, with a business offer that goes across the whole natural gas chain.

We are in constant evolution to meet our customers' highest expectations in terms of quality and reliability.

Our aim is to be a step ahead of the competition, with customized technologies and an after-sale service program undertaken with the highest grade of professionalism.



Pietro Fiorentini advantages



Localised technical support



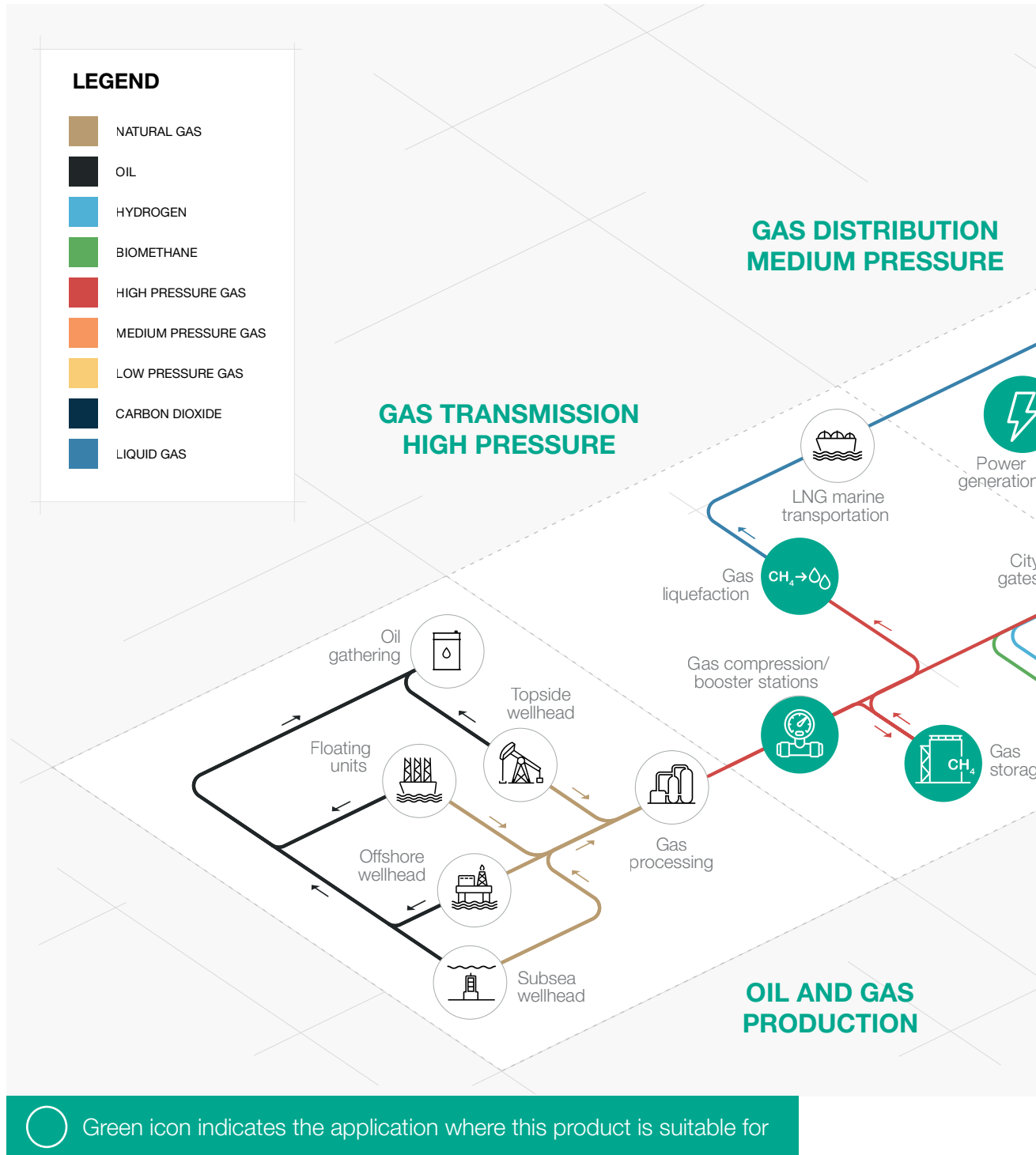
Experience since 1940



We operate in over 100 countries



Area of Application



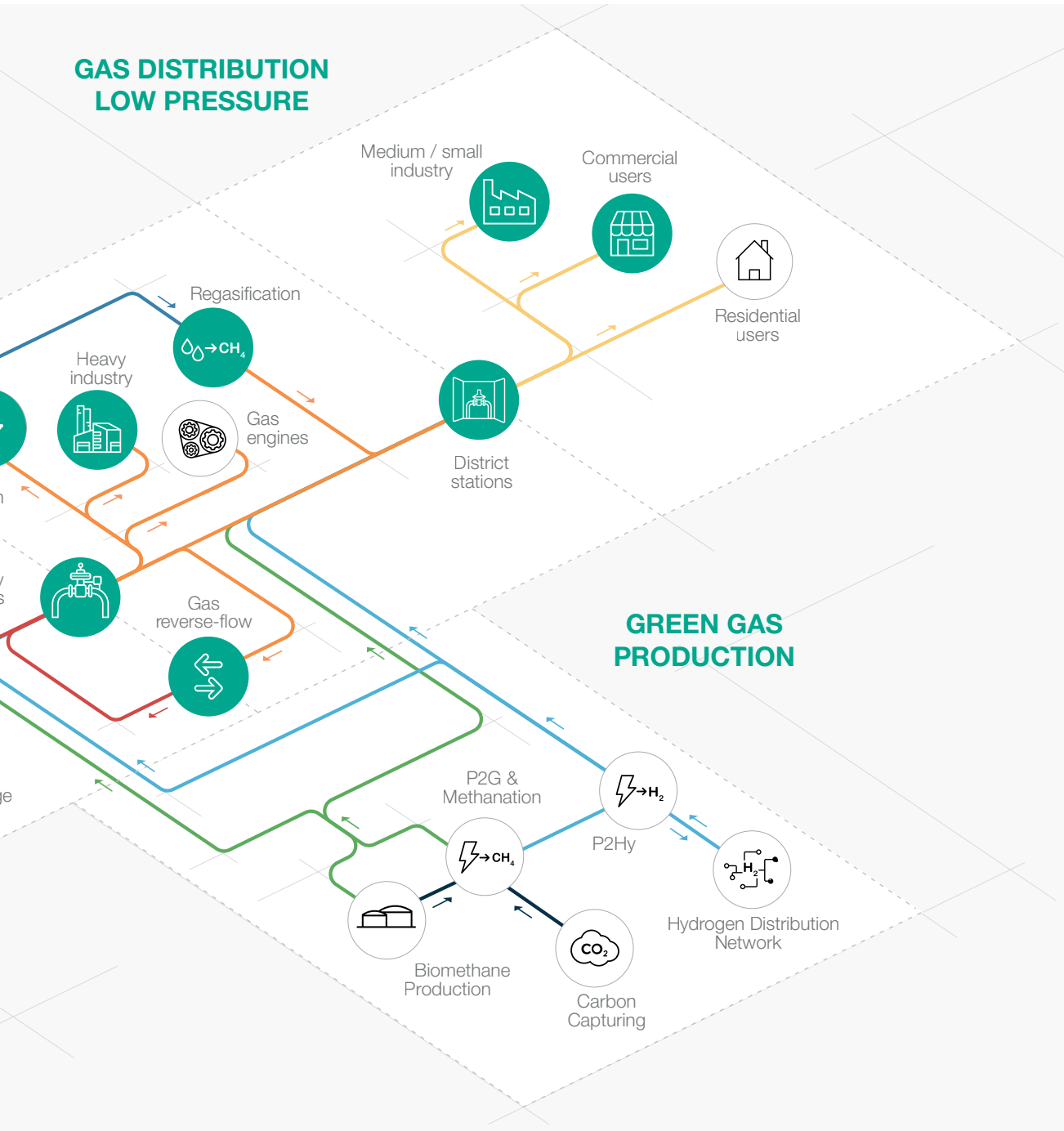


Figure 1 Area of application map



Introduction

iM-TM CT turbine meters, approved for custody transfer applications, is mainly used for high pressure transmission systems, power plants, heavy industry and for medium low pressure natural gas distribution networks.

This device is suitable for use with previously filtered non corrosive gases.

It is the natural evolution of the Pietro Fiorentini know how and experience in the gas industry. The operating principle of the turbine meter incorporates an innovative method of conditioning flow in the meter body.

A straightening section in the meter body conditions the gas flow by removing undesired swirl, and turbulence before it reaches the turbine rotor.

The dynamic forces from gas flow initiate rotation of the turbine rotor.

The precision machined rotor, mounted on a shaft, including high quality low friction stainless steel ball bearings allows to have a cartridge with high measurement quality.

The rotor of the turbine having helical blades and a known angle allows to guarantee the proportionality between the gas speed and the number of revolutions of the shaft.

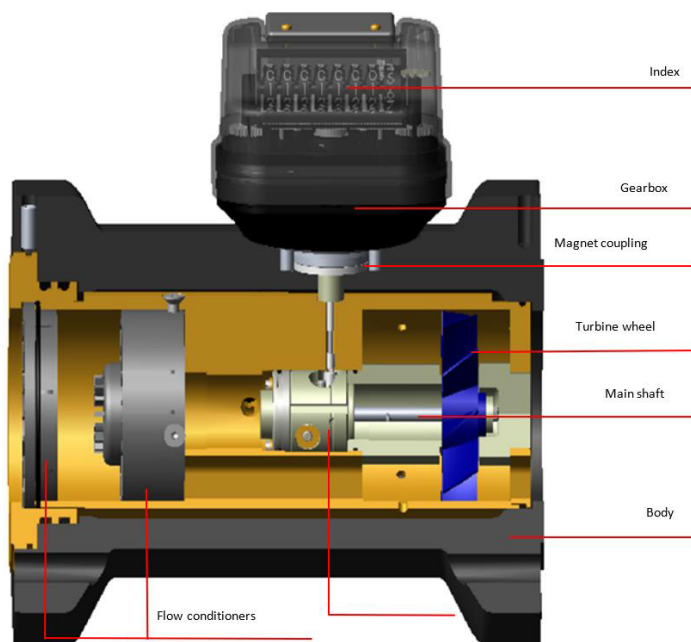


Figure 2 iM-TM CT turbine gas flow meter

Features

Meter cartridge assembly

iM-TM CT turbine meters product line extends from G40 through G4000.

Aluminium bodies are available up to 8" (20 bar) and steel bodies up to 12" (100 bar).

All sizes incorporate an innovative, removable measurement cartridge assembly.

The removable cartridge enables users to change the meter's volume capacity or perform critical maintenance by removing and installing a new cartridge.

The flexibility of the removable cartridge provides cost savings for common meter repairs, upgrades, and testing.

The removable cartridge also gives users the flexibility to design cost-effective gauging stations, especially for requirements requiring an increase in gauging capacity.

The iM-TM CT Turbine Meters is available with enhanced volumetric capacity by utilizing four different cartridge sizes for each meter body.



Figure 3 Turbine meters



Figure 4 Measuring cartridge

This feature offers modular flexibility in terms of minimum and maximum capacity, in accordance with European Standard EN 12261.

For example, the 6" turbine meter body may be ordered with a Qmax of 650 m³/h, 1000 m³/h, 1600 m³/h, or 2500 m³/h.

If flow parameters change customers can change the measurement cartridge.

This unique feature offers a distinct cost savings advantage, reducing the need to replace a complete meter or redesigning the metering station.

The cartridge and turbine wheel are machined from high quality aluminum to offer long term reliability and stability.

All cartridges are hard coated (anodized) to reduce wear and corrosion of the flow channels caused by contaminants within the gas stream.



Figure 5 Measuring cartridge



Figure 6 Turbine meter

Multifunctional index

iM-TM CT turbine meters utilize a magnetically coupled index.

A “drive” magnet couples to the “follower” magnet of the index, which in turn drives the odometer on the meter index.

The index uses an 8 digits odometer and provides direct readings in cubic meters.

The index has IP67 degree of protection.

The index can be removed or installed with just “one twist and a click”.

The magnetic coupling allows for adjustable orientation of 355° or exchange without decommissioning the meter.

A single index is adaptable to all turbine meter sizes due to the gear reduction (gear box).

The gear reduction is used to turn the drive magnet at an output ratio common to all turbine meters.

The turbine index also contains a pocket that can hold different types of Low Frequency (LF) pulse devices, such as reed switches, or fraud detection/tamper indication.



Figure 7 Turbine meter Index

Axial Load Compensation (ALC)

Since the axial load on the bearings is proportional to the density of the flowing gas, this load increases significantly when the meter operates at elevated pressures.

The iM-TM CT turbine meters reduce the axial load on bearings operating at elevated pressures with our innovative Axial Load Compensation (ALC) feature.

The Axial Load Compensation feature induces slightly higher pressure downstream of the turbine wheel, thus reducing mechanical friction on the bearings.

To further enhance bearing life we located bearings and gears upstream of the turbine wheel.

This protects bearings from contaminants, especially contaminants that tend to accumulate around the turbine wheel.

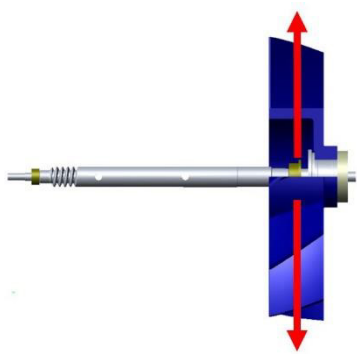


Figure 8 Bearing location

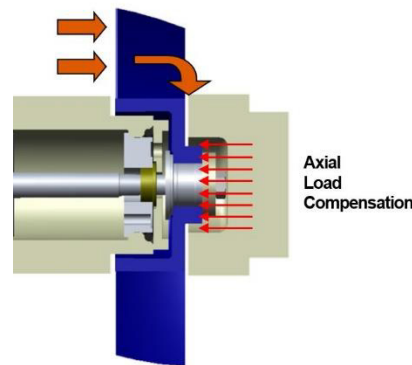


Figure 9 Axial Load Compensation

Oil refreshing & flushing lubrication system

The iM-TM CT turbine meters incorporate high quality precision bearings that should be kept clean and lubricated.

Meter performance is optimized by flushing contamination from the bearings and refreshing or adding of oil during operation.

Recommendations as to when to lubricate turbine meters varies by product design, customer procedures, and regulatory requirements.

Many regulatory agencies extend turbine meter re calibration intervals when utilizing a lubricating system.

Effective removal of dirt and dust along with oil refreshment enhances turbine meter accuracy. This is important in applications where gas quality is low.



Some gas networks have locations where flowing gas includes increased levels of dirt, entrapped liquids and other foreign materials.

For applications with inferior gas quality, conventional oil injection systems only add oil to bearings and other critical gears.

Flushing dirty oil can significantly improve bearing and gear performance.

The iM-TM CT turbine meters incorporate an inventive oil refreshing and flushing lubrication system.

During meter operation oil pumps into a reservoir in the bearing block.

A splash vane, rotating at main rotor shaft speed, lubricates all bearings, gears, and shafts. This splash vane also flushes dirty oil away from critical parts.

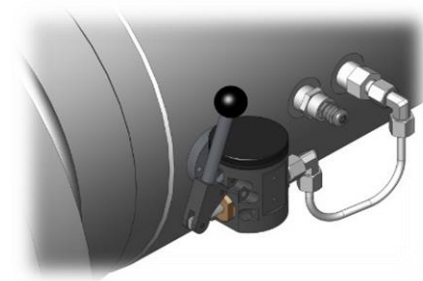


Figure 10 Oil pump

Multi stage flow conditioners

To promote superior meter accuracy, the iM-TM CT turbine meters product line features a multi stage flow conditioners with the turbine wheel positioned at the very rear end of the cartridge.

This creates twice the length for straightening the incoming flow profile as compared to conventional turbine meters.

Our integrated multi stage flow conditioner reduces the effects of high flow disturbances, complying with the European and major International directives and guidelines such as the OIML.

The pipe upstream of the turbine meter can have a minimum straight section of 2 DN.

The turbine meter design permits very compact M&R stations without sacrificing meter accuracy.

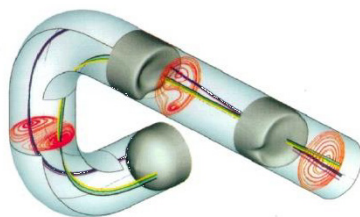


Figure 11 High flow disturbances

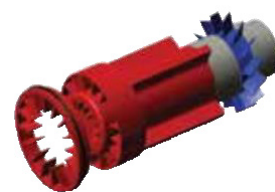


Figure 12 Flow conditioners

Calibration

The iM-TM CT turbine meters are each supplied with a calibration certificate. The initial verification and calibration are carried out at the factory on approved test benches. As an option, the turbine meters can be provided with high pressure calibration certificate.

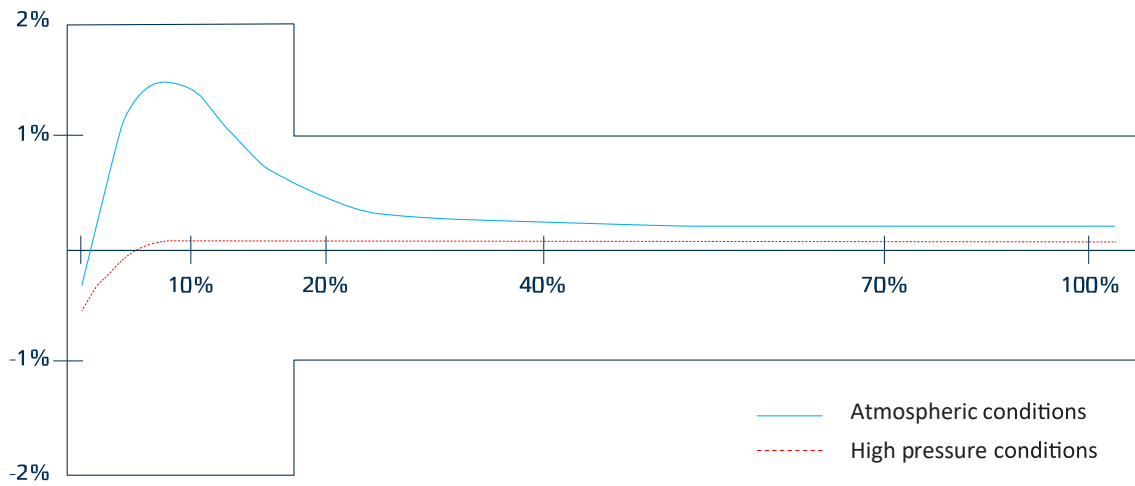


Figure 13 Typical error curve



iM-TM competitive advantages



Removable metrological cartridge assembly



Optimized bearing construction



Simplified maintenance and repair



Lightweight aluminum bodies



Biomethane compatible and 25% Hydrogen blending compatible. Higher blending available on request**



High performance aluminum alloy turbine wheel



Multi-stage integrated flow conditioners



Multi-functional Index



Axial Load Compensation (ALC)

(**) for aluminium and steel body

Features

Features	Values
Flow rates*	from 8 m ³ /h to 6500 m ³ /h from 282 cfm to 229545 cfm
Design pressure*	up to 10 MPa up to 100 barg
Ambient temperature*	from -40 °C to +65 °C from -40 °F to 145 °F
Gas temperature range*	from -25 °C to +55 °C from -13 °F to 131 °F
Accuracy	$Q_{min} \leq Q < Q_t \pm 2\%$ & $Q_t \leq Q \leq Q_{max} \pm 1\%$ (Q_t according to EN12261)
Rangeability	up to 1:20
Repeatability	better than 0.1%
Index Protection	IP 67
Applicable metrology standards	MID 2014/32/EU
Index & pulse out	<ul style="list-style-type: none"> 8 digits 2x low frequency pulse out (NO reed contact) 1x anti fraude out (NC reed contact)
Hazardous area certification	ATEX II 2 G Ex h IIB T6 Gb
Accessories	<ul style="list-style-type: none"> optical encoder index high frequency sensors
Nominal dimensions DN	Aluminium body from DN 50 to DN 200 Carbon steel body from DN 50 to DN 300
Connections*	ANSI 150/300/600 according to ASME B16.5 From PN 16 to PN100 according to EN 1092-1

(*) REMARK: Different functional features and/or extended temperature ranges available on request. Stated temperature ranges are the maximum for which the equipment's full performance, including accuracy, are fulfilled. Standard product may have a narrower range.

Table 1 Features

Materials and Approvals

Part	Material
Body	hard anodized aluminium alloy or carbon steel
Rotor	aluminium alloy
Shaft & Bearings	stainless steel
Gears	Technopolymer
Index enclosure	UV resistant polycarbonate case suitable for outdoor installation

REMARK: The materials indicated above refer to the standard models. Different materials can be provided according to specific needs.

Table 2 Materials

Construction Standards and Approvals

iM-TM turbine meters is designed to meet EN 12261 requirements.



EN 12261

The product is certified according to European Directive 2014/68/EU (PED), 2014/32/EU (MID), 2014/34/EU (ATEX).



PED



MID



ATEX

Capacity table

Available sizes nominal operating conditions (metric units)									
Model	Qmax	Qmin	Range	DN	PN	Length	Weight	LF impulses	Series
	m ³ /h	m ³ /h	max			mm	Kg	Imp. /m ³	
G40	65	13	1:5	50	PN 16 or ANSI 150	150	5.5	10	QUANTOMETERS Aluminium body
G65	100	10	1:10					1	
G100	160	16	1:10					80	
G100	160	16	1:10						
G160	250	25	1:10						
G250	400	20	1:20	100	PN 16 or ANSI 150	150	8.2	1	
G400	650	32	1:20						
G160	250	25	1:10						
G250	400	20	1:20	150	PN 16 or ANSI 150	150	8.2	1	
G400	650	32	1:20						
G650	1000	50	1:20						
G40	65	13	1:5	50	PN 16 or ANSI 150	150	5.5	10	CUSTODY TRANSFER Aluminium body
G65	100	5	1:20					1	
G100	160	8	1:20					80	
G100	160	8	1:20						
G160	250	13	1:20						
G250	400	20	1:20	100	PN 16 or ANSI 150	300	15	1	
G400	650	32	1:20						
G160	250	13	1:20						
G250	400	20	1:20	150	PN 16 or ANSI 150	450	30	1	
G400	650	32	1:20					0.1	
G650	1000	50	1:20						
G1000	1600	80	1:20	200	PN 16 or ANSI 150	600	57	1	
G1600	2500	130	1:20					0.1	
G650	1000	50	1:20						
G1000	1600	80	1:20	250	From PN16 to ANSI 600	750	75	1	CUSTODY TRANSFER Steel body
G1600	2500	130	1:20					0.1	
G2500	4000	200	1:20						
G40	65	13	1:5	50	From PN16 to ANSI 600	150	Depending of PN or Class designation	10	
G65	100	5	1:20					1	
G100	160	8	1:20					80	
G100	160	8	1:20						
G160	250	13	1:20						
G250	400	20	1:20	100	From PN16 to ANSI 600	300	Depending of PN or Class designation	1	
G400	650	32	1:20						
G160	250	13	1:20						
G250	400	20	1:20	150	From PN16 to ANSI 600	450	Depending of PN or Class designation	1	
G400	650	32	1:20					0.1	
G650	1000	50	1:20						
G1000	1600	80	1:20	200	From PN16 to ANSI 600	600	Depending of PN or Class designation	1	
G1600	2500	130	1:20					0.1	
G650	1000	50	1:20						
G1000	1600	80	1:20	250	From PN16 to ANSI 600	750	Depending of PN or Class designation	1	
G1600	2500	130	1:20					0.1	
G2500	4000	200	1:20						
G1600	2500	130	1:20	300	From PN16 to ANSI 600	900	Depending of PN or Class designation	1	
G2500	4000	200	1:20					0.1	
G4000	6500	320	1:20						

Table 3 Capacity and rangeability table (metric units)

Available sizes | nominal operating conditions (imperial units)

Model	Qmax	Qmin	Range	DN	PN	Length	Weight	LF impulses	Series
	cuft/h	cuft/h	max					inches	
G40	2295	459	1:5	2"	PN 16 or ANSI 150	5.9"	12	10	QUANTOMETERS Aluminium body
G65	3531	353	1:10					1	
G100	5650	565	1:10					3"	
G100	5650	565	1:10						
G160	8829	883	1:10	4"	PN 16 or ANSI 150	5.9"	18		
G250	14126	706	1:20						
G400	22955	1130	1:20					2"	
G160	8829	883	1:10	1					
G250	14126	706	1:20	3"	PN 16 or ANSI 150	9.4"	26		
G400	22955	1130	1:20						
G160	8829	459	1:20					4"	
G250	14126	706	1:20						
G400	22955	1130	1:20	6"	PN 16 or ANSI 150	17.7	66		1
G650	35315	1766	1:20					0.1	
G400	22955	1130	1:20					8"	PN 16 or ANSI 150
G650	35315	1766	1:20	0.1					
G1000	56504	2825	1:20	10"	From PN16 to ANSI 600	29.5	0.1		
G1600	88287	4591	1:20						
G650	35315	1766	1:20					12"	From PN16 to ANSI 600
G1000	56504	2825	1:20						
G1600	88287	4591	1:20						
G400	22955	1130	1:20	2"	From PN16 to ANSI 600	5.9"	5.9"	10	
G65	3531	177	1:20					1	
G100	5650	283	1:20					3"	From PN16 to ANSI 600
G100	5650	283	1:20						
G160	8829	459	1:20	4"	From PN16 to ANSI 600	11.8	11.8		
G250	14126	706	1:20						
G400	22955	1130	1:20					6"	From PN16 to ANSI 600
G160	8829	459	1:20	0.1					
G250	14126	706	1:20	8"	From PN16 to ANSI 600	23.6	23.6		
G400	22955	1130	1:20					0.1	
G650	35315	1766	1:20					10"	From PN16 to ANSI 600
G400	22955	1130	1:20	0.1					
G650	35315	1766	1:20	12"	From PN16 to ANSI 600	35.4	35.4		
G1000	56504	2825	1:20					0.1	
G1600	88287	4591	1:20					0.1	
G1000	56504	2825	1:20	10"	From PN16 to ANSI 600	29.5	29.5	1	
G1600	88287	4591	1:20					0.1	
G2500	141259	7063	1:20					12"	From PN16 to ANSI 600
G1600	88287	4591	1:20	0.1					
G2500	141259	7063	1:20	0.1					
G4000	229546	11301	1:20	10"	From PN16 to ANSI 600	29.5	29.5	1	
G1600	88287	4591	1:20					0.1	
G2500	141259	7063	1:20					0.1	

Table 4 Capacity and rangeability table (imperial units)



Accessories

Optical encoder index

For applications requiring serial communication, the turbine index is available with an encoder.

The encoder uses three optical sensors to detect light passing through a specially designed slotted disc rotating within the index.

The light detected passing through the disc is converted to a numeric value using Gray Code.

The system offers high resolution and allows for instant flow calculation.



Figure 14 Optical ecoder index

High Frequency sensor

Turbine meters can be provided with a HF (High Frequency) sensor.

The HF sensor can also be installed into the meter at a later time without having to remove the meter or the cartridge from the installation.

The sensor is designed and approved in accordance with ATEX.

The generated output signal complies with EN 60947 5 6/NAMUR.

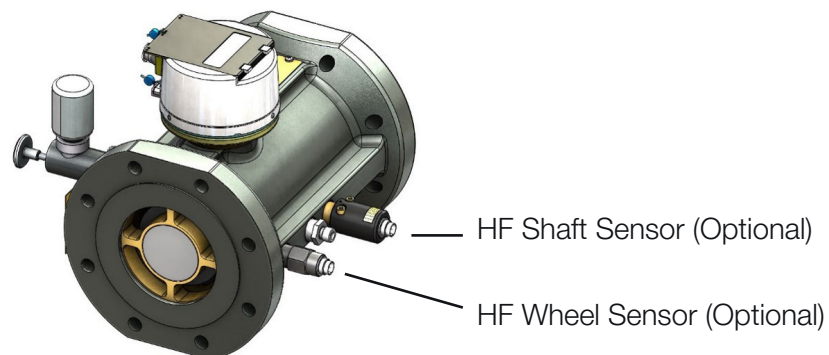


Figure 15 High Frequency sensor

Weights and Dimensions

iM-TM Steel body

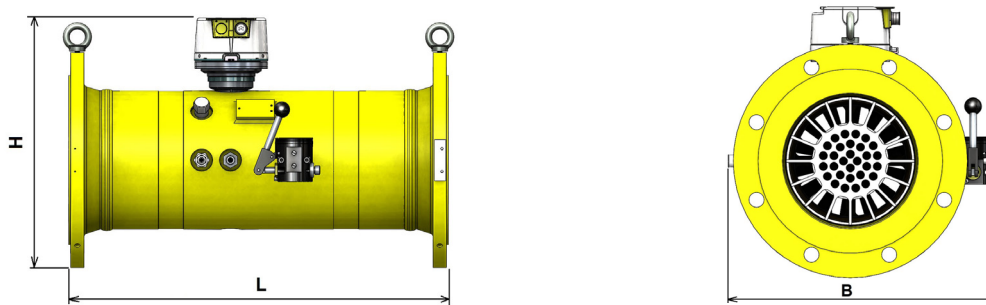


Figure 16 iM-TM steel body dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)											
CT Series (Custody Transfer) steel body											
Dimension (DN)		Class		L ± 5 mm		B ± 10 mm		H ± 10 mm		Weight	
		PN	ANSI	[mm]	inches	[mm]	inches	[mm]	inches	Kg	lbs
50	2"	16	150	150	5.9"	310	12.2"	250	9.8"	20	44"
		64	300	150	5.9"	310	12.2"	260	10.2"	20	44"
		100	600	150	5.9"	310	12.2"	260	10.2"	20	44"
80	3"	16	150	240	9.4"	330	13.0"	260	10.2"	30	66"
		64	300	240	9.4"	330	13.0"	300	11.8"	41	90"
		100	600	240	9.4"	330	13.0"	300	11.8"	43	95"
100	4"	16	150	300	11.8"	360	14.2"	285	11.2"	49	108"
		64	300	300	11.8"	345	13.6"	315	12.4"	52	115"
		100	600	300	11.8"	420	16.5"	330	13.0"	55	121"
150	6"	16	150	450	17.7"	410	16.1"	350	13.8"	82	181"
		64	300	450	17.7"	410	16.1"	375	14.8"	95	209"
		100	600	450	17.7"	440	17.3"	390	15.4"	112	247"
200	8"	16	150	600	23.6"	380	15.0"	395	15.6"	88	194"
		64	300	600	23.6"	400	15.7"	420	16.5"	113	249"
		100	600	600	23.6"	420	16.5"	440	17.3"	160	353"
250	10"	16	150	750	29.5"	445	17.5"	455	17.9"	138	304"
		64	300	750	29.5"	470	18.5"	480	18.9"	172	379"
		100	600	750	29.5"	510	20.1"	510	20.1"	245	540"
300	12"	16	150	900	35.4"	500	19.7"	515	20.3"	180	397"
		64	300	900	35.4"	530	20.9"	540	21.3"	300	661"
		100	600	900	35.4"	560	22.0"	560	22.0"	328	723"

Table 5 Weights and dimensions



iM-TM aluminium body dimensions

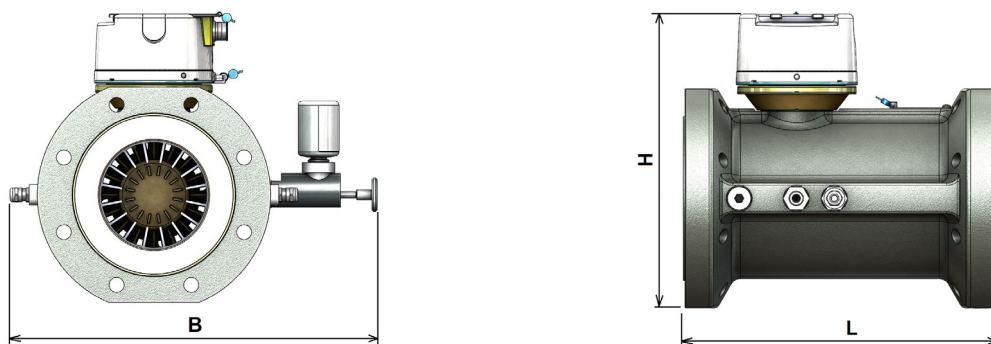


Figure 17 iM-TM aluminium body dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)

Q Series (quantometers) aluminium body PN 16 & ANSI 150

Dimension (DN)		L ± 5 mm		B ± 10 mm		H ± 10 mm		F min		Weight	
		[mm]	inches	[mm]	inches	[mm]	inches	[mm]	inches	Kg	lbs
50	2"	150	5.9	307	12.1	240	9.4	35	1.4	35	77
80	3"	120	4.7	330	13.0	270	10.6	40	1.6	40	88
100	4"	150	5.9	360	14.2	300	11.8	40	1.6	40	88

Table 6 Weights and dimensions

Weights and Dimensions (for other connections please contact your closest Pietro Fiorentini representative)

CT Series (Custody Transfer) aluminum body PN 16 & ANSI 150

Dimension (DN)		L ± 5 mm		B ± 10 mm		H ± 10 mm		F min		Weight	
		[mm]	inches	[mm]	inches	[mm]	inches	[mm]	inches	Kg	lbs
50	2"	150	5.9	307	12.1	240	9.4	35	1.4	5.5	12
80	3"	240	9.4	330	13.0	270	10.6	40	1.6	12	26
100	4"	300	11.8	360	14.2	300	11.8	40	1.6	15	33
150	6"	450	17.7	410	16.1	360	14.2	45	1.8	30	66
200	8"	600	23.6	470	18.5	390	15.4	55	2.2	57	126

Table 7 Weights and dimensions



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