Australian Government
Department of Industry, Science, Energy and Resources

National Measurement Institute

36 Bradfield Road, West Lindfield NSW 2070

Certificate of Approval

NMI 5/6B/231

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.

Avery-Hardoll Model BM250 Liquid-measuring System

submitted by Silea Liquid Transfer Srl
19 Via 1 Maggio,
Ozzano dell'Emilia Bolonga 40064
Italy

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 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 approved – certificate issued	08/12/21

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI 5/6B/231' 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.

Auxiliary devices used with this instrument shall comply with the requirements of General Supplementary Certificate 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*.

Darryl Hines
Manager
Policy and Regulatory Services

TECHNICAL SCHEDULE No 5/6B/231

1. Description of Pattern approved on 17/12/04

A bulk-flowmetering system incorporating an Avery-Hardoll model BM250 rotary motion positive displacement flowmeter (Table 1) for bulk metering of petroleum products other than LPG.

The pattern and variants are approved for use with various grades of pure biodiesel and biodiesel/distillate blends (to Australian government standard).

Note: The Avery-Hardoll model BM250 may alternatively be known as Liquid Controls model BM250

1.1 Field of Operation

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

- Minimum measured quantity, V_{min} 100 L (#1)
- Maximum flow rate, Q_{max} 1140 L/min
- Minimum flow rate, Q_{min} 115 L/min
- Maximum pressure of the liquid, P_{max} 1034 kPa
- Minimum pressure of the liquid, P_{min} 140 kPa (#2)
- Dynamic viscosity at 20°C 0.4 to 20 mPa.s (#3)
- Liquid temperature range -10 to 50°C
- Ambient temperature range -25 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 as marked on the data plate.

1.2 Components of the Flowmetering System (Figure 1)

(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.

Systems fitted with a positive displacement pump shall include a gas elimination device capable of continuously separating any air/vapours entrained in the liquid upstream of the flowmeter.

A centrifugal type pump may only be installed below the liquid level of the supply tank and 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.

These systems shall include a gas elimination device capable of removing any pockets of air/vapours that may form in the pipework upstream of the flowmeter.

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 between the pump and the flowmeter to prevent reverse flow and keep the pipework full of liquid at all times.

(iv) Gas Elimination Device

The gas elimination device, comprising a Liquid Controls model F-30 strainer fitted with a model A8180 or 18184A air/vapour eliminator (or any other equivalent approved gas elimination device), fitted upstream of the flowmeter to prevent vapours entering the flowmeter.

For applications where the duration of the shut-down period does not cause thermal contraction of the liquid and formation of pockets of gas upstream of the flowmeter, the gas elimination device may be modified for use as a strainer only, provided the supply tank incorporates a detector for low liquid-level.

(v) Measurement Transducer

The measurement transducer is an Avery-Hardoll model BM250 rotary motion positive displacement flowmeter (Figure 2) with a mechanical output shaft connected via 90° bevel gear to a micrometer type calibration adjustment mechanism with a slotted shaft into which the drive shaft of the calculator/indicator fits.

The calibrator has a thimble which can be rotated in the direction marked for increasing or decreasing the rotation rate of the drive shaft of the calculator/indicator. The amount by which the volume, displayed by the calculator/indicator, is increased or decreased is determined with reference to the scale divisions on the calibrator, marked 1%, 0.1% and 0.02%.

The calibration adjustment is carried out using the liquid the flowmeter is intended to measure. Provision is made for inserting a thermometer and fitting a pressure gauge for measuring the liquid temperature and pressure at the flowmeter during calibration.

(vi) Pulse Generator

A Liquid Controls model PODx pulse generator, or any other compatible (#) NMI approved pulse generator, is used. The PODx is described in the documentation of approval NSC S790.

(vi) Calculator/Indicator

A Liquid Controls model LCR.iQ calculator/indicator (Figure 2), or any other compatible (#) NMI-approved calculator/indicator, is used. The LCR.iQ is described in the documentation of approval NMI S790.

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

(vii) 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.

1.3 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/231
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	..... (#1)
Environmental class	class C or I (#2)

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

(#2) Class I applies to variations approved for use as mobile liquid-measuring systems.

The minimum measured quantity (V_{min}) is clearly visible on the indicating device, e.g. 'Minimum Delivery 100 L'.

1.4 Verification Provision

Provision is made for the application of a verification mark.

1.5 Sealing Provision

Provision is made for sealing access to the calibration mechanism.

The calibration mechanism is located behind the counter bracket cover, which is held in place by drilled head screws to allow application of wire-and-lead type seal, or similar.

2. Description of Variant 1 approved on 08/12/21

Using certain other Liquid Controls series flowmeters as listed in Table 1. The specifications for the model BM250 meter described in the pattern are shown in **bold**.

Flowmeters marked with the Avery-Hardoll name and logo are shown in Figure 6. Flowmeters may also be known as Liquid Controlls series flowmeters and markings include the Liquid Controls logo (Figure 3 and 4).

TABLE 1

Flowmeter Model (#1)	Flange size	Gas Eliminator Model (strainer with eliminator) (#2)	Maximum Flow (L/min)	Mininum Flow (L/min)	Minimum Delivery (L)
BM250 (S)	**DIN65**	**FS-3 with A89XX**	**1140**	**115**	**100**
BM950 (S)	DIN80	FS-3 with A89XX	1500	115	200
BM450 (D)	DIN80	FS-3 with A89XX	2050	200	200
BM550 (D)	DIN100	FS-4 with A89XX	2280	220	500
BM350 (D)	DIN100	FS-4 with A89XX	2800	125	500
BM650 (T)	DIN100	FS-4 with A89XX	3000	300	500
BM850 (T)	DIN150	FS-6 with A89XX	4250	200	500
DM (S)	DIN100	FS-4 with A89XX	2500	200	200

(#1) S, D or T between brackets stands for respectively Single, Double or Triple Chamber configuration. P_{max} for the flowmeter models is 1034 kPa

(#2) For certain systems designed for fuelling of aircraft, Strainer and gas elimination devices may not be required.

3. Description of Variant 2 approved on 08/12/21

As a mobile liquid-measuring system as shown in Figure 5, which is similar to the pattern except:

- The outlet of the flowmeter is fitted with a K-series air-activated check valve designed to stop the flow of liquid when air is detected by the air elimination device.

  Alternatively, the gas elimination device incorporates a high capacity stainer, either amodel F-7 (Hi-cap) or a model F-15 (Hi-cap) suitable for the 50 mm (2”) flowmeters or the 75 mm (3”) flowmeters respectively.

- A spring-loaded check valve is fitted between the gas elimination device and the flowmeter.

- The transfer device may be in the form of a nozzle at the end of a hose reel, in which case an anti-drain valve is fitted, that retains a pressure not less than 55 kPa, so that the pipework is maintained full of liquid up to the transfer point.
- Instruments marked Environmental Class I as described in **1.3 Descriptive Markings and Notices**

4. Description of Variant 3 approved on 08/12/21

A drum-filling liquid-measuring system (Figure 6) which is similar to the pattern except:

- The flowmeter is fitted with a pre-set device adjusted to deliver a verified/certified fixed quantity, which is equal to or greater than the minimum delivery specified for the flowmeter, and set to deliver at nominal flow rate. For systems with variable flow rate, the pre-set quantity is equal to or greater than twice the minimum delivery specified for the flowmeter.
- The pre-set device is mechanically linked to a control valve, either a V or VS series mechanically-activated piston valve, installed at the outlet of the flowmeter to automatically stop the delivery when the pre-set quantity is reached.
- The volume indicator is replaced with a fixed marking stating the batch quantity for which the flowmetering system is set, e.g. ‘PRE-SET FOR 200 L’.
- The outlet is either a drum-filling spear or a hose. If a spear is used, it is arranged to fully drain after each delivery so that the control valve is the transfer device. If a hose is used, it is fitted with a nozzle which has an anti-drain valve that retains a pressure not less than 55 kPa, so that the hose upstream of the nozzle is maintained full of liquid and the nozzle is the transfer device.

TEST PROCEDURE

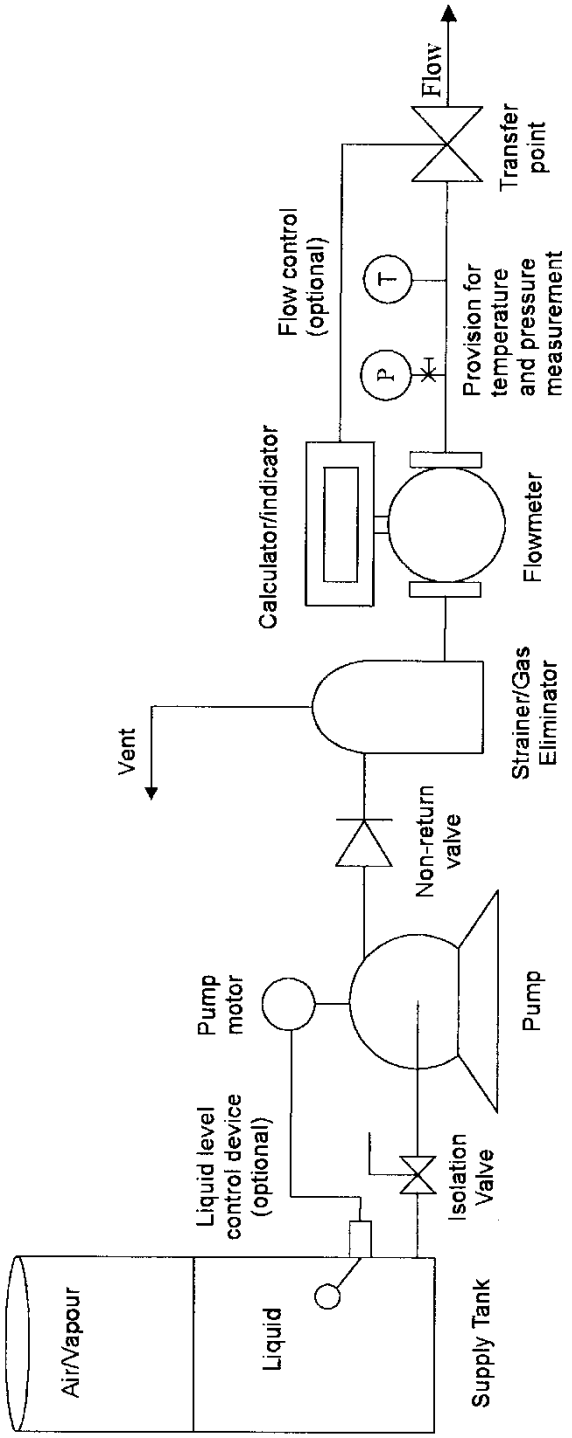
Instruments shall be tested in accordance with any relevant tests specified in the National Instrument Test Procedures.

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/231 – 1



Liquid Controls Model Liquid-measuring System (The Pattern)

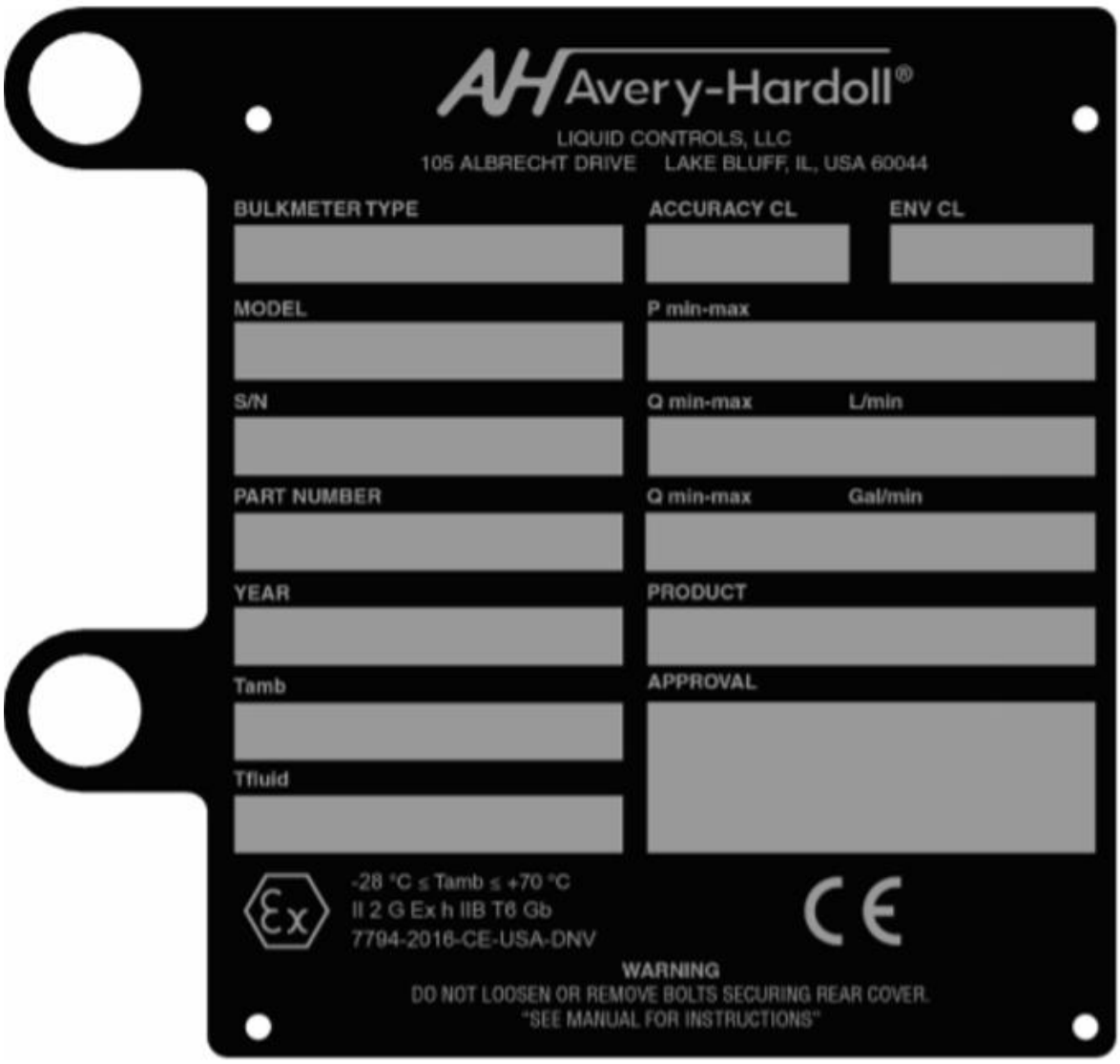
FIGURE 5/6B/231 – 2

Avery-Hardoll Model BM250 Flowmeter (The Pattern)

FIGURE 5/6B/231 – 3

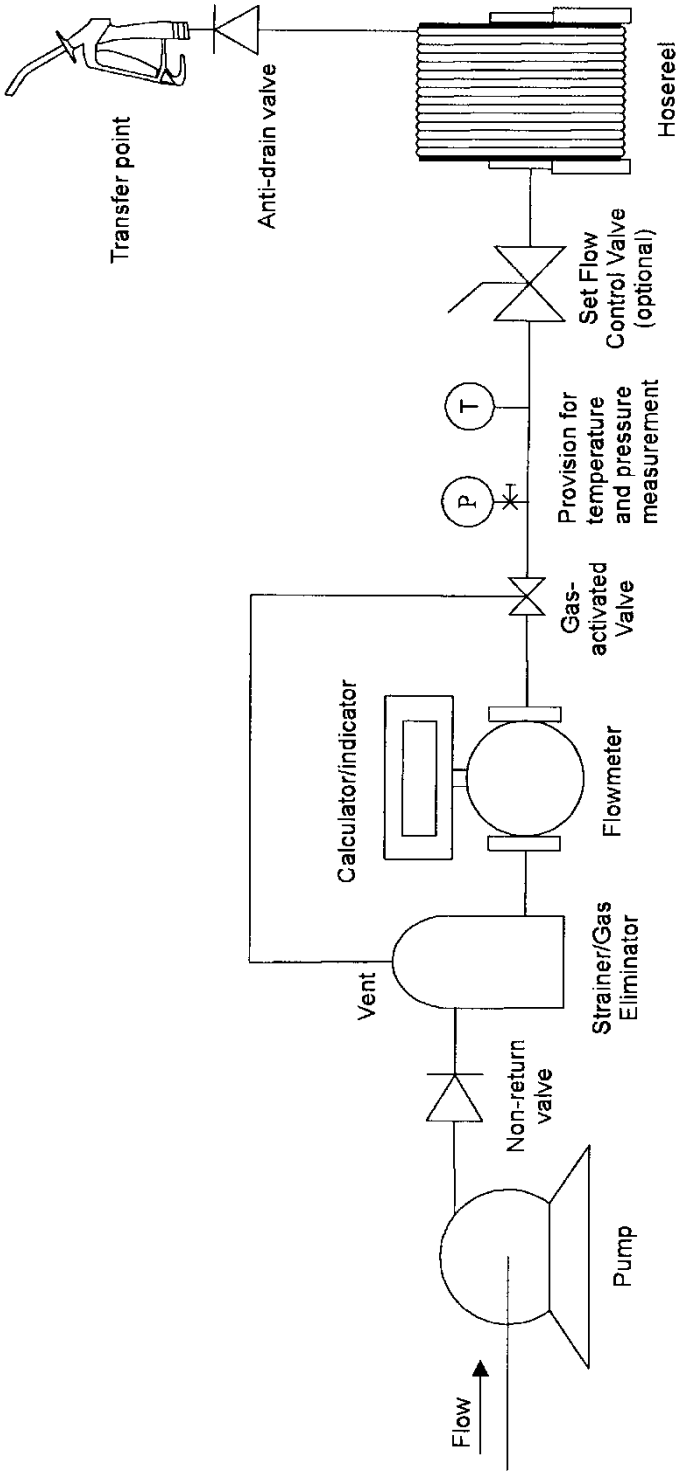
Liquid Controls Model DM Flowmeter (Variant 1)

FIGURE 5/6B/231 – 4



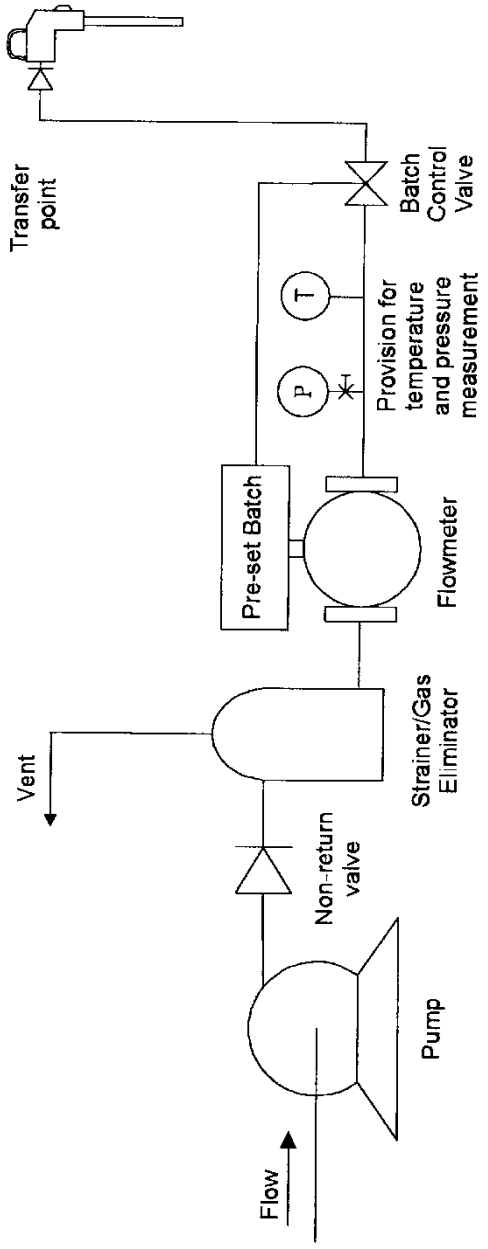
Avery-Hardoll series flowmeter markings (Variant 1)

FIGURE 5/6B/231 – 5



Liquid Controls Model Mobile Liquid-measuring System (Variant 2)

FIGURE 5/6B/231 – 6



Liquid Controls Model Drum-filling Liquid-measuring System (Variant 3)

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