Australian Government
Department of Industry, Science and Resources

National Measurement Institute

36 Bradfield Road, West Lindfield NSW 2070

Certificate of Approval

NMI 5/6B/226

Issued by the Chief Metrologist under Regulation 60
of the
National Measurement Regulations 1999

This is to certify that an approval for use for trade has been granted in respect of the instruments herein described.

Endress+Hauser Model Promass 300 Mass Bulk Flowmetering System

Submitted by Endress & Hauser Australia Pty Limited
Level 1, 16 Giffnock Avenue
Macquarie Park, NSW 2113
Australia

NOTE: This Certificate relates to the suitability of the pattern of the instrument for use for trade only in respect of its metrological characteristics. This Certificate does not constitute or imply any guarantee of compliance by the manufacturer or any other person with any requirements regarding safety.

This approval has been granted with reference to document NMI R 117 *Measuring Systems for Liquids Other than Water*, dated June 2011.

This approval is subject to review at the decision of the Chief Metrologist in accordance with the conditions specified in the document NMI P 106.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern & variant 1 approved – interim certificate issued	27/07/18
1	Pattern amended (level indicating device) – Variant 2 provisionally approved – interim certificate issued	10/09/18
2	Pattern and variant 1 approved – certificate issued	04/07/19
3	Pattern amended – Variant 3 provisionally approved – interim certificate issued	09/04/20

Document History (cont…)

Rev	Reason/Details	Date
4	Variant 2 amended (verification validity date) – Variant 3 approved – certificate issued	14/07/21
5	Pattern and Variant 3 amended (Density range) – certificate issued	13/11/23

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI 5/6B/226' and only by persons authorised by the submittor.

It is the submittor's responsibility to ensure that all instruments marked with this approval number are constructed as described in the documentation lodged with the National Measurement Institute (NMI) and with the relevant Certificate of Approval and Technical Schedule. Failure to comply with this Condition may attract penalties under Section 19B of the National Measurement Act and may result in cancellation or withdrawal of the approval, in accordance with document NMI P 106.

Special Conditions of Approval: (Provisional Approval Variant 2)

VARIANT 2 VALID FOR VERIFICATION PURPOSES UNTIL 1 AUGUST 2022

This approval is limited to five (5) sites only, the locations of which may be obtained from the National Measurement Institute. The submittor shall advise NMI in writing of the proposed location or serial number of each instrument prior to it being initially verified.

Instruments purporting to comply with Variant 2 of this approval shall be marked with approval number 'NMI P5/6B/226' and only by persons authorised by the submittor. (Note: The 'P' in the approval number may be a temporary marking.)

The approval will remain provisional pending completion of satisfactory testing and evaluation.

The submittor shall provide the NMI Pattern Approval Laboratory with copies of test results from the initial verification.

In the event of unsatisfactory performance the approval may be cancelled (or altered).

The submittor shall implement such modifications as required by NMI. In the event that such modifications (if any are required by NMI) are not made to the satisfaction of NMI, this approval may be withdrawn.

Signed by a person authorised by the Chief Metrologist to exercise their powers under Regulation 60 of the *National Measurement Regulations 1999*.

Darryl Hines
Manager
Policy and Regulatory Services

TECHNICAL SCHEDULE No 5/6B/226

1. Description of Pattern

approved on 27/07/18
amended on 13/11/23

An Endress+Hauser model Promass 300 mass bulk flowmetering system (Figure1) using any model of the Endress+Hauser Promass F, Promass O or Promass Q series of Coriolis type flow sensors (Figure 2) for bulk metering of liquids other than LPG, listed in Table 1 – Accuracy Class and Table 2 below for bulk metering of liquids other than LPG.

Table 1 – Accuracy Class

	Maximum pressure (MPa)	Oil and oil products, chemicals and potable liquids other than water Accuracy Class 0.3	Oil and oil products, chemicals and potable liquids other than water Accuracy Class 0.5
Product temperature range (^{0}C)		-10 / 90	
Promass F sensors	10	**M D V**	**M D V**
Promass O sensors	25.8	**M D V**	**M D V**
Promass Q sensors	10	**M D V**	**M D V**

Indicates approved measurements: M for Mass, D for Density, V for Volume.

Table 2
Minimum (Q_{min}) and Maximum flowrates (Q_{max}) and Minimum Measured Quantity (MMQ)

Promass F sensors	**DN8**	**DN 15**	**DN25**	**DN40**	**DN50**	**DN80**
Qmax (kg/min)	30	100	300	700	1000	3000
Qmin (kg/min)	1.5	5	15	37.5	58.3	150
MMQ sensor (kg)	2	5	20	20	20	200

	DN100	**DN150**				
Qmax (t/h)	270	720				
Qmin (t/h)	14	32				
MMQ sensor (kg)	200	500				

Promass O sensors	**DN8**	**DN 15**	**DN25**	**DN40**	**DN50**	**DN80**
Qmax (kg/min)	30	100	300	700	1000	3000
Qmin (kg/min)	1.5	5	15	37.5	58.3	150
MMQ sensor (kg)	2	5	20	20	20	200

	DN100	**DN150**				

Qmax (t/h)	270	720				
Qmin (t/h)	14	32				
MMQ sensor (kg)	200	500				

Promass Q sensors	**DN25**	**DN50**	**DN80**	**DN100**		
Qmax (t/h)	20	80	200	400		
Qmin (t/h)	0.45	2	6	14		
MMQ sensor (kg)	10	20	100	200		

1.1 Field of Operation

The field of operation of the measuring system is determined by the following characteristics:

- Minimum measured quantity, V_{min} or M_{min} (*) see table 2
- Maximum flow rate, Q_{max} see table 2
- Minimum flow rate, Q_{min} see table 2
- Maximum pressure of the liquid, P_{max} 10 000 kPa
- Density range 400 to 2000 kg/m³
- Ambient temperature range -40 to 55°C
- Liquid temperature range -10 to 90°C
- Accuracy class see table 1
- Power supply range 19.2 to 28.8 V DC
  100 to 264 V AC

(*) For minimum measured quantities (V_{min} or M_{min}) less than or equal to 200 kg, the scale interval of the calculator/indicator is 0.1 kg; for deliveries greater than 200 kg the scale interval is 1 kg.

1.2 Components of Measuring System

(i) Supply Tank

To ensure air does not enter the pipework, the supply tank incorporates an Endress+Hauser model Vibronic point level detection Liquiphant FTL50 level indicating device (Figure 3) or equivalent (**) for detecting low liquid level. The device must be positioned in the tank in a manner that the level of liquid detected will not be affected if the supply tank is positioned on an incline.

(**) 'Equivalent' is defined to mean other proprietary equipment of the same or better specifications requiring no changes to the software specified in this approval for satisfactory operation of the system.

(ii) Pump

A positive displacement, centrifugal or submersible turbine type pump may be used to provide flow through one or more flowmeters. The pump is fitted in a positive suction head (flooded suction) installation, i.e. below the liquid level in the supply tank.

For all combination of usage, the pump(s) shall be of sufficient capacity to ensure that each flowmeter can operate within its approved flow rate range.

(iii) Non-return Valve

A non-return valve between the pump and the flowmeter to prevent the reverse flow of the liquid, or an arrangement of the components and piping to keep the system (up to the transfer point) full of liquid at all times.

(iv) Gas Elimination Device

A gas elimination device need not be fitted as the flow metering system is designed to keep the pipework full of liquid at all times, and on the occasion that small amounts of vapour may form in the pipework, the mass of this vapour will be insignificant compared to the mass of liquid.

(v) Measurement Transducer

The measurement transducer of the pattern comprises an Endress+Hauser Promass F, Promass O or Promass Q series of flow sensors interfaced to an Endress+Hauser model Promass 300 microprocessor-based transmitter designed to provide pulse output signal proportional to the mass throughput. The transmitter is connected to an AC or DC power supply. The transmitter may be fitted with a liquid crystal display however this display is not approved for trade use.

The Promass 300 transmitter is mounted on top of the measurement sensor and may be optionally equipped with a remote display.

The Promass flow sensor may be used for measuring mass, volume and density. The minimum and maximum volumetric flow rate is derived from the mass flow rates divided by the density of the liquid. The V_{min} is equal to the M_{min} divided by the density.

The volume and density outputs for the Promass Q series flow sensors can be applied for trade measurement purposes.

The volume and density outputs for the Promass F, Promass O or Promass X series flow sensors can be applied for trade measurement purposes if at least one of the following two conditions is met:

1. A special density calibration, prior to installation in the field, has been performed.

2. A standard density calibration followed by a density calibration in the field on the liquid to be measured, has been performed.

The Promass 300 transmitter may have the following output options:

- single or double pulse, 90 degree or 180 degree phase shifted pulse-output for the transmission of volume or mass information;
- 4-20 mA output for the transmission of density (can also be used for input/output via HART protocol;
- status input or output; or
- MODbus 485 serial protocol.

The Promass flow sensor may be used for bi-directional measurements when delivering quantities greater than V_{min} or M_{min}.

For verification purposes, provision is made for inserting a thermometer and connecting a pressure gauge to measure the temperature and pressure of the liquid at the flowmeter.

(vi) Controller/Indicator

An ISOIL model VEGA II or model VEGA T calculator/indicator (Figure 4) or other compatible (#) NMI-approved calculator/indicator interfaced to the Promass 300 flow transmitter and configured to provide a signal output proportional to mass flow/volume throughput at observed temperature, or volume throughput referenced to 15ºC. The models VEGA II and VEGA T are described in the documentation of approval NMI 10/2/18.

(#) 'Compatible' is defined to mean that no additions/changes to hardware/software are required for satisfactory operation of the complete system.

(vii) Transfer Device

A transfer device, which defines the start and stop of the quantity measured, is installed downstream of the mass flowmeter. The transfer device is in the form of a positive shut-off component such as a manually or automatically-operated shut-off valve.

The transfer device may also be designed to control the flow rate within the specified flow rate range of the flowmeter.

1.3 Volume Conversion for Temperature

The system has the possibility to calculate the density and volume under reference conditions as specified in API Manual of Petroleum Measurement Standards, Chapter 11, Physical Properties Data, Section 1 and 2(2007) (also known as ASTM D1250-07). The following conversion methods are possible:

- API table 53/54A, 53/54B, 53/54C, 53/54D and 53/54E (15 °C reference temperature)

Note: the liquid temperature and, if needed, pressure have to be measured with external sensors. It is not allowed to use the temperature probe of the connected measurement sensor.

1.4 Verification Provision

Provision is made for the application of a verification mark.

1.5 Sealing Provision

Provision is made for sealing the cover of the transmitter (Figure 5) which contains the calibration functions of the instrument.

1.6 Markings and Notices

Each measuring system shall bear the following information, placed together either on the indicating device or on a data plate:

Manufacturer's identification mark or trade mark	…..
Meter model	…..
Serial number of the instrument	…..
Pattern approval mark	NMI 5/6B/226
Year of manufacture	…..
Maximum flow rate, Q_{max}	….. kg/min
Minimum flow rate, Q_{min}	….. kg/min
Maximum pressure of the liquid, P_{max}	….. kPa
Type of the liquid for which the system is verified	..... (##)
Environmental class	class C or I

(##) This may be located separately, e.g. on a metal tag sealed to the instrument.

The minimum measured quantity (V_{min} or M_{min}) is clearly visible on the indicating device, e.g. 'Minimum Delivery 200 kg', or alternatively the controller/indicator is programmed for deliveries equal to or greater than the stated minimum delivery.

2. Description of Variant 1 approved on 27/07/18

An Endress+Hauser model Promass 500 mass bulk flowmetering system (Figure 6). The system is similar to the pattern but with the flow sensor interfaced to a Promass 500 transmitter.

The Promass 500 transmitter is similar to the Promass 300 transmitter of the pattern but is mounted remotely from the measurement sensor with two possibilities.

(i) An analog version where the amplifier board is mounted inside the transmitter. The cable between the sensor and transmitter carries analogue signals.

(ii) A digital version where the amplifier board is mounted on top of the measurement sensor. The cable between the transmitter and amplifier board carries digital communication signals.

3. Description of Variant 2 provisional approved on 10/09/18

With the measurement transducers of the pattern using Endress+Hauser model Promass F and Promass X sensors (Figure 7) given in table 3 and 4 below.

Table 3 – Accuracy Class

	Maximum pressure (MPa)	Oil and oil products, chemicals and potable liquids other than water Accuracy Class 0.3	Oil and oil products, chemicals and potable liquids other than water Accuracy Class 0.5
Product temperature range (^{0}C)		-10 / 90	
Promass F sensors	10	**M D V**	**M D V**
Promass X sensors	10	**M D V**	**M D V**

Indicates approved measurements: M for Mass, D for Density, V for Volume.

Table 4
Minimum (Q_{min}) and Maximum flowrates (Q_{max}) and Minimum Measured Quantity (MMQ)

Promass F sensors	**DN250**
Qmax (t/h)	2200
Qmin (t/h)	90
MMQ sensor (kg)	1000

Promass X sensors	**DN350**
Qmax (t/h)	3500
Qmin (t/g)	137
MMQ sensor (kg)	1000

4. Description of Variant 3 provisionally approved on 09/04/20 approved on 14/07/21

Using Endress+Hauser model Promass F and Promass Q series flow sensors with the following Field of Operation:

4.1 Field of Operation

The field of operation of the measuring system is determined by the following characteristics:

- Minimum measured quantity, V_{min} or M_{min} (*) see table 2
- Maximum flow rate, Q_{max} see table 2
- Minimum flow rate, Q_{min} see table 2
- Maximum pressure of the liquid, P_{max} 10 000 kPa
- Density range 900 to 2000 kg/m^3
- Ambient temperature range -40 to 55°C
- Liquid temperature range -50 to 250°C (F Series)
- Liquid temperature range -50 to 205°C (Q Series)
- Accuracy class Class 1.0

TEST PROCEDURE

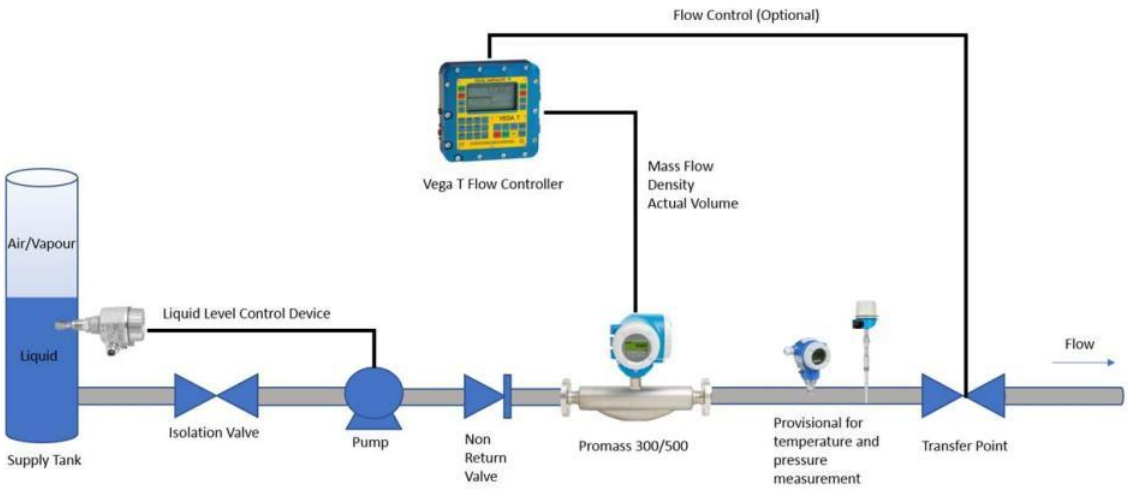
Instruments shall be tested in accordance with any relevant tests specified in the National Instrument Test Procedures. Tests should be conducted in conjunction with any tests specified in the approval documentation for any controller/indicator and/or any conversion device, etc. used.

The instrument shall not be adjusted to anything other than as close as practical to zero error, even when these values are within the maximum permissible errors.

Maximum Permissible Errors

The maximum permissible errors are specified in Schedule 1 of the *National Trade Measurement Regulations 2009*.

FIGURE 5/6B/226 – 1



Schematic drawing of a Promass 300 mass bulk flowmetering system.

FIGURE 5/6B/226 – 2

(a) Promass 300 F series flowmeter

(b) Promass 300 O series flowmeter

(c) Promass 300 Q series flowmeter

FIGURE 5/6B/226 – 3

Liquiphant FTL50 level indicating device

FIGURE 5/6B/226 – 4

ISOIL Model VEGA T Calculator/Indicator

FIGURE 5/6B/226 – 5

Sealing of Promass 300 Transmitter

FIGURE 5/6B/226 – 6

Promass 500 with F series flowmeter (Variant 1)

FIGURE 5/6B/226 – 7

Promass X series flowmeter (Variant 2)

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