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

Certificate of Approval

NMI 10/2/16

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.

Red Seal Measurement Model RML2000 Bulk LPG Mass Flowmetering System

submitted by Hurll Nu-Way Pty Ltd
14 Aristoc Road
Glen Waverley VIC 3150

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 1/11/19, and then every 5 years thereafter.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern approved – certificate issued	10/10/14

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI 10/2/16' 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*.

Dr A Rawlinson

TECHNICAL SCHEDULE No 10/2/16

1. Description of Pattern approved on 10/10/14

A Red Seal Measurement model RML2000 bulk LPG mass flowmetering system (Figure 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}) 10 L
- Minimum flow rate (Q_{min}) 60 L/min
- Maximum flow rate (Q_{max}) 300 L/min
- LPG density range (at 15°C) 507 to 585 kg/m³
- LPG temperature range -10°C to 50°C
- Maximum operating pressure 2400 kPa
- Minimum operating pressure maintained 100 kPa above the equilibrium vapour pressure
- Ambient temperature range -25°C to 55°C
- Accuracy class 1.0

1.2 Components of Measuring System

(i) Supply Tank

The supply tank has a bottom outlet larger than the pump outlet and has at least one return line fitted to the vapour space of the tank. A return line is required for the gas elimination device and for verification of the metering system.

(ii) Pump

The pump and the pipework are installed to provide a flow rate of at least three times the minimum flow rate specified for the flowmeter. The pump is positioned as close as possible to the supply tank and for other than submersible turbine pumps, the outlet of the supply tank has a continuous fall to the pump and the pipe diameter is equal to or greater than the pump inlet. A strainer may be fitted in the pipeline between the supply tank and the pump.

If the pump is not for the exclusive use of the flowmeter, the system is designed to ensure that the flow rate through each meter is maintained within the approved flow rate range for all combinations of alternative uses of the pump.

(iii) Gas Elimination Device (Figure 2)

The meter is protected protected from measurement of vapour by a Red Seal model 4D-MT, part number 400076-701 float-operated gas purger with integral strainer and may have a non-return valve to prevent reverse flow. The gas purger is fitted immediately upstream of the meter.

Any vapour detected by the gas extractor is vented back to the vapour space of the supply tank via a vapour return line, having a nominal bore not less than 20 mm in diameter. Also, a temperature probe is fitted to the gas purger for the temperature conversion device in the calculated/indicator.

(iv) Measurement Transducer (Figures 3 and 4)

The measurement transducer is a Neptune model RML2000 mass flowmeter consisting of a Neptune RML2000 (#) mass flowmeter sensor interfaced to a Neptune model MVD 700 (#) core processor, that in turn is interfaced to the calculator/indicator. The model MVD700 core processor, which may be mounted integral to the flowmeter, provides a pulse output to the calculator/indicator.

(#) The numbers listed are basic model numbers only – the full model number may have a variety of additional alphanumeric characters, which designate non-metrological features.

The model 700 core processor provides a drive frequency to the flow sensor to vibrate the measurement tubes, and monitors the pick-off signals as the measurement tubes vibrate at resonance. These signals are used to determine the mass flow rate (by the time shift between the two pick-off signals), the density of the flowing medium (by the resonant frequency of the vibrating tubes), and the volume flow rate at flowing conditions (by the ratio of the measured mass and measured density).

Additionally, the model 700 core processor provides the following functions:

- Read/write digital communication for configuration and calibration via ProLink;
- Storage of the Flow Cal Factor (FCF), density calibration factors, damping factors, slug flow limits/duration, and units of measurement; and
- Automatic correction for temperature effects on sensor tubes, and determination of sensor constants at zero flow.

(v) Calculator/Indicator

A Liquip model EMH 600 controller/indicator (Figure 5) as described in the documentation of approval NMI S407 or any other 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.

(vi) Pressure Differential Valve (Figure 6)

A Red Seal model 4D-MT, part number 400070-701 spring-loaded diaphragm valve is designed to maintain the pressure at the meter at least 100 kPa above the vapour pressure to prevent the formation of vapour. The low-pressure side of the device is connected to the vapour space of the supply tank either directly or via the vapour return line for the gas elimination device.

(vii) Transfer Device

The transfer point that defines the start and stop of measurement is either a valve or an LPG nozzle fitted to a pipe/hose connected to the outlet of the differential pressure valve with no intermediate connections that may divert the delivery (Figure 1). However, two delivery outlets may be installed provided an isolation valve is fitted before each delivery outlet (Figure 3) and that one or more notices are fitted near each isolation valve/delivery outlet indicating that only one outlet is to be in use at any one time.

The bulk LPG metering system is considered a non-interruptible system where the valve/nozzle is latched in the open position for the duration of the delivery; in addition, an operator monitors the entire delivery process and responds to any alarms given by the metering system.

1.3 Descriptive Markings and Notices

Each measuring system shall bear the following information, placed together on the meter:

Manufacturer's name or mark	……
Meter model	……
Serial number	……
Pattern approval number	NMI 10/2/16
Minimum flow rate	…… L/min
Maximum flow rate	…… L/min
Minimum operating pressure (at least 100 kPa above vapour pressure)	
Maximum operating pressure	…… kPa
Liquid temperature range	-10°C to 50°C
Density range at 15°C	507 to 585 kg/m^3
Accuracy class	1.0
Environmental class	Class I

In addition, the indicator is marked with the minimum delivery (V_{min}) specified for the metering system (e.g. 'Minimum delivery 10 L').

1.4 Verification Provision

Provision is made for the application of a verification mark.

1.5 Sealing Provision

Provision is made for sealing the calibration adjustment as shown in Figure 7.

TEST PROCEDURE

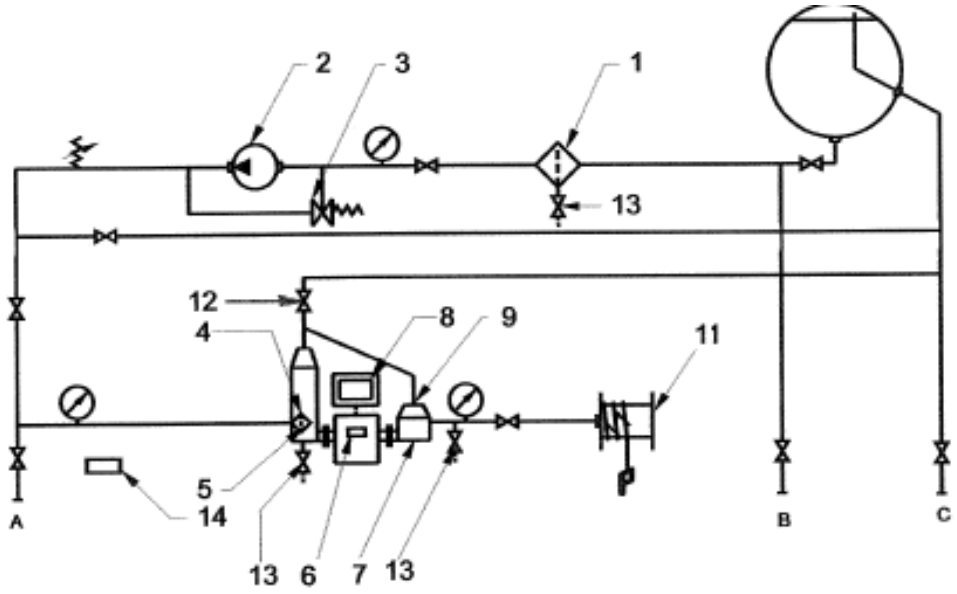
Instruments shall be tested in accordance with any relevant tests specified in the National Instrument Test Procedures.

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 10/2/16 – 1



Elements of the Red Seal Measurement measuring system on an LPG road tanker:

1. Filter Check valve
2. Cargo Pump
3. Bypass Valve
4. Gas Separator
5. Thermometer Well
6. Coriolis Sensor
7. Differential Valve
8. Electronic Register
9. Solenoid Valve (optional)
10. Cab Mounted Printer (optional) (Not Shown)
11. Hose
12. Vapour Return Line Valve
13. Purge Valve
14. System Nameplate

Thermometer Gauges (optional)

Manometer Gauges (optional)

Red Seal Measurement Model RML2000 Bulk LPG Mass Flowmetering System

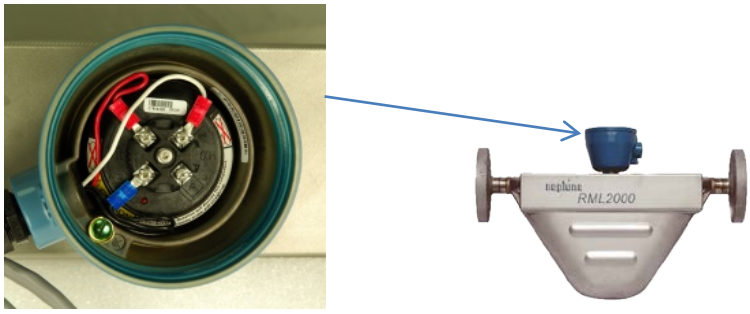
FIGURE 10/2/16 – 2

Red Seal Model 4D-MT Part Number 400076-701 Gas Purger

FIGURE 10/2/16 – 3

Neptune RML2000 Mass Flowmeter with Integral MVD700 Core Processor

FIGURE 10/2/16 – 4



Neptune Model MVD 700 Core Processor

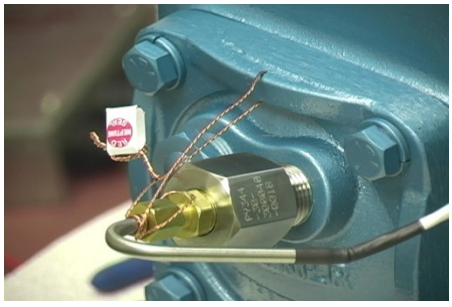
FIGURE 10/2/16 – 5

Liquip Model EMH 600 Controller/Indicator

FIGURE 10/2/16 – 6

Red Seal Model 4D-MT Part Number 400070-701 Pressure Differential Valve

FIGURE 10/2/16 – 7



Sealing of the Temperature Probe Installed on the Red Seal Gas Purger

~ End of Document ~