

Australian Government

Department of Industry, Innovation and Science

National Measurement Institute

Certificate of Approval

No 5/6B/217

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

Brodie Model BiRotor Plus B27X Liquid-Measuring System

submitted by	Brodie Mete	r Co. L	LC
	19267 Highway 301 North		
	Statesboro	GA	30461
	USA.		

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.

This approval becomes subject to review on 07/04/22, and then every 5 years thereafter.

Rev	Reason/Details	Date
0	Pattern & variants 1 to 2 approved – certificate issued	19/07/10
1	Pattern Reviewed – certificate issued	07/04/17
2	Variant1 amended – (added models) certificate issued	10/08/17

DOCUMENT HISTORY

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI 5/6B/217' 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 his powers under Regulation 60 of the *National Measurement Regulations 1999*.

Darryl Hines

TECHNICAL SCHEDULE No 5/6B/217

Pattern: Brodie Model BiRotor Plus B27X Liquid-Measuring System

Submittor: Brodie Meter Co. LLC 19267 Highway 301 North Statesboro GA 30461 USA

1. Description of Pattern

approved on 19/07/10

A bulk flowmetering system incorporating a Brodie model BiRotor Plus B27X rotary motion DN80 positive displacement flowmeter (Figure 1 and Table 1) for bulk metering of petroleum products other than LPG. Approved products include various grades of liquid hydrocarbons including petrol/ethanol blends and pure ethanol ('E100') and various grades of pure biodiesel and biodiesel/distillate blends (to Australian government standard). The pattern is approved for class 0.3 and class 0.5 operation.

1.1 Field of Operation

The field of operation of the measuring system is determined by the following characteristics (see also Table 1):

•	Minimum measured quantity, <i>V_{min}</i>	100 L	(#1)
•	Maximum flow rate, Q _{max}	2081 L/min	. ,
•	Minimum flow rate, Q _{min}	208 L/min	(#2)
•	Maximum pressure of the liquid, <i>P</i> _{max}	5100 kPa	
•	Minimum pressure of the liquid, <i>P</i> _{min}	65 kPa (nominal)	(#3)
•	Dynamic viscosity, η (at 20°C)	0.4 to 400 mPa.s	(#4)
•	Liquid temperature range	-10°C to 50°C	
•	Ambient temperature range	-25°C to 55°C	
•	Accuracy classes	0.3 and 0.5	
•	Applications	Static, pipeline or r	nobile

- (#1) The calculator/indicator indicates the volume at least in 1 L increments.
- (#2) For class 0.5, Qmin is 114 L/min
- (#3) As specified for the gas elimination device for effective operation.
- (#4) The flowmeter is adjusted to be correct for the liquid for which it is to be verified as marked on the name data plate.

1.2 The Liquid-Measuring System (Figure 1)

(i) Supply 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/vapour 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/vapour 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 value is fitted at least between the pump and the flowmeter to prevent the reverse flow of the liquid and keep the flowmeter full of liquid at all times.

(iv) Gas Elimination

The gas elimination device is a Brodie model SC or RL air eliminator/strainer (Figure 2), 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 a Brodie model BiRotor Plus B27X dual rotor DN80 positive displacement flowmeter (Figures 1 and 2) fitted with dual pick-off coils which produce an electrical output signal proportional to the volume throughput. The dual pick-off signals are conditioned by a signal pre-amplifier. The measuring transducer has the following characteristics:

•	Input supply voltage	9 to 28 V AC
•	Nominal k-factor	42 pulses/litre per channel
•	Maximum pulse output	1500 Hz per channel (nominal)
•	Cyclic Volume	0.937 L

Flowmeters may be mounted horizontally or vertically (Figure 1).

(vi) Calculator/Indicator

The calculator/indicator used is an M+F model MFX_4 (Figure 3) as described in documentation of approval NMI S495 or any other compatible NMI-approved calculator/indicator.

(vii) Checking Facility

When the voltage supply to the transmitter is interrupted, the calculator/indicator is to stop the delivery.

(viii) 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 Sealing and Verification Provision

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

Provision is also made for a verification mark to be applied.

1.4 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/217
Manufacturer's identification mark or trade mark	
Meter model	
Serial number of the instrument	
Year of manufacture	
Maximum flow rate, Q _{max}	kg/min
Minimum flow rate, <i>Q_{min}</i>	kg/min
Maximum pressure of the liquid, <i>P</i> _{max}	kPa
Minimum pressure of the liquid, <i>P</i> _{min}	kPa
Type of the liquid for which the system is verified	(##1)
Environmental class	class C
Accuracy classes	0.3 and 0.5 (##2)

- (##1) This may be located separately, e.g. on a metal tag sealed to the instrument.
- (##2) The instrument maybe marked with either accuracy class 0.3 or accuracy class 0.5 depending on application.

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

2. Description of Variants

2.1 Variant 1

approved on 19/07/10 Amended and approved on 07/08/17

Using certain other Brodie BiRotor Plus series flowmeters which are similar to the pattern except as set out below in Table 1 (the pattern is shown in **bold**). These model meters are approved for class 0.3 and class 0.5 operation.

Flowmeter Model	Size (mm)	Minimum Flow Rate (Q <i>min</i>) (L/min)	Maximum Flow Rate <i>(Qmax</i>) (L/min)	Minimum Measured Quantity <i>(Vmin</i>) (L)	K-factor (p/L)	Cyclic Volume (L)
B27X	DN80	208 (114 *)	2081	100	42	0.937
B28X	DN100	166	3406	200	25	1.9
B29X	DN150	166	4266	200	25	1.9
B30X	DN150	567	12500	500	10.5	8.3
B31X	DN200	567	12500	500	10.5	8.3
B32X	DN250	567	12500	500	10.5	8.3

TABLE 1

(*) The Minimum Flow Rate, Q*min* for the pattern for class 0.5 operation.

2.2 Variant 2

approved on 19/07/10

With a Brodie model BiRotor Plus SB25X flowmeter which is similar to the pattern except as set out below in Table 2. This model meter is approved for class 0.3 and class 0.5 operation.

Instruments are approved for use with various grades of liquid hydrocarbons including petrol/ethanol blends and pure ethanol ('E100') with a dynamic viscosity η (at 20°C) of 0.4 to 5 mPa.s. Instruments are marked accordingly.

TABLE 2

Flowmeter Model	Size (mm)	Minimum Flow Rate (<i>Qmin</i>) (L/min)	Maximum Flow Rate <i>(Qmax</i>) (L/min)	Minimum Measured Quantity <i>(Vmin</i>) (L)	K-factor (p/L)	Cyclic Volume (L)
SB25X	DN50	80 (50 *)	568	10	252	0.129

(*) The Minimum Flow Rate, Q*min* for class 0.5 operation.

TEST PROCEDURE

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

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

Maximum Permissible Errors

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

FIGURE 5/6B/217 - 1







Typical Brodie Model BiRotor Plus B27X Liquid-Measuring System

FIGURE 5/6B/217 - 2



(a) Brodie Model BiRotor Plus B27X Flowmeter





FIGURE 5/6B/217 - 3



(a) M+F Model MFX_4 Calculator/Indicator (in an IP20 Housing)



(b) Brodie Model BiRotor Plus SB25X Flowmeter
~ End of Document ~