



**Australian Government**  
**National Measurement  
Institute**

Bradfield Road, West Lindfield NSW 2070

**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

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 117-1, Measuring Systems for Liquids Other than Water, dated July 2004.

**CONDITIONS OF APPROVAL**

This approval becomes subject to review on 1 August 2012, and then every 5 years thereafter.

Instruments purporting to comply with this approval shall be marked with approval number 'NMI 5/6B/211' 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.

The National Measurement Institute reserves the right to examine any instrument or component of an instrument purporting to comply with this approval.

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

#### DESCRIPTIVE ADVICE

**Pattern:** approved 11 July 2007

- A Macnaught model WM50 bulk flowmetering system for bulk metering of petroleum products other than LPG.

**Variants:** approved 11 July 2007

1. With dual Reed switches.
2. With a single Reed switch and a single Hall Effect sensor.
3. Using certain WM (or M) series flowmeters as listed in Table 1.
4. With a Hontko HPN-6A series rotary encoder pulser.

Technical Schedule No 5/6B/211 describes the pattern and variants 1 to 4.

**Variant:** approved 1 September 2008

5. Model WM7 (M7) flowmeter for use to dispense AdBlue (aqueous urea solution).

Technical Schedule No 5/6B/211 Variation No 1 describes variant 5.

#### FILING ADVICE

Certificate of Approval No 5/6B/211 dated 12 March 2008 is superseded by this Certificate, and may be destroyed. The documentation for this approval now comprises:

Certificate of Approval No 5/6B/211 dated 19 November 2008  
Technical Schedule No 5/6B/211 dated 12 March 2008 (incl. Table 1  
and Test Procedure)  
Technical Schedule No 5/6B/211 Variation No 1 dated 19 November 2008  
(incl. Table 2)  
Figures 1 to 4 dated 12 March 2008

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



## TECHNICAL SCHEDULE No 5/6B/211

**Pattern:** Macnaught Model WM50 Liquid-measuring System

**Submittor:** Macnaught Pty Ltd  
41-49 Henderson Street  
TURELLA NSW 2205

### 1. Description of Pattern

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,  $P_{min}$  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.

**(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.

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

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 including all checking facilities.

**(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 hosereel (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/Certification Provision

Provision is made for the application of a verification/certification mark.

### 1.4 Sealing Provision

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

### 1.5 Descriptive Markings

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 Variants

### 1.1 Variant 1

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.

### 1.2 Variant 2

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

### 1.3 Variant 3

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 3) and the inlet and outlet ports may be either threaded or flanged (Figure 3).

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

- (#) The full model number of the meter is in the form 'WM50ARP-3xxEx' (or M50ARP-3xxEx) as set out overpage.
- (#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 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.

#### 1.4 Variant 4

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.

- (#) The full model number of the meter is in the form 'WM50ARP-3xxEx' (or M50ARP-3xxEx) as set out below:

'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.



## TEST PROCEDURE

Instruments should be tested in accordance any relevant tests specified in the Uniform 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.

### **Maximum Permissible Errors**

The maximum permissible errors are specified in Schedule 12 of the *National Measurement Regulations 1999*.

It is forbidden to adjust the calibration of the meter to an error other than as close as practical to zero error.

The meter is required to be verified/certified with the liquid that the meter is metering.

### **Hose Dilation Test**

The maximum permissible errors applicable for hose dilation are:

$\pm(0.01 \times \text{Minimum Measured Quantity})$  litres for systems without a hose reel;  
and

$\pm(0.02 \times \text{Minimum Measured Quantity})$  litres for systems with a hose reel.

### **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.

TECHNICAL SCHEDULE No 5/6B/211

VARIATION No 1

**Pattern:** Macnaught Model WM50 Liquid-measuring System

**Submittor:** Macnaught Pty Ltd  
41-49 Henderson Street  
TURELLA NSW 2205

**1. Description of Variant 5**

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%).

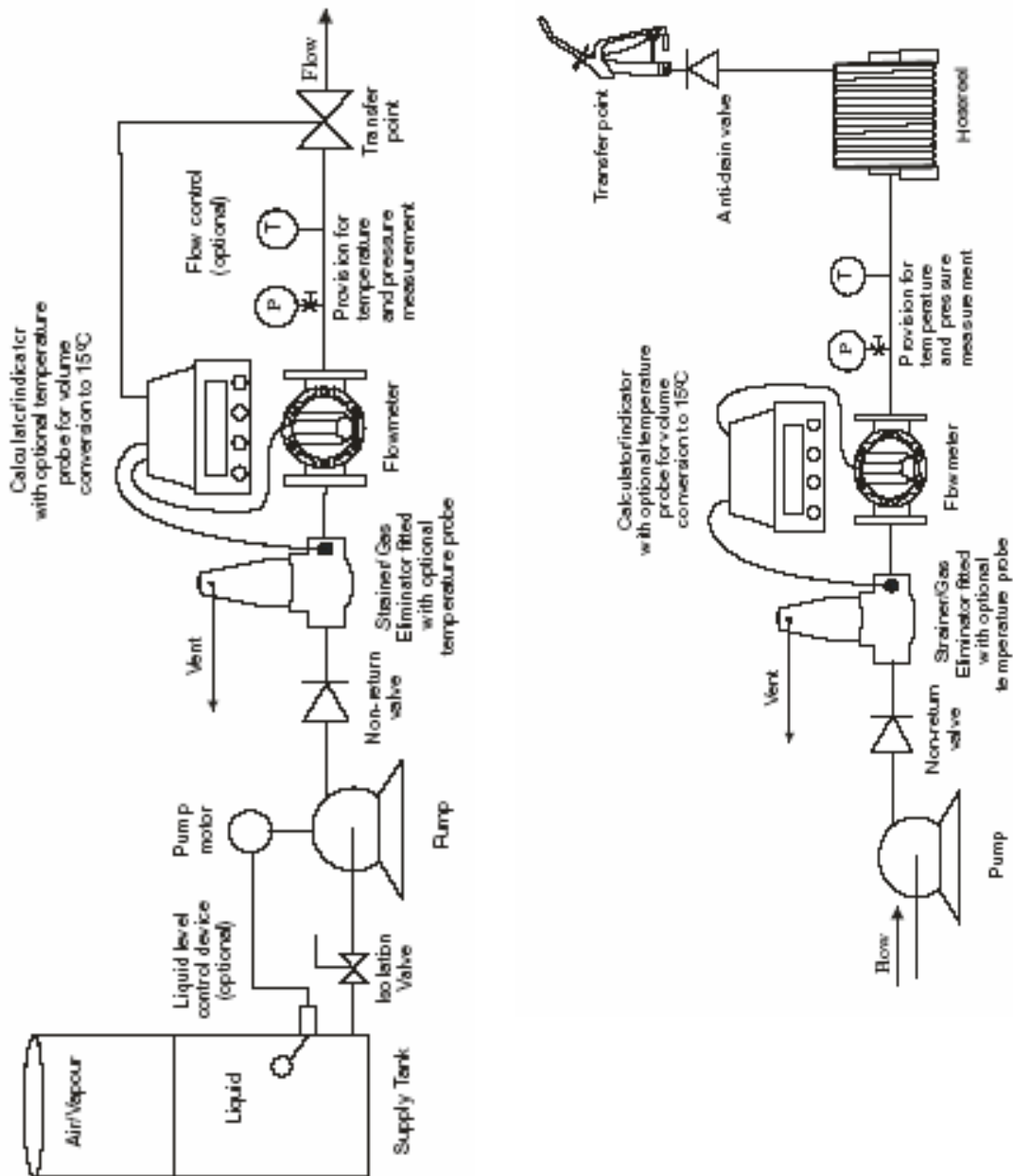
The model WM7 (M7) meter is similar to the pattern (WM50) but has specifications as listed below in Table 2.

TABLE 2

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 Technical Schedule No 5/6B/211 dated 12 March 2008.
- (#1) The minimum flow rate  $Q_{min}$  reduced to be 1/10 of  $Q_{max}$  when using the linearisation facility of the Enraf Trac-40 controller/indicator or any other compatible approved controller/indicator used.

FIGURE 5/6B/211 – 1



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

FIGURE 5/6B/211 – 2

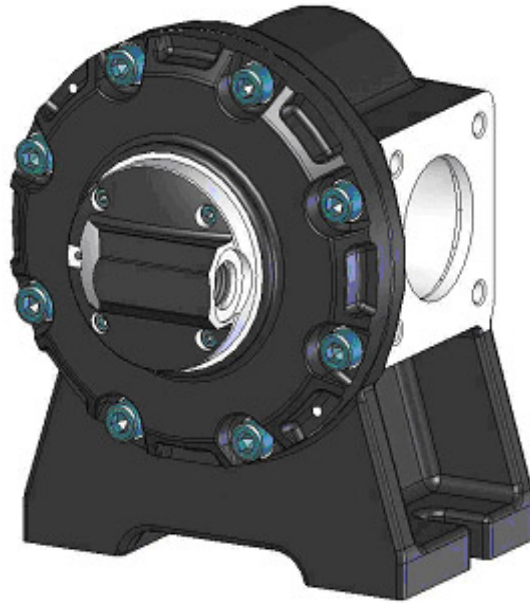


(a) Macnaught Model MAE21-CA1 Gas Extractor With Integral Filter/Strainer



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

FIGURE 5/6B/211 – 3



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



Model WM10 (or M10) With Threaded Ports



Model WM100 (or M100) With Flange Ports

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FIGURE 5/6B/211 – 4



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