Evaluation Certificate No 511-02080-02

Applicant:	**Endress+Hauser Flowtec AG** Kägenstrasse 7 4153 Reinach BL Schweiz
Requirements:	Dynamic measuring systems for liquids other than water - Part 1: Metrological and technical requirements OIML R 117-1:2007 WELMEC Guide 8.8 “General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments” Issue 2
Type of instrument:	**Coriolis flow meter**
Type designation:	**LPGmass**
Accuracy class:	1.0, 0.5, 0.3 (OIML R 117)
Characteristics:	Max. flow rate Q_{max}: ..... 30.0 l/min … 1200 l/min Min. flow rate Q_{min}: ..... 1.5 l/min … 60 l/min Pressure range: ..... 0.1 mbar … 100 bar Nominal diameter: ..... DN 8 ... DN 50 Liquid temperature: ..... -40 °C … +55 °C Ambient temperature: ..... -40 °C ... +55 °C Environmental class: M3, E2, H3
Certificate valid until:	1 August 2026
Certification body:	Conformity Evaluation Body METAS-Cert

3003 Bern-Wabern, 31 January 2018

Gulian Couvreur, Head METAS-Cert

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1 Name and type of instrument

Coriolis flow meter for the measurement of liquefied petroleum gas and oil products.
Type designation: LPGmass

2 Type description

The measuring principle is based on the Coriolis force and allows direct mass measurement of flowing fluids and density measurement of the fluid to convert the measured quantity into volume.

2.1 Construction

LPGmass is only available in a compact design, where the sensor and the electronics form one unit (Figure 1).

2.2 Measurement unit

The family of flow meters covers the nominal diameters of DN 8, DN 15, DN 25, DN 40 and DN 50, which covers the flow rate range from 1.5 l/min to 1200 l/min. The sensor housing and the measuring tube are made of stainless steel.

2.3 Indicating devices

The transmitter has no display as the flow meter is part of a measuring system that converts the output signal in mass, mass flow rate, volume, volume flow rate or volume at base conditions. The output signal is Modbus (the measured mass flow, totalized mass, volume flow, totalized volume or totalized volume at base conditions).

2.4 Measurement value processing

The flow of mass is measured directly from the phase shift of the inlet and the outlet of the tube as they oscillate in different direction at the same time due to the Coriolis force. Moreover, the oscillation frequency is a direct measure of the fluid density. Both the mass flow and the density are measured simultaneously and the volume flow can be determined by dividing mass flow with density.

2.5 Software / Firmware

The approved software version and the corresponding checksums are:

Type	FW-Number	Checksum	Validity	Revision certificate[1]
LPGmass	V01.03.01	0xF41E4DB9	Yes	00
LPGmass	V01.03.02	0x54AE3887	Yes	00
LPGmass	V01.03.03	0x87DFCB30	Yes	02

Software has a version number “Vxx.yy.zz”:

- xx: Main index
- yy: Sub index, changes if software function changes
- zz: Bug fix index

[1] Revision number of the evaluation certificate

The checksum is a fixed constant (not writeable) string in the software. Besides software version number there is a unique CRC32 checksum which is calculated over the whole machine code. It is a fixed part of the hex code in the serial flash memory. Every time the flowmeter is started the CRC32 checksum is calculated and compared with the reference. Also it is periodically calculated and compared during operation. The Software version and CRC32 checksum are readable string parameters via Modbus as shown in the following table:

Parameter	Register
Software version	7277
CRC 32 checksum	20386

2.6 Optional equipment and functions subjected to OIML requirements

N/a

3 Technical data

3.1 Rated operating conditions

Accuracy Class	1.0, 0.5, 0.3
Ambient temperature	-40 °C … 55 °C
Liquid temperature	-40 °C … 55 °C
Liquid pressure	0.1 mbar … 100 bar
Environmental class	M3, E2, H3
Installation conditions	U0 / D0
Liquid density	400 kg/m^3 … 1400 kg/m^3

3.2 Technical data

Accuracy class 1.0 for LPG

Nominal Diameter Threaded connector		DN08 3/8”	DN15 1/2”	DN25 1”	DN40 1 1/2”	DN50 2”
Q_{max}	l/min	36	135	360	880	1200
Q_{min}	l/min	0.8	1.5	3	8	10
Minimum measured quantity	l	2	5	20	50	80

Accuracy class 0.5 for oil and oil products

Nominal Diameter Threaded connector		DN08 3/8”	DN15 1/2”	DN25 1”	DN40 1 1/2”	DN50 2”
Q_{max}	l/min	36	135	360	880	1200

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Q_{min}	l/min	2	3	6	20	60
Minimum measured quantity	l	2	5	20	50	80

Accuracy class 0.3 for oil and oil products

Nominal Diameter Threaded connector		DN08 3/8”	DN15 1/2”	DN25 1”	DN40 1 1/2”	DN50 2”
Q_{max}	l/min	36	135	360	880	1200
Q_{min}	l/min	2.4	9	12	22	60
Minimum measured quantity	l	2	5	20	50	80

Mass flow rate

The minimum and maximum mass flow rate is equal to the volume flow rates multiplied with the density of the liquid. The MMQ on mass is equal to the MMQ on volume multiplied with the density of the liquid.

Volume at base conditions

The LPGmass is equipped with an internal temperature sensor. The volume measured at metering conditions can be converted into the volume at base conditions.

3.3 Technical documents

All of the documents and drawings used for the conformity assessment have been submitted to METAS-Cert and are listed in the document named *511-02080_CH_ENDRESS_HAUSER_FLOWTEC_Doc_List_TEC.docx*.

4 Equipment and functions not subjected to OIML requirements

Ex i barrier

LPGmass consists of the Ex i barrier and the meter itself. The connection between the Ex i barrier and the meter itself is an internal interface. This interface is not accessible for an end user. LPGmass must be used together with the Ex i Barrier

5 Conditions for the market introduction

The flow meter shall be clearly and indelibly marked with the following information:

- Brand or name of the manufacturer
- Year of manufacture, serial number
- Evaluation certificate number (511-02080)
- Minimum measured quantity, MMQ

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6 Requirements for manufacturing, putting into use and utilisation

6.1 Requirements for the manufacturing

For LPG applications the metrological examination must be performed using a traceable volume, a mass reference or a master meter and can be based on a water calibration.

The tested flow rates have to cover the flow rate range requested by the measuring system for the intended application.

This procedure is justified because of the fact that tests have proven that the volume accuracy of water is representative for volume accuracy on LPG.

For other oil products, the metrological examination must be performed by using a traceable standard at conditions which are close as possible to the target application.
The tested flow rates have to cover the flow rate range requested by the measuring system for the intended application.

6.1.1 Information accompanying the meter

The manufacturer undertakes to provide information and instructions for use (operating instructions) with the devices placed on the market as this allows the users to connect the measurement device safely and according to the intended purpose.

6.2 Requirements for the putting into use

See the assembly and operating instructions

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6.3 User instructions

See the assembly and operating instructions.

7 Control of devices in operation

7.1 Test documents

See the assembly and operating instructions

7.2 Testing equipment

The metrological examination must be performed using a traceable volume, a mass reference or a master meter. The used test equipment must cover the flow rates mentioned in chapter 6.1.

7.3 Identification

The type designation should be taken from the type plate.

7.4 Metrological test

The metrological tests must be carried out according to national applicable regulations.

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8 Security measures

8.1 Securing the meter casing

The cover of the electronics housing is secured with a bracket on the electronics housing. The threaded pin has a hole to receive a wire, which is passed through the grommet in the housing and fixed with a seal as shown in Figure 3.

Activation of the custody transfer mode

To activate custody transfer mode the instrument cover must be removed and the switch “Write protection” turned on. To the deactivate custody transfer mode switch it off again. Activation and de-activation of the custody transfer mode is stored in the internal log book (Figure 2).

9 Certificate history

Version	Date	Description
511-02080	2 August 2016	Intitial Evalutation Certificate
511-02080-01	18 August 2017	Increased the mechanical resistance class to M3
511-02080-02	31 January 2018	New FW Version 01.03.03

10 Pictures and drawings

Figure 1 – Flow meter type LPGmass

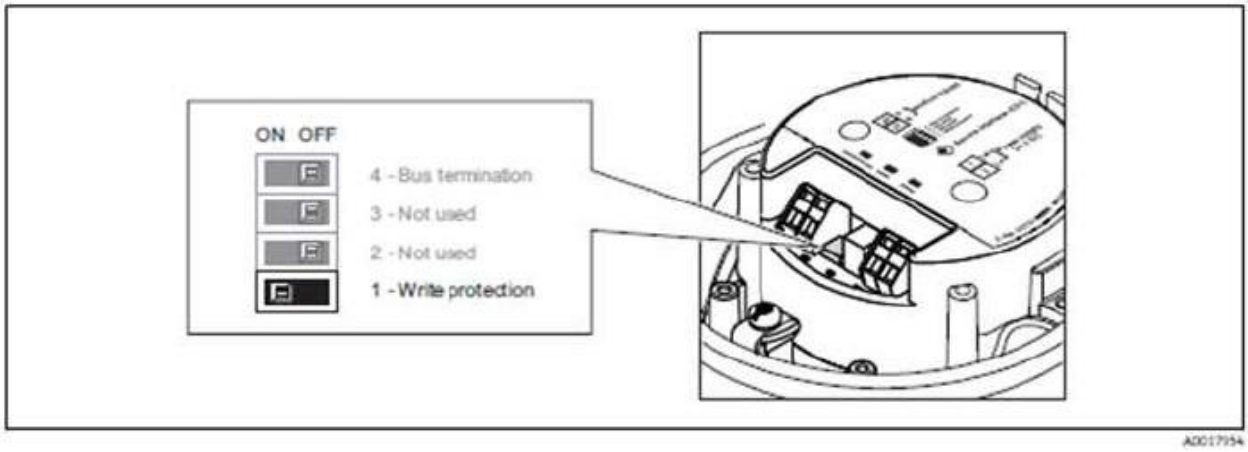

Figure 2 – Activation of custody transfer mode

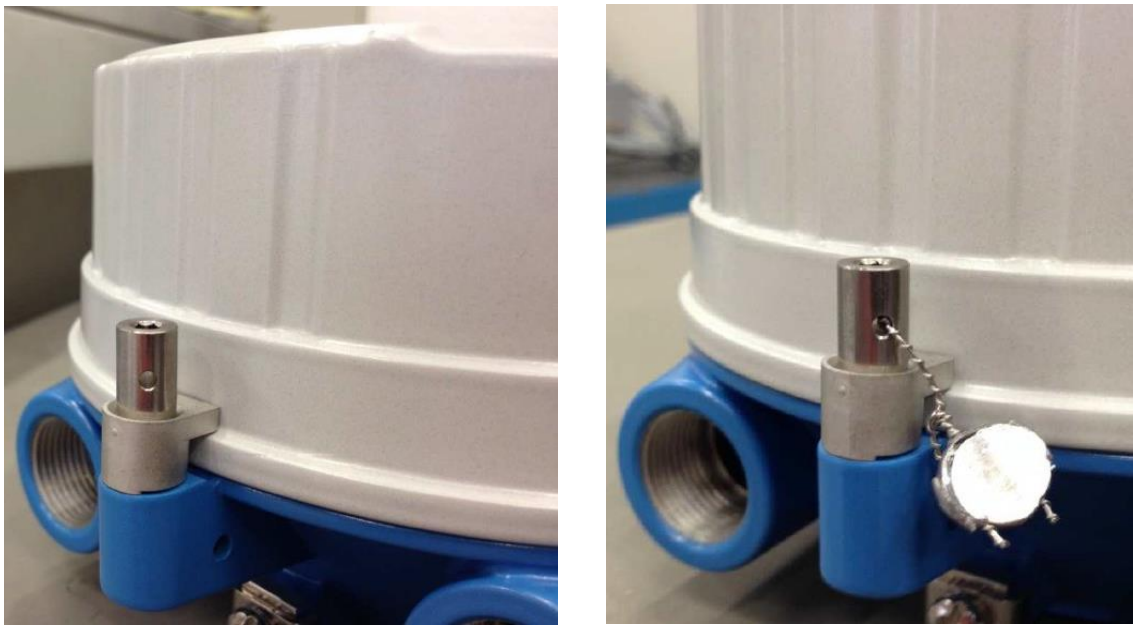

Figure 3 – Sealing of the cover of the electronics housing

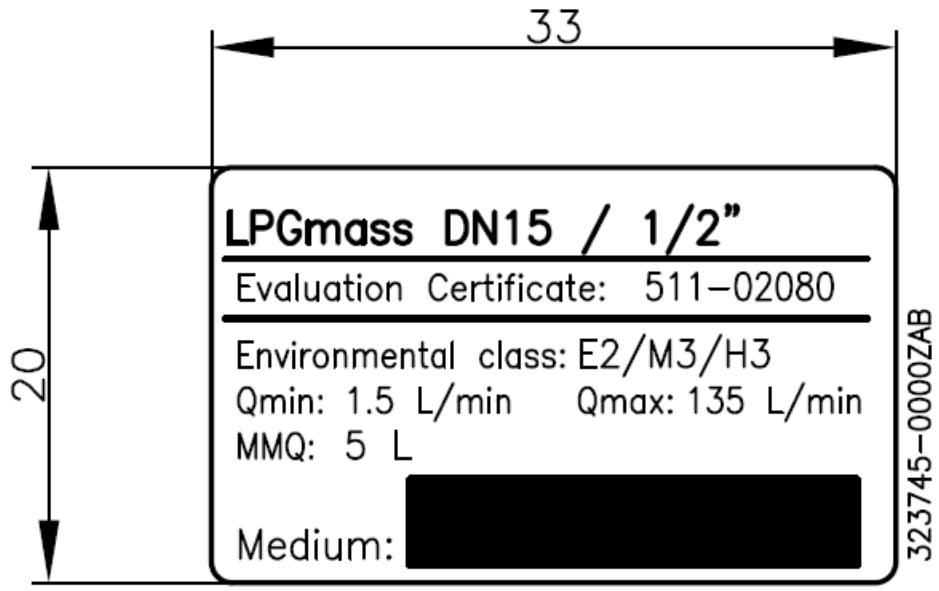

Figure 4 – Example of the markings