



Australian Government
Department of Industry,
Innovation and Science

National Measurement Institute

Certificate of Approval

No 5/6B/211

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.

Macnaught Model WM50 Liquid-measuring System

submitted by Macnaught Pty Ltd
41-49 Henderson Street
TURELLA NSW 2205

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 becomes subject to review on **3/05/22**, and then every 5 years thereafter.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern & variants 1 to 4 approved – interim certificate issued	11/07/07
1	Pattern & variants 1 to 4 approved – certificate issued	12/03/08
2	Variant 5 approved – interim certificate issued	1/09/08
3	Variant 5 approved – certificate issued	19/11/08
4	Variant 6 approved – interim certificate issued	12/08/09
5	Variant 6 approved – certificate issued	2/09/09

Rev	Reason/Details	Date
6	Pattern & variants 1 to 6 reviewed & updated – certificate issued	15/05/13
7	Pattern reviewed & updated – certificate issued	03/05/17

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI 5/6B/211' and only by persons authorised by the submitter.

It is the submitter'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.

Auxiliary devices used with this instrument shall comply with the requirements of General Supplementary Certificates No S1/0/A or No S1/0B.

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



Dr A Rawlinson

TECHNICAL SCHEDULE No 5/6B/211

1. Description of Pattern

approved on 11/07/07

A bulk flowmetering system incorporating a Macnaught model WM50 (*) 50 mm positive displacement flowmeter (Figure 1 and Table 1) for bulk metering of petroleum products other than LPG.

(*) The full model number of the meter is in the form 'WM50ARP-3xxEx' – refer to Table 1.

1.1 Field of Operation

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

- Minimum measured quantity, V_{min} 200 L (#1)
- Maximum flow rate, Q_{max} 350 L/min
- Minimum flow rate, Q_{min} 35 L/min
- Maximum pressure of the liquid, P_{max} 1800 kPa
- Minimum pressure of the liquid, P_{min} 90 kPa (#2)
- Dynamic viscosity 0.5 to 250 mPa.s (at 20°C) (#3)
- Liquid temperature range -10°C to 50°C (#4)
- Ambient temperature range -25°C to 55°C
- Accuracy class 0.5

(#1) The calculator/indicator indicates the volume at least in 1 L increments.

(#2) As specified for the gas elimination device for effective operation.

(#3) The flowmeter is adjusted to be correct for the liquid for which it is to be verified/certified as marked on the data plate.

(#4) Range may be reduced by the calculator/indicator volume conversion for temperature to 15°C facility.

1.2 Components of the Flowmetering System

(i) Tank

A supply tank which may incorporate a detector for low liquid-level. The detector is used to prevent further deliveries when the low liquid-level is reached, and prevents air from entering the pipework.

(ii) Pump

A positive displacement, centrifugal or submersible turbine type pump may be used to provide flow through one or more flowmeters.

A submersible turbine type pump may be used either alone or supplying a centrifugal type pump positioned above or below the liquid level of the supply tank.

The pump(s) is/are positioned either in a flooded suction configuration, i.e. below the liquid level in the supply tank or in a manner such that the inlet pressure is always greater than the atmospheric pressure and saturated vapour pressure of the liquid.

In any case, for all combination of usage, the pump(s) shall be of sufficient capacity to ensure that each flowmeter can operate over its approved flow rate range.

(iii) Non-return Valve

A non-return valve is fitted upstream of the flowmeter to prevent reverse flow and keep the pipework full of liquid at all times.

(iv) Gas Elimination Device (Figure 2a)

A Macnaught model MAE21-CA1 gas extractor with an integral filter/strainer (or any other equivalent (*) approved gas elimination device), fitted as close as practical to the flowmeter inlet to prevent vapour entering the flowmeter.

For applications where the liquid viscosity exceeds 20 mPa.s at 20°C, for example light oils and hydraulic fluids, the supply tank has low liquid-level detection to automatically stop the pump and a gas elimination device need not be fitted.

(*) '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 complete system.

(v) Measurement Transducer

The measurement transducer is a Macnaught model WM50ARP-3E positive displacement flowmeter (Figure 2b) incorporating oval gear rotors with two magnets per rotor that pass across a pulser circuit board with dual Hall Effect sensors to produce a dual output signal proportional to the volume throughput. The measuring transducer has the following characteristics:

Input supply voltage	4.5 to 24 DC
Pulse output	Square wave output proportional to supply voltage
Nominal k-factor	6.68 pulses/litre per channel
Maximum pulse output	39 Hz per channel
Cyclic Volume	299.40 mL

The flowmeter may be mounted in horizontal or vertical pipelines provided the shaft from the meter to the pulser is in the horizontal plane.

(vi) Calibration Adjustment

The flowmeter calibration adjustment is achieved using the k-factor and/or meter factor facility provided by the compatible (#) approved controller/indicator.

Provision is made in the pipework for measuring the liquid temperature and pressure at the flowmeter during verification/certification of the system.

The calibration adjustment is carried out using the liquid which the flowmeter is intended to measure.

(vii) Controller/Indicator

An Enraf Contrec model Trac-40 controller/indicator or any other compatible (#) approved controller/indicator. The Trac-40 is described in the documentation of approval NMI S367A.

For applications where volume at 15°C is required, the approved controller/indicator incorporates volume conversion for temperature facility and is connected to a temperature probe fitted as close as practical to the flowmeter.

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

(viii) Power Supply

The power supply to the measurement transducer may be provided either by:

- (a) Connecting to the auxiliary power supply provided by the controller/indicator, such as the Enraf Trac-40, which also incorporates a control relay to stop the pump in the event of a power failure; or
- (b) Connecting to a common power source defined by wiring, such that in the event of the power supply failure to the measurement transducer, the delivery pump is simultaneously affected and the flow stops.

(ix) Transfer Device

The transfer device is located downstream of the flowmeter and clearly defines the start and stop of the measured quantity. The transfer device may be in the form of a breakaway coupling, a nozzle or a positive shut-off component, such as a manually or automatically operated flow control valve. Whatever the transfer device used, the pipework upstream of the transfer device shall be maintained full of liquid.

The system may have more than one transfer point however the pipework design is such that once the measurement starts the flow continues through the intended transfer point until delivery is finalised; there is no possibility for diverting the measured quantity other than through the intended transfer point.

If a nozzle is used, the nozzle has an anti-drain valve installed either in the nozzle or immediately before it, and having a retaining pressure valve of not less than 55 kPa: the nozzle is the transfer device.

The pipework between the gas eliminator device and the transfer point shall be kept full of liquid during the measurement and shutdown periods.

For systems with hose reel (Figure 1), the volume between the flowmeter and the transfer point shall not exceed the specified minimum measured volume (V_{min}) for the flowmeter.

1.3 Verification Provision

Provision is made for the application of a verification mark.

1.4 Sealing Provision

Refer to approval for the controller/indicator used for sealing requirements.

1.5 Descriptive Markings and Notices

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

Pattern approval mark	NMI 5/6B/211
Manufacturer's identification mark or trade mark
Meter model
Serial number of the instrument
Year of manufacture
Maximum flow rate, Q_{max} L/min
Minimum flow rate, Q_{min} L/min
Maximum pressure of the liquid, P_{max} kPa
Minimum pressure of the liquid, P_{min} kPa
Type of the liquid for which the system is verified (#)
Environmental class	class C

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

The minimum measured quantity (V_{min}) is clearly visible on the indicating device, e.g. "Minimum Delivery 200 L".

2. Description of Variant 1 approved on 11/07/07

The dual Hall Effect sensors replaced by dual Reed switches having a contact rating of 15 VA and a maximum voltage rating of 150 V DC.

3. Description of Variant 2 approved on 11/07/07

The dual Hall Effect sensors replaced by a single Reed switch and a single Hall Effect sensor.

4. Description of Variant 3 approved on 11/07/07

Using certain other Macnaught WM series flowmeters as listed in Table 1 below. Meters may also be known as M series of the same models.

The meters are also available in a base mount housing (Figure 3a) and the inlet and outlet ports may be either threaded or flanged (Figures 3b or 3c, respectively).

TABLE 1

Flowmeter Model (#)	Minimum Flow Rate (Q_{min}) (L/min)	Maximum Flow Rate (Q_{max}) (L/min)	Minimum Delivery (V_{min}) (L)
WM10	24 (#2)	120	20
WM40	50 (#2)	250	50
WM50 (#3)	70 (#2)	350	200
WM80 (#1) (#3)	140 (#2)	700	200
WM100 (#1) (#3)	240 (#2)	1200	200

- (#1) Fitted with model MAE21-CA1 gas extractor or any other compatible approved gas extractor.
- (#2) The minimum flow rate Q_{min} reduced to be 1/10 of Q_{max} when using the linearisation correction facility of the Enraf Trac-40 controller/indicator or any other compatible approved controller/indicator used.
- (#3) When these model flowmeters are fitted with the rotary encoder pulser of Variant 4, the minimum delivery (V_{min}) is 100 litres.
- (#) The full model number of the meter is in the form 'WM50ARP-3xxEx' (or M50ARP-3xxEx) as set out below in Table 2.

TABLE 2

'WM' (or 'M') designates meter series

'50' designates nominal meter size in mm, e.g. the pattern (model WM50) is nominally 50 mm (2 inch)

'A' designates meter body material, namely
A = aluminium; or
B = bronze; or
S = 316 stainless steel.

'R' designates rotor material, namely
R = resin (WM10, WM40 & WM50 (or M equivalents) only);
S = 316 stainless steel (all models); or
A = aluminium (WM80 & WM100 (or M equivalents) only)

'P' designates output, namely
P = integral pulser; or
FB = high resolution pulser

'-3' designates process connections, e.g. 3 = ANSI-150 flanges (can be in the range 1 – 17 representing the meter port size and 'Form, e.g. ANSI flanged or BSPP threaded)

'x' designates construction type, namely
Blank = pipe mount;
P = plant (foot mount); or
C = compact (foot mount)

'x' designates configuration, namely
Blank = pipe mount meter; or
0 - 9 = meter configuration (for foot mount meter only)

'E' designates sensor type, namely
Blank = dual Reed PCB;
E = dual Hall Effect PCB; or
ER = Reed/Hall Effect PCB

'x' designates seal (O-ring) material, namely
Blank = Nitril (NBR);
V = Viton;
K = Teflon encapsulated; or
J = EDPM

5. Description of Variant 4

approved on 11/07/07

With the pulser of the pattern replaced by certain models of the Hontko HPN-6A (*) series of rotary encoder pulsers (Figure 4).

(*) The full model number of the pulser has additional alphanumeric suffixes.

The pulser characteristics are as follows:

- Supply voltage: 8 to 26 V DC
- Pulse output: Square wave output proportional to supply voltage.
- Maximum shaft rotation: 2000 rpm
- Number of outputs: Three channels (A, B and Z).
- Resolution:

- (i) WM10, WM40, WM50 flowmeters may be fitted with a pulser that has 100 pulses per shaft revolution for channels A and B; 50 pulses per shaft revolution for channel Z.
- (ii) M80 and M100 are fitted with a pulser that has 1000 pulses per shaft revolution for channels A and B; 500 pulses per shaft revolution for channel Z.

When this pulser is fitted to the WM50, WM80 or WM100 flowmeters (or their M series versions), the minimum delivery (V_{min}) is 100 litres.

6. Description of Variant 5

approved on 2/09/08

A bulk flowmetering system incorporating a Macnaught model WM7 (or M7) 25 mm positive displacement flowmeter constructed of PPS (Ryton) material and approved for use with AdBlue fluid AUS32 (aqueous urea solution 32.5%).

The model WM7 (M7) meter is similar to the pattern (WM50) but has specifications as listed below in Table 3.

TABLE 3

Flowmeter Model (#)	Minimum Flow Rate (Q_{min}) (L/min)	Maximum Flow Rate (Q_{max}) (L/min)	Minimum Delivery (V_{min}) (L)
WM7	14 (#1)	70	15

(#) The full model number of the meter is in the form 'WM7RRP-1xxEx' (or M7RRP-1xxEx) as set out in Table 2 for the pattern.

(#1) The minimum flow rate Q_{min} reduced to be 1/10 of Q_{max} when using the linearisation correction facility of the Enraf Trac-40 controller/indicator or any other compatible approved controller/indicator used.

7. Description of Variant 6

approved on 12/08/09

A bulk flowmetering system incorporating any Macnaught WM series flowmeter, as listed in Table 4 below. Meters may also be known as M series of the same models.

7.1 Field of Operation

The field of operation for this variant is as described for the pattern except for the following characteristics:

- Minimum measured quantity, V_{min} as listed in Table 4 below
 - Maximum flow rate, Q_{max} as listed in Table 4 below
 - Minimum flow rate, Q_{min} as listed in Table 4 below
 - Dynamic viscosity (at 20°C) (*)
- (*) to include products such as:
- (i) AdBlue fluid AUS32 (aqueous urea solution 32.5%), 0.5 to 20 mPa.s;
 - (ii) Stock feed additives, 20 to 1000 mPa.s; and
 - (iii) Worm castings, vermicast, etc. 0.5 to 20 mPa.s.

TABLE 4

Flowmeter Model [#]	Minimum Flow Rate (Q_{min}) (L/min)	Maximum Flow Rate (Q_{max}) (L/min)	Minimum Delivery [#1] (V_{min}) (L)	Material of Construction [#2]	Approved Products [#3]
M7	14 [#6]	70	15	PI	S & W
M10	24 [#6]	120	20	Al & SS	A, S & W
M40	50 [#6]	250	50	Al & SS	A, S & W
M50 [#6]	70 [#6]	350	200	Al & SS	A, S & W
M80 [#4] [#6]	140 [#6]	700	200	Al & SS	A, S & W
M100 [#4] [#4]	240 [#6]	1200	200	Al & SS	A, S & W

[#] The full model number of the meter is in the form 'WM50ARP-3xxEx' (or M50ARP-3xxEx) as set out in Table 2 for the pattern.

[#1] Minimum measured quantity, V_{min} , also known as Minimum Delivery.

[#2] Al = aluminium, PI = plastic, SS = 316 stainless steel.

[#3] A = AdBlue, S = stock feed additives, W = worm castings.

[#4] Fitted with a model MAE21-CA1 gas extractor or any other compatible approved gas extractor.

[#5] The minimum flow rate Q_{min} reduced to be 1/10 of Q_{max} when using the linearisation correction facility of the Enraf Trac-40 controller/indicator or any other compatible approved controller/indicator used.

[#6] When these model flowmeters are fitted with the rotary encoder pulser of Variant 4, the minimum delivery (V_{min}) is 100 litres.

TEST PROCEDURE No 5/6B/211

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

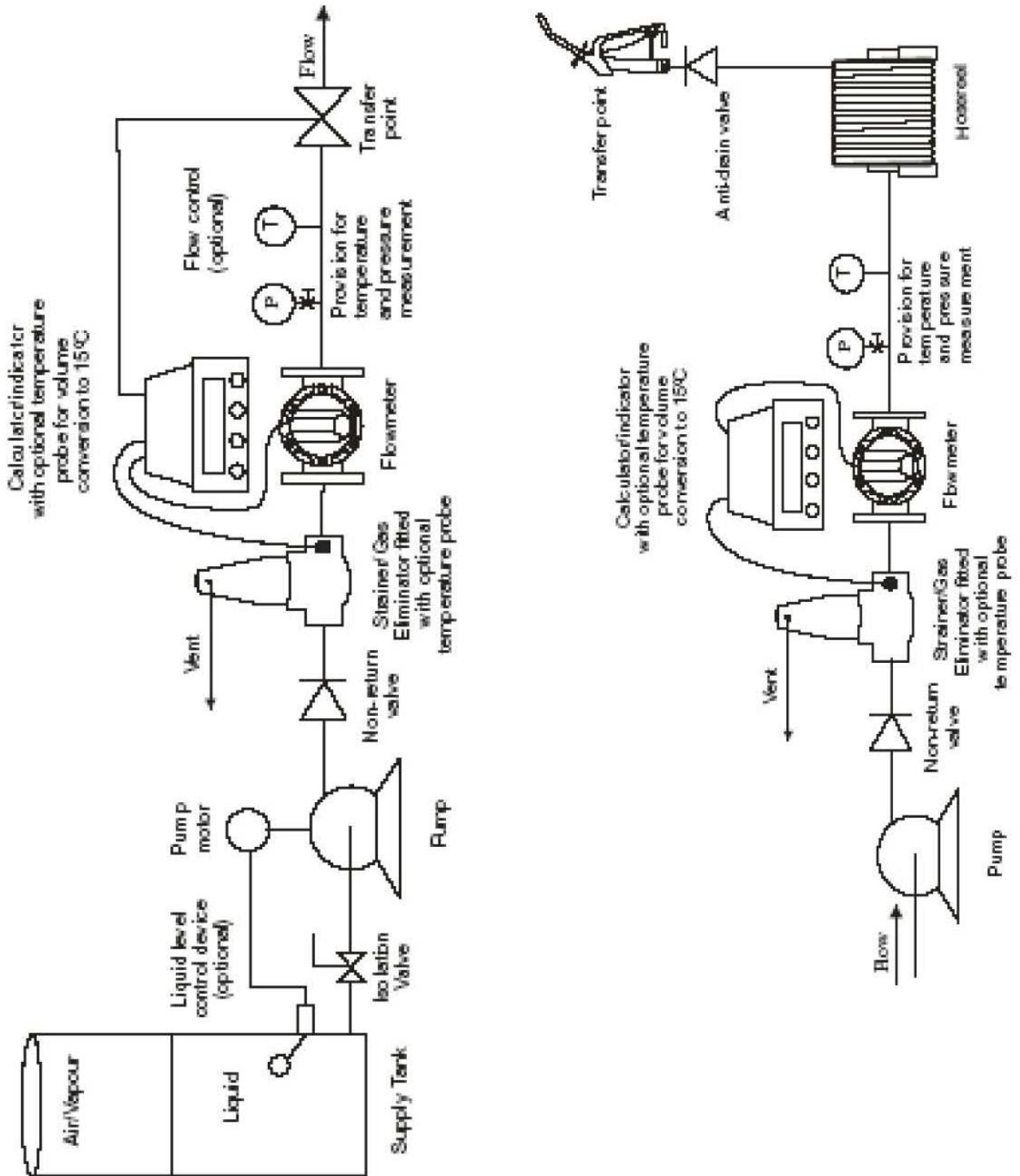
The maximum permissible errors are specified in Schedule 1 of the *National Trade Measurement Regulations 2009*.

Power Failure Test

This test need only be carried out for new installations or when the power supply wiring to the measurement transducer or controller/indicator has been altered.

Interrupt the power supply to the measurement transducer and check that the delivered volume and the volume displayed by the controller/indicator does not exceed a volume equal to the sum of 0.5% of the delivered volume plus 5% of V_{min} specified for the flowmeter.

FIGURE 5/6B/211 – 1



Macnaught Model WM50 Flowmetering System
(Including Showing a Typical Delivery System With Hose Reel)

FIGURE 5/6B/211 – 2

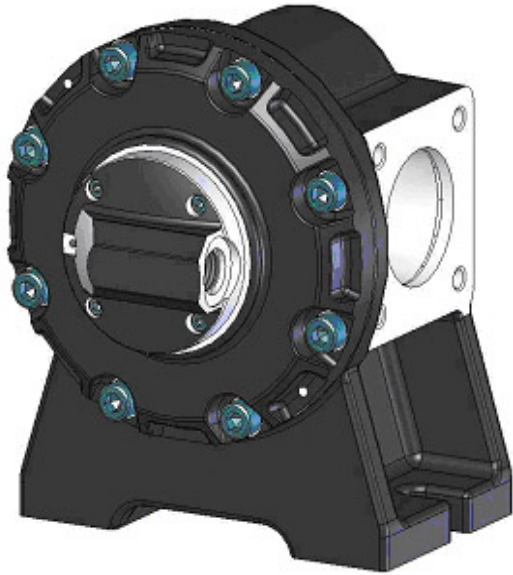


(a) Macnaught Model MAE21-CA1 Gas Extractor With Integral Filter/Strainer



(b) Macnaught Model WM50ARP-3E Flowmeter With Integral Pulsar

FIGURE 5/6B/211 – 3



(a) WM (or M) Series Flowmeter With Base (Foot) Mount Body



(b) Model WM10 (or M10) With Threaded Ports



(c) Model WM100 (or M100) With Flange Ports

FIGURE 5/6B/211 – 4



Macnaught Model M50 Flowmeter with a Hontko HPN-6A Series Rotary Encoder Pulser

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