



Australian Government  
Department of Industry, Science,  
Energy and Resources

## National Measurement Institute

36 Bradfield Road, West Lindfield NSW 2070

### Certificate of Approval NMI 10/2/17

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.

Liquip Model VTM Bulk LPG Flowmetering System

submitted by           Liquip International Pty Limited  
148B Newton Road  
Wetherill Park   NSW   2164

**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 2011.

#### DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern and variants 1 & 2 provisionally approved – interim certificate issued	25/07/14
1	Pattern and variants 1 & 2 approved – certificate issued	5/11/14
2	Pattern amended (new meter image) – certificate issued	20/11/14
3	Pattern and variants 3 provisionally approved – interim certificate issued	21/05/15
4	Pattern and variant 3 approved – certificate issued	11/10/16
5	Amend address – certificate issued	25/11/20

## CONDITIONS OF APPROVAL

### General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI 10/2/17' and only by persons authorised by the submitter.

Instruments purporting to comply with this approval and currently marked 'NMI P10/2/17' may be re-marked 'NMI 10/2/17' but only by persons authorised by the submitter.

It is the submitter'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 10/2/17

**1. Description of Pattern** **provisionally approved on 25/07/14**  
**approved on 5/11/14**

A Liquip model VTM 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/m<sup>3</sup> (#)
- 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 (x) 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) Vapour Elimination Device**

Either a Neptune model 4D-MT (or Liqua Tech model VE2) 2" gas extractor (Figure 2a) or a Liquid Controls model MA8310 float-operated gas extractor (Figure 2b) 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 or a Liquip model 4155 temperature probe (Pt 100) 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 2) 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 3a) or a Liquid Controls model A 2843 differential pressure valve (Figure 3b) 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 Liquip model EMH 600 calculator/indicator (via a Liquip model DPI-100 device) (as described in the documentation of approval NMI S407) 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 15°C. 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.

**(viii) Printer**

An Epson model TM-295 (\*) slip printer (or a Liquip Touchstar Blaster model BD422003-C17 printer) is required to be interfaced to the calculator/indicator for systems with the temperature compensation facility enabled for indicating the delivered volume at 15°C 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 Liquip model EMH 600 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.

A segment check is performed on the display only at power up. An easily accessible power switch is located on the vehicle to enable the checking of the segments before each delivery.

### (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 4) 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 10/2/17
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 <sup>3</sup>
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 EMH 600 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 **provisionally approved on 25/07/14** **approved on 5/11/14**

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-100A	450 [##]	22	20
<b>VTM-150A (*)</b>	<b>500</b>	<b>100</b>	<b>100</b>
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.

### 3. Description of Variant 2 **provisionally approved on 25/07/14** **approved on 5/11/14**

For use with a Liquip model DFV-100 and DFV-102 calculator/indicator (approval NMI S609).

### 4. Description of Variant 3 **provisionally approved on 21/05/15** **approved on 11/10/16**

With an alternative piping arrangement without flow straighteners.

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 straight pipe with a bore equal to that of the meter and is at least 10 pipe diameters long.

## TEST PROCEDURE No 10/2/17

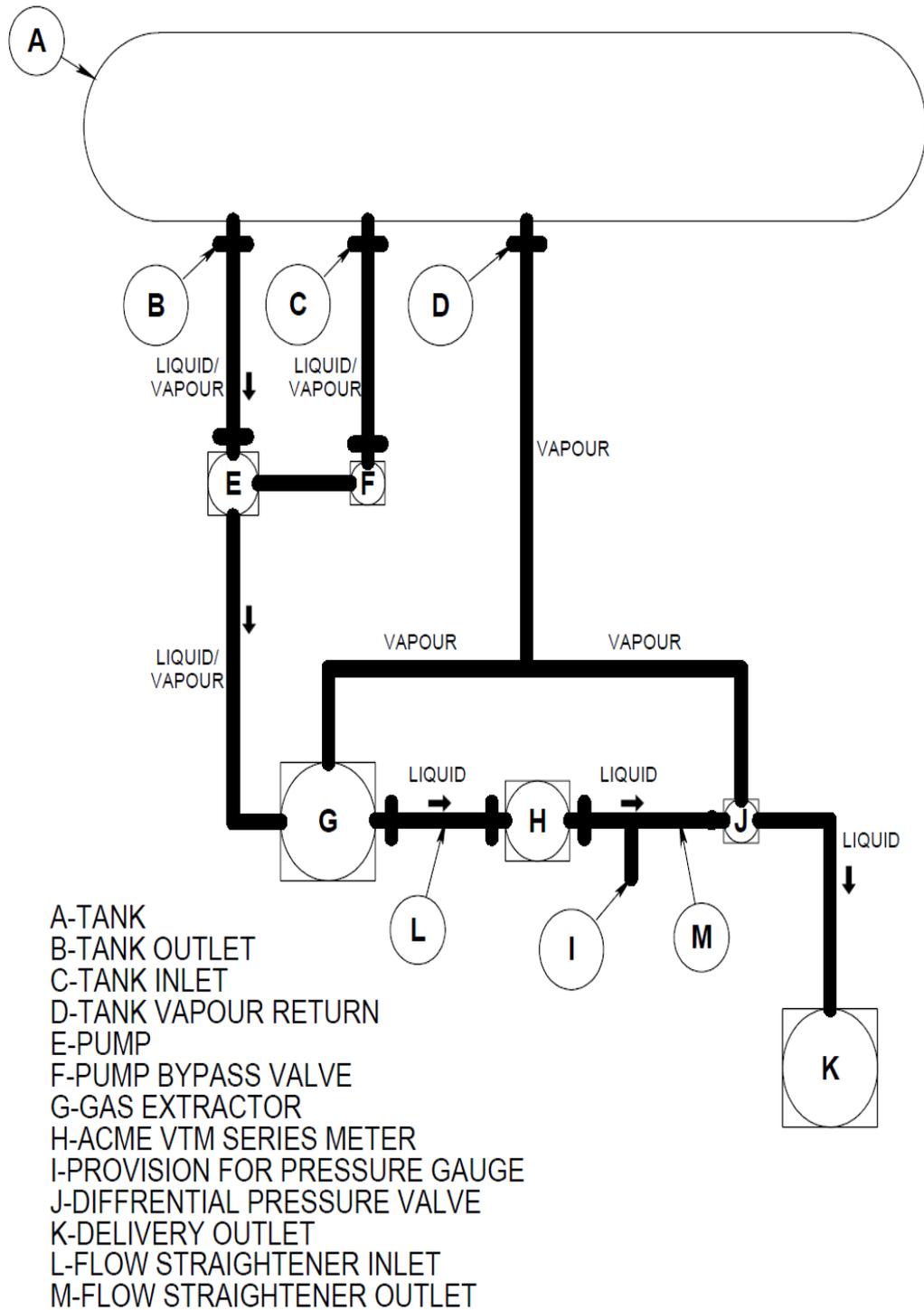
Instruments shall be tested in accordance with any relevant tests specified in the National Instrument Test Procedures.

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

### **Maximum Permissible Errors**

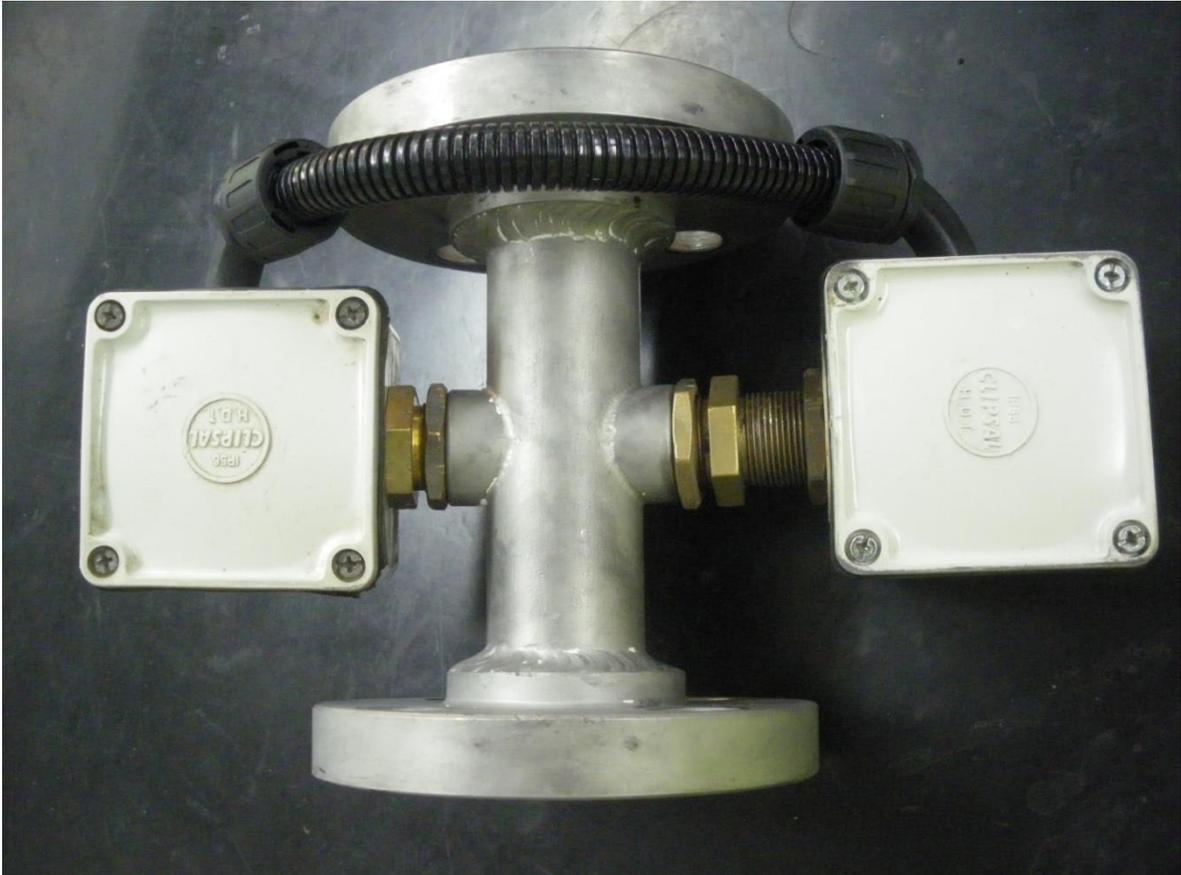
The maximum permissible errors are specified in Schedule 1 of the *National Trade Measurement Regulations 2009*.

FIGURE 10/2/17 – 1



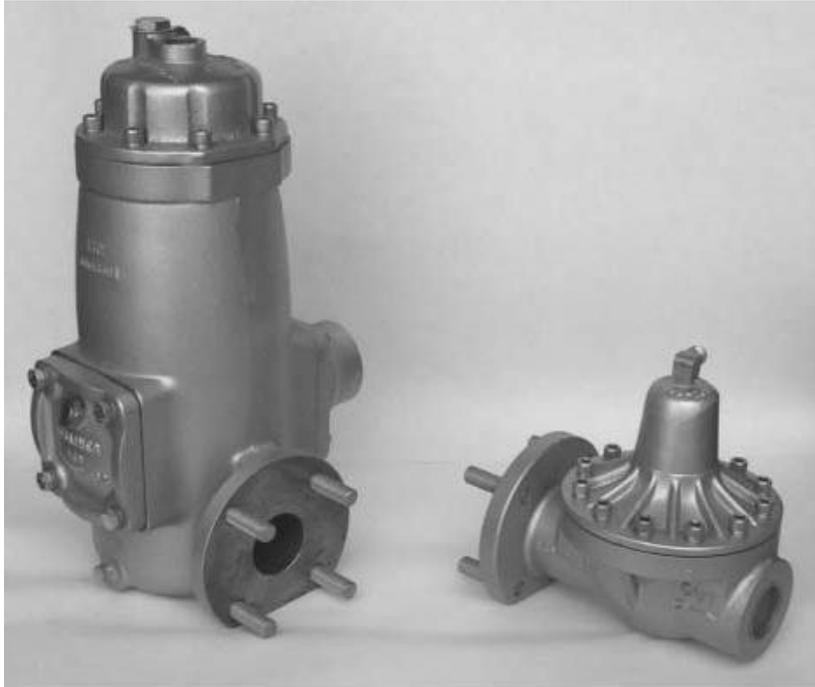
Typical Liquip Model VTM Bulk LPG Mass Flowmetering System

FIGURE 10/2/17 – 2



Acme Model VTM 150A Turbine Flowmeter

FIGURE 10/2/17 – 3

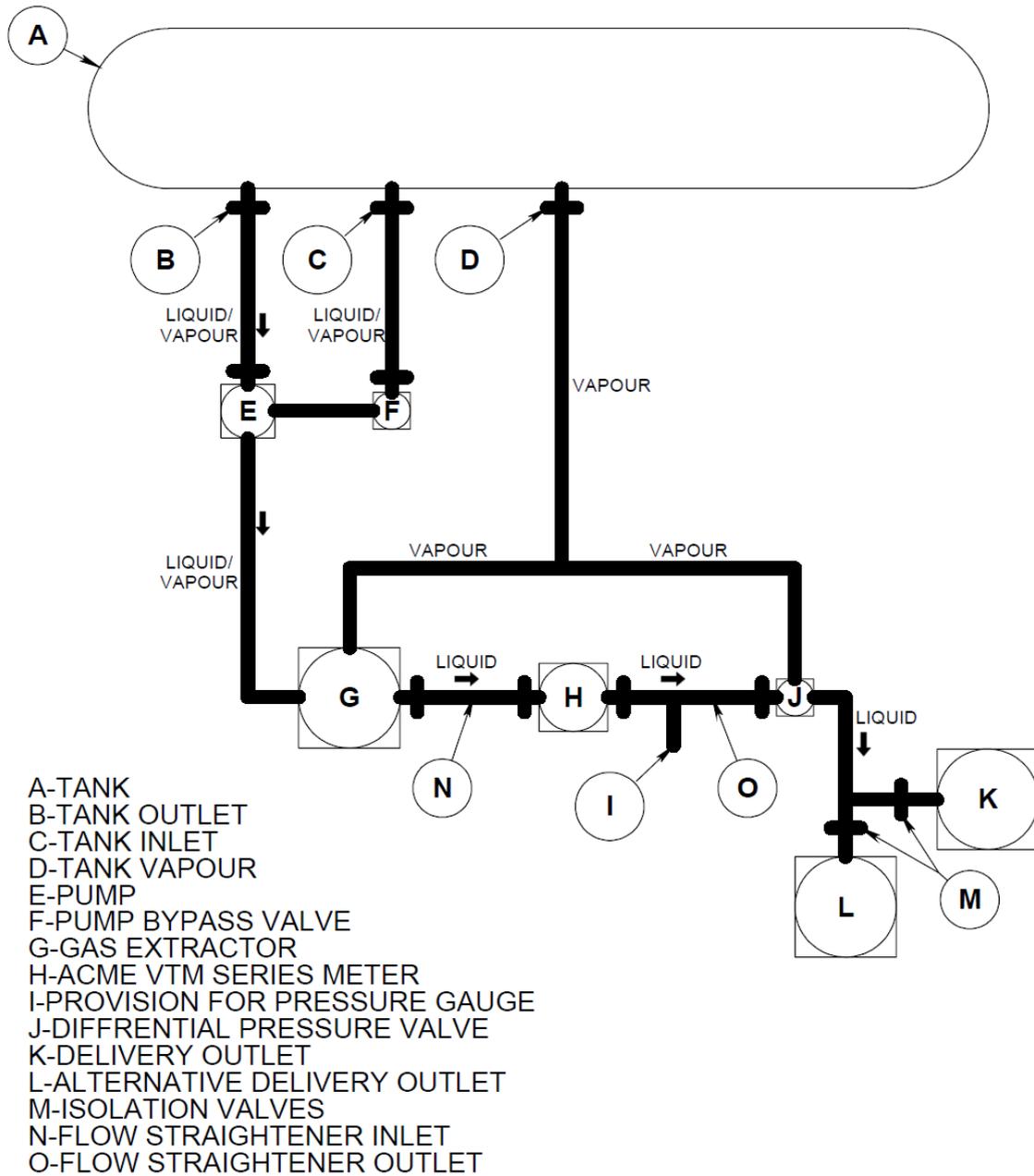


(a) Neptune/Liqua Tech Gas Extractor and  
Neptune/Liqua Tech Differential Pressure Valve



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

FIGURE 10/2/17 – 4



Typical Liquip Model VTM Bulk LPG Mass Flowmetering System  
With Two Delivery Outlets