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

Certificate of Approval

NMI 10/2/6A

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.

Acme Model VTM 150A Bulk LPG Flowmetering System

submitted by Acme Fluid Handling Pty Ltd
32 Greens Road
Dandenong VIC 3175

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, July 2004.

This approval becomes subject to review on 1/09/17, and then every 5 years thereafter.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern and variants 1 & 2 approved – interim certificate issued	15/08/02
1	Pattern and variants 1 to 3 – certificate issued	8/05/03
2	Variant 1 amended – notification of change issued	24/08/06
3	Pattern and variants 1 to 3 reviewed – notification of change issued	16/10/07
4	Pattern and variants 1 to 3 reviewed & updated – variant 4 approved – certificate issued	24/11/11
5	Variant 5 approved – certificate issued	29/11/13
6	Pattern amended (calculator/indicator) – certificate issued	03/07/14

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with approval number 'NMI (or NSC) 10/2/6A' 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 Certificates No S1/0/A or 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 10/2/6A

1. Description of Pattern — approved on 15/08/02 amended 24/11/11

An Acme model VTM 150A bulk LPG 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} 100 L
- Maximum flow rate, Q_{max} 500 L/min
- Minimum flow rate, Q_{min} 100 L/min
- Maximum pressure of the liquid, P_{max} 1000 kPa

LPG density range (at 15°C) 505 to 580 kg/m³ (#)
LPG liquid temperature range -10°C to 50°C
Ambient temperature range -25°C to 55°C
Accuracy class Class 1.0
Maximum operating pressure (P_{max}) 1900 kPa
Minimum operating pressure (P_{min}) at least 100 kPa above vapour pressure

The system is approved for vehicle-mounted installations as a non-interruptible measuring system (see clause **1.2 (vii) Transfer Device**).

(#) Within the density range specified, the calculator/indicator is required to be manually set for the density of LPG being metered.

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

Either a positive displacement or centrifugal pump, with integral or external pump bypass valve, is positioned as close as possible to the outlet of the supply tank. The pipe from the supply tank has a continuous fall to the pump inlet and has a diameter not smaller than that of the pump outlet pipe.

(iii) Gas Elimination Device

Either a Neptune model 4D-MT (or Liqua Tech model VE2) 2” gas extractor (Figure 2) or a Liquid Controls model MA8310 float-operated gas extractor (Figure 3) is connected upstream of the meter flow straighteners. 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.

The gas extractor incorporates a strainer to protect the meter and has a non-return valve to prevent reverse flow.

(iv) Temperature Transducer

An Acme model TP 200 temperature probe is fitted to the gas extractor which also has a thermometer well for verifying the measured temperature of LPG.

(v) Measurement Transducer

The measurement transducer is an Acme model VTM 150A 32 mm turbine flowmeter (Figure 1b) incorporating dual signal pick-off with pre-amplifier.

The outlet of the meter is connected to a straight pipe with a bore equal to that of the meter and is at least 5 pipe diameters long. The inlet of the meter is connected to a flow straightener pipe with a bore equal to that of the meter and is at least 10 pipe diameters long. The flow straightener comprises a bundle of parallel and tangential tubes fixed together and held rigidly in the pipe.

(vi) Differential Pressure Valve

A Neptune model 4D-MT (or Liqua Tech model VE2) 2" differential pressure valve (Figure 2a) or a Liquid Controls model A 2843 differential pressure valve (Figure 2b) is installed downstream of the meter to maintain the LPG in liquid phase and allow flow when the pressure of LPG at the meter is at least 100 kPa above its vapour pressure. The vapour side of the pressure differential valve is connected to the vapour space of the supply tank via the vapour return line.

Provision is made for a pressure gauge to be fitted between the differential pressure valve and the meter.

(vii) Calculator/Indicator

(a) Applicable to instruments manufactured up to and including 03/07/14

An Acme model 6000 calculator/indicator (as described in the documentation of approval NSC S170B) is used, or any other compatible (#) approved calculator/ indicator that incorporates electronic volume conversion for temperature facility to indicate the delivered volume of LPG at 15ºC. The density of LPG is manually entered into the calculator/indicator. The meter non-linearity correction facility may be enabled to reduce the meter error as a function of flowrate.

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

For minimum measured quantities less than 200 L, the resolution of the calculator/indicator is set to display the delivered volume in 0.1 L increments.

(b) Applicable to instruments manufactured after 03/07/14

An Acme model 6000 calculator/indicator (as described in the documentation of approvals NSC S170B or NMI S170C) is used.

The density of LPG is manually entered into the calculator/indicator. The meter non-linearity correction facility may be enabled to reduce the meter error as a function of flowrate.

For minimum measured quantities less than 200 L, the resolution of the calculator/indicator is set to display the delivered volume in 0.1 L increments.

(viii) Printer

An Epson model TM-295 (*) slip printer is required to be interfaced to the calculator/indicator for systems with the temperature compensation facility enabled for indicating the delivered volume at 15ºC and where the density is operator selectable.

(*) 'Equivalent' is defined to mean other proprietary equipment of the same or better specifications requiring no changes to software for satisfactory operation of the complete system.

(ix) Checking Facilities

The checking facility of the Acme model 6000 calculator/indicator displays an error message either when the meter is disconnected or if a discrepancy is detected between the dual output signals produced by the meter.

In addition, when the checking facility detects communication problems between the required printer and the calculator/indicator, no further transactions are possible until the communication with the printer is established and transaction details are printed.

The display segment check is initiated whenever the volume is reset to zero.

(x) 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

Instruments are marked with the following data, together in one location, in the form shown at right:

Manufacturer's mark, or name written in full	……
Meter model	……
Serial number	……
NSC approval number	NMI (or NSC) 10/2/6A
Year of manufacture	……
Minimum flow rate	100 L/min
Maximum flow rate	500 L/min
Density range at 15°C	505 to 580 kg/m^3
Nominal k-factor (pulses/litre)	……
Environmental classes	Class C, I (#)
Accuracy class	1.0
Maximum operating pressure	…… kPa
Minimum operating pressure	at least 100 kPa above vapour pressure

In addition, the indicator is marked with the minimum delivery (V_{min}) specified for the metering system.

Instruments fitted with more than one delivery outlet must have one or more notices fitted near each isolation valve/delivery outlet indicating that only one outlet is to be in use at any one time.

(#) Both these classes represent the same ambient temperature range of -25°C to 55°C but class I is for mobile systems.

1.4 Sealing Provision

The Acme model 6000 calculator/indicator has provision for sealing the access to the calibration parameters.

1.5 Verification Provision

Provision is made for the application of a verification mark.

2. Description of Variant 1 — approved on 8/05/03 amended 24/11/11

With certain other models of Acme turbine flowmeters having metering capacities as listed in Table 1 below:

TABLE 1

Meter Model	Maximum Flow Rate, Q_{max} L/min	Minimum Flow Rate, Q_{min} L/min	Minimum Delivery, V_{min} L
VTM-050A	50	8	5
VTM-075A	100	20	20
VTM-100A	450 [##]	22	20 [##]
VTM-150A (*)	**500**	**100**	**100**
VTM-200A	1450	200	200 (**)

(*) The specifications for the meter of the pattern are in **bold** type.

(**) The calculator/indicator for this model meter may be set to display the volume in 0.01 L, 0.1 L or 1 L increments.

[##] Variant 5 to amend VTM-100A approved on 29/11/13

3. Description of Variant 2 — approved on 8/05/03 amended 24/11/11

Acme model VTM100A or VTM150A turbine flowmeters replacing the flowmeter in existing approved vehicle-mounted installations which incorporate a Neptune model 4D (or Liqua Tech model VE2) 1½" gas extractor and a Neptune model 4D (or Liqua Tech model VE2) 1½" differential pressure valve.

4. Description of Variant 3 approved on 8/05/03

For use with anhydrous ammonia for liquid temperatures between 0°C and 40°C. This variant uses an Acme model 6000 calculator/indicator as described in the documentation of approvals NSC S170B and NMI S170C but with conversion factors for anhydrous ammonia utilised to indicate the volume at 15ºC.

5. Description of Variant 4 approved on 24/11/11

Any model meter listed in Table 1 may be used without the flow straighteners described in clause **1.2 (v) Measurement Transducer**.

6. Description of Variant 5 approved on 29/11/13

The Acme model VTM-100A listed in Table 1 may be used with the following extended flow rates:

Maximum flow rate, Q_{max}	450 L/min
Minimum flow rate, Q_{min}	22 L/min (#)

(#) Linearity correction may be used.

TEST PROCEDURE No 10/2/6A

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

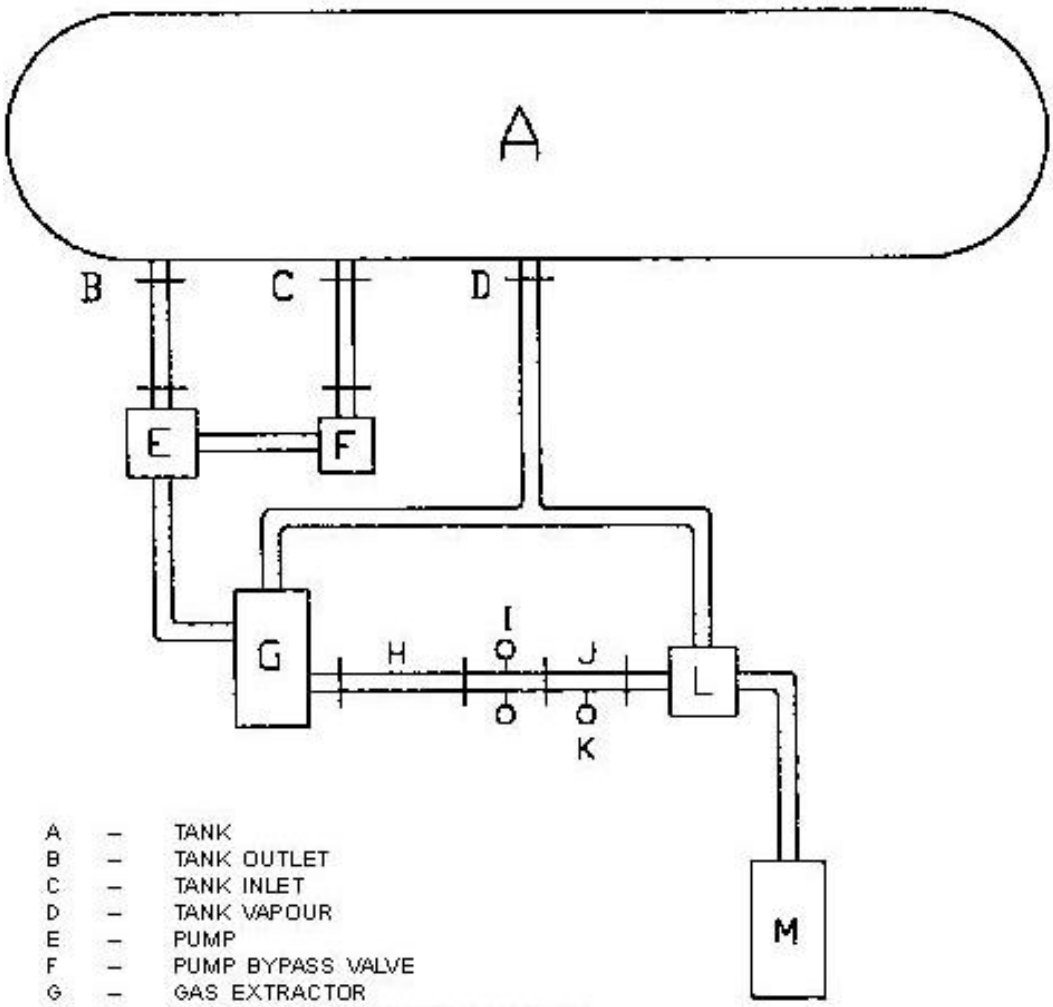
The tests should be conducted in conjunction with any test specified in the approval documentation for any devices used with this metering system.

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 10/2/6A – 1

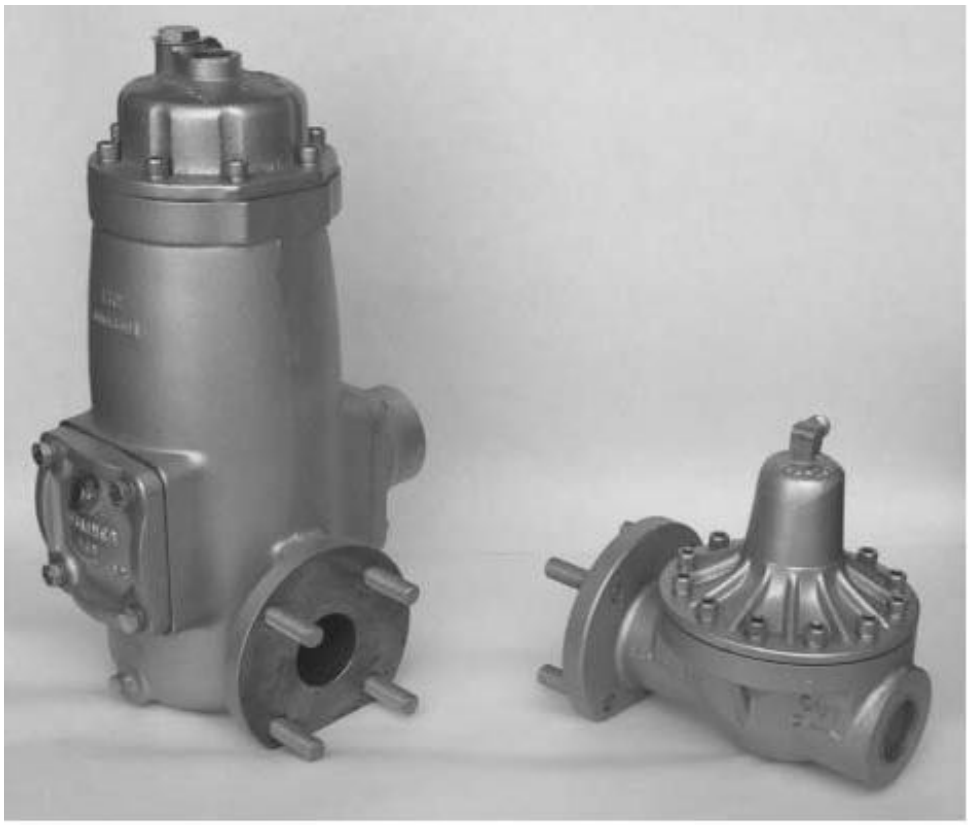


A	–	TANK
B	–	TANK OUTLET
C	–	TANK INLET
D	–	TANK VAPOUR
E	–	PUMP
F	–	PUMP BYPASS VALVE
G	–	GAS EXTRACTOR
H	–	METER INLET FLOW STRAIGHTENER
I	–	ACME VTM SERIES METER
J	–	METER OUTLET FLOW STRAIGHTENER
K	–	PROVISION FOR PRESSURE GAUGE
L	–	DIFFERENTIAL PRESSURE VALVE
M	–	DELIVERY OUTLET

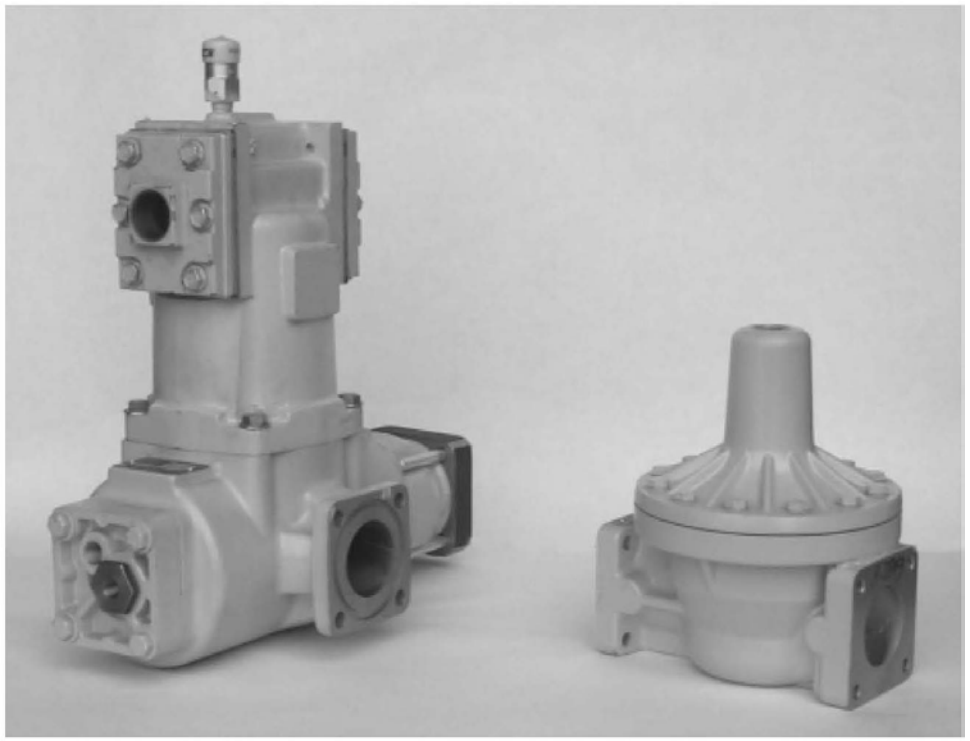
(a) Typical Acme VTM Series Bulk LPG Flowmetering System

(b) Acme Model VTM 150A Turbine Flowmeter

FIGURE 10/2/6A – 2

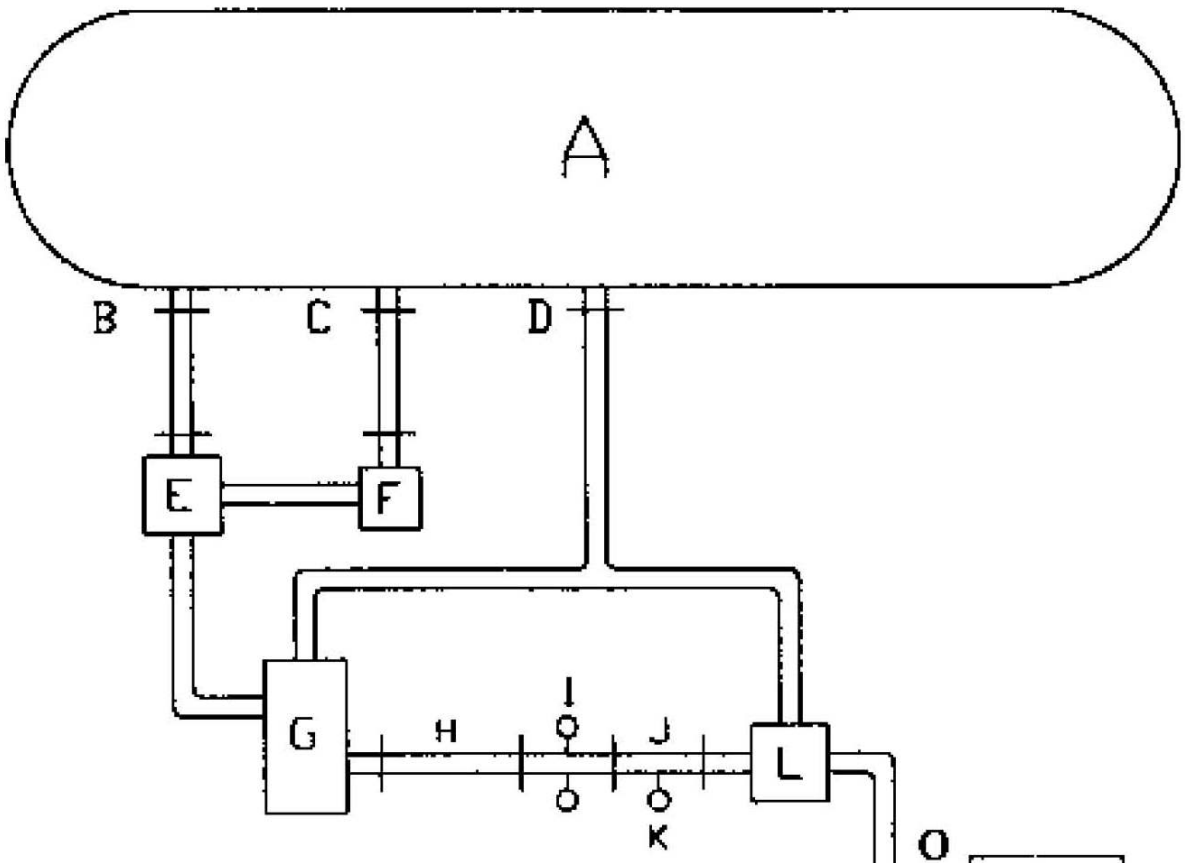


(a) Neptune/Liqua Tech Gas Extractor and
Neptune/Liqua Tech Differential Pressure Valve



(b) Liquid Controls Model MA8310 Gas Extractor and
Liquid Controls Model A 2843 Differential Pressure Valve

FIGURE 10/2/6A – 3



A – TANK
B – TANK OUTLET
C – TANK INLET
D – TANK VAPOUR
E – PUMP
F – PUMP BYPASS VALVE
G – GAS EXTRACTOR
H – METER INLET FLOW STRAIGHTENER
I – ACME VTM SERIES METER
J – METER OUTLET FLOW STRAIGHTENER
K – PROVISION FOR PRESSURE GAUGE
L – DIFFERENTIAL PRESSURE VALVE
M – DELIVERY OUTLET
N – ALTERNATE DELIVERY OUTLET
O – ISOLATION VALVES

Typical Acme VTM Series Bulk LPG Flowmetering System
With Two Delivery Outlets

~ End of Document ~