Australian Government
Department of Industry, Science, Energy and Resources

National Measurement Institute

36 Bradfield Road, West Lindfield NSW 2070

Certificate of Approval

NMI 5/6B/99A

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.

S.A.M.P.I. Model SM15K. Cl1 Liquid-measuring 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 Measuring Systems for Liquids Other than Water, dated June 2011.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern & variants 1 to 4 approved – certificate issued	31/05/05
1	Variants 5 & 6 approved – certificate issued	30/08/07
2	Pattern & variants 1 to 6 reviewed – variants 7 to 9 approved – certificate issued	23/09/10
3	Pattern & variants 1 to 9 updated & reviewed – certificate issued	14/12/16
4	Variant 10 approved – certificate issued	30/11/18
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 5/6B/99A' 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*.

Darryl Hines
Manager
Policy and Regulatory Services

TECHNICAL SCHEDULE No 5/6B/99A

1. Description of Pattern approved on 31/05/05

A bulk-flowmetering system incorporating a S.A.M.P.I. model SM15 K. Cl1 rotary motion positive displacement flowmeter (Figure 1 and Table 1) for bulk metering of petroleum products other than LPG.

1.1 Field of Operation

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

• Minimum measured quantity, V_{min}	500 L	(#1)
• Maximum flow rate, Q_{max}	1000 L/min	
• Minimum flow rate, Q_{min}	100 L/min	
• Maximum pressure of the liquid, P_{min}	1000 kPa	
• Minimum pressure of the liquid, P_{min}	150 kPa	(#2)
• Dynamic viscosity at 20°C	0.4 to 20 mPa.s	(#3)
• Liquid temperature range	-10 to 50°C	
• Ambient temperature range	-25 to 55°C	
• Accuracy class	0.5	

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

(#2) As specified for the gas elimination device for effective operation.

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

1.2 System Description (Figure 1)

(i) 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/vapours 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/vapours 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 valve is fitted between the pump and the flowmeter to prevent reverse flow and keep the pipework full of liquid at all times.

(iv) Gas Elimination Device

The gas elimination device, comprising a S.A.M.P.I. model 42100 gas elimination and a model 42986 strainer assembly (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 S.A.M.P.I. model SM15 K. Cl1 rotary motion positive displacement flowmeter (Table 1 and Figure 1) with a mechanical output shaft connected via 90° bevel gear to a micrometer type calibration adjustment mechanism with a slotted shaft into which the drive shaft of the calculator/indicator fits. Note: The gear arrangement and calibration mechanism may be removed when fitting an approved pulse output device interfaced to an electronic calculator/indicator.

The calibrator has a thimble which can be rotated in the direction marked for increasing or decreasing the rotation rate of the drive shaft of the calculator/indicator. The amount by which the volume, displayed by the calculator/indicator, is increased or decreased is determined with reference to the scale divisions on the calibrator, marked 1%, 0.1% and 0.02%.

The measurement transducer is suitable for accuracy Class 0.3.

The calibration adjustment is carried out using the liquid the flowmeter is intended to measure.

Provision is made for inserting a thermometer and fitting a pressure gauge for measuring the liquid temperature and pressure at the flowmeter during calibration.

(vi) Calculator/Indicator

The calculator/indicator is an approved Veeder-Root mechanical register, as described in the documentation of approval S184B. The drive shaft of the calculator/indicator is designed to fit the slotted shaft of the flowmeter calibration mechanism.

To facilitate the deliveries, a pre-set mechanism may be fitted between the mechanical calculator/indicator and the flowmeter provided the pre-set device is marked “Pre-set Amount Not for Trade Use” or similar wording. The pre-set device is mechanically linked to a S.A.M.P.I. model V7 flow control valve to automatically stop the delivery. Upon completion of delivery, the volume delivered is displayed by the calculator/indicator, which may differ from the pre-set amount.

The Veeder-Root mechanical register and the pre-set device may be replaced with any other compatible approved calculator/indicator and pre-set device.

(vii) 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 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 number	NMI 5/6B/99A	
Manufacturer's identification mark or trade mark	…..	
Meter model	…..	
Serial number of the instrument	…..	
Year of manufacture	…..	
Maximum flow rate, Q_{max}	….. L/min	
Minimum flow rate, Q_{min}	….. L/min	
Maximum pressure of the liquid, P_{max}	….. kPa	
Minimum pressure of the liquid, P_{min}	….. kPa	
Type of the liquid for which the system is verified	.....	(#)
Environmental class	class I	

(#) This may be located separately, e.g. on a metal tag sealed to the instrument.

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

1.4 Verification Provision

Provision is made for the application of a verification mark.

1.5 Sealing Provision

Provision is made for sealing access to the calibration mechanism.

2. Description of Variant 1 approved on 31/05/05

Using certain other S.A.M.P.I. flowmeters as listed in Table 1. All models are fitted with a S.A.M.P.I. model 42100 gas eliminator.

TABLE 1

Flowmeter Model (#1)	Strainer Model	Flow Rate (L/min) Q_{min}	Flow Rate (L/min) Q_{max}	Minimum Measured Quantity V_{min} (L)
SM5	42151	25	250	50 (#2)
SM7	42151	50	500	100 (#2)
SM10	42151	55	550	100 (#2)
SM15 (Figure 2)	42986	100	1000	100 or 500 (*) (#3)
SM25	42986	115	1150	200 or 500 (*) (#3)
SM30 (Figure 4)	44000	170	1700	200 or 500 (*) (#3)

(#1) Note that the flowmeter models listed in Table 1 are basic model numbers only – the full model numbers may have a variety of additional alphanumeric characters, e.g. SM15 CX. Cl1, where:

'SM' designates flowmeter.

'15' designates the capacity of the meter; other capacities are listed in Table 1.

'C' designates flowmeter with volume register, strainer and air eliminator – designation 'K' includes pre-set device and pre-set valve.

'X' designates that an air check valve is fitted; if 'blank' no air check valve fitted.

'Cl1' designates 'class 1' use for standard petroleum products – 'Cl2' designates 'class 2' use for aviation fuel or jet fuel.

(#2) The calculator/indicator indicates the volume at least in 0.1 L increments.

(#3) The calculator/indicator indicates the volume at least in 0.1 or 1 L (*) increments.

3. Description of Variant 2 approved on 31/05/05

As a mobile liquid-measuring system (excluding for aircraft refuelling) as shown in Figure 3 and which includes the following:

- S.A.M.P.I. models SM5, SM7, and SM10 (all similar to the SM15, Figure 2) meters fitted with a gas elimination device consisting of a S.A.M.P.I. model 42100 gas eliminator and a model 42151 strainer and a S.A.M.P.I. model X-7 air or gas activated check valve; or
- S.A.M.P.I. models SM15 (Figure 2) and SM25 (similar to the SM30, Figure 4) meters fitted with a gas elimination device consisting of a S.A.M.P.I. model 42100 gas eliminator and a model 42986 strainer and a S.A.M.P.I. model X-15 air or gas activated check valve.

The air or gas-activated check valve is connected by means of a rigid bleed line to one of two vent ports at the top of the gas eliminator. Both ports are fitted with reed valves. When air or gas is present, the gas eliminator float drops and opens the reed valves, expelling air or gas through the vent port. Air or gas pressure acting on the check valve causes the valve to close; this prevents flow through the meter. Once the valve is closed the air or gas is vented to the vapour space in the supply tank or atmosphere, through the second port of the gas eliminator. As air or gas is expelled the gas eliminator fills up with liquid; the float rises and closes the reed valves. As the pressure on the check valve is relieved, the valve opens allowing flow of liquid through the meter.

The system may comprise a pump, together with a pressure control valve (if necessary), and a valve fitted downstream of the pressure control valve to provide flow rate control (Figure 3). The valve is fitted with a mechanism to prevent setting flow rates below Q_{min}. Downstream of the flow valve is a flexible hose and hose reel. The transfer device is in the form of either a nozzle or a dry-break coupling at the end of the hose.

The pump is fitted in a positive suction head (flooded suction) installation, i.e. below the liquid level in the supply tank. A non-return valve is located between the pump and the meter to keep the system full of liquid at all times.

Any nozzle used shall have an integral outlet control valve. If the nozzle is fitted with an integral anti-drain valve, the valve shall be immediately before the outlet control valve or a separate anti-drain valve may be fitted to the nozzle end of the hose. The anti-drain valve retaining pressure shall be not less than 55 kPa.

4. Description of Variant 3 approved on 31/05/05

A drum-filling liquid-measuring system (Figure 5) which includes the following:

- A S.A.M.P.I. model SM5 or SM7 meter as listed in Table 1.
- A S.A.M.P.I. gas eliminator/strainer assembly as listed in Table 1.
- A S.A.M.P.I. model V7 pre-set control valve for use with the Veeder-Root pre-set counter, where the pre-set mechanism is configured to repeat fixed deliveries of either 60 (SM5 flowmeter only), 200 or 205 litres and is marked PRE-SET FOR BATCHES '#' LITRES or BATCHES '#' LITRES (where '#' equals one of the approved pre-set quantities). The pre-set counter of this variant shall be sealed to prevent unauthorised adjustment or dismantling.
- The transfer device in the form of an outlet control valve, with integral anti-drain valve. The valve may be closed manually or by the pre-set counter. The outlet is either a drum-filling spear or a hose. If a spear is used, it is arranged to fully drain after each delivery so that the control valve is the transfer device. If a hose is used, it is fitted with a nozzle which has an anti-drain valve installed either in the nozzle or immediately before it, and having a retaining pressure of not less than 55 kPa; in this case the nozzle is the transfer device.

The system is arranged such that the meter operates at a constant flow rate (±5% of nominal) within the maximum and minimum flow rate range specified in Table 1.

5. Description of Variant 4 approved on 31/05/05

A vehicle-mounted measuring system incorporating a branched bulk outlet positioned between the pump and the non-return valve upstream of the gas elimination device. The flow from the pump can only be diverted either to the bulk outlet or to the non-return valve, by means of a mechanism (such as a three-way valve) that requires a single action or operation to ensure that the flow is set in the direction which is clearly visible to the parties involved.

The bulk outlet is marked with the pattern approval mark(s) for the measuring system (e.g. dipstick measuring system) and the maximum permissible errors applicable for verification and certification of the quantity throughput via the branched bulk outlet.

6. Description of Variant 5 approved on 30/08/07

The pattern and variants for use to dispense various grades of petrol which may include up to 10% ethanol ('E10').

7. Description of Variant 6 approved on 30/08/07

The pattern and variants constructed for use to dispense various grades of pure biodiesel and biodiesel/distillate blends (to Australian government standard).

8. Description of Variant 7 approved on 23/09/10

The pattern and variants for use to dispense various grades of petrol which may include up to 99% ethanol ('E99').

9. Description of Variant 8 approved on 23/09/10

The pattern and variants constructed for use to dispense various liquids having a dynamic viscosity at 20°C from 0.4 to 1000 mPa.s.

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

10. Description of Variant 9 approved on 23/09/10

As a mobile liquid-measuring system for aircraft refuelling similar to system described for variant 2 but as shown in Figures 6 to 8.

11. Description of Variant 10 approved on 30/11/18

The pattern and variants fitted with a non-return valve after the flowmeter as an alternative to the non-return valve described in **1.2 System Description**.

The system must prevent reverse flow and keep the pipework full of liquid at all times. No branches or bypasses are permitted upstream of the meter.

TEST PROCEDURE

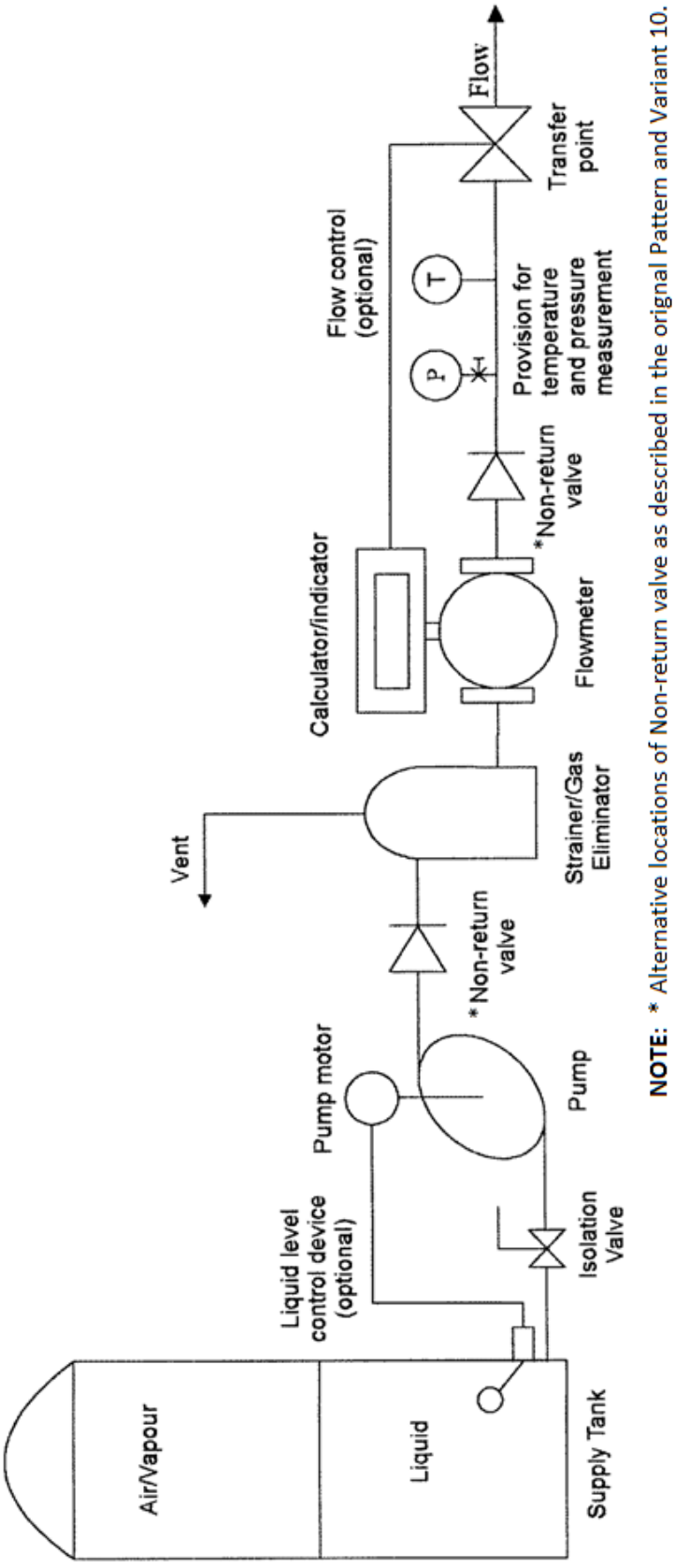
Instruments shall be tested in accordance with any relevant tests specified in the National Instrument Test Procedures. Tests should be conducted in conjunction with any tests specified in the approval documentation for any controller/indicator and/or any conversion device, etc. used.

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 the *National Trade Measurement Regulations 2009*.

FIGURE 5/6B/99A – 1

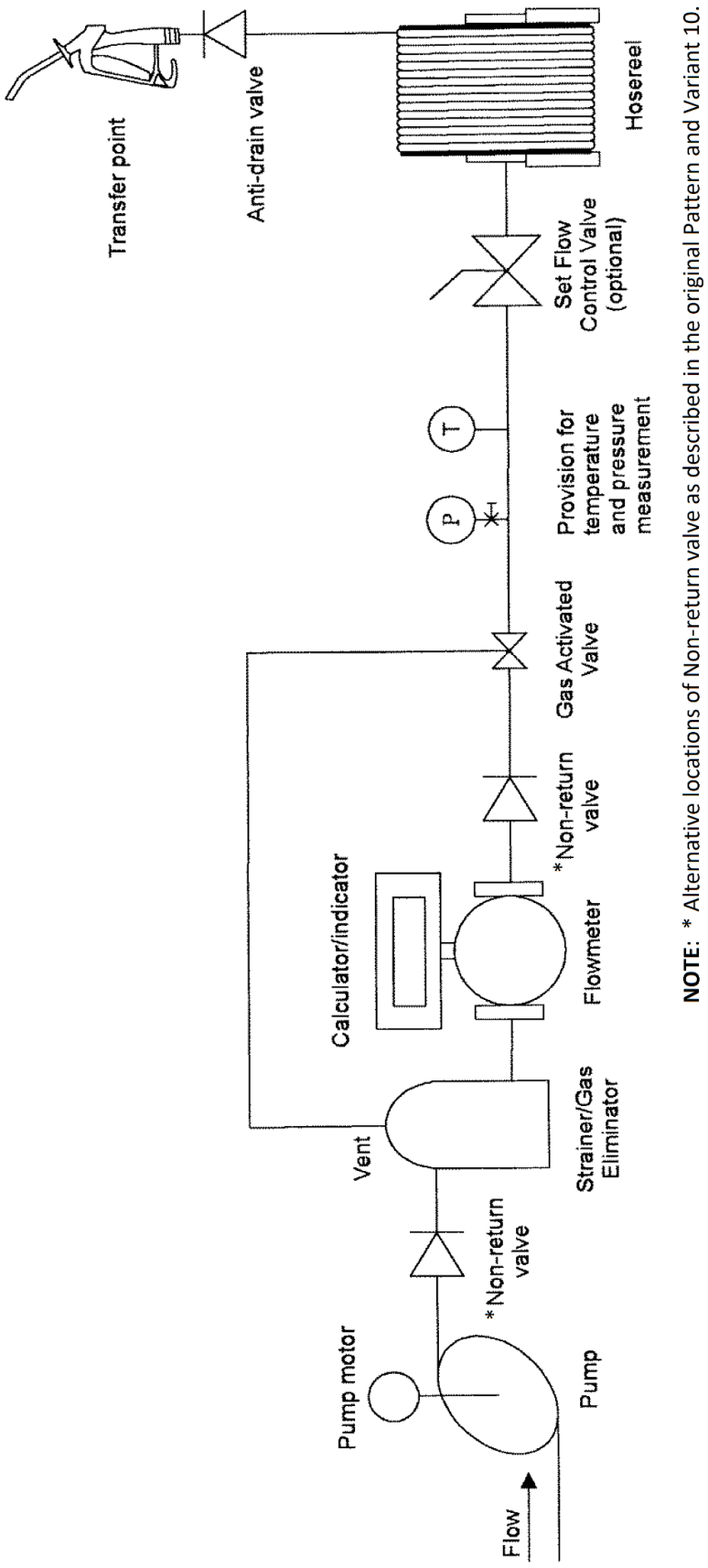


Typical S.A.M.P.I. Liquid-measuring System

FIGURE 5/6B/99A – 2

S.A.M.P.I. Model SM15 K. Cl1 Flowmeter
With S.A.M.P.I. Gas Elimination Device, Veeder-Root Calculator/indicator and Air Check Valve

FIGURE 5/6B/99A – 3



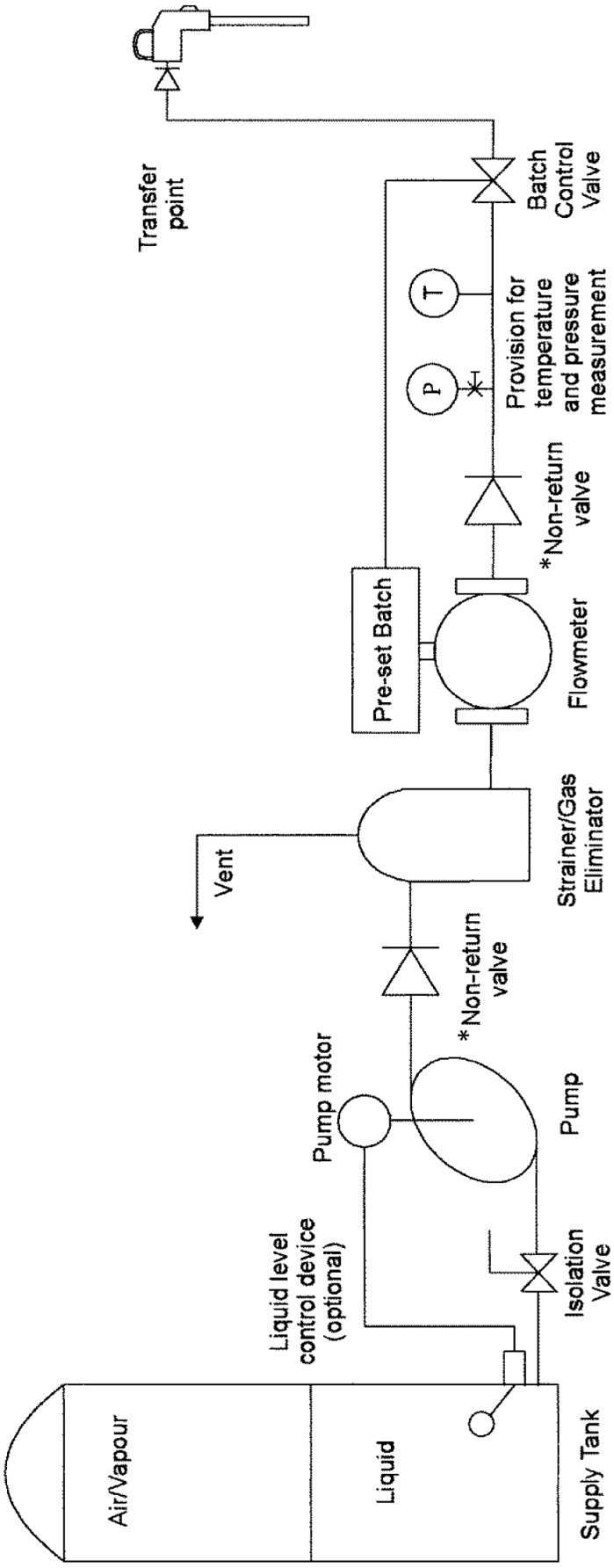
NOTE: * Alternative locations of Non-return valve as described in the original Pattern and Variant 10.

Typical S.A.M.P.I. Mobile Liquid-measuring System

FIGURE 5/6B/99A – 4

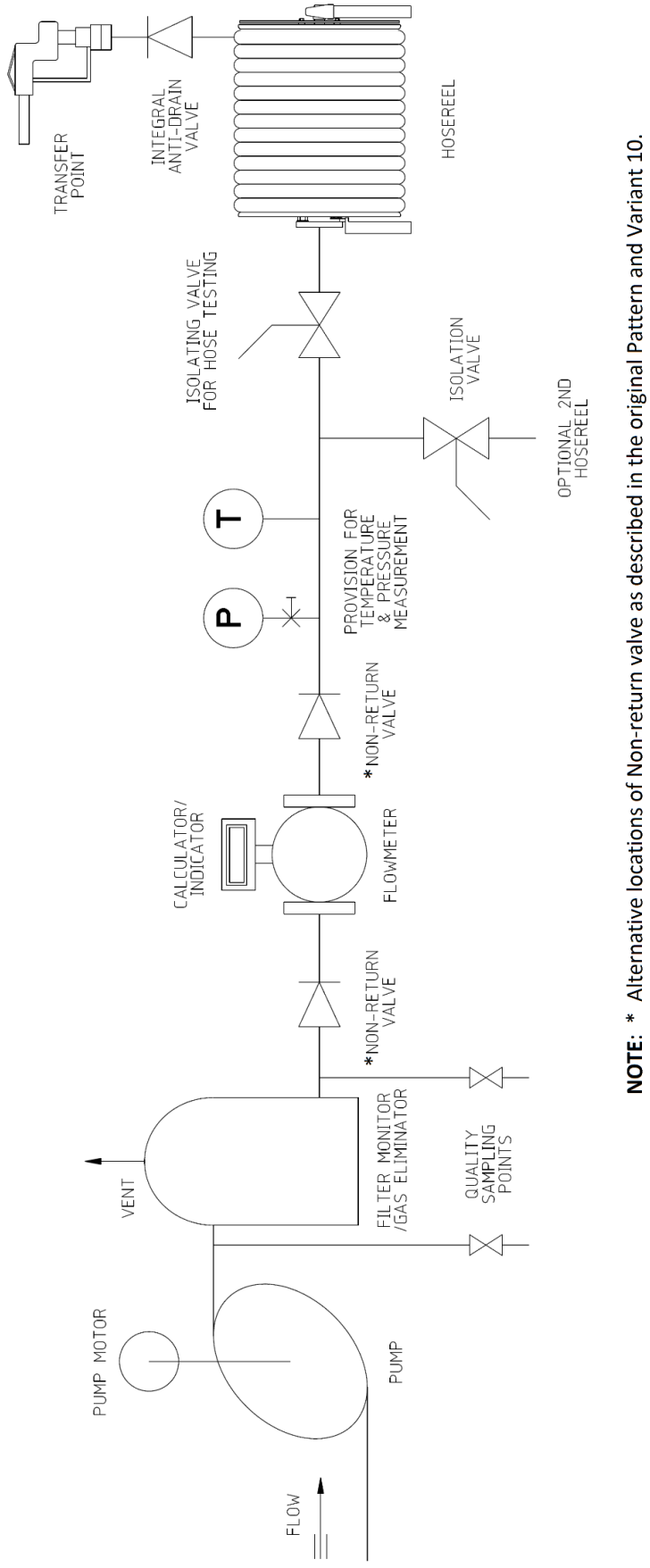
S.A.M.P.I. Model SM30 Flowmeter
With S.A.M.P.I.Gas Elimination Device and Veeder-Root Calculator/indicator

FIGURE 5/6B/99A – 5



Typical S.A.M.P.I. Drum-filling Liquid-measuring System

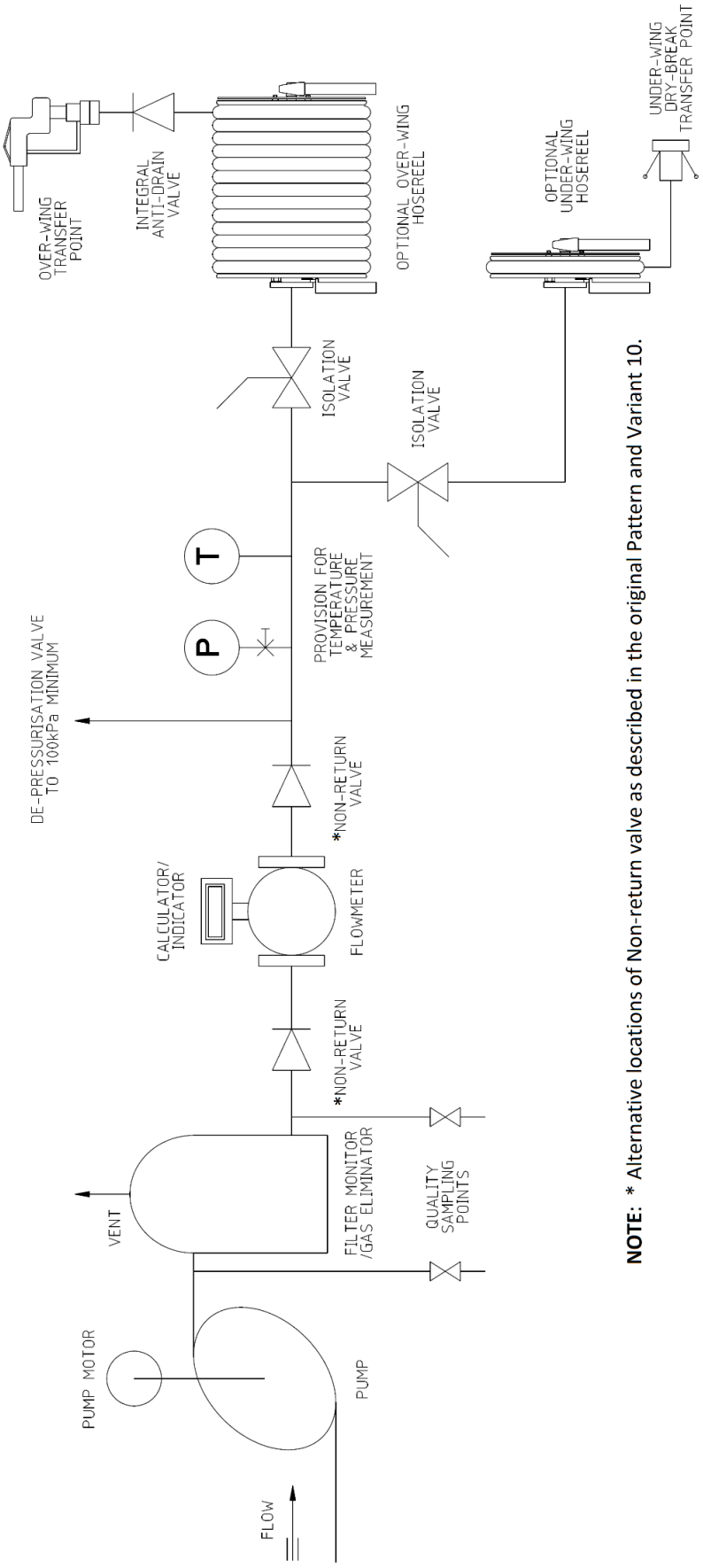
FIGURE 5/6B/99A – 6



NOTE: * Alternative locations of Non-return valve as described in the original Pattern and Variant 10.

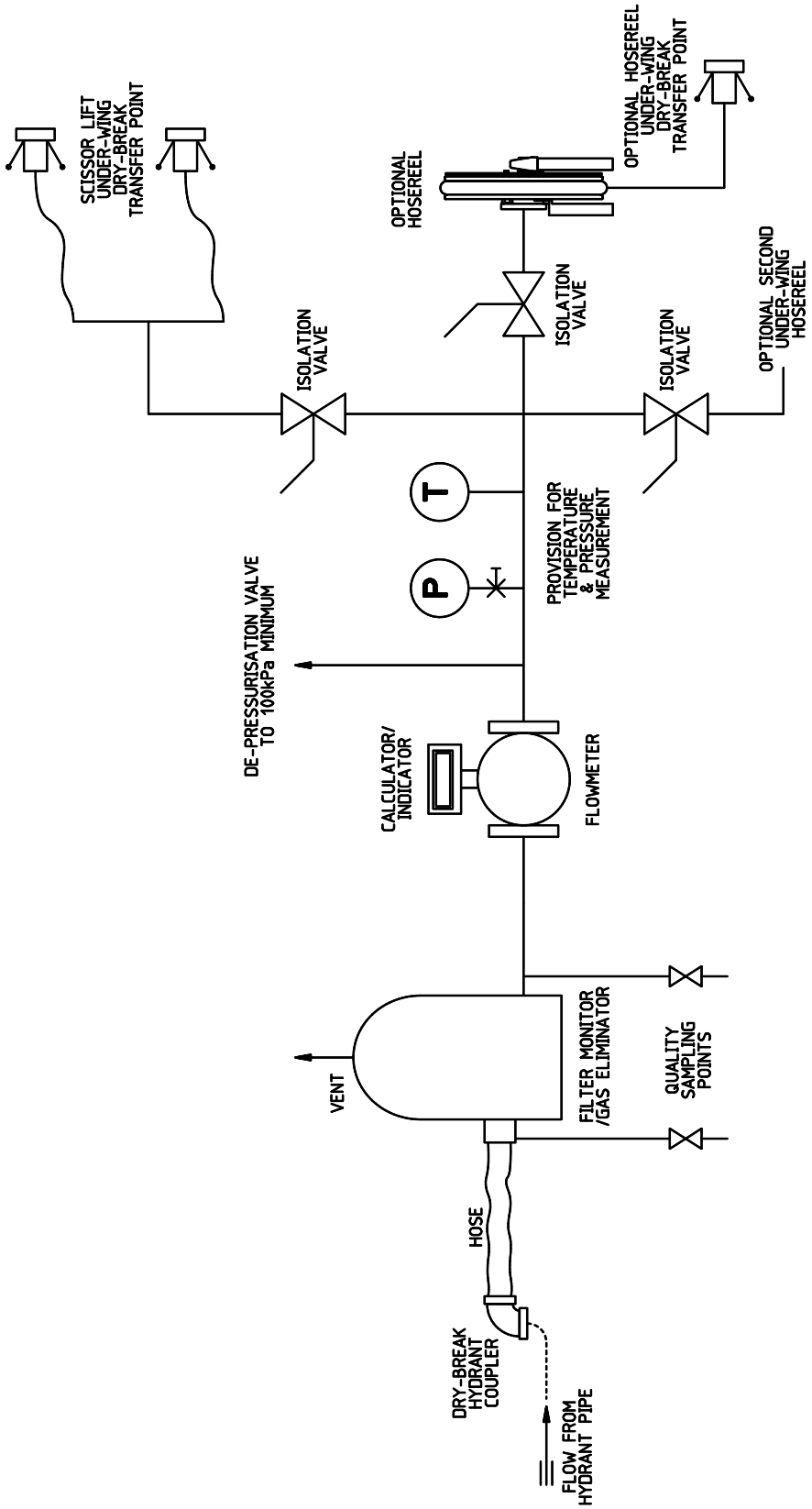
Typical S.A.M.P.I. Jet A-1 Aviation Tanker Refueller Liquid-measuring System

FIGURE 5/6B/99A – 7



Typical S.A.M.P.I. Jet A-1 Aviation Tanker Refueller Liquid-measuring System

FIGURE 5/6B/99A – 8



Typical S.A.M.P.I. Hydrant Dispenser Liquid-measuring System

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