Australian Government
National Measurement Institute
Bradfield Road, West Lindfield NSW 2070

Interim
Certificate of Approval
NMI 10/2/15

VALID FOR VERIFICATION PURPOSES UNTIL 7 MAY 2014

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.

Flow Instruments Model Flowcom 3000 Bulk Cryogenic Flowmetering System

submitted by Flow Instruments
Heiligenstock 34 c-f
Solingen, Nordrhein-Westfalen 42697
GERMANY

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 NMI R81, *Dynamic Measuring Devices and Systems for Cryogenic Liquids*, dated August 2009, and with reference to document 117-1, *Measuring for Liquids Other Than Water*, dated June 2011.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern & variant 1 provisionally approved – interim certificate issued	18/06/13
1	Pattern & variant 1 approved – interim certificate issued	7/02/14

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI 10/2/15' 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.

1. Description of Pattern provisionally approved on 18/06/13 approved 7/02/14

A Flow Instruments model Flowcom 3000 vehicle-mounted bulk flowmetering system for bulk metering of cryogenic products.

1.1 Field of Operation

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

TABLE 1

Product (#1)	Temperature Range (K)	Pressure Range (MPa rel.)	Density Range (kg/m³)
Liquid nitrogen (LIN)	77 to 116	0.1 to 3.0	819.3 to 701.6
Liquid argon (LAR)	84 to 134	0.1 to 3.0	1407.8 to 1241.2
Liquid oxygen (LOX)	81 to136	0.1 to 3.0	1142.0 to 1012.1
Liquified natural gas (LNG)	103 to 173	0.1 to 27.0	301 to 478

- Minimum measured quantity, V*min* 500 kg (#2)
- Maximum flow rate, Q*max* 633 kg/min (#3)
- Ambient temperature range –25°C to 55°C
- Accuracy class Class 2.5

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

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

(#3) Flow rates depend on the meter model and size, and the type of product.

1.2 Components of the Measuring System

- **Supply Tank**

The supply tank is designed to maintain the cryogenic liquid within the temperature range specified for the product in its liquid state. An outlet is provided at the bottom of the tank leading to the inlet of the pump via an isolation valve.

- **Pump**

Either a positive displacement or centrifugal pump with integral or external pump by-pass valve is positioned as close as possible to the outlet of the supply tank with sufficient flow capacity to maintain the delivery within the flow rate range specified for the flowmeter.

- **Power Supply**

The instrument operates with a 9 to 35 V DC power supply.

- **Measurement Transducer**

The measurement transducer is either a Metering Section model CFI or model SWM flowmeter. A differential pressure is created in the metering section as a result of mass flow, and a differential pressure measurement converter changes the differential pressure into a 4-20 mA signal, which is changed into a digital signal by the calculator/indicator.

- **Temperature Transducer**

The temperature transducer is a PT100-Thermometer (100 ohms @ 0°C, –200°C to +85°C) connected as 4-wire. Alternatively, a temperature transducer with a 4 to 20 mA output may be used. The temperature transducer is fitted upstream of the flowmeter.

- **Calculator/Indicator**

A Flow Instruments model Flowcom 3000 calculator/indicator is used.

The liquid volume measured by the flowmeter is converted to mass based on tables given in Annex C of OIML R81, *Dynamic Measuring Devices and Systems for Cryogenic Liquids*, dated 1998, namely Table 1-b for Argon, Table 4-b for Nitrogen and Table 5-b for Oxygen. The mass is then converted to volume of gas in cubic metres at 15 ºC and 101.325 kPa, based on constants given in the Test Procedure.

For the purpose of meter verification the calculator/indicator has provision for displaying the delivery of liquid in litres.

2. Description of Variant 1 provisionally approved on 18/06/13 approved 7/02/14

A Flow Instruments model Flowcom 3000 vehicle-mounted bulk flowmetering system for bulk metering of liquefied carbon dioxide and liquid nitrous oxide.

2.1 Field of Operation

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

TABLE 1

Product (#1)	Temperature Range (K)	Pressure Range (MPa rel.)	Density Range (kg/m³)
Carbon Dioxide (CO2)	218 to 268	0.1 to 25.0	957.5 to 1174
Nitrous Oxide (N2O)	213 to 268	0.1 to 25.0	957.5 to 1172.7

- Minimum measured quantity, V*min* 500 kg (#2)
- Maximum flow rate, Q*max* 550 kg/min (#3)
- Ambient temperature range –25°C to 55°C
- Accuracy class Class 1.5

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

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

(#3) Flow rates depend on the meter model and size

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

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