Australian Government
Department of Industry, Science and Resources

National Measurement Institute

36 Bradfield Road, West Lindfield NSW 2070

# Certificate of Approval

# NMI 14/3/46

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.

ABB AquaMaster4 Model Water Meter

submitted by ABB Limited
Oldends Lane
Stonehouse Gloucestershire GL10 3TA
United Kingdom

**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 49-1 Water Meters Intended for the Metering of Cold Potable Water and Hot Water*, Part 1 Metrological and Technical Requirements*, dated May 2022 and NMI M 10-1 Meters Intended for the Metering of Water in Full Flowing Pipes*, Part 1 Metrological and Technical Requirements*, dated July 2010.

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 & Variants 1, 2 & 3 approved – certificate issued | 03/10/19 |
| 1 | Pattern & Variants 1 to 3 reviewed (various), Variants 4 to 7 approved – certificate issued | 25/03/22 |
| 2 | Pattern amended (software versions) – certificate issued | 24/10/22 |

| Rev | Reason/Details | Date |
|---|---|---|
| 3 | Pattern & Variant 1 amended (model numbers and software versions), Variants 4 & 5 amended (meter size and flowrate) – certificate issued | 15/03/24 |

## CONDITIONS OF APPROVAL

### General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI 14/3/46' 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.

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 14/3/46

## 1. Description of Pattern

**approved on 03/10/19**
**amended on 25/03/22**
**amended on 24/10/22**
**amended on 15/03/24**

An ABB AquaMaster4 DN40 water meter intended for the metering of cold potable and non-potable water.

### 1.1 Field of Operation

The field of operation of the measuring system using the ABB AquaMaster4 DN40 model water meter is determined by the following characteristics:

| | |
|---|---|
| Minimum flow rate, $Q_1$ | 0.0625 $m^3/h$ |
| Transition flow rate, $Q_2$ | 0.10 $m^3/h$ |
| Maximum continuous flow rate, $Q_3$: | 25.00 $m^3/h$ |
| Overload flow rate, $Q_4$ | 31.25 $m^3/h$ |
| Flow rate ratio, $Q_3/Q_1$: | 400 |
| Maximum admissible water temperature: | 50 °C |
| Temperature Class: | T50 |
| Ambient air temperature range: | -25 °C to +55 °C |
| Maximum admissible pressure: | 1600 kPa |
| Pressure loss class: | Δp40 |
| Accuracy class: | 1, 2 or 2.5 |
| Flow profile sensitivity class: | U0/D0 – see table 1 |
| Electromagnetic class: | E1 (residential) or E2 (industrial) |
| Environmental class: | B or O (indoor & outdoor) |
| Orientation: | All positions |
| Flow Direction: | Forward/reverse |
| Power supply: | Battery powered: 2 x 3.6 V<br>(operating range: 2.9 – 3.6 V) |

## 1.2 Features/Functions

The ABB AquaMaster4 DN40 model water meter (Figure 1 and 2) consists of a reduced bore, rubber lined ABB electromagnetic flow sensor (FEW411.R) connected to an ABB AquaMaster4 model signal transmitter (FET411).

Note: See Variant 1 for more information and options regarding the model designations and configurations of the flow sensor and signal transmitter. Software variants (clause 1.4) were additionally introduced with reduced interface functionality and removal of pressure measurement options.

Connection type: Flanged

Display: The signal transmitter incorporates an electronic calculator and indicating device (Figure 2) capable of providing a maximum display of 999 999 999 $m^3$. The indicating device incorporates a programmable decimal point position, allowing the maximum display to be adjusted based upon the value of $Q_3$. In all cases the value of the maximum display shall comply with the requirements of NMI R 49-1. The indicating device can be switched to display in litres (L), allowing for a verification scale interval of 0.01 L.

Communications(1): Pulse, RS485, RTU Modbus, Sensus protocol

Materials: Flow sensor: Epoxy coated stainless steel

Flow converter: Polymer material

Meter length: 200 mm

(1) The pattern and variants may be fitted and/or configured with the communication options listed in this Certificate. However, the primary indication of volume displayed by the indicating device of the meter is the approved indication of volume.

## 1.3 Conditions

### 1.3.1 Installation Conditions

No flow straightener or flow conditioner is required.

For accuracy class 1 and 2, the flow profile sensitivity class is U0/D0.

For accuracy class 2.5, the installation conditions are specified in Table 1.

**Table 1 Minimum pipe lengths required by flow disturbance type**

| Flow Sensor | Disturbance Type (*) | Minimum number of upstream pipe lengths (DN) | Minimum number of downstream pipe lengths (DN) |
|---|---|---|---|
| FEW4XY.R | 1 | 0 | 0 |
| | 2 | 0 | 0 |
| | 3 | 0 | 0 |

(*) For information on the different types of flow disturbances which are examined as part of pattern approval, refer to NMI M 10-2.

### 1.3.2 Specified Installations and Open Channel Emplacements (Accuracy Class 2.5)

The meter (pattern and variants) has not been tested or evaluated for performance in specified installations or open channel emplacements as part of this approval.

More information regarding specified installation and open channel emplacement testing may be found in NMI M 10-1 and NMI M 10-2.

### 1.3.3 Water Quality

The meter is approved for use in the metering of potable water supplies.

The meter is approved for use in the metering of non-potable water supplies.

The meter is approved for use in water with conductivity > 50 µS/cm

## 1.4 Software Version

The Pattern and Variants are approved with the software versions specified in Table 2 below.

**Table 2 Software Versions**

| Software Part Code | Software version | Checksum | Remarks |
|---|---|---|---|
| 3KXF004476U0113 | 01.00.15 | 0xBD1C4895 | NA |
| 3KXF208402U0113 | 03.00.03 | B26AFE6B | Full functionality |
| | 03.00.04 | 6E98963A | Full functionality |
| | 03.02.00 | E12E5C04 | Full functionality |
| | 03.03.02 | D4D1E40B | Full functionality |
| | 03.03.03 | CEEF45F1 | Full functionality |
| | 03.03.06 | DAC51328 | Improvements to electrode resistance calculations. |
| | 03.04.00 | 277BA336 | Improvements to sensor diagnostics. |
| 3KXF208402U0313 | 02.00.02 | 84EBD1C8 | Reduced functionality without pressure measurement, logger or Sensus communications. |
| | 02.00.03 | D93FDB0F | Reduced functionality as above. Improvements to electrode resistance calculations |
| 3KXF208402U0513 | 02.00.01 | C28EAA16 | Reduced functionality without pressure measurement, Modbus communications. |
| | 02.00.02 | 9F333FBC | Reduced functionality as above. Improvements to electrode resistance calculations |

### 1.5 Verification Provision

Provision is made for the application of a verification mark.

### 1.6 Sealing Provision

#### 1.6.1 Software

To prevent unauthorised modification of any legally relevant metrological parameter the transmitter must be put into “metrological read-only” mode, via the activation of the “read-only” switch (Figure 3). A suitable anti-tamper seal shall be fitted (Figure 4) such that, in the event of unauthorized tampering, it is clearly evident that the fitted legal metrology seal has been broken.

The physical memory within both the transmitter and sensor are buried with potting such that attempts to swap the memory would result in evidence of damage to the meter.

#### 1.6.2 Hardware

The flow sensor is sealed to the transmitter via the application of physical seals such that any attempts to access metrologically significant components is made clearly evident.

## 1.7 Descriptive Markings and Notices

Instruments are marked with the following data, either grouped or distributed on the casing, the indicating device dial or an identification plate (Figure 5):

| | |
|---|---|
| Manufacturer's name or mark | ... |
| Serial number | ... |
| Pattern approval number | NMI 14/3/46 |
| Numerical value of maximum continuous flow rate, $Q_3$ | ... |
| Flow rate ratio, $Q_3/Q_1$ | ... |
| Unit of measurement | $m^3$ |
| Temperature class (1) | T50 |
| Maximum admissible pressure (2) | 1600 kPa |
| Maximum pressure loss (3) | 40 kPa or Δp40 |
| Orientation (4) | … |
| Flow profile sensitive class (5) | U0/D0 |
| Direction of flow | → or similar |
| Accuracy class (6) | 1, 2 or 2.5 |

(1) Optional for Class T30

(2) Optional for meters with MAP of 1400 kPa or 600 kPa for DN ≥ 500

(3) Optional for Class Δp 63

(4) Optional for meters approved for all orientations

(5) Optional for U0/D0 meters

(6) Optional for class 2 meters

For instruments that incorporate electronic devices, the following information can either be physically marked on the instrument or provided electronically via the indicating device or similar means:

| | |
|---|---|
| Electromagnetic class | E1 or E2 |
| Environmental class | B or O |
| For meters with an external power supply | the voltage and frequency |
| For battery powered meters | a replacement date or similar indication of expected battery life |

## 2. Description of Variant 1

**approved on 03/10/19**
**amended on 25/03/22**
**amended on 15/03/24**

The Pattern and Variants are approved in both compact and remote arrangements (Figure 6).

The model designation of the ABB electromagnetic flow sensor is FEW4XY.Z.

Where: X is either: 1 (standard) or 3 (advanced)

Y is either: 1 (compact), 2 (remote) or 8 (remote sensor)

Z is either: R (reduced bore, rubber lined), V (virtual full bore, polypropylene lined) or F (full bore, elastomer lined).

The model designation of the ABB AquaMaster4 signal transmitter is FET4XY.

Where: X is either: 1 (standard) or 3 (advanced)

Y is either: 1 (compact), 2 (remote) or 8 (remote transmitter)

In the compact arrangement, the signal transmitter is connected to the flow sensor as an integral unit.

In the remote arrangement, the flow sensor and signal transmitter are housed separately and connected via a cable with a maximum length of 150 metres. The remote arrangement incorporates alternative physical seals (Figure 7).

In the remote arrangement components that are described with either the model designations of 2 (remote) or 8 (remote sensor/transmitter) are identical except for the model number.

## 3. Description of Variant 2

**approved on 03/10/19**
**amended on 25/03/22**

The Pattern and Variants are approved with the battery/renewable energy powered FEW4XY.R (reduced bore, rubber lined) flow sensor (Figure 8) with the different sensor sizes, accuracy classes, flowrates and associated characteristics as specified in Tables 3 to 6.

**Table 3 Reduced bore flow sensor – battery/renewable energy powered**

| Flow sensor size | Accuracy class | $Q_1$ ($m^3/h$) | $Q_2$ ($m^3/h$) | $Q_3$ ($m^3/h$) | $Q_4$ ($m^3/h$) | Ratio $Q_3/Q_1$ |
|---|---|---|---|---|---|---|
| DN40 | 1 & 2 | 0.0625 | 0.1 | 25 | 31.25 | 400 |
| | 2.5 | 0.1 | - | 25 | 31.25 | 250 |
| DN50 | 1 & 2 | 0.1 | 0.16 | 40 | 50 | 400 |
| | 2.5 | 0.16 | - | 40 | 50 | 250 |
| DN65 | 1 | 0.39375 | 0.63 | 63 | 78.75 | 160 |
| | 2 | 0.1575 | 0.252 | 63 | 78.75 | 400 |
| | 2.5 | 0.252 | - | 63 | 78.75 | 250 |
| DN80 | 1 | 0.625 | 1.0 | 100 | 125 | 160 |
| | 2 | 0.25 | 0.4 | 100 | 125 | 400 |
| | 2.5 | 0.4 | - | 100 | 125 | 250 |
| DN100 | 1 | 1.0 | 1.6 | 160 | 200 | 160 |
| | 2 | 0.4 | 0.64 | 160 | 200 | 400 |
| | 2.5 | 0.64 | - | 160 | 200 | 250 |
| DN125 | 1 | 1.0 | 1.6 | 160 | 200 | 160 |
| | 2 | 0.4 | 0.64 | 160 | 200 | 400 |
| | 2.5 | 0.64 | - | 160 | 200 | 250 |

**Table 4 Reduced bore flow sensor – battery/renewable energy powered**

| Flow sensor size | Accuracy class | $Q_1$ ($m^3/h$) | $Q_2$ ($m^3/h$) | $Q_3$ ($m^3/h$) | $Q_4$ ($m^3/h$) | Ratio $Q_3/Q_1$ |
|---|---|---|---|---|---|---|
| DN150 | 1 & 2 | 1.0 | 1.6 | 400 | 500 | 400 |
| | 2.5 | 1.6 | - | 400 | 500 | 250 |
| DN200 | 1 & 2 | 1.575 | 2.52 | 630 | 787.5 | 400 |
| | 2.5 | 2.52 | - | 630 | 787.5 | 250 |
| DN250 | 1 | 6.25 | 10 | 1000 | 1250 | 160 |
| | 2 | 2.5 | 4 | 1000 | 1250 | 400 |
| | 2.5 | 4 | - | 1000 | 1250 | 250 |
| DN300 | 1 | 10 | 16 | 1600 | 2000 | 160 |
| | 2 | 4 | 6.4 | 1600 | 2000 | 400 |
| | 2.5 | 6.4 | - | 1600 | 2000 | 250 |
| DN350 | 1 | 10 | 16 | 1600 | 2000 | 160 |
| | 2 | 4 | 6.4 | 1600 | 2000 | 400 |
| | 2.5 | 6.4 | - | 1600 | 2000 | 250 |
| DN400 | 1 | 15.625 | 25 | 2500 | 3125 | 160 |
| | 2 | 12.5 | 20 | 2500 | 3125 | 200 |
| | 2.5 | 20 | - | 2500 | 3125 | 125 |
| DN450 | 1 | 15.625 | 25 | 2500 | 3125 | 160 |
| | 2 | 12.5 | 20 | 2500 | 3125 | 200 |
| | 2.5 | 20 | - | 2500 | 3125 | 125 |

**Table 5 Reduced bore flow sensor – battery/renewable energy powered**

| Flow sensor size | Accuracy class | $Q_1$ ($m^3/h$) | $Q_2$ ($m^3/h$) | $Q_3$ ($m^3/h$) | $Q_4$ ($m^3/h$) | Ratio $Q_3/Q_1$ |
|---|---|---|---|---|---|---|
| DN500 | 1 | 100 | 160 | 4000 | 5000 | 40 |
| | 2 | 40 | 64 | 4000 | 5000 | 100 |
| | 2.5 | 63.5 | - | 4000 | 5000 | 63 |
| DN600 | 1 | 157.5 | 252 | 6300 | 7875 | 40 |
| | 2 | 63 | 100.8 | 6300 | 7875 | 100 |
| | 2.5 | 100 | - | 6300 | 7875 | 63 |

Alternative flowrate values may be selected under the following conditions:

- Values of $Q_3$ shall not be greater that those specified in Tables 3, 4 & 5;
- Values of $Q_1$ shall not be less than those specified in Tables 3, 4 & 5;
- The ratio $Q_4/Q_3$ shall be 1.25;
- For accuracy class 1 and 2, the ratio of $Q_2/Q_1$ shall be 1.6;
- For accuracy class 1 and 2, the ratio of $Q_3/Q_1$ shall be not less than 40 and shall be selected as per clause 4.1.4 of NMI R 49-1; and
- For accuracy class 2.5, the ratio of $Q_3/Q_1$ shall be selected as per clause 3.1 of NMI M 10-1.

The Pattern and Variants incorporating the battery/renewable energy powered FEW4XY.R flow sensor have the following installation conditions:

- No flow straightener or flow conditioner is required.
- For accuracy class 1 and 2, the flow profile sensitivity class is U0/D0.
- For accuracy class 2.5, the installation conditions are specified in Table 1 (see 1.3.1. above).

The Pattern and Variants incorporating the battery/renewable energy powered FEW4XY.R flow sensor have the following power supply options:

- Renewable energy power (DC powered): 6 – 32 V
- Battery power: 2 x 3.6 V (operating range: 2.9 V – 3.6 V)

The Pattern and Variants are approved with the following pressure loss classes based upon flow sensor size and type:

Reduced bore:

- For sizes DN40 and DN50:Δp40 (40 kPa)
- For sizes DN65 to DN600: Δp63 (63 kPa)

**Table 6 Flow sensor sizes, length and verification scale interval**

| Flow sensor size | Meter length (mm) | Verification scale interval ($m^3$) |
|---|---|---|
| DN40 & DN50 | 200 | 0.0001 |
| DN65 | 200 | 0.001 |
| DN80 | 200 | |
| DN100 & DN125 | 250 | |
| DN150 | 300 | |
| DN200 | 350 | 0.01 |
| DN250 | 450 | |
| DN300 | 500 | |
| DN350 | 550 | |
| DN400 | 600 | |
| DN450 | 700 | |
| DN500 | 770 | 0.1 |
| DN600 | 920 | |

## 4. Description of Variant 3

**approved on 03/10/19**
**amended on 25/03/22**

The Pattern and Variants are approved with the AC mains powered FEW4XY.R (reduce bore, rubber lined) flow sensor, with the different sensor sizes, accuracy classes, flowrates and associated characteristics as specified in Tables 7 to 9.

AC mains power supply: 85-240 VAC @ 50/60 Hz (with internal battery back-up)

**Table 7 Reduced bore flow sensor – AC mains powered**

| Flow sensor size | Accuracy class | $Q_1$ ($m^3/h$) | $Q_2$ ($m^3/h$) | $Q_3$ ($m^3/h$) | $Q_4$ ($m^3/h$) | Ratio $Q_3/Q_1$ |
|---|---|---|---|---|---|---|
| DN40 | 1 | 0.05 | 0.08 | 25 | 31.25 | 500 |
| | 2 | 0.025 | 0.04 | 25 | 31.25 | 1000 |
| | 2.5 | 0.04 | - | 25 | 31.25 | 630 |
| DN50 | 1 | 0.08 | 0.128 | 40 | 50 | 500 |
| | 2 | 0.04 | 0.064 | 40 | 50 | 1000 |
| | 2.5 | 0.063 | - | 40 | 50 | 630 |
| DN65 | 1 & 2 | 0.063 | 0.1008 | 63 | 78.75 | 1000 |
| | 2.5 | 0.1 | - | 63 | 78.75 | 630 |
| DN80 | 1 & 2 | 0.1 | 0.16 | 100 | 125 | 1000 |
| | 2.5 | 0.159 | - | 100 | 125 | 630 |
| DN100 | 1 | 0.32 | 0.512 | 160 | 200 | 500 |
| | 2 | 0.16 | 0.256 | 160 | 200 | 1000 |
| | 2.5 | 0.254 | - | 160 | 200 | 630 |
| DN125 | 1 | 0.32 | 0.512 | 160 | 200 | 500 |
| | 2 | 0.16 | 0.256 | 160 | 200 | 1000 |
| | 2.5 | 0.254 | - | 160 | 200 | 630 |
| DN150 | 1 & 2 | 0.4 | 0.64 | 400 | 500 | 1000 |
| | 2.5 | 0.63 | - | 400 | 500 | 630 |
| DN200 | 1 & 2 | 0.63 | 1.008 | 630 | 787.5 | 1000 |
| | 2.5 | 1.0 | - | 630 | 787.5 | 630 |

**Table 8 Reduced bore flow sensor – AC mains powered**

| Flow sensor size | Accuracy class | $Q_1$ ($m^3/h$) | $Q_2$ ($m^3/h$) | $Q_3$ ($m^3/h$) | $Q_4$ ($m^3/h$) | Ratio $Q_3/Q_1$ |
|---|---|---|---|---|---|---|
| DN250 | 1 | 2.0 | 3.2 | 1000 | 1250 | 500 |
| | 2 | 1.0 | 1.6 | 1000 | 1250 | 1000 |
| | 2.5 | 1.59 | - | 1000 | 1250 | 630 |
| DN300 | 1 | 3.2 | 5.12 | 1600 | 2000 | 500 |
| | 2 | 1.6 | 2.56 | 1600 | 2000 | 1000 |
| | 2.5 | 2.54 | - | 1600 | 2000 | 630 |
| DN350 | 1 | 3.2 | 5.12 | 1600 | 2000 | 500 |
| | 2 | 1.6 | 2.56 | 1600 | 2000 | 1000 |
| | 2.5 | 2.54 | - | 1600 | 2000 | 630 |
| DN400 | 1 & 2 | 5.0 | 8.0 | 2500 | 3125 | 500 |
| | 2.5 | 7.94 | - | 2500 | 3125 | 315 |
| DN450 | 1 & 2 | 5.0 | 8.0 | 2500 | 3125 | 500 |
| | 2.5 | 7.94 | - | 2500 | 3125 | 315 |
| DN500 | 1 | 8.0 | 12.8 | 4000 | 5000 | 500 |
| | 2 | 4.0 | 6.4 | 4000 | 5000 | 1000 |
| | 2.5 | 6.35 | - | 4000 | 5000 | 630 |
| DN600 | 1 | 12.6 | 20.16 | 6300 | 7875 | 500 |
| | 2 | 6.3 | 10.08 | 6300 | 7875 | 1000 |
| | 2.5 | 10.0 | - | 6300 | 7875 | 630 |

Alternative flowrate values may be selected under the following conditions:

- Values of $Q_3$ shall not be greater that those specified in Tables 7 & 8;
- Values of $Q_1$ shall not be less than those specified in Tables 7 & 8;
- The ratio $Q_4/Q_3$ shall be 1.25;
- For accuracy class 1 and 2, the ratio of $Q_2/Q_1$ shall be 1.6;
- For accuracy class 1 and 2, the ratio of $Q_3/Q_1$ shall be not less than 40 and shall be selected as per clause 4.1.4 of NMI R 49-1; and
- For accuracy class 2.5, the ratio of $Q_3/Q_1$ shall be selected as per clause 3.1 of NMI M 10-1.

The Pattern and Variants incorporating the AC mains powered (with internal battery back-up) FEW4XY.R flow sensor have the following installation conditions:

- No flow straightener or flow conditioner is required.
- For accuracy class 1 and 2, the flow profile sensitivity class is U0/D0.
- For accuracy class 2.5, the installation conditions are specified in Table 1 (see 1.3.1. above).

The Pattern and Variants are approved with the following pressure loss classes based upon flow sensor size and type:

Reduced bore:

- For sizes DN40 and DN50: Δp40 (40 kPa)
- For sizes DN65 to DN600: Δp63 (63 kPa)

**Table 9 Flow sensor sizes, length and verification scale interval**

| Flow sensor size | Meter length (mm) | Verification scale interval ($m^3$) |
|---|---|---|
| DN40 & DN50 | 200 | 0.0001 |
| DN65 | 200 | |
| DN80 | 200 | |
| DN100 & DN125 | 250 | 0.001 |
| DN150 | 300 | |
| DN200 | 350 | |
| DN250 | 450 | |
| DN300 | 500 | 0.01 |
| DN350 | 550 | |
| DN400 | 600 | |
| DN450 | 700 | |
| DN500 | 770 | |
| DN600 | 920 | |

## 5. Description of Variant 4

**approved on 03/10/19**
**amended on 25/03/22**
**amended 15/03/24**

The Pattern and Variants are approved with the following alternative battery/renewable energy powered flow sensors:

- AquaMaster4 FEW4XY.V (virtual full bore, polypropylene lined) (Figure 9)
- AquaMaster4 FEW4XY.F (full bore, elastomer lined) (Figure 10)

with the sensor sizes, accuracy classes, flowrates and associated characteristics as specified in Tables 10 to 15.

**Table 10 (Virtual) full bore flow sensor – battery/renewable energy powered**

| Flow sensor size | Accuracy class | Q1 ($m^3/h$) | Q2 ($m^3/h$) | Q3 ($m^3/h$) | Q4 ($m^3/h$) | Ratio Q3/Q1 |
|---|---|---|---|---|---|---|
| DN40 | 1 | 0.32 | 0.512 | 40 | 50 | 125 |
| | 2 | 0.16 | 0.256 | 40 | 50 | 250 |
| | 2.5 | 0.25 | - | 40 | 50 | 160 |
| DN50 | 1 | 0.504 | 0.8064 | 63 | 78.75 | 125 |
| | 2 | 0.252 | 0.4032 | 63 | 78.75 | 250 |
| | 2.5 | 0.394 | - | 63 | 78.75 | 160 |
| DN65 | 1 & 2 | 0.4 | 0.64 | 100 | 125 | 250 |
| | 2.5 | 0.625 | - | 100 | 125 | 160 |
| DN80 | 1 & 2 | 0.64 | 1.024 | 160 | 200 | 250 |
| | 2.5 | 1.0 | - | 160 | 200 | 160 |
| DN100 | 1 & 2 | 1.0 | 1.6 | 250 | 312.5 | 250 |
| | 2.5 | 1.56 | - | 250 | 312.5 | 160 |
| DN125 | 1 & 2 | 1.0 | 1.6 | 250 | 312.5 | 250 |
| | 2.5 | 1.56 | - | 250 | 312.5 | 160 |
| DN150 | 1 | 5.04 | 8.064 | 630 | 787.5 | 125 |
| | 2 | 2.52 | 4.032 | 630 | 787.5 | 250 |
| | 2.5 | 3.94 | - | 630 | 787.5 | 160 |

**Table 11 (Virtual) full bore flow sensor – battery/renewable energy powered**

| Flow sensor size | Accuracy class | Q1 ($m^3/h$) | Q2 ($m^3/h$) | Q3 ($m^3/h$) | Q4 ($m^3/h$) | Ratio Q3/Q1 |
|---|---|---|---|---|---|---|
| DN200 | 1 | 8.0 | 12.8 | 1000 | 1250 | 125 |
| | 2 | 4.0 | 6.4 | 1000 | 1250 | 250 |
| | 2.5 | 6.25 | - | 1000 | 1250 | 160 |
| DN250 | 1 | 12.8 | 20.48 | 1600 | 2000 | 125 |
| | 2 | 6.4 | 10.24 | 1600 | 2000 | 250 |
| | 2.5 | 10 | - | 1600 | 2000 | 160 |
| DN300 | 1 | 20 | 32 | 2500 | 3125 | 125 |
| | 2 | 10 | 16 | 2500 | 3125 | 250 |
| | 2.5 | 15.625 | - | 2500 | 3125 | 160 |
| DN350 | 1 & 2 | 16 | 25.6 | 4000 | 5000 | 250 |
| | 2.5 | 25 | - | 4000 | 5000 | 160 |
| DN400 | 1 & 2 | 16 | 25.6 | 4000 | 5000 | 250 |
| | 2.5 | 25 | - | 4000 | 5000 | 160 |
| DN450 | 1 & 2 | 25.2 | 40.32 | 6300 | 7875 | 250 |
| | 2.5 | 39.375 | - | 6300 | 7875 | 160 |
| DN500 | 1 & 2 | 25.2 | 40.32 | 6300 | 7875 | 250 |
| | 2.5 | 39.375 | - | 6300 | 7875 | 160 |
| DN600 | 1 | 78.75 | 126 | 6300 | 7875 | 250 |
| | 2 | 39.375 | 63 | 6300 | 7875 | 250 |
| | 2.5 | 63 | - | 6300 | 7875 | 100 |
| DN700 | 1 | 200 | 320 | 10,000 | 12,500 | 50 |
| | 2 | 100 | 160 | 10,000 | 12,500 | 100 |
| | 2.5 | 158.7 | - | 10,000 | 12,500 | 63 |

**Table 12 (Virtual) full bore flow sensor – battery/renewable energy powered**

| Flow sensor size | Accuracy class | Q1 ($m^3/h$) | Q2 ($m^3/h$) | Q3 ($m^3/h$) | Q4 ($m^3/h$) | Ratio Q3/Q1 |
|---|---|---|---|---|---|---|
| DN750 | 1 | 200 | 320 | 10,000 | 12,500 | 50 |
| | 2 | 100 | 160 | 10,000 | 12,500 | 100 |
| | 2.5 | 158.7 | - | 10,000 | 12,500 | 63 |
| DN800 | 1 | 200 | 320 | 10,000 | 12,500 | 50 |
| | 2 | 100 | 160 | 10,000 | 12,500 | 100 |
| | 2.5 | 158.7 | - | 10,000 | 12,500 | 63 |
| DN900 | 2 | 158.7 | 254 | 10,000 | 12,500 | 63 |
| | 2.5 | 250 | - | 10,000 | 12,500 | 40 |
| DN1000 | 2 | 160 | 250 | 16,000 | 20,000 | 100 |
| | 2.5 | 253.97 | - | 16,000 | 20,000 | 63 |
| DN1050 | 2 | 160 | 250 | 16,000 | 20,000 | 100 |
| | 2.5 | 253.97 | - | 16,000 | 20,000 | 63 |
| DN1100 | 2 | 254 | 406.4 | 16,000 | 20,000 | 63 |
| | 2.5 | 400 | - | 16,000 | 20,000 | 40 |
| DN1200 | 2 | 254 | 406.4 | 16,000 | 20,000 | 63 |
| | 2.5 | 400 | - | 16,000 | 20,000 | 40 |
| DN1350 | 2 | 400 | 640 | 16,000 | 20,000 | 40 |
| | 2.5 | 400 | - | 16,000 | 20,000 | 40 |
| DN1400 | 2 | 400 | 640 | 16,000 | 20,000 | 40 |
| | 2.5 | 400 | - | 16,000 | 20,000 | 40 |
| DN1500 | 2 | 400 | 640 | 16,000 | 20,000 | 40 |
| | 2.5 | 400 | - | 16,000 | 20,000 | 40 |
| DN1600 | 2 | 400 | 640 | 16,000 | 20,000 | 40 |
| | 2.5 | 400 | - | 16,000 | 20,000 | 40 |
| DN1650 | 2 | 400 | 640 | 16,000 | 20,000 | 40 |
| | 2.5 | 400 | - | 16,000 | 20,000 | 40 |

Alternative flowrate values may be selected under the following conditions:

- Values of $Q_3$ shall not be greater that those specified in Tables 10, 11 & 12;
- Values of $Q_1$ shall not be less than those specified in Tables 10, 11 & 12;
- The ratio $Q_4/Q_3$ shall be 1.25;
- For accuracy class 1 and 2, the ratio of $Q_2/Q_1$ shall be 1.6;
- For accuracy class 1 and 2, the ratio of $Q_3/Q_1$ shall be not less than 40 and shall be selected as per clause 4.1.4 of NMI R 49-1; and
- For accuracy class 2.5, the ratio of $Q_3/Q_1$ shall be selected as per clause 3.1 of NMI M 10-1.

The Pattern and Variants incorporating the FEW4XY.V flow sensor have the following installation conditions:

- No flow straightener or flow conditioner is required.
- For accuracy class 1 and 2, the flow profile sensitivity class is U0/D0.
- For accuracy class 2.5, the installation conditions are specified in Table 13.

**Table 13 Minimum pipe lengths required by flow disturbance type**

| Flow Sensor | Disturbance Type (*) | Minimum number of upstream pipe lengths (DN) | Minimum number of downstream pipe lengths (DN) |
|---|---|---|---|
| FEW4XY.V | 1 | 0 | 0 |
| | 2 | 0 | 0 |
| | 3 | 0 | 0 |

(*) For information on the different types of flow disturbances which are examined as part of pattern approval, refer to NMI M 10-2.

The Pattern and Variants incorporating the FEW4XY.F flow sensor have the following installation conditions:

- No flow straightener or flow conditioner is required.
- For accuracy class 1 and 2, the flow profile sensitivity class is U3/D0.
- For accuracy class 2.5, the installation conditions are specified in Table 14.

**Table 14 Minimum pipe lengths required by flow disturbance type**

| Flow Sensor | Disturbance Type (*) | Minimum number of upstream pipe lengths (DN) | Minimum number of downstream pipe lengths (DN) |
|---|---|---|---|
| FEW4XY.F | 1 | 3 | 0 |
| | 2 | 3 | 0 |
| | 3 | 3 | 0 |

(*) For information on the different types of flow disturbances which are examined as part of pattern approval, refer to NMI M 10-2.

The Pattern and Variants incorporating the FEW4XY.V and FEW4XY.F flow sensor have the following power supply options:

- Renewable energy power (DC powered): 6 – 32 V
- Battery power: 2 x 3.6 V (operating range: 2.9 V – 3.6 V)

The Pattern and Variants are approved with the following pressure loss classes based upon flow sensor size and type:

(Virtual) full bore:

- For sizes DN40 and DN50: Δp10 (10 kPa)
- For sizes DN65 to DN200: Δp16 (16 kPa)
- For sizes DN250 to DN1650: Δp10 (10 kPa)

**Table 15 Flow sensor sizes, length and verification scale interval**

| Flow sensor size | Meter length (mm) | Verification scale interval ($m^3$) |
|---|---|---|
| DN40 & DN50 | 200 | 0.001 |
| DN65 | 200 | |
| DN80 | 200 | |
| DN100 & DN125 | 250 | |
| DN150 | 300 | 0.01 |
| DN200 | 350 | |
| DN250 | 450 | |
| DN300 | 500 | |
| DN350 | 550 | |
| DN400 | 600 | |
| DN450 | 600 | |
| DN500 | 600 | |
| DN600 | 800 | 0.1 |
| DN700 | 700 | |
| DN750 | 762 | |
| DN800 | 800 | |
| DN900 | 900 | 1 |
| DN1000 | 1000 | |
| DN1050 | 1067 | |
| DN1100 | 1118 | |
| DN1200 | 1200 | |
| DN1350 | 1350 | |
| DN1400 | 1400 | |
| DN1500 | 1524 | |
| DN1600 | 1600 | |
| DN1650 | 1650 | |

## 6. Description of Variant 5

**approved on 25/03/22**
**amended on 15/03/24**

The Pattern and Variants are approved with the following alternative AC mains powered flow sensors:

- AquaMaster4 FEW4XY.V (virtual full bore, polypropylene lined)
- AquaMaster4 FEW4XY.F (full bore, elastomer lined)

with the sensor sizes, accuracy classes, flowrates and associated characteristics as specified in Tables 16 to 22.

AC mains power supply: 85-240 VAC @ 50/60 Hz (with internal battery back-up)

**Table 16 (Virtual) full bore flow sensor – AC mains powered**

| Flow sensor size | Accuracy class | Q1 ($m^3/h$) | Q2 ($m^3/h$) | Q3 ($m^3/h$) | Q4 ($m^3/h$) | Ratio Q3/Q1 |
|---|---|---|---|---|---|---|
| DN40 | 1 & 2 | 0.08 | 0.128 | 40 | 50 | 500 |
| | 2.5 | 0.127 | - | 40 | 50 | 315 |
| DN50 | 1 & 2 | 0.126 | 0.2016 | 63 | 78.75 | 500 |
| | 2.5 | 0.2 | - | 63 | 78.75 | 315 |
| DN65 | 1 & 2 | 0.2 | 0.32 | 100 | 125 | 500 |
| | 2.5 | 0.32 | - | 100 | 125 | 315 |
| DN80 | 1 & 2 | 0.32 | 0.512 | 160 | 200 | 500 |
| | 2.5 | 0.508 | - | 160 | 200 | 315 |
| DN100 | 1 & 2 | 0.5 | 0.8 | 250 | 312.5 | 500 |
| | 2.5 | 0.79 | - | 250 | 312.5 | 315 |
| DN125 | 1 & 2 | 0.5 | 0.8 | 250 | 312.5 | 500 |
| | 2.5 | 0.79 | - | 250 | 312.5 | 315 |
| DN150 | 1 | 2.52 | 4.032 | 630 | 787.5 | 250 |
| | 2 | 1.26 | 2.016 | 630 | 787.5 | 500 |
| | 2.5 | 2.0 | - | 630 | 787.5 | 315 |
| DN200 | 1 | 4.0 | 6.4 | 1000 | 1250 | 250 |
| | 2 | 2.0 | 3.2 | 1000 | 1250 | 500 |
| | 2.5 | 3.17 | - | 1000 | 1250 | 315 |

**Table 17 (Virtual) full bore flow sensor – AC mains powered**

| Flow sensor size | Accuracy class | Q1 ($m^3/h$) | Q2 ($m^3/h$) | Q3 ($m^3/h$) | Q4 ($m^3/h$) | Ratio Q3/Q1 |
|---|---|---|---|---|---|---|
| DN250 | 1 | 6.4 | 10.24 | 1600 | 2000 | 250 |
| | 2 | 3.2 | 5.12 | 1600 | 2000 | 500 |
| | 2.5 | 5.08 | - | 1600 | 2000 | 315 |
| DN300 | 1 | 10 | 16 | 2500 | 3125 | 250 |
| | 2 | 5.0 | 8.0 | 2500 | 3125 | 500 |
| | 2.5 | 7.94 | - | 2500 | 3125 | 315 |
| DN350 | 1 & 2 | 40 | 64 | 4000 | 5000 | 100 |
| | 2.5 | 63.49 | - | 4000 | 5000 | 63 |
| DN400 | 1 & 2 | 40 | 64 | 4000 | 5000 | 100 |
| | 2.5 | 63.49 | - | 4000 | 5000 | 63 |
| DN450 | 1 & 2 | 63 | 100.8 | 6300 | 7875 | 100 |
| | 2.5 | 100 | - | 6300 | 7875 | 63 |
| DN500 | 1 & 2 | 63 | 100.8 | 6300 | 7875 | 100 |
| | 2.5 | 100 | - | 6300 | 7875 | 63 |
| DN600 | 1 & 2 | 63 | 100.8 | 6300 | 7875 | 100 |
| | 2.5 | 100 | - | 6300 | 7875 | 63 |
| DN700 | 1 | 100 | 160 | 10,000 | 12,500 | 100 |
| | 2 | 50 | 80 | 10,000 | 12,500 | 200 |
| | 2.5 | 80 | - | 10,000 | 12,500 | 125 |
| DN750 | 1 | 100 | 160 | 10,000 | 12,500 | 100 |
| | 2 | 50 | 80 | 10,000 | 12,500 | 200 |
| | 2.5 | 80 | - | 10,000 | 12,500 | 125 |

**Table 18 (Virtual) full bore flow sensor – AC mains powered**

| Flow sensor size | Accuracy class | Q1 ($m^3/h$) | Q2 ($m^3/h$) | Q3 ($m^3/h$) | Q4 ($m^3/h$) | Ratio Q3/Q1 |
|---|---|---|---|---|---|---|
| DN800 | 1 | 100 | 160 | 10,000 | 12,500 | 100 |
| | 2 | 50 | 80 | 10,000 | 12,500 | 200 |
| | 2.5 | 80 | - | 10,000 | 12,500 | 125 |
| DN900 | 1 | 158.7 | 253.9 | 10,000 | 12,500 | 63 |
| | 2 | 80 | 128 | 10,000 | 12,500 | 125 |
| | 2.5 | 125 | - | 10,000 | 12,500 | 80 |
| DN1000 | 1 | 160 | 256 | 16,000 | 20,000 | 100 |
| | 2 | 80 | 128 | 16,000 | 20,000 | 200 |
| | 2.5 | 128 | - | 16,000 | 20,000 | 125 |
| DN1050 | 1 | 160 | 256 | 16,000 | 20,000 | 100 |
| | 2 | 80 | 128 | 16,000 | 20,000 | 200 |
| | 2.5 | 128 | - | 16,000 | 20,000 | 125 |
| DN1100 | 1 | 253.9 | 406.2 | 16,000 | 20,000 | 63 |
| | 2 | 128 | 204.8 | 16,000 | 20,000 | 125 |
| | 2.5 | 200 | - | 16,000 | 20,000 | 80 |
| DN1200 | 1 | 253.9 | 406.2 | 16,000 | 20,000 | 63 |
| | 2 | 128 | 204.8 | 16,000 | 20,000 | 125 |
| | 2.5 | 200 | - | 16,000 | 20,000 | 80 |
| DN1350 | 1 | 400 | 640 | 16,000 | 20,000 | 40 |
| | 2 | 200 | 320 | 16,000 | 20,000 | 80 |
| | 2.5 | 254 | - | 16,000 | 20,000 | 63 |
| DN1400 | 1 | 400 | 640 | 16,000 | 20,000 | 40 |
| | 2 | 200 | 320 | 16,000 | 20,000 | 80 |
| | 2.5 | 254 | - | 16,000 | 20,000 | 63 |
| DN1500 | 1 | 400 | 640 | 16,000 | 20,000 | 40 |
| | 2 | 200 | 320 | 16,000 | 20,000 | 80 |
| | 2.5 | 254 | - | 16,000 | 20,000 | 63 |

**Table 19 (Virtual) full bore flow sensor – AC mains powered**

| | | | | | | |
|---|---|---|---|---|---|---|
| DN1600 | 1 | 400 | 640 | 16,000 | 20,000 | 40 |
| | 2 | 200 | 320 | 16,000 | 20,000 | 80 |
| | 2.5 | 400 | - | 16,000 | 20,000 | 40 |
| DN1650 | 1 | 400 | 640 | 16,000 | 20,000 | 40 |
| | 2 | 200 | 320 | 16,000 | 20,000 | 80 |
| | 2.5 | 400 | - | 16,000 | 20,000 | 40 |
| DN1800 | 1 | 320 | 512 | 16,000 | 20,000 | 50 |
| | 2 | 320 | 512 | 16,000 | 20,000 | 50 |
| | 2.5 | 400 | - | 16,000 | 20,000 | 40 |

Alternative flowrate values may be selected under the following conditions:

- Values of $Q_3$ shall not be greater that those specified in Tables 16, 17, 19 & 19;
- Values of $Q_1$ shall not be less than those specified in Tables 16, 17, 18 & 19;
- The ratio $Q_4/Q_3$ shall be 1.25;
- For accuracy class 1 and 2, the ratio of $Q_2/Q_1$ shall be 1.6;
- For accuracy class 1 and 2, the ratio of $Q_3/Q_1$ shall be not less than 40 and shall be selected as per clause 4.1.4 of NMI R 49-1; and
- For accuracy class 2.5, the ratio of $Q_3/Q_1$ shall be selected as per clause 3.1 of NMI M 10-1.

The Pattern and Variants incorporating the FEW4XY.V flow sensor have the following installation conditions:

- No flow straightener or flow conditioner is required.
- For accuracy class 1 and 2, the flow profile sensitivity class is U0/D0.
- For accuracy class 2.5, the installation conditions are specified in Table 20.

**Table 20 Minimum pipe lengths required by flow disturbance type**

| Flow Sensor | Disturbance Type (*) | Minimum number of upstream pipe lengths (DN) | Minimum number of downstream pipe lengths (DN) |
|---|---|---|---|
| FEW4XY.V | 1 | 0 | 0 |
| | 2 | 0 | 0 |
| | 3 | 0 | 0 |

(*) For information on the different types of flow disturbances which are examined as part of pattern approval, refer to NMI M 10-2.

The Pattern and Variants incorporating the FEW4XY.F flow sensor have the following installation conditions:

- No flow straightener or flow conditioner is required.
- For accuracy class 1 and 2, the flow profile sensitivity class is U3/D0.
- For accuracy class 2.5, the installation conditions are specified in Table 21.

**Table 21 Minimum pipe lengths required by flow disturbance type**

| Flow Sensor | Disturbance Type (*) | Minimum number of upstream pipe lengths (DN) | Minimum number of downstream pipe lengths (DN) |
|---|---|---|---|
| FEW4XY.F | 1 | 3 | 0 |
| | 2 | 3 | 0 |
| | 3 | 3 | 0 |

(*) For information on the different types of flow disturbances which are examined as part of pattern approval, refer to NMI M 10-2.

The Pattern and Variants are approved with the following pressure loss classes based upon flow sensor size and type:

(Virtual) full bore:

- For sizes DN40 and DN50: Δp10 (10 kPa)
- For sizes DN65 to DN200: Δp16 (16 kPa)
- For sizes DN250 to DN1800: Δp10 (10 kPa)

**Table 22 Flow sensor sizes, length and verification scale interval**

| Flow sensor size | Meter length (mm) | Verification scale interval ($m^3$) |
|---|---|---|
| DN40 & DN50 | 200 | 0.0001 |
| DN65 | 200 | |
| DN80 | 200 | 0.001 |
| DN100 & DN125 | 250 | |
| DN150 | 300 | |
| DN200 | 350 | 0.01 |
| DN250 | 450 | |
| DN300 | 500 | |
| DN350 | 550 | 0.1 |
| DN400 | 600 | |
| DN450 | 700 | |
| DN500 | 770 | |
| DN600 | 920 | |
| DN700 | 700 | |
| DN750 | 762 | |
| DN800 | 800 | |
| DN900 | 900 | |
| DN1000 | 1000 | |
| DN1050 | 1067 | |
| DN1100 | 1118 | |
| DN1200 | 1200 | |
| DN1350 | 1350 | 1 |
| DN1400 | 1400 | |
| DN1500 | 1524 | |
| DN1600 | 1600 | |
| DN1650 | 1650 | |
| DN1800 | 1800 | |

## 7. Description of Variant 6 approved on 25/03/22

The Pattern and Variants are approved with the AquaMaster4 signal transmitter and the alternative AquaMaster3 FEV 2 electromagnetic full bore flow sensor (Figure 11 and 12) with the sensor sizes, flowrates and associated characteristics as specified in Tables 23 to 25.

**Table 23 AquaMaster3 FEV 2 full bore flow sensor**

| Flow sensor size | Accuracy class | Q1 ($m^3/h$) | Q2* ($m^3/h$) | Q3 ($m^3/h$) | Q4 ($m^3/h$) | Ratio Q3/Q1 |
|---|---|---|---|---|---|---|
| DN40 | 2 & 2.5 | 0.25 | 0.40 | 40 | 50 | 160 |
| DN50 | 2 & 2.5 | 0.39375 | 0.63 | 63 | 78.75 | 160 |
| DN65 | 2 & 2.5 | 0.625 | 1.0 | 100 | 125 | 160 |
| DN80 | 2 & 2.5 | 1.0 | 1.6 | 160 | 200 | 160 |
| DN100 | 2 & 2.5 | 1.5625 | 2.5 | 250 | 312.5 | 160 |
| DN125 | 2 & 2.5 | 1.5625 | 2.5 | 250 | 312.5 | 160 |
| DN150 | 2 & 2.5 | 3.9375 | 6.3 | 630 | 787.5 | 160 |
| DN200 | 2 & 2.5 | 6.25 | 10 | 1000 | 1250 | 160 |

***** For class 2 meters only.

Alternative flowrate values may be selected under the following conditions:

- Values of $Q_3$ shall not be greater that those specified in Table 23;
- Values of $Q_1$ shall not be less than those specified in Table 23;
- The ratio $Q_4/Q_3$ shall be 1.25;
- For accuracy class 2, the ratio of $Q_2/Q_1$ shall be 1.6;
- For accuracy class 2, the ratio of $Q_3/Q_1$ shall be not less than 40 and shall be selected as per clause 4.1.4 of NMI R 49-1; and
- For accuracy class 2.5, the ratio of $Q_3/Q_1$ shall be selected as per clause 3.1 of NMI M 10-1.

The Pattern and Variants incorporating the AquaMaster3 FEV 2 full bore flow sensor have the following power supply options:

- Renewable energy power (DC powered): 6 – 32 V
- Battery power: 2 x 3.6 V (operating range: 2.9 V – 3.6 V)
- AC mains power supply: 85-240 VAC @ 50/60 Hz (with internal battery back-up)

The Pattern and Variants incorporating the AquaMaster3 FEV 2 full bore flow sensor have the following installation conditions:

- No flow straightener or flow conditioner is required.
- For accuracy class 2, the flow profile sensitivity class is U0/D0.
- For accuracy class 2.5, the installation conditions are specified in Table 24.

**Table 24 Minimum pipe lengths required by flow disturbance type**

| Flow Sensor | Disturbance Type (*) | Minimum number of upstream pipe lengths (DN) | Minimum number of downstream pipe lengths (DN) |
|---|---|---|---|
| FEV 2 | 1 | 0 | 0 |
| | 2 | 0 | 0 |
| | 3 | 0 | 0 |

(*) For information on the different types of flow disturbances which are examined as part of pattern approval, refer to NMI M 10-2.

The Pattern and Variants are approved with the following pressure loss classes based upon flow sensor size and type:

(Virtual) full bore:

- For sizes DN40 and DN50: Δp10 (10 kPa)
- For sizes DN65 to DN200: Δp16 (16 kPa)

**Table 25 Flow sensor sizes, length and verification scale interval**

| Flow sensor size | Meter length (mm) | Verification scale interval ($m^3$) |
|---|---|---|
| DN40 & DN50 | 200 | 0.001 |
| DN65 | 200 | 0.001 |
| DN80 | 200 | 0.001 |
| DN100 & DN125 | 250 | 0.001 |
| DN150 | 300 | 0.01 |
| DN200 | 350 | 0.01 |

## 8. Description of Variant 7 approved on 25/03/22

The Pattern and Variants are approved with the alternative WaterMaster signal transmitter and WaterMaster FEV, WaterMaster FEW or WaterMaster FEF (virtual full bore, polypropylene lined or full bore, elastomer lined) electromagnetic flow sensor (Figure 13 and 14) with the sensor sizes, flowrates and associated characteristics specified in Tables 26 to 29.

**Table 26 WaterMaster virtual/ full bore flow sensor**

| Flow sensor size | Accuracy class | Q1 ($m^3/h$) | Q2 ($m^3/h$) | Q3 ($m^3/h$) | Q4 ($m^3/h$) | Ratio Q3/Q1 |
|---|---|---|---|---|---|---|
| DN40 | 2 | 0.25 | 0.40 | 40 | 50 | 160 |
| | 2.5 | 0.40 | - | 40 | 50 | 100 |
| DN50 | 2 | 0.39375 | 0.63 | 63 | 100 | 160 |
| | 2.5 | 0.63 | - | 63 | 100 | 100 |
| DN65 | 2 | 0.625 | 1.0 | 100 | 125 | 160 |
| | 2.5 | 1.0 | - | 100 | 125 | 100 |
| DN80 | 2 | 1.0 | 1.6 | 160 | 200 | 160 |
| | 2.5 | 1.6 | - | 160 | 200 | 100 |
| DN100 | 2 | 1.5625 | 2.5 | 250 | 312.5 | 160 |
| | 2.5 | 2.5 | - | 250 | 312.5 | 100 |
| DN125 | 2 | 1.5625 | 2.5 | 250 | 312.5 | 160 |
| | 2.5 | 2.5 | - | 250 | 312.5 | 100 |
| DN150 | 2 | 3.9375 | 6.3 | 630 | 787.5 | 160 |
| | 2.5 | 6.3 | - | 630 | 787.5 | 100 |
| DN200 | 2 | 6.25 | 10 | 1000 | 1250 | 160 |
| | 2.5 | 10 | - | 1000 | 1250 | 100 |
| DN250 | 2 | 10 | 16 | 1600 | 2000 | 160 |
| | 2.5 | 16 | - | 1600 | 2000 | 100 |
| DN300 | 2 | 15.625 | 25 | 2500 | 3125 | 160 |
| | 2.5 | 25 | - | 2500 | 3125 | 100 |

**Table 27 WaterMaster virtual/ full bore flow sensor**

| Flow sensor size | Accuracy class | Q1 ($m^3/h$) | Q2 ($m^3/h$) | Q3 ($m^3/h$) | Q4 ($m^3/h$) | Ratio Q3/Q1 |
|---|---|---|---|---|---|---|
| DN350 | 2 | 25 | 40 | 4000 | 5000 | 160 |
| | 2.5 | 40 | - | 4000 | 5000 | 100 |
| DN400 | 2 | 25 | 40 | 4000 | 5000 | 160 |
| | 2.5 | 40 | - | 4000 | 5000 | 100 |
| DN450 | 2 | 40 | 64 | 4000 | 5000 | 100 |
| | 2.5 | 63.49 | - | 4000 | 5000 | 63 |
| DN500 | 2 | 40 | 64 | 4000 | 5000 | 100 |
| | 2.5 | 63.49 | - | 4000 | 5000 | 63 |

Alternative flowrate values may be selected under the following conditions:

- Values of $Q_3$ shall not be greater that those specified in Table 26 and 27;
- Values of $Q_1$ shall not be less than those specified in Table 26 and 27;
- The ratio $Q_4/Q_3$ shall be 1.25;
- For accuracy class 2, the ratio of $Q_2/Q_1$ shall be 1.6;
- For accuracy class 2, the ratio of $Q_3/Q_1$ shall be not less than 40 and shall be selected as per clause 4.1.4 of NMI R 49-1; and
- For accuracy class 2.5, the ratio of $Q_3/Q_1$ shall be selected as per clause 3.1 of NMI M 10-1.

The Pattern and Variants incorporating the WaterMaster FEV, WaterMaster FEW or WaterMaster FEF flow sensor have the following power supply options:

- DC powered: 24 V DC (+/-30%  (18.46V to 31.2V DC) @ <0.4A)
- LOW VOLTAGE  24 V AC +10 % / -30% @ <7 VA
- Mains 85 to 265 V AC @ < 7 VA

The Pattern and Variants incorporating the WaterMaster FEV, WaterMaster FEW or WaterMaster FEF flow sensor have the following installation conditions:

- No flow straightener or flow conditioner is required.
- For accuracy class 2, the flow profile sensitivity class is U0/D0.
- For accuracy class 2.5, the installation conditions are specified in Table 28.

**Table 28 Minimum pipe lengths required by flow disturbance type**

| Flow Sensor | Disturbance Type (*) | Minimum number of upstream pipe lengths (DN) | Minimum number of downstream pipe lengths (DN) |
|---|---|---|---|
| FEV, FEW, FEF | 1 | 0 | 0 |
| | 2 | 0 | 0 |
| | 3 | 0 | 0 |

(*) For information on the different types of flow disturbances which are examined as part of pattern approval, refer to NMI M 10-2.

The Pattern and Variants are approved with the following pressure loss classes based upon flow sensor size and type:

(Virtual) full bore:

- For sizes DN40 and DN50: Δp10 (10 kPa)
- For sizes DN65 to DN200: Δp16 (16 kPa)
- For sizes DN250 to DN500: Δp10 (10 kPa)

**Table 29 Flow sensor sizes, length and verification scale interval**

| Flow sensor size | Meter length (mm) | Verification scale interval ($m^3$) |
|---|---|---|
| DN40 & DN50 | 200 | 0.001 |
| DN65 | 200 | 0.001 |
| DN80 | 200 | 0.001 |
| DN100 & DN125 | 250 | 0.001 |
| DN150 | 300 | 0.01 |
| DN200 | 350 | |
| DN250 | 450 | |
| DN300 | 500 | |
| DN350 | 550 | |
| DN400 | 600 | |
| DN450 | 700 | |
| DN500 | 770 | |

TEST PROCEDURE No 14/3/46

This Approval and Certificate is issued only with respect to the design (the pattern and variants) of the water meter described herein. The calibration and measurement accuracy of individual water meters manufactured and marked in accordance with the approved pattern and variants should be verified in accordance with the test procedures specified below, or as required by relevant legislation.

Water meters tested for initial verification shall comply with the Certificate of Approval, Technical Schedule, and the maximum permissible errors for verification at the operating conditions in effect at the time of verification. Maximum permissible errors for verification of water meters are given in the *National Trade Measurement Regulations 2009* (Cth).

Water meters shall be verified in accordance with NITP 14 *National Instrument Test Procedures for Utility Meters*.

For accuracy class 2.5 meters:

- The maximum permissible errors for initial verification shall be ±2.5% from $Q_1$ to $Q_4$.
- The flow rates specified for initial verification in NMI M 10-2 shall replace the flow rates specified in NITP 14.

NOTE: NMI reserves the right to vary this procedure. Any such variation shall be notified in writing by NMI.

FIGURE 14/3/46 – 1


ABB AquaMaster4 Model Water Meter – The Pattern

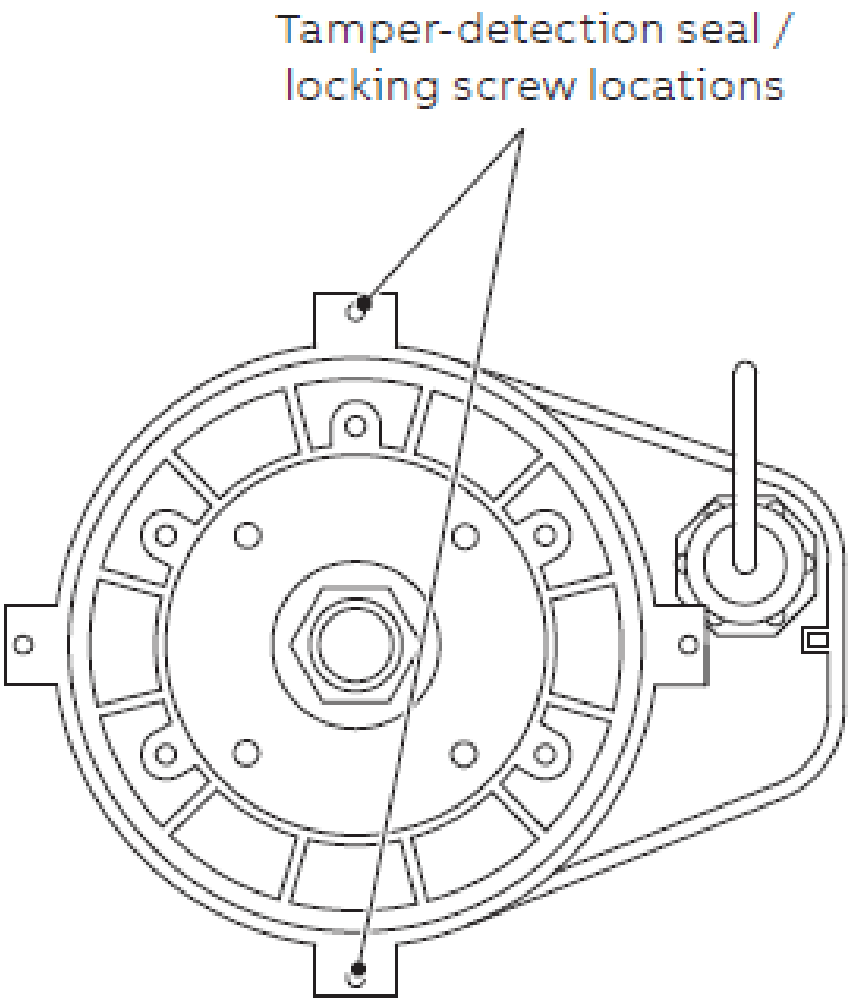
FIGURE 14/3/46 – 2


AquaMaster4 signal transmitter (indicating device) – The Pattern

FIGURE 14/3/46 – 3

AquaMaster4 – Sealing Device: read-only switch

FIGURE 14/3/46 – 4




AquaMaster4 – Sealing Device: physical seals

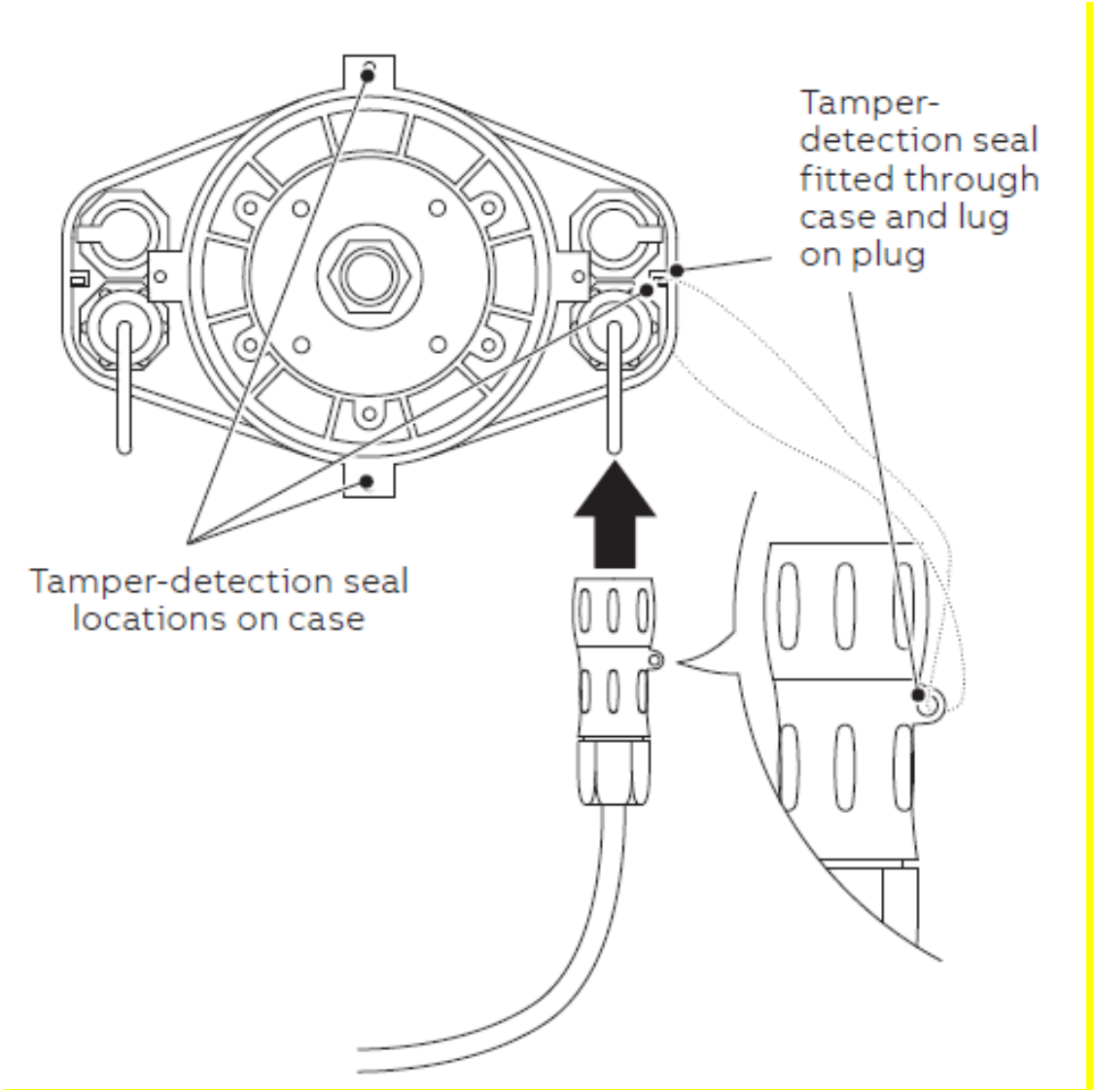
FIGURE 14/3/46 – 5


AquaMaster4 – Example of Required Markings

FIGURE 14/3/46 – 6


AquaMaster4 – Compact and Remote Arrangements

FIGURE 14/3/46 – 7




AquaMaster4 – Remote Arrangement Sealing

FIGURE 14/3/46 – 8


AquaMaster4 – FEW4XX.R sensor (Variant 1 to 3)

FIGURE 14/3/46 – 9

AquaMaster4 – FEW4XX.V sensor (Variant 4 & 5)

FIGURE 14/3/46 – 10


AquaMaster4 – FEW4XX.F sensor (Variant 4 & 5)

FIGURE 14/3/46 – 11

AquaMaster FEV 2 electromagnetic full bore flow sensor – Variant 6

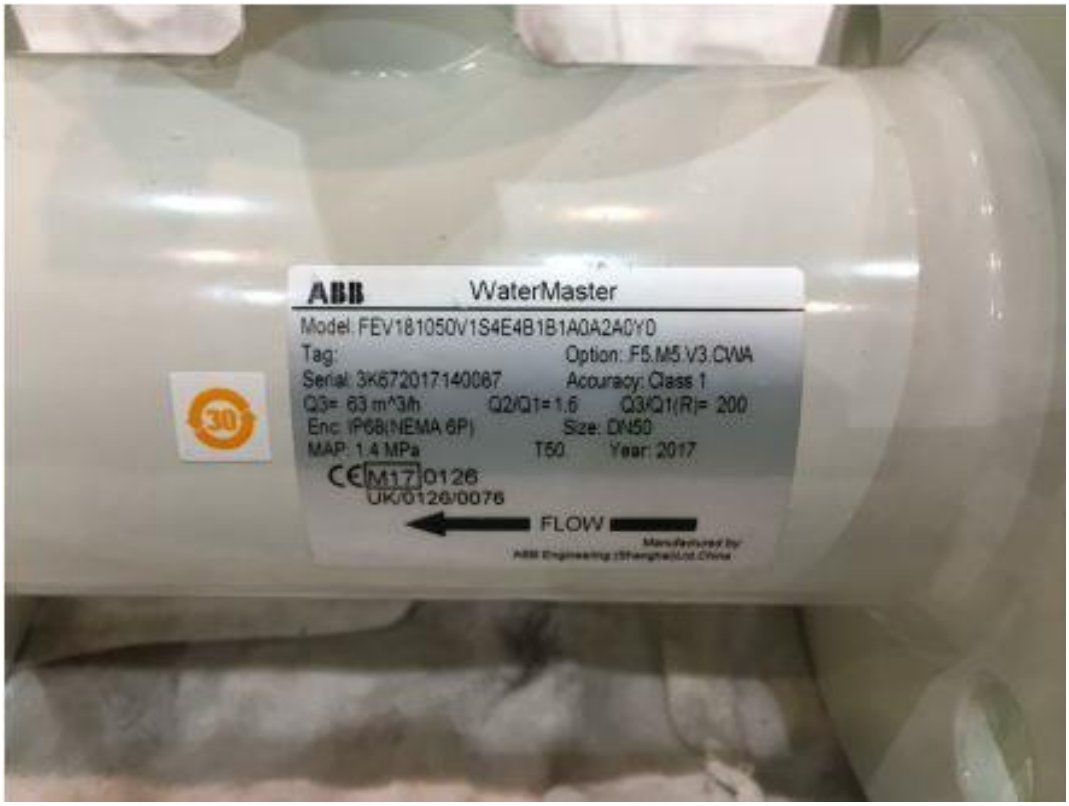
FIGURE 14/3/46 – 12


AquaMaster FEV 2 flow sensor (example markings) – Variant 6

FIGURE 14/3/46 – 13

WaterMaster compact and remote versions – Variant 7

FIGURE 14/3/46 – 14




WaterMaster (example markings) – Variant 7

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