English Version

OMEGA VI

ROTARY GAS METER

Installation, Operation and Maintenance Manual (IOM)

vemm tec
Messtechnik GmbH

MANAGEMENT SYSTEM CERTIFICATION
DNV·GL
ISO 9001 = ISO 14001

Installation, Operation and Maintenance Manual (IOM)

CONTENTS

LIST OF FIGURES

LIST OF FORMULAS

LIST OF TABLES

1 INTRODUCTION

1.1 Dear customer

Congratulations with your purchase of a high quality measurement device, the OMEGA VI Rotary Gas Meter. To take full advantage of the potential of your metering equipment we advise you to thoroughly read this manual and follow the recommendations and warnings.

This manual makes recommendations to enable you to obtain high accurate metering results and prescribes the handling, installation and maintenance of your rotary meter. It is very important that you follow the safety recommendations at installation, hook up, and the maintenance guidelines. This document also contains the unit dimensions and operational ranges and describes performance, calibration and outputs of the instrument.
vemm tec Messtechnik GmbH is certified according to ISO 9001:2008 and ISO 14001:2004.

1.2 Notice

vemm tec Messtechnik GmbH ("***vemm tec***") shall not be liable for technical or editorial errors in this manual or omissions from this manual. ***vemm tec*** makes no warranties, express or implied, including the implied warranties of merchantability and fitness for a particular purpose with respect to this manual and, in no event, shall vemm tec be liable for any special or consequential damages including, but not limited to, loss of production, loss of profits, etc.

Product names used herein are for manufacturer or supplier identification only and may be trademarks/registered trademarks of these companies.

1.3 Brief description

The ***vemm tec*** OMEGA VI Rotary Gas Meter is designed in accordance with all major international standards. The approval for custody transfer in the European Community (according to the MID directive is granted under number MID DE-13-MI002-PTB005; other approvals are available. The meter is used for high-accuracy applications and measurements where a large rangeability is required.

The OMEGA VI is a positive displacement meter for volume and flow rate measurement with a mechanical counter and electronic pulse outputs. It is suited for measurement of clean, dry, non-corrosive gases like natural gas, propane, butane, air, nitrogen, and many others. The gas must be dry and filtered. A filter and sieve needs to be applied just before the meter at least during the first weeks of operation.

1.4 Parts and documents supplied with the OMEGA VI

Your package contains:
- OMEGA VI – Rotary Gas Meter
- Bottle with lubricant for initial lubrication
- Male connectors (depending on your order. Male plugs are delivered unassembled for connection on site)
- Copies of calibration documents (if applicable)
- Copies of pressure test documents (if applicable)
- "Installation, Operation and Maintenance Manual" (this manual)

The complete original certificates as ordered will be shipped separately. If applicable (and if ordered) the documents supplied are:
- Inspection Certificate EN 10204 - 3.1
- Pressure test certificates (hydro test and air seal test)
- Verification certificate
- Certificate of Conformity
- Calibration results (data and error curve)
- High pressure calibration certificate
- CE Deklaration of conformity

- Material certificates
- Others on request

Each shipment is checked for completeness and released by Quality Assurance Staff prior to shipment.
You should check the meter and accessories by means of the order acknowledgement and the delivery note for completeness and for any damages caused during transport. Please immediately contact your sales agent, if the goods are incomplete or damaged.

1.5 Instructions for transportation, storage, and conservation

CAUTION:
- **A rotary meter is a high precision instrument; it must be handled with care.**
- **Never use the index head to lift the meter.**
- **During storage as well as during transport, mounting, and operation, the axis of the rotors must always be in horizontal position.**
- **Before dismantling for transport, the lubrication oil must be drained off from the oil reservoir.**
- **Lubrication of the meter may only be performed after the meter has been installed.**

Before each transport – even for small movements – and for changing the flow direction, the lubrication oil must be removed. The meter is supplied **without** lubrication oil in the reservoir(s) for transport, but oil for initial lubrication is delivered in a bottle.

Never use the index (counter) head of your OMEGA VI as a handle bar or lifting handle. The counter head is a delicate part with many shafts and gears that may be damaged with inappropriate handling. Improper use may cause inaccurate measurements.

The meter should only be lifted with straps or with lifting lugs. Lifting lugs are provided at the DN80 and DN100 models. During transport beware of shocks. The rotor axis must always be in horizontal position.

Each meter is delivered with plastic covers on the inlet and outlet flanges to protect against dirt, solid particles or water. The flanges should be covered again before any further transportation.

vemm tec suggests storing the OMEGA VI in the original packing with protective inlays to avoid damage during storage. OMEGA VI rotary gas meters must be stored in a non-condensing atmosphere in a temperature range from -40 to +70 °C. The flanges must be covered during storage. If a meter is stored for more than 3 months or under alternative conditions, the meter needs to be conserved properly.

vemm tec suggests keeping in store the original crating/packing of your OMEGA VI for later use.

Please use the original crating/packing and fixing materials to secure your OMEGA VI during all further transports, and to avoid damage during transport.

1.6 Principle of operation

The OMEGA VI rotary gas meter measures the quantity of a flowing gas at actual gas pressure and actual gas temperature, i.e. at measurement conditions. The metering principle of OMEGA VI is displacement of the metering chamber content by two specially shaped rotors. The rotation of the rotors is transferred to a mechanical counter and accumulated as volume at measurement conditions. In addition volume and flow proportional electronic pulses are generated for registration and/or for volume conversion to base conditions with a conversion device.

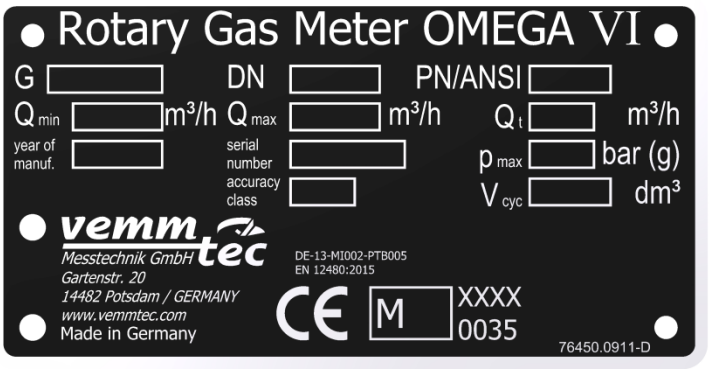
The OMEGA VI has two identicalal, lob shaped rotors that roll off on each without ever touching, inside the housing. A very small differential pressure of 0.02 mbar is sufficient to start the rotors and the meter. The performance of the meter is constant over years, because there is no wear on the moving parts in the measuring chamber. The rotors alternating seal the two measurement chambers and they have so called dirt tracks. The use of dirt tracks allows small dirt particles to pass the meter without blocking the rotors. The bearings and gears of the meter are permanently lubricated by an oil mist.

The DN50 (2”) meters have 1 oil reservoir at the front (counter site), the DN80 (3”) and DN100 (4”) models have 2 oil reservoirs; one at the front and one at the rear.
The body housing is made of ductile iron (EN-GJS-400-18-LT); the side casings of aluminium (AlSi7Mg0.3). These rigid body materials are sufficient to allow pressures up to 20 bar (o) (2000 kPa), a temperature stability during operation and good noise dampening effects.

1.7 Nameplate details

Your meter is equipped with a main label. Figure 1 shows the English version. Alternatively, labels are available in German or other languages. The label contains information such as size, pressure rating and flow rate, valid for this meter. Please refer to Table 15 to check size and G-rating. Flange ratings and maximum operating pressures are listed in Table 6. Only use the meter in the indicated ranges for flow, pressure and temperature.

Figure 1: Name plate (Examples English version)



1.8 Documentation

1.8.1 Approvals

The OMEGA VI was specifically designed to be in accordance with relevant international standards. Please refer to Table 8 for a list of technical standards, rules and guidelines.

If your meter was ordered to be in accordance with a specific (country) approval the main label should be in accordance with that approval. Refer to Table 9 for available approvals. If no specific approval was specified at the time of order, the standard label in English language will be applied.

1.8.2 Inspection certificate EN 10204 - 3.1

Every meter can be delivered with a single sheet “Inspection Certificate EN 10204 - 3.1” (Figure 2)

As an option, you may have ordered the complete Material Certification Package 3.1, containing:
- “Hydro Test Protocol” and “Air Seal Test Protocol”
- Material certificates of pressure containing parts

Additional certification must be ordered separately, for example: other non-destructive test reports or third party inspection certificates.

1.8.3 Hydro test and air seal test

Every OMEGA VI is pressure tested in accordance with the pressure class of the flanges and with the appropriate standards and customer requirements. Flange ratings and maximum operating pressures of the OMEGA VI are mentioned in Table 6.

- Hydro test of the meter housing at 2 x maximum operating pressure (MOP).
- Air seal test of the completely assembled meter at 1.1 x maximum operating pressure

Certificates of these tests are included in the optional 3.1. Material Certification Package (This must be requested at the time of your order.)

1.8.4 Verification and calibration

Your OMEGA VI was calibrated with the standard flow range (as mentioned in Table 15), or with another flow range according to local regulations or a flow range on your request.

Gas flow meters for custody transfer purposes used in EC each need verification under the regulations of the EC Measuring Instruments Directive (MID): 2014/32/EU. Such verification will be performed at our accredited test centre for gas meters. The master meters and sensors of our calibration installations are traceable to the German metrology authorities PTB. Alternatively the verification may be performed by a notified body under Module F.

A factory calibration with air at ambient conditions can be performed at above mentioned calibration facility. The ***vemm tec*** "Certificate of Conformity" proves that the meter has been tested and complies with the stated error limits.

In both cases (verification or factory calibration) a two page annex with the measured data and curve can be issued at additional cost.

Each OMEGA VI has been flow tested, quality checked, and sealed.

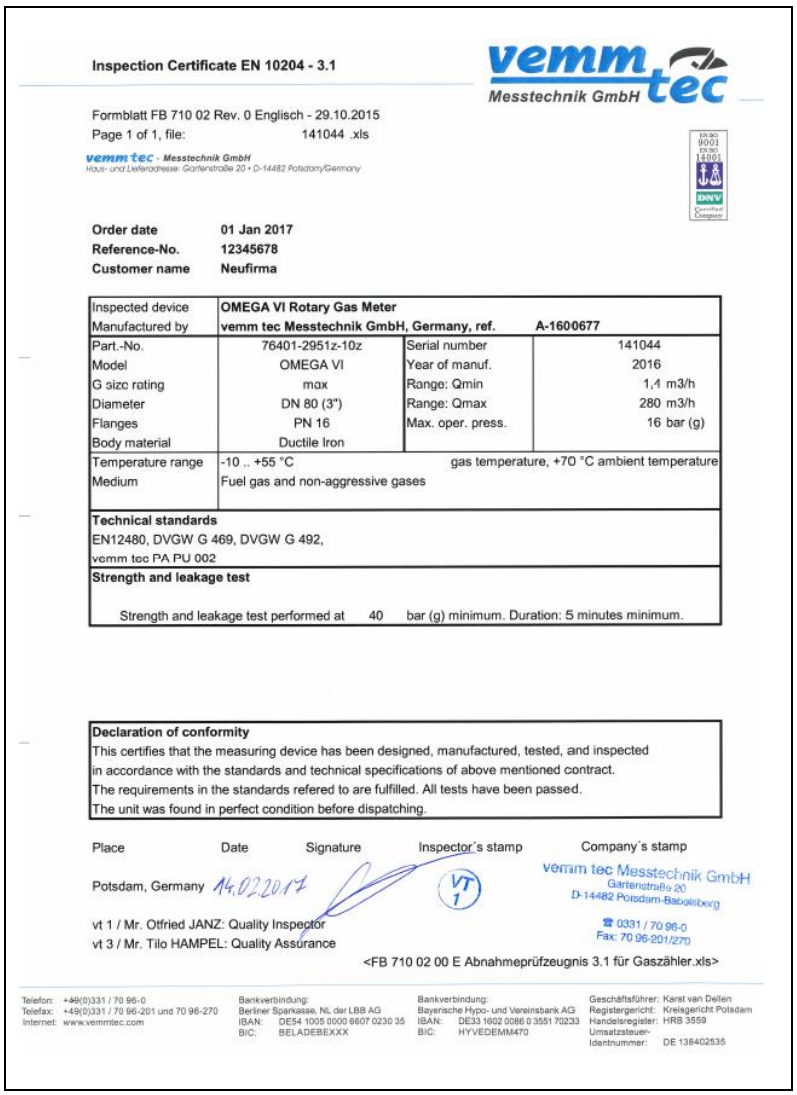
- After verification, the meter is sealed.
- If the meter is factory calibrated, it is sealed with factory seals.

* Please verify that all seals are present before mounting the meter in the pipeline (refer to Figure 14, Figure 15 and Figure 16, for seal locations). If any of the seals are broken, removed or damaged, the meter may not be used for custody transfer measurements in most countries. The seals must not be painted. Your warranty will become void, if any lead seal with the original stamp is damaged.

OMEGA VI rotary gas meters may be operated at elevated pressures without the necessity of a high pressure calibration. However if a client wants a high pressure calibration can be arranged at the vemm tec high pressure test facility or at external high pressure test facilities, such as PIGSAR, Dorsten (Germany), EnBW, Stuttgart (Germany) or FORCE, Vejen (Denmark). Most of these facilities are approved for verifications in the EC. Please enquire for more information.

Sample Certificates

Figure 2: Inspection certificate EN 10204 – 3.1 (example)



Inspection Certificate EN 10204 - 3.1

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Formblatt FB 710 02 Rev. 0 Englisch - 29.10.2015
Page 1 of 1, file: 141044 .xls

vemm tec - Messtechnik GmbH
Haus- und Lieferadresse: Gartenstraße 20 • D-14482 Potsdam/Germany

Order date 01 Jan 2017
Reference-No. 12345678
Customer name Neufirma

Inspected device	**OMEGA VI Rotary Gas Meter**		
Manufactured by	**vemm tec Messtechnik GmbH, Germany, ref.**		**A-1600677**
Part.-No.	76401-2951z-10z	Serial number	141044
Model	OMEGA VI	Year of manuf.	2016
G size rating	max	Range: Qmin	1,4 m3/h
Diameter	DN 80 (3")	Range: Qmax	280 m3/h
Flanges	PN 16	Max. oper. press.	16 bar (g)
Body material	Ductile Iron		
Temperature range	-10 .. +55 °C	gas temperature, +70 °C ambient temperature	
Medium	Fuel gas and non-aggressive gases		

Technical standards
EN12480, DVGW G 469, DVGW G 492,
vemm tec PA PU 002

Strength and leakage test

Strength and leakage test performed at 40 bar (g) minimum. Duration: 5 minutes minimum.

Declaration of conformity
This certifies that the measuring device has been designed, manufactured, tested, and inspected in accordance with the standards and technical specifications of above mentioned contract.
The requirements in the standards refered to are fulfilled. All tests have been passed.
The unit was found in perfect condition before dispatching.

Place	Date	Signature	Inspector´s stamp	Company´s stamp
Potsdam, Germany	14.02.2017		VT 1	vemm tec Messtechnik GmbH Gartenstraße 20 D-14482 Potsdam-Babelsberg ☎ 0331 / 70 96-0 Fax: 70 96-201/270

vt 1 / Mr. Otfried JANZ: Quality Inspector
vt 3 / Mr. Tilo HAMPEL: Quality Assurance

<FB 710 02 00 E Abnahmeprüfzeugnis 3.1 für Gaszähler.xls>

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Telefax: +49(0)331 / 70 96-201 und 70 96-270
Internet: www.vemmtec.com

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Berliner Sparkasse, NL der LBB AG
IBAN: DE54 1005 0000 6607 0230 35
BIC: BELADEBEXXX

Bankverbindung:
Bayerische Hypo- und Vereinsbank AG
IBAN: DE33 1602 0086 0 3551 70233
BIC: HYVEDEMM470

Geschäftsführer: Karst van Dellen
Registergericht: Kreisgericht Potsdam
Handelsregister: HRB 3559
Umsatzsteuer-Identnummer: DE 138402535

Figure 3: Calibration certificate (example), performed with air at ambient conditions

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Calibration facility for gas measurement equipment with ambient air

THE STANDARDS USED FOR MEASUREMENTS ARE TRACEABLE TO THE NATIONAL STANDARDS OF THE FEDERAL REPUBLIC OF GERMANY AT THE PHYSIKALISCH-TECHNISCHE BUNDESANSTALT (PTB):

Calibration Certificate

Type:	Omega VI	**Size:**	DN 50 (2")	
Sales Order:		**Pressure Rating:**	PN 16	
Serial Number:	141008	**Flow Rating:**	Gmax	
Approval Number:	DE-13-MI002-PTB005	**Qmin:**	0,75	[m³/h]
Year of Manufacture:	2016	**Qmax:**	120,00	[m³/h]
Normalisation Wheels:	32/40	**k-factor (HF1):**	--	[imp/m³]
Customer:		**k-factor (HF2):**	--	[imp/m³]
		k-factor (HF3):	--	[imp/m³]
Manufacturer:	vemm tec	**k-factor (HF4):**	--	[imp/m³]
Test Date:	17.11.2016	**k-factor (1R1):**	10,0000	[imp/m³]
Calibrator:	Büchner	**k-factor (2R1):**	--	[imp/m³]
		Error Limits:		
		Qmax >= Q >= Qt:	+/- 1,00	[%]
		Qt > Q >= Qmin:	+/- 2,00	[%]
		Qt:	12.000	[m³/h]

Potsdam, 17.11.2016

Signature

vemm tec Messtechnik GmbH
Gartenstraße 20
D-14482 Potsdam-Babelsberg
Stamp
☎ 0331 / 70 96-0
Fax: 70 96-201 / 270

Certificate number: 0004103 Page: 1

Not valid without signature and stamp. No changes and modifications allowed without permission of certified personnel.

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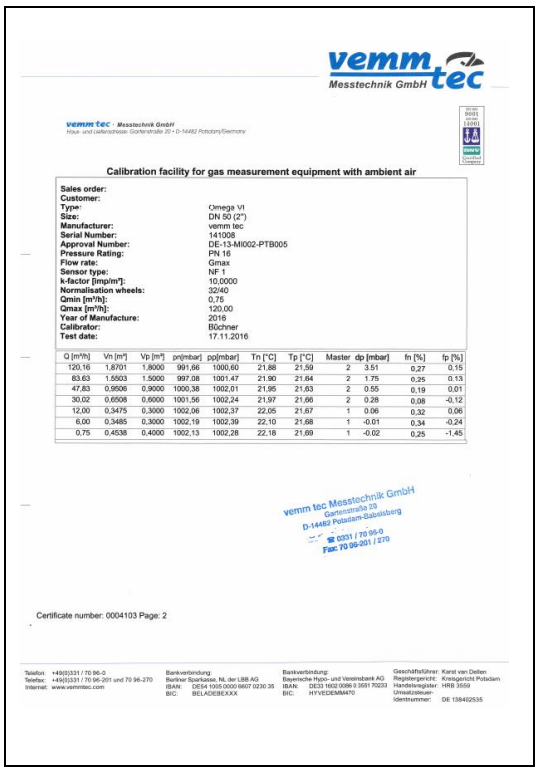

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Calibration facility for gas measurement equipment with ambient air

Sales order:	
Customer:	
Type:	Omega VI
Size:	DN 50 (2")
Manufacturer:	vemm tec
Serial Number:	141008
Approval Number:	DE-13-MI002-PTB005
Pressure Rating:	PN 16
Flow rate:	Gmax
Sensor type:	NF 1
k-factor [imp/m³]:	10,0000
Normalisation wheels:	32/40
Qmin [m³/h]:	0,75
Qmax [m³/h]:	120,00
Year of Manufacture:	2016
Calibrator:	Büchner
Test date:	17.11.2016

Q [m³/h]	Vn [m³]	Vp [m³]	pn[mbar]	pp[mbar]	Tn [°C]	Tp [°C]	Master	dp [mbar]	fn [%]	fp [%]
120,16	1,8701	1,8000	991,66	1000,60	21,88	21,59	2	3,51	0,27	0,15
83,63	1,5503	1,5000	997,08	1001,47	21,90	21,64	2	1,75	0,25	0,13
47,83	0,9506	0,9000	1000,38	1002,01	21,95	21,63	2	0,55	0,19	0,01
30,02	0,6508	0,6000	1001,56	1002,24	21,97	21,66	2	0,28	0,08	-0,12
12,00	0,3475	0,3000	1002,06	1002,37	22,05	21,67	1	0,06	0,32	0,06
6,00	0,3485	0,3000	1002,19	1002,39	22,10	21,68	1	-0,01	0,34	-0,24
0,75	0,4538	0,4000	1002,13	1002,28	22,18	21,69	1	-0,02	0,25	-1,45

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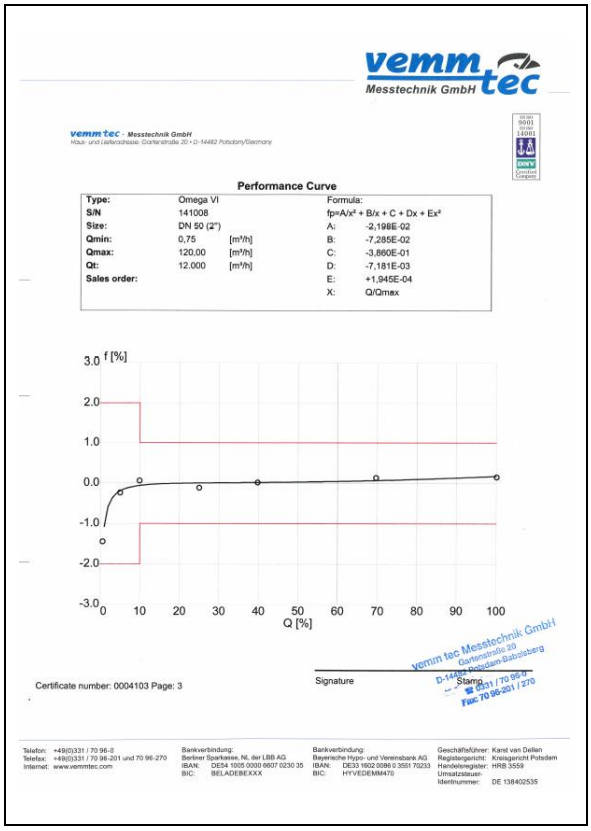

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Performance Curve

Type:	Omega VI	Formula:	
S/N	141008		$fp=A/x^4 + B/x + C + Dx + Ex^4$
Size:	DN 50 (2")	A:	-2,198E-02
Qmin:	0,75 [m³/h]	B:	-7,285E-02
Qmax:	120,00 [m³/h]	C:	-3,860E-01
Qt:	12,000 [m³/h]	D:	-7,181E-03
Sales order:		E:	+1,945E-04
		X:	Q/Qmax

Certificate number: 0004103 Page: 3

Signature

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Umsatzsteuer-Identnummer: DE 138402535

2 INSTALLATION

2.1 Safety instructions and warnings: See back page

2.2 Instructions specific to the EC Pressure Equipment Directive (PED)

This chapter identifies specific installation and operation instructions necessary to ensure compliance with the Essential Safety Requirements (ESR) of the European Economic Area Pressure Equipment Directive (PED) 2014/68/EU.
The applicable (PED) certificates are issued by TÜV Rheinland under number: 01 202 610 Q 07 0001 (for Mudule D) and DVGW Product Identification No. CE-0085CO0170 (for module B).

This document applies to OMEGA VI Rotary Gas Meters manufactured by ***vemm tec*** Messtechnik GmbH (Potsdam, Germany).

vemm tec Messtechnik GmbH's OMEGA VI are supplied as components to be installed in the end users gas system. It is therefore the responsibility of the end user to ensure compliance with the requirements of the directive and regulations quoted in this section. Guidance for compliance of the relevant Essential Safety Requirements of the Pressure Equipment Directive 2014/68/EU is given below.

Table 1: Essential Safety Requirements (ESR) of the Pressure Equipment Directive (PED)
(Part 1, continued on next page)

PED ESR Ref.	**Essential Safety Requirements (ESR)**	**Compliance Requirement**
2.3	**Provisions to ensure safe handling and operation.** The method of operation specified for pressure equipment must be such as to preclude any reasonably foreseen risk in operation of the equipment. Particular attention must be paid, where appropriate to the following.	
	Closures & openings	During removal and replacement of any parts such as the index head, the lubrication system, high frequency sensors or thermo-wells the end user shall ensure that the meter has been properly isolated and the internal pressure has been safely vented.
	Devices to prevent physical access whilst pressure or a vacuum exists	The end user shall ensure that the OMEGA VI is installed in a properly designed system with access limitation in place if required.
	Surface temperature.	It is the responsibility of the end user to assess the expected surface temperature in service and, if necessary, take precautions to avoid personnel coming into contact with the equipment.
	Decomposition of unstable fluids	It is not envisaged that, for the designed service, the equipment shall come into contact with unstable fluids; however the end user should assess the risk and take any steps considered necessary.

Table 1: Essential Safety Requirements (ESR) of the Pressure Equipment Directive (PED) (Part 2)

2.4	**Means of examination** Pressure equipment must be designed and constructed so that all necessary examinations to ensure safety can be carried out.	For the examination of all pressure containing parts of the OMEGA VI the meter needs to be removed from the line. It is the responsibility of the end user to ensure that the internal pressure has been safely vented before the meter is removed from the line. It is also the responsibility of the end user to use suitable tools and that the employees performing the removal are well trained in assembling and disassembling high pressure gas lines and related equipment. The end user should refer to this "Installation, Operation and Maintenance Manual" supplied with each meter. It is not considered that the process medium for which the equipment is designed will give rise to severe corrosion/erosion problems. It is the end user's responsibility to monitor any change in the process medium that may cause concern.
2.5	**Means of draining and venting** Harmful effects such as vacuum collapse, corrosion and uncontrolled chemical reactions must be avoided.	It is the responsibility of the end user to ensure that the equipment is installed in a well-designed piping system to avoid such hazards.
2.6	**Corrosion or other chemical attack**	It is not considered that the process medium for which the equipment is designed will give rise to severe corrosion problems. It is the end user's responsibility to monitor any change in the process medium that may cause concern.
2.7	**Wear**	It is not considered that the use of the OMEGA VI for fluid metering will give rise to any abnormal wear problems. It is the responsibility of the end user to install any necessary filtration upstream of the OMEGA VI to maintain the condition of the process medium and to take care that no moisture or particles larger than 10 µm can enter the meter.
2.10	**Protection against exceeding the allowable limits of the pressure equipment**	The OMEGA VI must be installed in a well-designed piping system with adequate protection against excessive pressure.
2.12	**External fire**	The OMEGA VI has no special accessories for fire damage limitation. It is the responsibility of the end user to provide adequate fire fighting facilities on site.
7.3	**Pressure limiting devices, particularly for pressure vessels**	The OMEGA VI is not a pressure vessel and has no integral pressure limiting devices. It is the responsibility of the end user to ensure that the OMEGA VI is installed in a well-designed system so that momentary pressure surges are limited to fewer than 10 % of the OMEGA VI's maximum operating pressure.

2.3 Installation

Your OMEGA VI is a high precision metering instrument that can only perform efficiently when the installation guidelines are followed.

NOTE: Install the meter preferably indoors. If installed outdoors, it is recommended to protect the meter from direct sunlight and rain.

Table 2: Mounting equipment for installation in the piping

Diameter [mm] [Inch]	Connecting elements to be used per meter PN 10 / 16	Connecting elements to be used per meter ANSI 150#
DN 50 (2”)	8 stud bolts: M16 x 70 mm	8 stud bolts: 5/8” 10 UNC x 2.5”
DN 80 (3“)	16 stud bolts: M16 x 70 mm	8 stud bolts: 5/8” 10 UNC x 2.5”
DN 100 (4“)	16 stud bolts: M16 x 70 mm	16 stud bolts: 5/8” 10 UNC x 3”

Always use new gaskets of non-brittle material of the proper size and pressure rating for installation. Carefully remove inlet and outlet covers completely and take care that no any particles fall into the meter. Flanges should be cleaned before installation and be free of clinging materials. Gaskets should not protrude into the pipe.

The pipe flanges and the meter flanges must be parallel to each other. Please account for the thickness of the gaskets when sizing and installing the meter. For long piping sections leading into or from the meter expansion joints or expansion curves should be considered. This is to prevent extreme stresses to work on the meter body. **The meter must be installed free of piping induced tension.**

The level mounting of the meter must be checked. (For the best performance use a level gauge.) The axis of the rotors must always be in horizontal position. That means, the **counter head is at the side**, never at the top or at the bottom of the meter. This also applies during transport of the meter.

For the DN80 (3”) and DN100 (4”) models, please allow enough distance at the rear end of the gas meter for servicing (change of the oil). The DN50 (2”) model has no oil container at the rear and can be placed close to a wall or close to other parts. Take care in the designof the system that it must be possible to read out the counter of the meter and that the DN80 and DN100 models must be accessible from the rear for changing the lubricant.

Suggested minimum clearance	DN50 models	DN80 / DN100 models
Front side (read out)	40 cm	40 cm
Back side	1 cm	20 cm

The piping must be installed in a way that minimizes the stresses on the meter body. Stress on the meter housing may cause the rotors to touch and increase the friction. Friction may impair the meter performance in meter range and/or accuracy, particularly in the low flow rates. To prevent stresses to exceed pre-set limits the mounting screws must be tightened first manually and than cross-wise using a torque wrench. The torque to hold and seal the piping and flanges to the meter should not exceed 60 Nm.

When installing a system start with the meter and work to the outside of the installation. Use a torque wrench to control the bold tension.

After installation a differential pressure of 0.02 mbar across this meter is sufficient to start the rotation of the meter, e.g. slight puff. If a significantly higher gas pressure is needed; this is an indication that either the meter body is fitted with too much mechanical stress, dirt and/or particles are collected in the measurement chambers.

2.3.1 Lubrication system and lubrication before start up

vemm tec supplies the initial amount of bearing lubrication oil with each OMEGA VI. The amount of oil supplied depends on size and intended installation position of the meter.Transportation and handling must be performed without oil in the reservoirs. Accordingly each meter is supplied without any oil in the reservoirs of the meter. Before start-up operation you must proceed as follows.

The meter must not be lubricated before installation is finished.
The meter must be depressurized and out of service, while oil reservoirs are filled.

Lubrication before start-up

After installation, but before starting of operation, the oil reservoirs must be filled with lubrication oil. Oil should be filled through the bores in the side casing as indicted in Figure 5. The oil drains are also indicated in the figure. The filling level is correct when oil level is in the middle of the oil level glass (see Figure 4).

Figure 4: Oil level glass

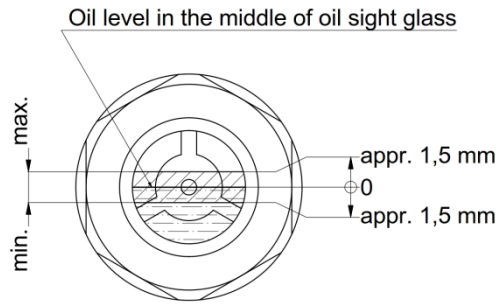


Table 3: Amount of lubricant

Diameter [mm] [Inch]	**Horizontal gas flow** (Front reservoir / Rear reservoir)	**Vertical gas flow** (Front reservoir / Rear reservoir)
DN 50 (2”)	30 ml / none	80 ml / none
DN 80 (3“)	35 ml / 20 ml	70 ml / 40 ml
DN 100 (4“)	35 ml / 20 ml	70 ml / 40 ml

Step 1: Fill the reservoir with oil (see Figure 5) until the right oil level (see Figure 4). (The DN50 has 1 reservoir at the front, the DN80 and DN100 has 2 reservoirs, one at the front, 1 at the rear)
Step 2: Check the oil level
Step 3: Close the oil filling plug after filling.

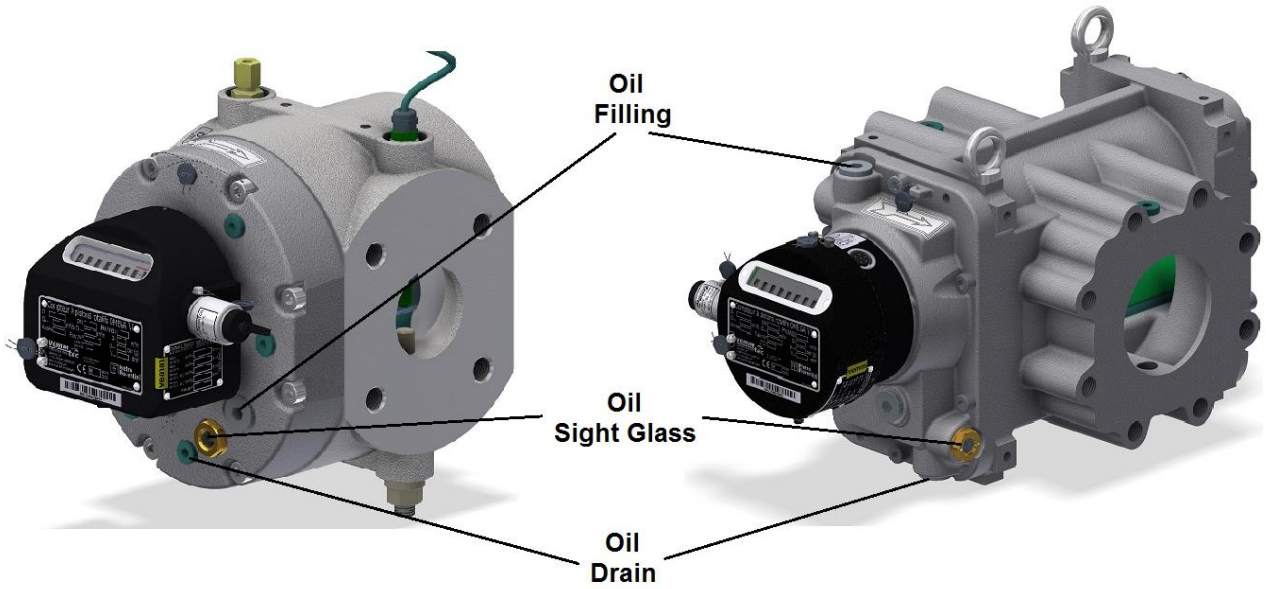
The initial lubrication is sufficient for 7 years of operation in most cases. In exceptional cases only, e.g. dirty gas, lubrication should be performed more often.

The following oil type is recommended and delivered with the meter:

- Shell Morlina 10 (Tellus 10) or equivalent for gas temperatures ≥ -10 °C
  Alternatively, equivalent oils with viscosity ISO-VG 10 may be used.
- Isoflex PDP38 for heavy duty applications and possible operation at low temperatures < -10 °C

If the rotors or the inner meter body were smeared with oil by accident, the surfaces must be wiped off, then cleaned with a solvent and wiped dry again.

Figure 5: Oil filling bores and oil drains



2.3.2 Required upstream and downstream length

Special inlet and outlet sections are not required for the OMEGA VI rotary gas meter. The gas meter itself may be installed hanging free, if it is connected with appropriate flanges. The piping close to the meter must be adequately supported.

2.3.3 Flow direction and orientation

The flow direction of the meter is indicated on the meter with an arrow. The index head is standard mounted for flow direction from left to right, unless specified differently at the time of your order.

The OMEGA VI rotary gas meter is available for horizontal or vertical flow direction. This means all four mounting positions can be obtained (see Table 4):

- from left to right (standard), from right to left
- from top to bottom (recommended for vertical installation), from bottom to top

The flow direction of the gas through the meter is indicated with an arrow on the meter body. It stays the same in all cases.

In all cases, the rotors (and rotor shafts) of the OMEGA VI must be in perfect horizontal position. That is always the case with vertical piping. Horizontal mounting positions require, that the counter head is located at the side and never above or below the body. Use a level gauge to mount the meter perfectly horizontal.

The index head of the OMEGA VI is equipped with an 8-digit non-resetable mechanical counter. For ease of reading the head can be turned 350° without violating the lead seals.

2.3.3.1 Exchanging the oil level glass

OMEGA VI rotary gas meters can be refitted for other positions. The DN80 and DN100 models can be refitted for each other position. The DN50 comes in 2 models; each refittable for one other position. (see Table 4: Mounting options OMEGA VI) For changing the position: change the position of the oil level glass and turn the index head if required.

Exchanging the oil level glass with the corresponding screw plug is carried out as follows:
· If any oil is in the meter drain it (and keep it for refilling)
· The oil level glass can be removed (and fitted again) by a face pin spanner (tap size 2 mm)
· The screwed plug can be removed (and fitted again) with an L-shaped hexagon key (8 mm)
· Check if the oil is clean and fill the OMEGA VI only when the meter is installed at its final place (do not ship with oil in the containers). For the correct oil level please see Table 3: Amount of lubricant

Figure 6: Repositioning of the oil level glass: Tools

face pin spanner (tap size 2 mm)

oil level glass

Plug

By default, the pressure measurement point must be attached on the gas inlet side and the temperature sensor must be attached to the outlet side. A wrench 14 mm (temperature sensor) and a wrench 17 mm (pressure measurement point) shall be used for the exchange.

2.3.3.2 Repositioning of the index head

The Index head of the OMEGA VI gas rotary meter can be turned without breaking the legal seal of the meter!

OMEGA VI rotary gas meters DN50

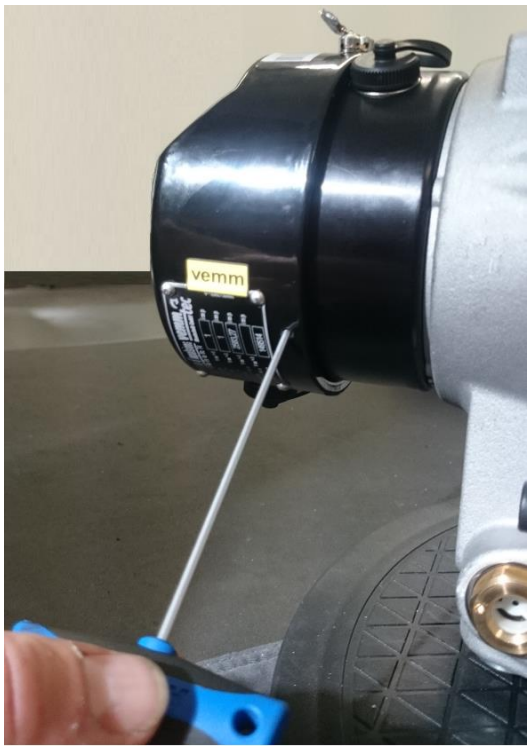
The index head of the rotary gas meters size DN50 can be turned without any tools. Just take the upper part of the index in both hands and carefully move the index clockwise or counter clockwise.
The index can be turned through 350° If you feel a stop before the index is in the desired position; just move in the other direction.

Figure 7: Turning the DN50 index head

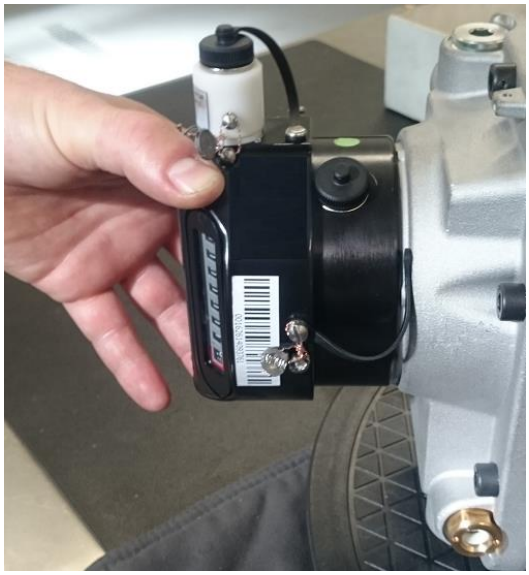
OMEGA VI rotary gas meters DN80 and DN100

The index head of the rotary gas meters size DN80 and DN100 can be turned after loosening 2 screws. *)

Figure 8: Turning the DN80 and DN100 index head



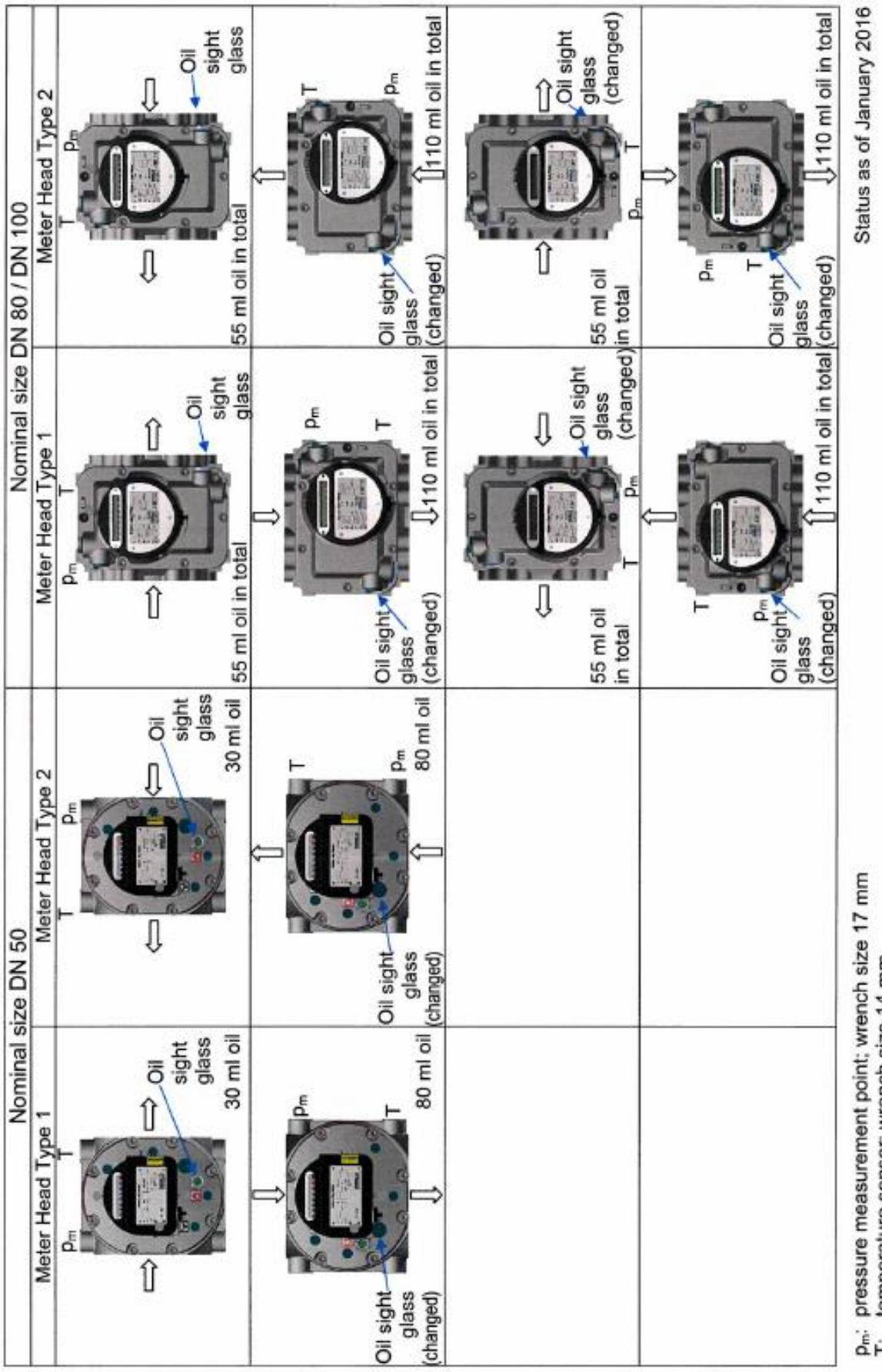
After loosening the one Allen screw and one flat screw (see position at the pictures) the index head can be turned manually. Just take the upper part of the index in both hands and carefully move the index clockwise or counter clockwise.



The index can be turned through 350° If you feel a stop before the index is in the desired position; just move in the other direction. Tighten the two screws when the right position is reached. Do tighten the screws just with low force! *)

*) Required tools: - Allen Wrench 2 mm
- Flat Screwdriver No 4

Table 4: Mounting options OMEGA VI



2.3.4 Volume conversion

vemm tec can provide you with volume conversion devices, ranging from a converter with only basic features to a sophisticated flow computer. The latter has features like curve correction, valve control, gas chromatograph readout, and other customer specified functions. We offer such devices as our PTZ-BOX 3.0. Please enquire for more details.

A PTZ-BOX gas volume converter; connected with the OMEGA VI will convert the volume measured at actual conditions to volume at base conditions according to the following formula (nomenclature according to EN 12405).

Formula 1: Volume conversion

$$V_b = \frac{p}{p_b} \bullet \frac{T_b}{T} \bullet \frac{Z_b}{Z} \bullet V$$

V_b	=	Volume at base conditions	(converted volume)	[m³]
V	=	Volume at measurement conditions	(unconverted volume)	[m³]
		(number of pulses from the gas meter divided by the gas meter's k-factor)		
p	=	Absolute gas pressure at measurement conditions (actual pressure)		[bar abs]
p_b	=	Absolute pressure at base conditions	(1.01325 bar or other specified pressure)	[bar]
T_b	=	Absolute temperature at base conditions	(273.15 K or other specified temperature)	[K]
T	=	Absolute gas temperature at measurement conditions		[K]
Z_b	=	Compressibility factor of the gas at base conditions		
Z	=	Compressibility factor of the gas at measurement conditions		

2.3.5 Connection pressure sensor at p_m-point

4 Taps (2x M12x1.5 and 2x M16x1.5) are located on the meter housing to enable the measurement of the pressure and temperature of the meter. They must be shut before start up and during operation, either with a screw plug or with a connection to a pressure sensor. Possibly a converter M12x1.5 (female) needs to be added to adapt to the pressure sensor pipe.

The pressure for volume conversion shall be measured at the upstream pressure point marked with p_m (pressure at measurement conditions), especially for custody transfer applications. This point is plugged with a plug M12x1.5 or M16x1.5. The pressure reference point should be used for connecting the pressure sensor of the volume converter (or flow computer) in order to convert the measured volume to base conditions (also called standard or normal conditions). The p_m-point is used during the determination of the meter calibration curve and this p_m-point should be used for custody transfer applications. Using a different pressure point may cause small systematic errors in the flow measurement and consequently the conversion to base conditions.

A second tapping is located downstream at the meter body. It might be marked P. This pressure connection is also M12x1.5 or M16x1.5. It may be used for a local pressure indication or to measure the differential pressure (pressure drop) of the meter between p_m- point and P-point. This is to check the smooth running of the rotary meter after installation, or over time to check for wear. A differential pressure of 0.02 mbar should be sufficient to bring the rotors into movement under nearly atmospheric conditions. If the meter needed a much higher differential pressure to be set in motion, this would indicate a problem.

2.3.6 Temperature measurement

A temperature sensor is required when a volume converter or flow computer is used to convert the measured volume to base conditions, in some countries called standard or normal conditions. The temperature sensor should be installed in a thermo-well.

A temperature sensor can be installed in the meter or in the upstream section to the meter, up to 2 D in the upstream piping. The tip of the sensor should be in the middle third of the piping cross section. Typically a resistance temperature sensor is used, like a Pt 100, Pt 500, or Pt 1000. It is recommended to put some heat conducting paste or oil into the thermowell, before the temperature sensor is inserted into the thermowell and fastened. This assures good heat transfer between thermowell and sensor, and thus correct measurement. In practice there will not be a significant difference in upstream and downstream temperature.

A second thermo-well close to the other one may be added to allow in-line checking of the main temperature sensor.

The easiest way of installation is to use the PT-Ring of **vemm tec Messtechnik GmbH** that is to be installed at the inlet of the meter between the meter and the flange. It contains one or two temperature pockets. In any case, the second pocket should be installed close to the first pocket. All these alternatives allow the sensors to be removed for testing and/or repair, without shutting down the line.

vemm tec also supply a combined thermowell and pressure connection point. This device should be mounted in or upstream the meter (M16x1.5).

OMEGA VI can be equipped with 1 or 2 thermo-wells integrated in the meter body. Do not replace these thermo-wells by other models and do not remove these thermo-wells when the meter is pressurized.

2.3.7 Density measurement

When a line density meter is used, the above mentioned requirements for pressure and temperature should be followed for the location of the density meter. Please refer to the recommendations of the density meter manufacturer for optimal results.

2.3.8 Energy measurement

In order to calculate the energy content of the passed gas, the converted volume is to be multiplied by the heating value. The volume conversion is described in Section 2.3.4. The heating value of the gas can be determined in several ways. The mostly used methods are:

- On-line analysis with a process gas chromatograph
- On-line analysis with a calorimeter
- Laboratory analysis of a collected sample
- Calculation by pipeline simulation

The **vemm tec** PTZ-BOX gas volume converters can do the energy calculation as standard.

2.3.9 Index head and pulse sensors

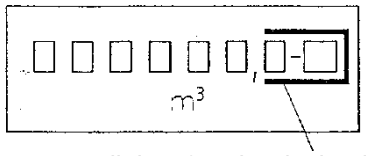
The OMEGA VI is standard equipped with the universal index head:

- The standard OMEGA VI index head is rated IP 67 after IEC 60529, which is dust-tight and protected against water jets. All OMEGA VI sockets with 6 pin connectors for pulse sensors are also rated IP 67 when properly connected or when the supplied cap is fitted in place.

Every index head is equipped with high-quality bearings and polished gears for low-friction. To ensure that each revolution of the mechanical counter corresponds with a known volume, a final factory calibration is performed. As a part of this calibration, the ratio of the adjustment gears is checked and if necessary adjusted. These gears are inside the index head and the head is lead-sealed to prevent unauthorized access.

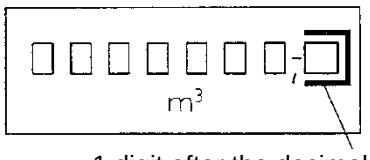
The mechanical counter totalizes the actual volume passing through the meter. A large eight-digit (non-resetable) display shows the totalized volume.

Figure 9: Mechanical counter reading at the index head display



2 digits after the decimal *

DN 50 (2”): G25, G40, G65



1 digit after the decimal *

DN 80 (3”): G100, G160
DN 100 (4“): G160, G250

* The hyphen in front of the last digit is for easy read out of the marks of the last roll and has no meaning as a decimal sign

For easy reading of the volume indicated at the display, the index head of all models can be turned through 350° without violating the lead seal (see 2.3.3.2).

CAUTION: Do not break the seals when turning the index head.

Your OMEGA VI gas meter is standard supplied with one Reed pulse sensor. Additional sensors (such as a second Reed sensor or high frequency NAMUR sensor) are available, sometimes depending on type approval. All sockets are covered by a protection cap. The pins have been allocated to the sensors according to Figure 10.
The frequency signal (LF pulses from the reed sensor 1R1 or HF pulses from the NAMUR sensor) can be obtained via a female connector in the counter head.

Table 5: Pulse sensors at the index head

Code	**Description**	**Maximum frequency ***	**Remarks**
1R1	LF-Reed switch	< 0,5 Hz	Standard
2R1	LF-Reed switch	< 0.5 Hz	Option, retractable
HF3	HF-NAMUR sensor	12 – 300 Hz	Option

* The maximum pulse frequency depends on meter size: Please refer to Table 14 for typical values.

The socket of the pulse sensor is located at the index head. A label is located besides the socket, which indicates the type of pulse sensor, the k-factor (number of pulses per cubic meter) and the connecting pins and their polarity.

The socket at the meter is a female connector. A corresponding male connector can be supplied with your meter. The male connector is shipped unassembled, for your choice of cable and length to make the field connections. See also the pin scheme of the connectors in Figure 10.

You will find more information about the sensor type and electrical connection schematics in the following sections of this manual.

2.3.10 Specification of reed switch (1R1 and 2R1 in the index head)

As standard the index head is equipped with one low frequency reed contact closure switch (1R1) which gives one pulse per revolution of the last digit roll of the counter. Depending on the meter size the volume per pulse can be 0.1 or 1 m³ (see Table 14). The additional 2R1 sensor can be applied on request when the applicable type approval allows.

DN80 and DN100 versions of the OMEGA VI with $Q_{min} \leq 4$ m³/h need a HF3 sensor to fully comply with the standard with respect to the time needed for the calibration at the lowest flow points.

A reed switch generates a low frequency contact closure signal. This signal can be used to connect to a flow converter (often battery powered) which may be located beside the meter in the hazardous area. Reed switches require no external power for the circuit to generate pulses.

If the reed switch is connected to non-intrinsically safe devices, a barrier should be used. Please refer to the connector diagram in Figure 10 and electrical connection schematics in Section 2.3.12.

2.3.11 Specification HF NAMUR sensor (HF3)

HF NAMUR sensors are proximity sensors that are mounted in the meter. The sensor provides a pulse signal at the moment that a metal part passes. In this case the metal is applied to a synthetic disk. The signal of the NAMUR sensor is a switching current signal according to EN 60947-6/6 and the sensor needs minimum 8.2 V powering. This sensor cannot be used in combination with battery powered devices. Please refer to the connector diagram in Figure 10 and electrical connection schematics in Section 2.3.12. For the transfer of the signal outside the hazardous area a dedicated NAMUR barrier is needed. The ATEX approval of this HF3 sensor is provided as Figure 13.

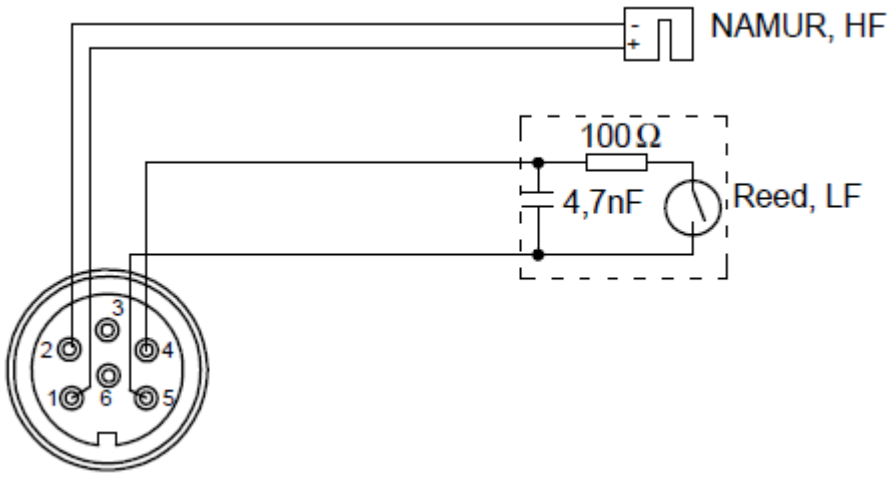
2.3.12 Electrical connection schematics for pulse sensors

Please refer to Table 5: Pulse sensors at the index head; with the available pulse sensors and to the connector diagram in Figure 10. An example of the connection of a pulse sensor is given in the following drawing.

CAUTION: For use with hazardous gas in potentially hazardous area never hook up the meter to non-intrinsically-safe circuits.

The interface/barrier between hazardous and safe area operations must be suitable for the purpose and can be purchased from ***vemm tec***. Please refer to the recommended safety barriers in Table 12 for connecting to non-intrinsically safe equipment.

Figure 10: Connection and wiring diagram of the frequency sensors



Alternative pin allocation is possible: refer to the pulse label at the index head for final information.

2.3.13 Required settings for flow computers and flow converters

The k-factor setting for your flow computer/flow converter is shown on the label fitted beside the appropriate connector. These impulse values are the same as the values shown on the calibration certificate/initial verification sheet. The values given on the label are the results of calibration and these values should be used in any volume converting device connected to the meter.

WARNING: Some devices use the k-factor [Imp/m³]. Other devices use the reciprocal value [m³/Imp]. Please check carefully which value should be used in your device.

In the event your computer provides curve correction, k-factors should be set for several flow rates. Please refer to the manual of your flow computer for applying these factors.

The low frequency Reed switch sensors are provided with a electronic filter (see Figure 10) preventing bouncing signals.

3 OPERATION

3.1 Accuracy

Standard accuracy limits for all OMEGA VI models are in accordance with the EC Measuring Instruments Directive (2014/32/EU); (accuracy class 1.0), EN 12480 and many other countries regulations:

± 1 % for $Q_t \leq Q \leq Q_{max}$ ± 2 % for $Q_{min} \leq Q < Q_t$

Were:
Q is the actual flow [m³/h]
Q_{max} is the maximum flow of the meter [m³/h]
Q_{min} is the minimum flow of the meter [m³/h]
Q_t is the transition flow were the accuracy changes [m³/h]; according to our MID approval, for a range >1 : 30, Q_t = 10 % $Q_{max;}$ for ≤1 : 30, Q_t = 20 % Q_{max}, for other approvals or standards other values of Q_t may apply.

Between Q_t and Q_{max}, the linearity of metering at atmospheric pressure is typically ≤ 0.5 %.
The repeatability of the OMEGA VI is ± 0.1 % or better.

If specified in your order, other accuracy limits or a special linearity will be applicable.

3.2 Operating flow range

The flow range of the OMEGA VI (Q_{min} : Q_{max}) depend on size and temperature range. This range is the standard performance under ambient pressure. Please refer to Table 15.
The OMEGA VI rotary gas meter still operates properly far below Q_{min}, however the accuracy at these low flow rates decreases.

3.2.1 Overload

The OMEGA VI is designed to compensate a flow rate overload of maximum 20% above Q_{max} for a limited time of operation (<1 hour). The overload must occur gradually and without pulsations. Excessive overranging, pressure waves and overspeeding may damage your meter and causes excessive wear on bearings and gears.

3.2.2 Maximum ramp-up

Sudden flow or pressure changes can damage the meter. The flow; and consequently also the pressure shall be controlled in a way that maximum pressure change is 350 mbar/s.

3.3 Temperature range

The standard temperature range under MID approval is between -25 °C and +55 °C (gas and ambient temperature).
The temperature range according to PED is -25 °C to +55 °C for the gas temperature and -20 °C to +70 °C for the ambient temperature. For a better operating range the gas and ambient temperature can be limited to -10 °C and +55 °C.
For customer specific applications, other temperature ranges may apply when other approvals allow (or when no approvals are required). The temperature range for storage of the meter is -40 °C and +70 °C.

3.4 Maximum pressure

Flange rating and maximum operating pressure of your meter are indicated on the main label at the meter and in the calibration certificate. The OMEGA VI has a maximum pressure of 20 bar(g)

Table 6: Flange rating and maximum operating pressure

Flange rating	Maximum operating pressure [bar g]
PN 10	10
PN 16	16
ANSI 150 #	20

3.5 Pressure loss under operating conditions

The meter should smoothly start to rotate at just 0.02 mbar differential pressure across the meter. If significantly higher pressures are needed to start rotation, this indicates that the meter body is installed with high internal stresses (see Section 2.3), or contamination braking the rotors. In either case the meter performance is degraded.
The minimized pressure loss in ambient air is an important design parameter of the OMEGA VI (see Table 16 and the following formula). This simplified formula assumes a purely quadratic behaviour which is not exactly the case due to fluid dynamic effects.

Formula 2: Pressure loss under operating conditions (simplified calculation)

$$\Delta p \approx \Delta p_r \bullet \frac{\rho}{\rho_r} \bullet \left(\frac{Q}{Q_{\max}} \right)^2$$

Δp	=	Pressure loss at measurement conditions	[mbar]	(with the measured gas)
Δp_r	=	Pressure loss at reference conditions	[mbar]	(see Table 16 at 100 % flow)
ρ	=	Density at measurement conditions	[kg/m³]	(actual density of the measured gas)
ρ_r	=	Density at reference conditions	[kg/m³]	(0.8 kg/m³ with natural gas)
Q	=	Actual flow rate of the measured gas	[m³/h]	
Q_{max}	=	Maximum flow rate of the gas meter	[m³/h]	(see Table 16)

3.6 Material of construction

The standard materials of construction are listed below. Some gas types require special materials, please check the material compatibility or enquire at ***vemm tec*** (see also Table 10).

Table 7: Standard material specification

Part description	Material description
Housing	Body:Ductile Iron (EN-GJS-400-18-LT); Side covers Durable Aluminium Alloy
Rotors	Aluminium
Bearings	Stainless steel
Shafts	Stainless steel
Gears	Stainless steel or synthetic material
Magnetic Coupling	Stainless steel
Index Head	Aluminium
Counter	Synthetic material
Counter Plate	Aluminium

3.7 Gas composition and flow conditions

The standard OMEGA VI can be used for all non-aggressive gases, like natural gas, methane, propane, butane, air, nitrogen, etc. Never use a standard meter for other applications without a ***vemm tec*** confirmation. In Table 10 you will find a listing of gases suitable for the OMEGA VI.

The OMEGA VI reaches its full potential when the rotors are subjected to uniform and undisturbed gas velocity within the meter housing. In practice, the performance of the OMEGA VI may also slightly depend on the installation. The OMEGA VI is substantially less sensitive for effect from flow disturbances than other devices. In poorly designed gas-metering installations, some conditions can lead to increased error of the meter.

Pulsating gas flow and intermittent flows however should be avoided. Large and fast pressure fluctuations should also be avoided. When filling a piping section, always let the pressure and flow increase **slowly** to avoid overloading. The maximum allowable pressure raise is 350 mbar/s. Open valves very carefully and slowly. Preferably install bypass lines over ball valves to fill the line before opening the valve.

Heavy vibrations must be avoided.

The gas flow must be free from contaminants, water, condensates, dust and particles. These can damage the delicate bearings and the rotor. When dust collects over time, it has an adverse effect on the metering accuracy. Dirty gases should be filtered with a 10 micron particle filter. In case of condensate, particularly for outdoor use of the meter, liquid separators a required. They must be installed near the inlet of the meter. The flow direction from top to bottom is recommended in these cases.

In all cases it is strongly recommended to install a coars filter or sieve during the first weeks of operation in a new installation.

Installing the meter in the lowest point in a metering system must be avoided, as liquids and dirt tend to collect and concentrate there.

When clean piping cannot be assured it is strongly recommended to install filters or sieves, eventually temporarily. Vemm tec can provide you with different sieves, depending on application and expected severity. Sieves should have no larger mesh size than 430 µm or mesh 40. If the flow through the meter is from bottom to top, two sieves should be installed, one at the inlet and the other one at the outlet of the meter. If the differential pressure (pressure drop) across the sieve shall be monitored, an additional pressure measurement point must be installed at the inlet of the sieve.

Fill the oil reservoirs of your OMEGA VI before start up and refresh the oil at 7 year intervals (see Sections 2.3.1 and 4.1).

Gas meters are occasionally over-dimensioned or oversized. This may be due to higher future flow rates or seasonal fluctuations. When a gas meter operates below its stated minimum flow rate, this typically results in a negative error.

4 MAINTENANCE

4.1 Regular lubrication

It is recommended to check the lubrication oil level every six months. Please refer to the oil type mentioned in Section 2.3.1.

If the oil is to be re-filled the gas meter must not be running and must be relieved of pressure, but may remain in the line. Please fill oil in the reservoirs (1 reservoir for the DN50, 2 reservoirs for the larger meters), so that the oil level reaches the middle of the level glass that is located at each container, e.g. with a syringe or wash bottle. Please observe at every start up the directions for start-up (see Section 2.3).

An oil change should be performed after 7 years of operation. The meter must not be running and must be relieved of pressure, but may remain in the line. The used oil can be drained from the reservoirs by removing the drain plug. Please fill oil in the 1 or 2 reservoirs and take care that the oil level reaches the middle of the inspection glasses, e.g. with a syringe or wash bottle. The quantity to replace is mentioned in Section 2.3. and depends on installation position.

The rotating and moving parts in the index head do not need lubrication.

4.2 Spare parts

No commissioning spare parts are required. Under normal operating conditions no operational spare parts are required. Under extreme operating/environmental conditions or where meters are situated in less accessible areas, spare part storage as mentioned in Table 11 can be considered. For special circumstances, dedicated spare parts lists may be applicable.

The following 2 years operation spare parts and lubricants might come into consideration (part numbers depending on diameter and G-rate):

- Lubrication oil Connector for pulse sensors (male)
- Electronic revision set for index head
- Index head complete

A repair of defective meters is preferably performed by the manufacturer; a new calibration is needed afterwards. Spare parts and labour hours will be quoted after inspection.

For custody transfer purposes and for best performance after repair, OMEGA VI should be calibrated at an approved calibration facility. See Section 4.3 in this manual.

4.3 Recalibration

Legal requirements for recalibration are different in each country and are not covered by the MID.

Example: *After the German legal guidelines "Eichordnung Appendix B No. 7.3" (originally published 12.08.1988 and amended 08.02.2007) the term for legal re-verification is 16 years for rotary gas meters up to maximum flow rate 1600 m³/h. If the performance of the rotary gas meter is legally confirmed before expiry of this period, the legal term is extended with another 16 years.*

If no recalibration requirements apply, ***vemm tec*** suggests a recalibration period of 6 – 12 years. This period should be more frequent when operating in harsh conditions, such as dirty gas or pulsating flow. ***vemm tec*** can perform verifications or factory calibrations with ambient air. When the meter is checked or reconditioned, a new calibration should also be performed.

In addition, you can recalibrate the meter with high pressure gas.
Please refer to Section 1.8.4.

5 WARRANTY

OMEGA VI Rotary Gas Meters supplied by ***vemm tec*** are guaranteed against defects due to faulty material or workmanship for a period of 12 months from the delivery date of the Goods, according to the General Terms and Conditions of Business (GTC)of the **vemm tec** Messtechnik GmbH (vemm tec) for Export, unless otherwise agreed in writing.

Replacement parts provided under the terms of this declaration are warranted for the remainder of the warranty period applicable to the Goods, as if such parts were original components of the Goods.
This warranty does not extend

(i) to non-compliance to the “Installation, Operation and Maintenance Manual”
(ii) to damages caused by unsuitable or incorrect use, faulty installation, or operation by the Customer or third parties, natural wear and tear, faulty or negligent treatment or maintenance, the use of unsuitable operating or substitute materials, deficient assembly and damages caused by chemical, electronic or electric influence
(iii) to equipment, materials, parts and accessories manufactured by others
(iv) to correctness of any externally performed calibrations, either at ambient conditions or at elevated pressure

The warranty also becomes invalid when devices supplied with our seal no longer possess the original, undisturbed seal.

vemm tec accepts no liability for Goods being fit for the purpose required by the Customer unless it shall have been given full and accurate particulars of the Customer's requirements and of the conditions under which the Goods are required to be used.

Upon written notification received by **vemm tec** within the above-stated warranty period of any failure to conform to the above warranty, upon return prepaid to the address specified by **vemm tec** of any non-conforming original part or component, and upon inspection by **vemm tec** to verify said non-conformity, **vemm tec** at its sole option either shall repair or replace said original part or component or complete OMEGA VI rotary gas meter without charge to the Customer, or shall refund to the Customer the price thereof. Externally performed calibrations are not covered by warranty. However, if ***vemm tec***’s inspection fails to verify the claimed non-conformity the Customer will be liable for any costs incurred by **vemm tec** in investigating the claimed non-conformity. The remedies set forth herein are exclusive without regard to whether any defect was discoverable or latent at the time of delivery of the Goods to the Customer.

Goods, once delivered, may be returned to ***vemm tec*** only with prior written authority from ***vemm tec*** unless those Goods are accepted by ***vemm tec*** as being defective as to material or workmanship. In the event of a return being authorized by ***vemm tec***, ***vemm tec*** shall have the right to charge carriage to and from the delivery location and the costs involved in the removal of the Goods from the Customer's premises.

All further claims of the Customer against **vemm tec** as well as our subcontractors are – in accordance with the law – excluded, including compensation for consequential damages and damages based on repairs and replacements, except in the case of conscious negligence or compulsory liability for the lack of guaranteed qualities.

Claims for warranty and service need to be addressed to the ***vemm tec*** office or to the ***vemm tec*** agent where the meters originally are ordered.

6 TABLES AND FIGURES

Table 8: Technical standards, rules and guidelines

International and German standards	
EN 12480	Rotary displacement gas meters
EN 50014-20	Electrical equipment for areas subject to explosion Hazard General provisions - Intrinsically safety
DIN 30690	Components in gas supply, requirements for components in gas supply systems
EO-AV, Appendix 7, Part 1	Eichordnung (German regulations for custody transfer): Volume gas meters
EN 60947-5/6	Standard on NAMUR sensors
EC (European Community) directives	
2014/68/EU	Pressure equipment directive (PED)
2014/32/EC	Measuring instruments directive (MID)
2014/34/EU	Equipment or protective systems intended for use in potentially explosive atmospheres (ATEX)
PTB (Germany) guidelines	
PTB A 7.1	Volume gas meters, April 1998 (Matching the former EC Guidelines)
PTB-Prüfregeln Band 4	Volume gas meters, 1982
PTB-Prüfregeln Band 29	Measurement devices for gas: Low pressure test of gas meters, 2003
PTB-Prüfregeln Band 30	Measurement devices for gas: High pressure test of gas meters, 2003
DVGW (Germany) regulations	
G 260/I	Gas quality
G 260/II	Supplementary rules for gases of the second gas family
G 261	Measuring gas quality
G 285	Hydrate inhibition in natural gas with methanol
G 469	Pressure testing for piping and systems in gas supply
G 486	Real gas factors and compressibility factors in natural Gas
G 491	Construction and equipping for gas measurement control systems with input pressure above 4 bar up to 100 bar
G 492/II	Systems for large quantities gas measurement with an operating pressure above 4 bar up to 100 bar
G 493	Procedure for granting DVGW certification for manufacturers of pressure control and gas measurement equipment
G 495	Gas pressure control systems and systems for large-quantity gas measurement, monitoring and servicing
OIML	
R137-1	Gas meters (replacing the OIML R6, R31 and R32)
R140	Measuring systems for gaseous fuels

Many national standards and laws are based on the above.

Table 9: List of approvals

Metrological approvals	
2014/32/EC	Measuring instruments directive: OMEGA VI Rotary Gas Meters. Module B Approval No DE-13-MI002-PTB005 (Figure 12) (in combination with Module D or Module F).
Additional approvals	China (CMI) Tunisia (CGN) Serbia Approvals in other countries are pending.
Explosive atmosphere	
2014/34/EC	Equipment or protective systems intended for use in potentially explosive atmospheres. Figure 13 is the ATEX certificate of an optional applied HF3 sensor. The Reed switch is considered as a simple apparatus and thus do not need ATEX certification.
Pressurized equipment	
2014/68/EU	Pressure equipment directive: the OMEGA VI rotary gas meter is designed according to the rules of the PED. The applicable (PED) certificates are issued by: TÜV Rheinland under number: 01 202 610 Q 07 0001 (for Module D) DVGW Product Identification No. CE-0085CO0170 (for Module B).

Figure 11: ***vemm tec*** ISO 9001 / 14001 certificate

DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

Certificate No: 123188-2012-AE-GER-DAkkS | Initial certification date: 27. June 2009 | Valid: 18. February 2016 - 15. September 2018

This is to certify that the management system of

vemm tec Messtechnik GmbH

vemm tec Messtechnik GmbH
Gartenstr. 20, 14482 Potsdam, Germany

has been found to conform to the Management System standards:

ISO 9001:2008
ISO 14001:2004

This certificate is valid for the following scope:

Design, engineering, manufacturing, installation, calibration, sales and services of equipment, components and systems for Gas- and Fluid Measurement Technology

Place and date: **Essen, 14. February 2016**

DAkkS Deutsche Akkreditierungsstelle D-ZM-18453-01-00

For the issuing office: **DNV GL - Business Assurance** **Schnieringshof 14, 45329 Essen, Germany**

Thomas Beck Technical Manager

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.
ACCREDITED UNIT: DNV GL Business Assurance Zertifizierung und Umweltgutachter GmbH, Schnieringshof 14, 45329 Essen, Germany.
TEL:+49 201 7296-222. www.dnvgl.de/assurance

Please enquire for the last version!

Figure 12: MID Module B approval

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin
Nationales Metrologieinstitut

EG-Baumusterprüfbescheinigung

EC Type-examination Certificate

Ausgestellt für: *Issued to:*	vemm tec Messtechnik GmbH Gartenstr. 20 14482 Potsdam
gemäß: *In accordance with:*	Anhang B der Richtlinie 2004/22/EG des Europäischen Parlaments und des Rates vom 31. März 2004 über Messgeräte (ABl. L 135 S. 1) *Annex B of the Directive 2004/22/EC of the European Parliament and of the Council of 31 March 2004 on measuring instruments (OJ L 135 p. 1)*
Geräteart: *Type of instrument:*	Gaszähler *Gas meter*
Typbezeichnung: *Type designation:*	Omega VI
Nr. der Bescheinigung: *Certificate No.:*	DE-13-MI002-PTB005, Revision 2
Gültig bis: *Valid until:*	13.06.2023
Anzahl der Seiten: *Number of pages:*	19
Geschäftszeichen: *Reference No.:*	PTB-1.42-4075562
Notifizierte Stelle: *Notified Body:*	0102

Zertifizierung: *Certification:* Braunschweig, 15.02.2016

Im Auftrag *On behalf of PTB*
Dr. Rainer Kramer

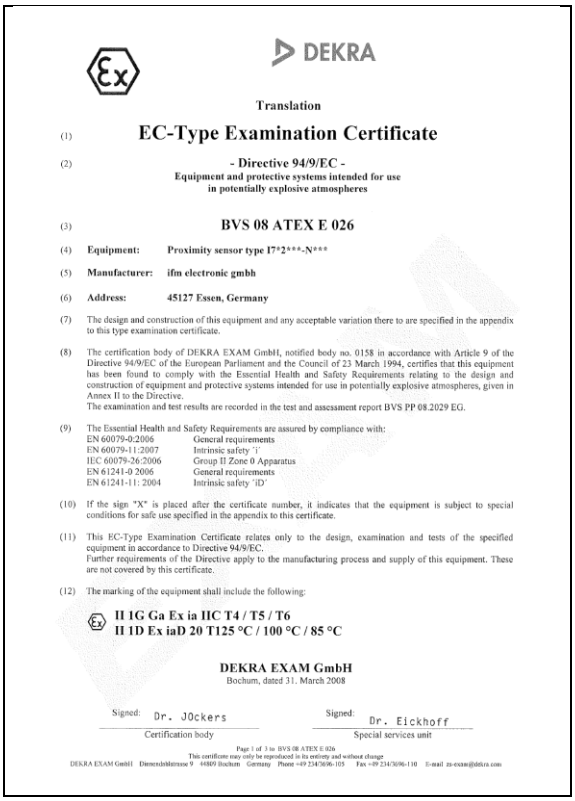
Siegel *Seal*

Bewertung: *Evaluation:*
Im Auftrag *On behalf of PTB*
Dr. Roland Schmidt

R3-020553

EG-Baumusterprüfbescheinigungen ohne Unterschrift und Siegel haben keine Gültigkeit. Diese EG-Baumusterprüfbescheinigung darf nur unverändert weiterverbreitet werden. Auszüge bedürfen der Genehmigung der Physikalisch-Technischen Bundesanstalt.
EC Type-examination Certificates without signature and seal are not valid. This EC Type-examination Certificate may not be reproduced other than in full. Extracts may be taken only with the permission of the Physikalisch-Technische Bundesanstalt.

Figure 13: ATEX approval of the HF sensor



DEKRA

Translation

(1) **EC-Type Examination Certificate**

(2) **- Directive 94/9/EC -**
Equipment and protective systems intended for use in potentially explosive atmospheres

(3) **BVS 08 ATEX E 026**

(4) **Equipment:** **Proximity sensor type I7*2***-N*****

(5) **Manufacturer:** **ifm electronic gmbh**

(6) **Address:** **45127 Essen, Germany**

(7) The design and construction of this equipment and any acceptable variation there to are specified in the appendix to this type examination certificate.

(8) The certification body of DEKRA EXAM GmbH, notified body no. 0158 in accordance with Article 9 of the Directive 94/9/EC of the European Parliament and the Council of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.
The examination and test results are recorded in the test and assessment report BVS PP 08.2029 EG.

(9) The Essential Health and Safety Requirements are assured by compliance with:

EN 60079-0:2006	General requirements
EN 60079-11:2007	Intrinsic safety 'i'
IEC 60079-26:2006	Group II Zone 0 Apparatus
EN 61241-0 2006	General requirements
EN 61241-11: 2004	Intrinsic safety 'iD'

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the appendix to this certificate.

(11) This EC-Type Examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to Directive 94/9/EC.
Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

II 1G Ga Ex ia IIC T4 / T5 / T6
II 1D Ex iaD 20 T125 °C / 100 °C / 85 °C

DEKRA EXAM GmbH
Bochum, dated 31. March 2008

Signed: Dr. JOckers
Certification body

Signed: Dr. Eickhoff
Special services unit

This certificate may only be reproduced in its entirety and without change
DEKRA EXAM GmbH Dinnendahlstrasse 9 44809 Bochum Germany Phone +49 234/3696-105 Fax +49 234/3696-110 E-mail zs-exam@dekra.com

Table 10: Gas types

Gas type	**Symbol**	**Density at base conditions (1.013 bar abs.) [kg/m³]**	**Meter housing**	**Notes**
Air		1.29	Standard	
Argon	Ar	1.78	Standard	
Butane	C_4H_{10}	2.70	Standard	
Carbon dioxide	CO_2	1.98	Standard	Except foodstuff industry
Carbon monoxide	CO	1.25	Standard	
Ethane	C_2H_6	1.36	Standard	
Helium	He	0.18	Standard	Please enquire
Methane	CH_4	0.72	Standard	
Natural Gas		0.83	Standard	
Nitrogen	N_2	1.25	Standard	
Pentane	C_5H_{12}	3.46	Standard	
Propane	C_3H_8	2.02	Standard	

For not mentioned gasses, please enquire at ***vemm tec***.

Table 11: Spare parts listing

Description	**Part-number**	
Index head internals	Please enquire (Fitted for the requested meter: Please mention the serial number of your meter)	
Index head complete	Please enquire (Completely mounted with counter for a particular size, G-rate and serial number)	
Lubrication oil	Shell Morlina S2 BL10 or equivalent (minimum gas temperature ≥ -10 °C)	ISOFLEX PDP 38 or equivalent (minimum gas temperature < -10 ° C)
Bottle with 50 ml oil	76250.1003	76850.1004
Bottle with 80 ml oil	76250.1001	76850.1001
Bottle with 110 ml oil	76250.1002	76850.1002
Bottle with 500 ml oil	76250.1007	76850.1007
Bottle with 1000 ml oil	76250.1005	76850.1005

Table 12: Intrinsically safe equipment

(Please find more information in the internet at www.pepperl-fuchs.com and www.turck.de)

Fuction	Input Channels			Output			Power	Serial Number	
	Number	Reed switch	HF Namur	Number	Transistor	Analogue 0/4-20 mA	VAC/VDC	Make: Turck	Make: Pepperl + Fuchs
Transformer Isolated Barrier	1	X	X	2	active	-	24 VDC	IM1-12Ex-T	KFD2-ST2-Ex1.LB
Transformer Isolated Barrier	2	X	X	2	active	-	24 VDC	IM1-22Ex-T	KFD2-ST2-Ex2
Transformer Isolated Barrier	1	X	X	2	passive	-	24 VDC		KFD2-SOT2-Ex1.LB
Transformer Isolated Barrier	2	X	X	2	passive	-	24 VDC	IM1-22Ex-T	KFD2-SOT2-Ex2
Transformer Isolated Barrier	2	X	X	2	passive	-	115 VAC	IM1-22Ex-T	KFA5-SOT-Ex2
Transformer Isolated Barrier	2	X	X	2	passive	-	230 VAC	IM1-22Ex-T	KFA6-SOT2-EX2
Frequency-Current Convertor	1	X	X	1		X	24 VDC	IM21-14Ex-CDTRI	KFD2-UFC-Ex1.D
Frequency-Current Convertor	1	X	X	1		X	85-253 VAC	IM21-14Ex-CDTRI	KFU8-UFC-Ex1.D
Frequency devider	1	X	X	1	passive		24 VDC	IM21-14Ex-CDTRI	KFD2-UFC-Ex1.D
Frequency devider	1	X	X	1	passive		85-253 VAC	IM21-14Ex-CDTRI	KFU8-UFC-Ex1.D
Frequency monitor switch	1	X	X	1	passive		24 VDC	IM21-14Ex-CDTRI	KFD2-UFC-Ex1.D
Frequency monitor switch	1	X	X	1	passive		85-253 VAC	IM21-14Ex-CDTRI	KFU8-UFC-Ex1.D

The indicated models are suggested by the applicable manufacturers. In case the devices are not delivered by ***vemm tec*** *,* ***vemm tec*** *can not be hold* responsibel for unproper operation.

Carefully check the maximum frequency the devices can handle!

Figure 14: Seals of the OMEGA VI DN50 (2”)

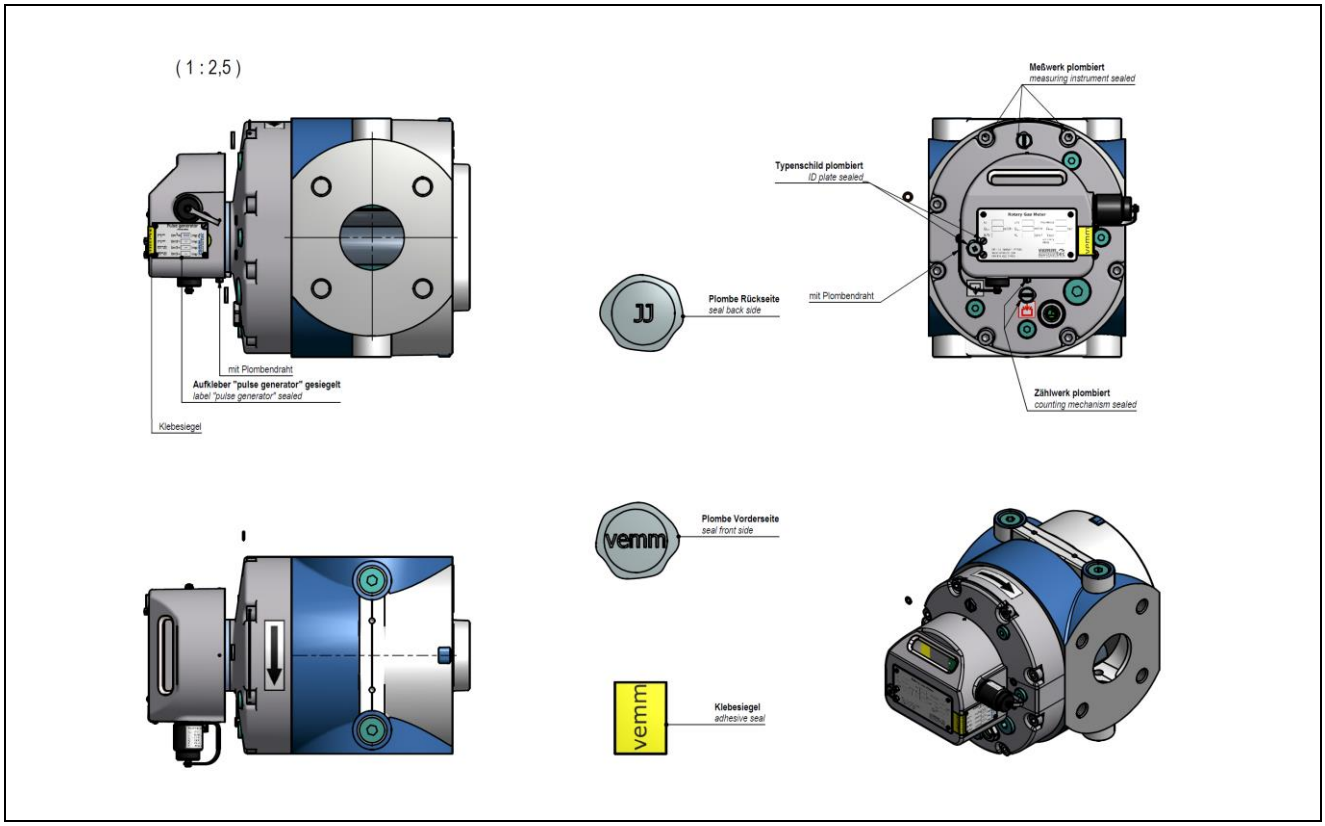


Figure 15: Seals of the OMEGA VI DN80 (3”)

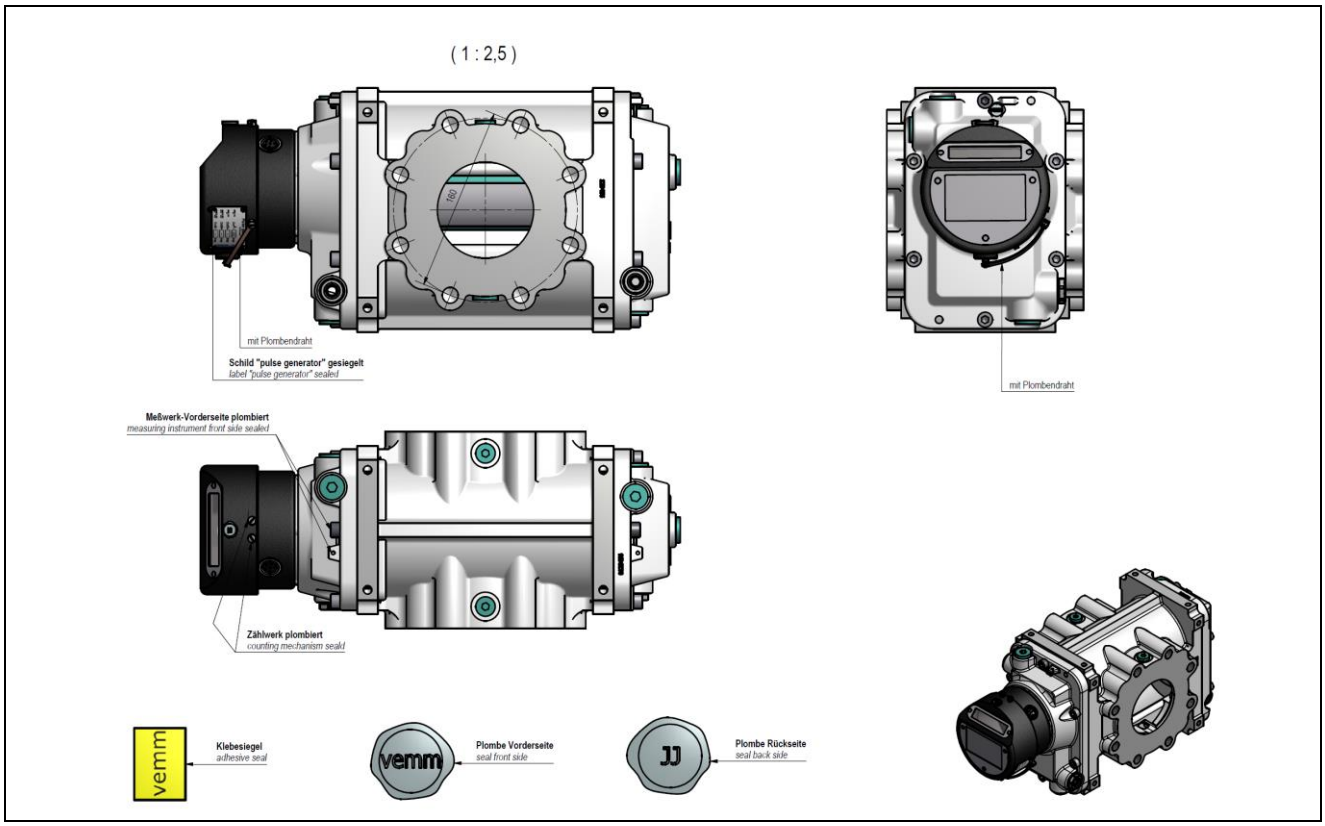


Figure 16: Seals of the OMEGA VI DN100 (4”)

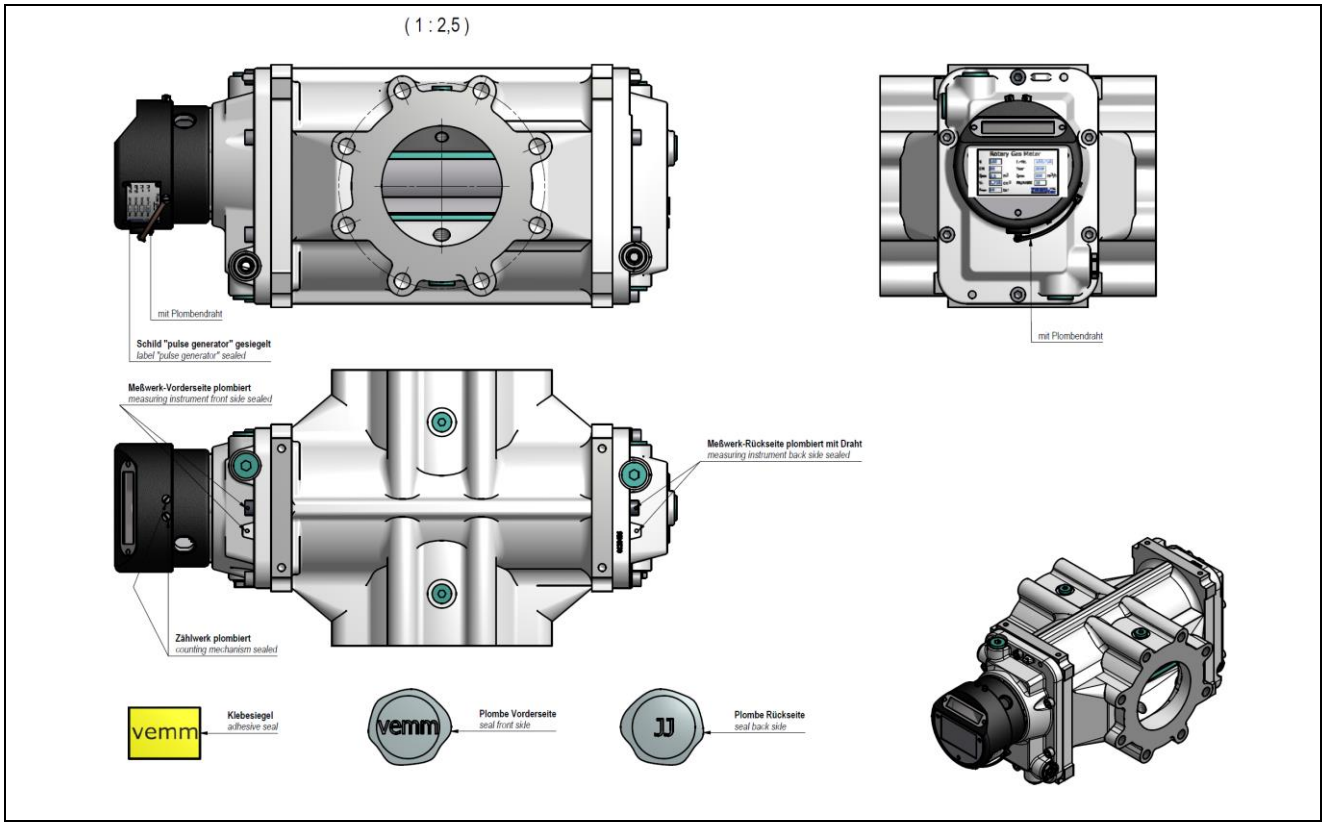


Figure 17: Exploded view of the OMEGA VI DN50 (2”)

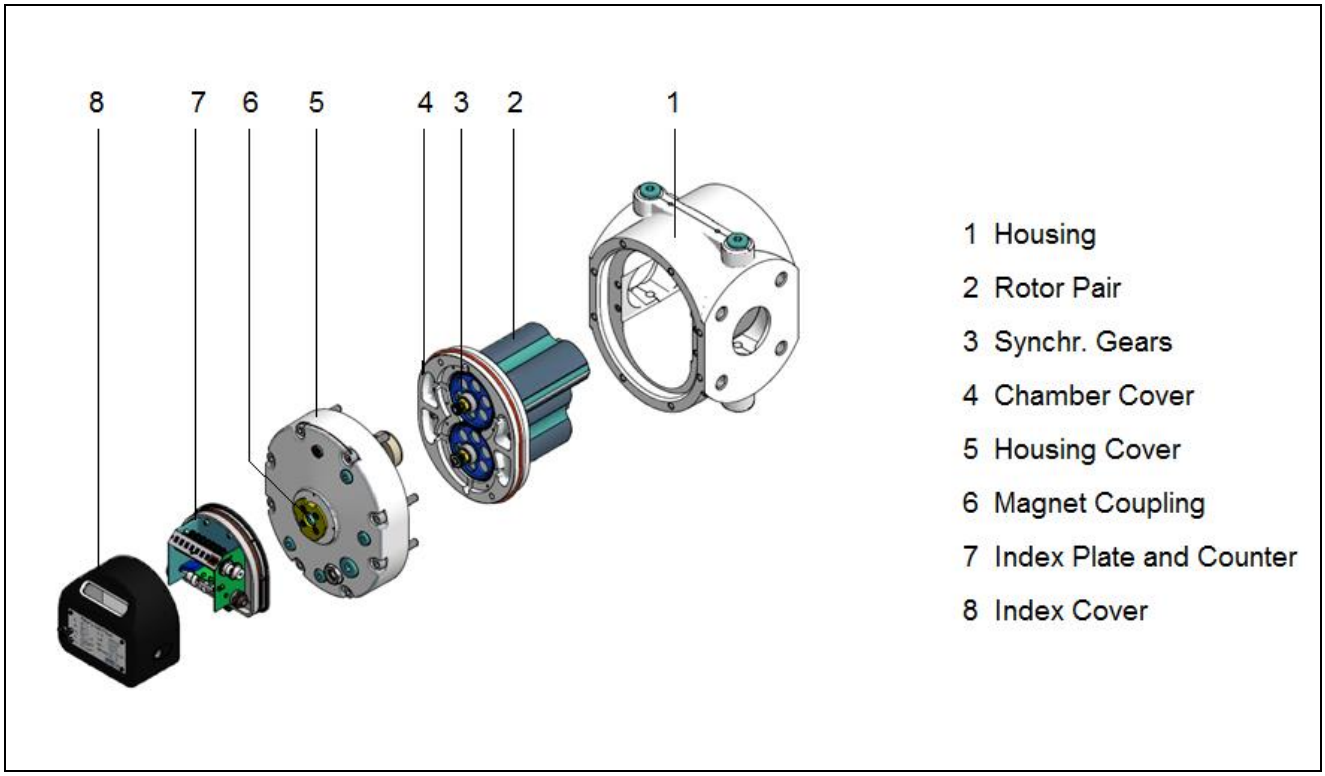


Figure 18: Exploded view of the OMEGA VI DN80 (3”)

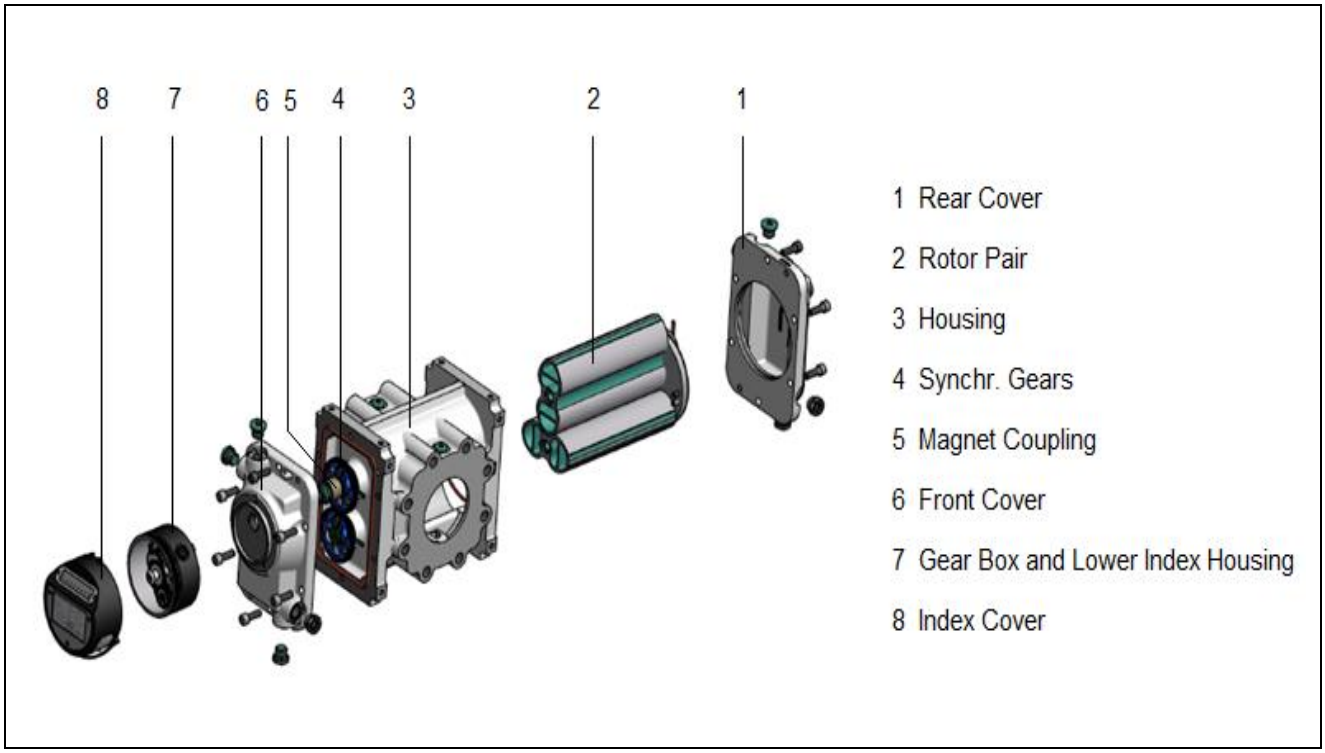


Figure 19: Exploded view of the OMEGA VI DN100 (4”)

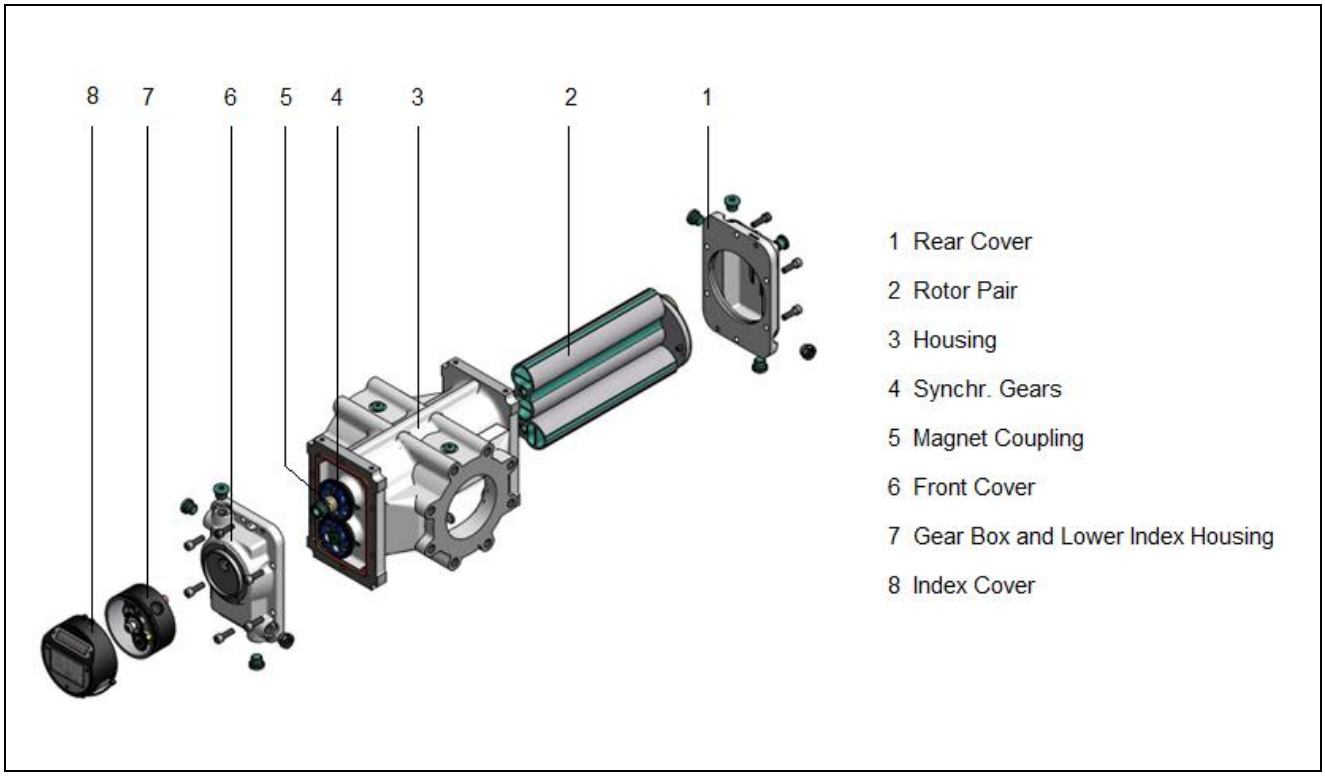


Table 13: Measurement chamber and rotor data

Diameter [mm] [Inch]	**G-Rating**	**Measurement chamber volume V_{cycl} [dm³ / rotation]**	**Rotational speed at Q_{max} [min^{-1}]**	**Rotor length [mm]**
DN 50 (2”)	G 25	0.95	710	110
	G 40	0.95	1150	110
	G 65	0.95	1770	110
	Max.	0.95	2130	110
DN 80 (3”) *)	G 100	1.72	1550	200
	G 160	1.72	2425	200
	Max.	1.72	2710	200
DN 100 (4”) **)	G 160	2.36	1760	275
	G 250	2.36	2820	275
	Max.	2.36	3380	275

*) DN80 G65 available on request
**) DN100 G100 available on request

Table 14: Frequencies and k-factors

Diameter [mm] [Inch]	**G-Rating**	**Max. frequency 1R1 (Reed) [Hz]**	**k-Factor 1R1 (Reed) [Imp/m³]**	**Max. frequency HF3 (NAMUR) *) [Hz]**	**k-Factor HF3 (NAMUR) *) [Imp/m³]**
DN 50 (2”)	G 25	0.11	10	4.17	375.00
	G 40	0.18	10	6.77	375.00
	G 65	0.28	10	10.42	375.00
	Max.	0.33	10	12.50	375.00
DN 80 (3”) **)	G 100	0.044	1	157.8	3551.0
	G 160	0.069	1	246.6	3551.0
	Max.	0.077	1	276.2	3551.0
DN 100 (4”) **)	G 160	0.069	1	149.6	2153.7
	G 250	0.11	1	239.3	2153.7
	Max.	0.13	1	287.2	2153.7

*) Nominal value; Final k-Factor will be determined during calibration
**) For the DN80 and DN100 versions of the OMEGA VI with only a Reed switch and at a flow ≤ 4 m³/h; the calibration time is more than the standard states.

Table 15: Diameter and flow rate combinations, start-up pressure difference

Nominal diameter	**G-rating**	**Qmax**	**Qmin** **-10 °C to +55 °C**	**Range** **-10 °C to +55 °C**	**Qmin** **-25 °C to +55 °C**	**Range** **-25 °C to +55 °C**	**Minimum start-up pressure difference**	**Minimum start-up flow**
[mm] [Inch]		**[m³/h]**	**[m³/h]**		**[m³/h]**		**[mbar]**	**[m³/h]**
DN 50 (2”)	G 25	40	0.80	1 : 50	2.00	1 : 20	0.02	0.1
	G 40	65	1.00	1 : 65	2.20	1 : 30	0.02	0.1
	G 65	100	1.00	1 : 100	1.50	1 : 65	0.02	0.1
	Max.	120	0.75	1 : 160	1.80	1 : 65	0.02	0.1
DN 80 (3”)	G 100	160	1.60	1 : 100	5,30	1 : 30	0.02	0.2
	G 160	250	1.60	1: 160	4	1 : 65	0.02	0.2
	Max.	280	1.40	1 : 200	4	1 : 70	0.02	0.2
DN 100 (4”)	G 160	250	2.50	1 : 100	8	1 : 30	0.02	0.25
	G 250	400	2.50	1 : 160	8	1 : 50	0.02	0.25
	Max.	480	2.40	1 : 200	8	1 : 60	0.02	0.25

Table 16: Gas velocity and pressure loss

Nominal diameter **[mm] [inch]**	**G-rating**	**Qmax** **[m³/h]**	**Gas velocity (pipeline Sch. 40)** **at Qmax [m/s]**	**Pressure loss *) at Qmax** **[mbar]**	**Pressure loss **) at Qmax** **[mbar]**
DN 50 (2“)	G 25	40	6.1	0.3	<0.2
	G 40	65	8.3	0.8	<0.5
	G 65	100	12.8	1.9	<1.2
	Max.	120	15.3	2.8	<1.8
DN 80 (3”)	G 100	160	8.3	1.8	<1.2
	G 160	250	13.0	4.4	<2.9
	Max.	280	14.5	5.5	<3.6
DN 100 (4”)	G 160	250	8.4	2.8	<1.8
	G 250	400	13.5	7.1	<4.6
	Max.	480	16.2	10.2	<6.6

*) with air at ambient pressure
**) with natural gas at 1 bar(a)

Figure 20: Dimensional drawing

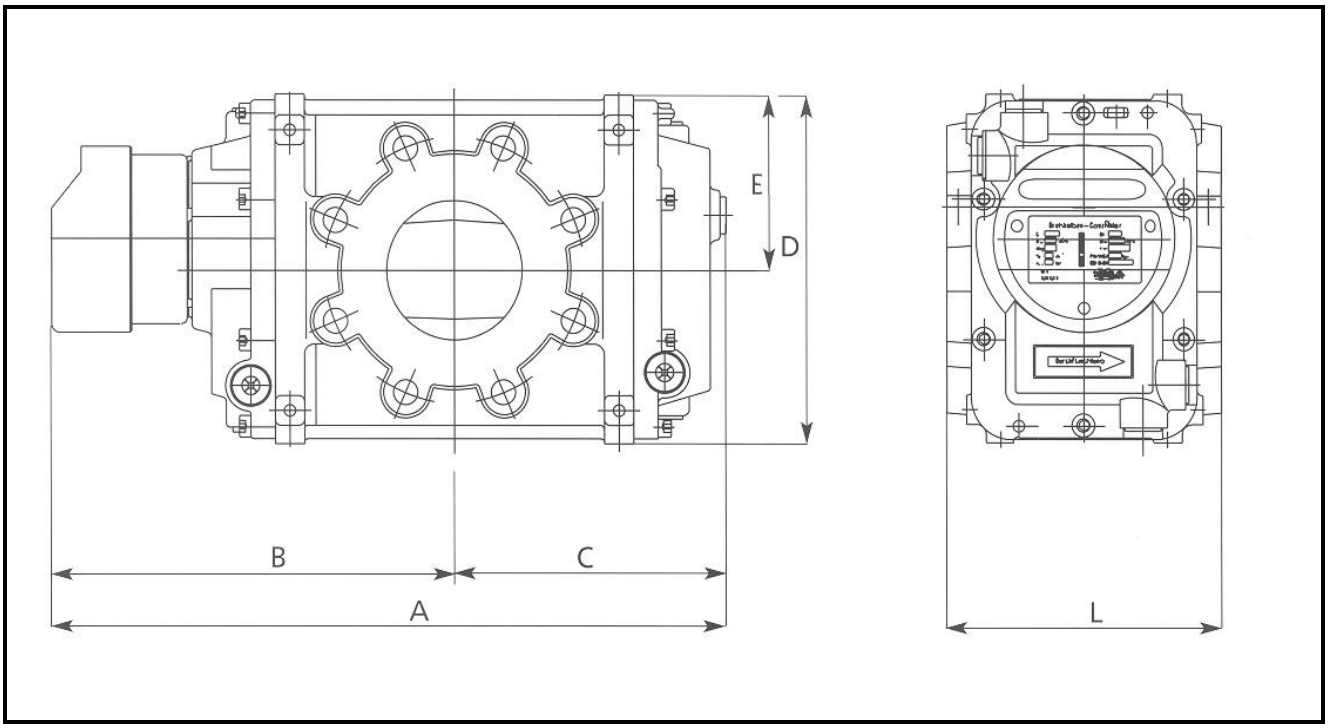


Table 17: Dimensions and weights

Nominal diameter	**Weight and dimensions**					
[mm] [Inch]	L Length between flanges [mm]	A Width [mm]	B Centre to top of index [mm]	D Height [mm]	E Top to centre [mm]	Weight [kg]
DN 50 (2”)	171	281	196	210	105	22
DN 80 (3”)	171	416	248	212	106	21
DN 100 (4”)	241	495	290	212	106	33

7 SAFETY INSTRUCTIONS AND WARNINGS

Please refer to section 2.2 for specific warnings in the EC Pressure Equipment Directive (2014/68/EU).

The meter supplied to you is a sensitive, high-quality metering instrument and for best performance should be handled with care. **The meter should only be lifted with straps or with lifting lugs. Never use the index (counter) head or the sensors as a handle bar or lifting handle.** Improper use may cause inaccurate measurements.

During storage as well as during transport, mounting, and operation, **the rotor axis must always be in horizontal position**. That means, the counter head must always be at the side, never at the top or at the bottom of the meter.

Lubrication of the meter may only be performed after the meter has been installed. **Before all transports and before any mounting position change – even if the meter is only moved a short way – the lubrication oil must be let off of both side casings**. Remaining oil might smear the rotors and thus negatively affect the meter's performance. **Oil must be removed or refilled, while the meter is depressurized and out of service. Lubricate your OMEGA VI before the first use.**

Your meter may be equipped with electronic sensors. The electrical circuits are designed to be intrinsically safe (after EN 60947-5/6 NAMUR). **For use with hazardous gas in potentially hazardous area never hook up the meter to non-intrinsically-safe circuits.** Refer to hook-up diagrams for all sensor types later in this section.

The meter must be installed level, and free of piping forces on the meter. Stress on the meter body may cause additional rotational friction for the free running rotors which may in turn affect the measurement range and accuracy. **Maximum torque for fixing the meter against the pipe flanges is 60 Nm.** IF there is piping induced tension, a stress compensator is required before or after the meter. **Use only studs and nuts appropriate for the application and pressure class of the meter. Use new and correct size non-brittle gaskets only.** Ensure that flange faces are free from dirt and sharp metal filings. **Take care that no particles can enter the meter.** Gaskets should not protrude into the piping. The piping must be **free of all dirt**, welding beats, oil and other liquids.

Do not hydro test the meter. This was done before assembly in the factory. Water or any other liquid media will damage the meter.

Before disassembly of the meter, please observe the following rules:

- **For safety reasons NEVER disassemble a gas meter under pressure.**
- **Do not remove or break any of the lead seals** on a custody transfer meter, because in most countries the legal status of the meter for custody transfer measurement will become invalid. The meter must be re-calibrated at an approved test facility to regain legal status. The warranty as mentioned in the first part of this manual is only applicable if all of the lead seals are undamaged and in place with the original seal stamp.
- If you replace critical internal parts (rotor, bearings, gears or complete internal components) **the meter should be recalibrated at a flow test facility** for the best accuracy. If the meter is to be used in a custody transfer application, the flow laboratory must be approved for custody transfer calibration.

Slowly and carefully fill your gas pipeline and meter-run. **Always fill** the meter pipeline section **from the upstream side** of your OMEGA VI. Reverse flow and/or over load may damage the meter. Rapid gas expansion and overflow causes temperature extremes. Initial flow may cause collected dust and particles to travel and damage your meter. To **empty** a gas filled metering section, a vent **downstream** of the meter should be used, to avoid reverse flow through your OMEGA VI.

Please report any problems to the manufacturer.

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Internet: http://www.vemmtec.com

Changes in course of technical development are reserved.
(301-002-005)