OIML Certificate

OIML Member State
The Netherlands

Number R137/2012-B-NL1-19.02
Project number 1902506

Issuing authority	NMi Certin B.V. Person responsible: C. Oosterman
Applicant and Manufacturer	Cameron 1000 McClaren Woods Drive, Coraopolis PA 15108, Pennsylvania United States of America
Identification of the certified type	A **Ultrasonic gas meter** Type: Caldon LEFM 38xCi [1] Caldon LEFM 34xCi [2]
Characteristics	See page 2 and further

This OIML Certificate is issued under scheme B

This Certificate attests the conformity of the above identified type (represented by the sample(s) identified in the OIML Type Evaluation Report) with the requirements of the following Recommendation of the International Organization of Legal Metrology (OIML):

R 137-1 (2012) "Gas meters"

Accuracy class 0.5[1] ; 1.0 [2]

This Certificate relates only to the metrological and technical characteristics of the type of measuring instrument covered by the relevant OIML International Recommendation identified above. This Certificate does not bestow any form of legal international approval.

Important note: Apart from the mention of the Certificate's reference number and the name of the OIML Member State in which the Certificate was issued, partial quotation of the Certificate and of the associated OIML Type Evaluation Report(s) is not permitted, although either may be reproduced in full.

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[1] LEFM 38xCi meter approved for accuracy class 0.5
[2] LEFM 34xCi meter approved for accuracy class 1.0

Issuing Authority **NMi Certin B.V., OIML Issuing Authority NL1**
29 April 2019

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OIML Certification System

INSPECTION RvA I 122

The conformity was established by the results of tests and examinations provided in the associated report(s):

- No. NMi-12200428-01 dated 15 January 2014 that includes 40 pages;
- No. NMi-12200428-02 dated 16 January 2014 that includes 8 pages;
- No. NMi-14200132-01 dated 30 September 2015 that includes 30 pages;
- No. NMi-1902506-01 dated 29 April 2019 that includes 18 pages.

Characteristics of the measuring instrument
In Table 1 the general characteristics of the measuring instrument are presented.

Table 1 General characteristics

Diameter size			Minimum v_{min} [m/s]	Minimum v_t [m/s]	Maximum v_{max} [m/s]
Inch	DN	Typical ranges [mm]			
4[3]	100	80 ~ 110	0,30	3,05	36,6
6	150	124 ~ 163			
8	200	173 ~ 214			
10	250	215 ~ 267			
12	300	257 ~ 316		1,5	
14	350	284 ~ 348			
16	400	325 ~ 398			
18	450	366 ~ 449			
20	500	408 ~ 499			
22	550	450 ~ 550			
24	600	490 ~ 599			
26	650	635 ~ 645			
28	700	679 ~ 696			
30	750	730 ~750			
32	800	777 ~ 797			
34	850	801 ~ 851			
36	900	851 ~ 901			
38	950	902 ~ 949			
40	1000	953 ~ 1000			
42	1050	1004 ~ 1045			

The corresponding flow rates can be calculated as follows:

$$Q = v \cdot \frac{1}{4} \cdot \pi \cdot D^2 \cdot 3600$$

Where:
Q = flow rate [m³/h]

[3] Only applicable for the LEFM 38xCi meter and not for the LEFM 34xCi.

v = velocity [m/s]
D = diameter [m]

1.1.1 Measuring principle
In document 10504/0-06, the measuring principle is described.

1.1.2 Bi-directional flow
All sensors can be used to measure flow in forward and reverse directions. For use in a bi-directional application, the meter has to be calibrated in both directions. See also the conditions as stated in chapter 3.

1.1.3 Operating pressure range
The spool piece and the transducers may be used at an absolute pressure from 8 bar up to 255 bar. For this pressure range the flow characteristics as mentioned in section 1.2.1 are applicable.

1.1.4 RTD input
The measured temperature can be used for correction of the thermal expansion of the meter body.

1.1.5 Software specification (refer to WELMEC 7.2):

- Software type P;
- Risk Class C;
- Extensions S, L, D and T are not applicable.

Software version	Checksum	Release date
G2 electronics		
101A960 03.01.02	FCEE	January 29, 2014
101A960 03.01.03	185E	March 17, 2014
101A960 04.01.01	13F8	October 14, 2014
G3 electronics		
SW00062 01.01.01	E4781D8F	April 30, 2015
SW00070 01.02.01	E2E72794	September 3, 2015
SW00082 01.01.03	48CDDFA8	February 22, 2016
SW000082 01.01.04	106F0E18	June 14, 2016

Software version	Checksum	Release date
SW000082 01.01.05	C92E28DF	June 27, 2016
SW000082 01.01.06	881927E2	August 8, 2016
SW000082 01.01.07	2CF3D2F1	December 19, 2016
SW000082 01.01.08	669F8ED9	January 11, 2017
SW000082 01.01.10	AB14ADF4	January 23, 2017
SW000082 01.01.11	21AB2489	November 2, 2017
SW000082 01.01.12	674D72F2	February 6, 2018

The software version and checksum can be readout via Modbus or on the display after (re)powering the meter.

1.1.6 Gas meter configuration

LEFM 34xCi
The LEFM 340Ci exists in the following possible configurations: (see also document 10504/3-01).

LEFM 340Ci
Four measurement paths in one plane

LEFM 341Ci/342Ci/343Ci
With additional check or diagnostic path(s): four measurement paths in one plane with an additional horizontal check path and/or vertical diagnostic path

LEFM 344Ci
Two four-path meters in one body used either as two separate gas meters or in a pay or check arrangement; each meter has all four paths in one vertical plane.
Each electronic head provides measurement and diagnostic data from the associated four paths and has insignificant influence on the performance of other meter. See document number 10504/6-01.

LEFM 38xCi
Eight-path meter is equipped with eight measuring paths in a horizontal configuration. (see also document 10504/0-06). One long path and/or one short path may fail and the meter still meets the requirements for custody transfer.

LEFM 388Ci (dual 8-path)
Two eight-path meters in one body used either as two separate gas meter set in custody transfer or in a pay and check arrangement. Each meter is equipped with eight measuring paths in a horizontal configuration. Each electronic head provides measurement and

diagnostic data from the associated eight paths and has insignificant influence on the performance of the meter. See also document 10504/6-02. For either eight-path meter one long path and/or one short path may fail, and the meter still meets the requirements for custody transfer.

1.1.7 Operation and presentation of legal data
The meter is standard equipped with an electronic display (see also paragraph 1.5.1 of this description). The operation is further described in document 10504/0-07 for the G2 electronics and document no. 10504/2-06 for the G3 electronics.

Diagnostic data describing proper functioning of the meter can be viewed through modbus.

1.1.8 Totalizers and (optional) bi-directional flow measurement
The meter is equipped with totalizers which indicate the flow in forward and (optional) reverse direction.
These totalizers indicate the volume with 9 integers.
On the meter an arrow indicates the positive and negative direction of flow.

Accountable alarms
If malfunctions are detected a visible alarm will be performed which remains present until the alarm is acknowledged and the cause of the alarm is suppressed.

General information concerning the installation of the gas meter.

Measuring installations using the LEFM 3xxCi shall have straight pipe sections both upstream and downstream of the meter. The internal diameter of the pipe sections must be the same as the inlet and outlet diameter of the meter. The pipe sections shall be considered identical if their diameters differ by no more than 3 %. For unidirectional flow, the thermowell should be installed downstream of the meter. The distance from the downstream flange face to the thermowell should be between 2 and 5 internal diameters. For bi-directional flow installations, thermowells should be located at between 3 and 5 diameters from the flange of the meter.

<u>LEFM 34xCi</u>

Inlet piping configuration no. 1: 10D

Measuring installations using the LEFM 34xCi with 10 diameters or more of straight pipe upstream (without a flow conditioner) and 3 diameters downstream are suitable for piping arrangements that cause only mild disturbances. Examples of permitted pipe arrangements upstream of the 10 diameters are bends, tees, reducers and expanders, including single bends and out-of-plane combinations.

Inlet piping configuration no. 2: 15D inclusive of a flow conditioner

Measuring installations using the LEFM 34xCi with 15 diameters or more of straight pipe upstream inclusive of a flow conditioner (see document 10504/0-09) with its inlet located 10 diameters from the meter, and with 3 diameters downstream are suitable for piping arrangements that cause severe disturbances including combinations of out-of-plane bends in combination with partial blockage of

the pipe. An example of a severe disturbance would be a 50 % open gate valve installed between out-of-plane bends.

LEFM 38xCi

Inlet piping configuration no. 1: 5D

Measuring installations using the LEFM 38xCi with 5 diameters or more of straight pipe upstream (without a flow conditioner) and 3 diameters downstream are suitable for piping arrangements that cause only mild disturbances excluding expanders where the upstream pipe is smaller than the meter diameter. Examples of permitted pipe arrangements upstream of the 5 diameters are bends, tees and reducers, including single bends and out-of-plane combinations.

Inlet piping configuration no. 2: 10D

Measuring installations using the LEFM 380Ci with 10 diameters or more of straight pipe upstream (without a flow conditioner) and 3 diameters downstream are suitable for piping arrangements that cause only mild disturbances including expanders where the upstream pipe is smaller than the meter diameter. Examples of permitted pipe arrangements upstream of the 10 diameters are bends, tees, reducers and expanders, including single bends and out-of-plane combinations.

Inlet piping configuration no. 3: 15D

Measuring installations using the LEFM 380Ci with 15 diameters or more of straight pipe upstream (without a flow conditioner) and 3 diameters downstream are suitable for piping arrangements that cause severe disturbances including combinations of out-of-plane bends in combination with partial blockage of the pipe. An example of a severe disturbance would be a 50 % open gate valve installed between out-of-plane bends.

Inlet piping configuration no. 4: 15D inclusive of a flow conditioner

Measuring installations using the LEFM 380Ci with 15 diameters or more of straight pipe upstream inclusive of a flow conditioner (see document 10504/0-09) with its inlet located 10 diameters from the meter, and with 3 diameters downstream are suitable for piping arrangements that cause severe disturbances including combinations of out-of-plane bends in combination with partial blockage of the pipe. An example of a severe disturbance would be a 50 % open gate valve installed between out-of-plane bends.

Replacement of transducers and electronics

The ultrasonic transducers and the electronics can be replaced with units of the same type – see section 1.1 – and the meter still meets the requirements without the need for recalibration. After exchange of a part of the system, a diagnostic check shall be carried out. After exchange of an electronic board all parameters of the old electronics board need to be transferred to the replacement CPU board.