



Australian Government  
Department of Industry,  
Science and Resources

**National  
Measurement  
Institute**

36 Bradfield Road, West Lindfield NSW 2070

**Certificate of Approval  
NMI 5/6B/232**

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 International Model Swift Delivery Liquid Measuring System

submitted by           Liquip International Pty Ltd  
                                  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.

This approval is subject to review at the decision of the Chief Metrologist in accordance with the conditions specified in the document NMI P 106.

**DOCUMENT HISTORY**

<b>Rev</b>	<b>Reason/Details</b>	<b>Date</b>
0	Pattern & variants approved – certificate issued	14/06/23
1	Provisional status Removed – certificate issued	20/10/23

## CONDITIONS OF APPROVAL

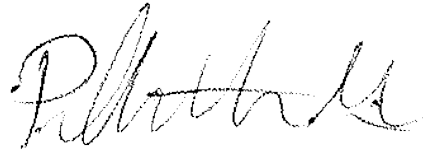
### General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI 5/6B/232' and 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 Certificates 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 Phillip Mitchell**  
A/g Manager  
Policy and Regulatory Services

TECHNICAL SCHEDULE No 5/6B/232

**1. Description of Pattern** **approved on 14/06/23**

The pattern is a Liquip International model Swift Delivery dynamic volume measuring system for vehicle tank compartments (Figure 1). The system continuously measures the volume of liquid (other than LPG) delivered from non-pressurised vehicle tank compartment. The measuring system is able to deliver two different products e.g., product A or product B separately through a single pump. One hose dedicated for product A. A bulk outlet or second hose for product B (Figure 1).

**1.1 Field of Operation**

Minimum Measured Quantity, ( $V_{min}$ ) must be specified for each compartment at initial verification. Determine the volume of liquid for which the relative error from all sources at the smallest sensitivity "LITRES/mm" of the tank or compartment would not exceed 1%. This value is rounded up to the next multiple of 100 L in the form of  $1 \times 10^n$ ,  $2 \times 10^n$  or  $5 \times 10^n$  litres, where n is a whole number and shall not exceed one quarter ( $\frac{1}{4}$ ) of the compartment's nominal capacity.

(Generally the smallest sensitivity will be at widest part of the tank or compartment).

- Dynamic viscosity 0.4 to 20 mPa.s (at 20 °C)
- Liquid temperature range -10 °C to 50 °C
- Environmental Class: -25 °C to 55 °C (Environmental Class I) (\*)
- -10 °C to 55 °C (Environmental Class N)
- (\*)
- Operating voltage range: 9 to 30 V DC
- Accuracy Class: class 0.5
- Note: The Swift Delivery system is a radar measuring device and is required to be calibrated and used with liquids of similar dielectric constant e.g., petrol, kerosene and distillate.
- The system is approved for indicating the delivery of hydrocarbons (other than LPG) such as various grades of petrol which may include up to 10% ethanol ('E10') and various grades of pure biodiesel and biodiesel/distillate blends (to Australian government standard) either to the compartment or from the compartment.

(\*) Refer to the corresponding measurement transducer models for the appropriate Environmental Class.

**1.2 System Design**

The Swift Delivery System is approved for bulk flowmetering when fitted to a non-pressurised tank or compartment, of a capacity from 0.5 kilolitres to 105 kilolitres, fitted to or forming part of a vehicle. Refer to General Certificate 9/0/B Vehicle Tanks of Capacities 0.5 to 105 kilolitres.

The system is configured to continuously measure the liquid level to calculate and indicate the volume delivered based on measurements of liquid level in the compartment.

The system (Figure 1) comprises a Liquip International model DFV1xx calculator/indicator interfaced to not more than nine (9) Liquip International model DIP130/DIP150 (for Environmental Class I) or DFV130/DFV150 (for Environmental Class N) radar gauges one for each tank/compartment.

The calibrated volume between compartment's manifold through pipework to the air eliminator is considered a fixed volume intermediate compartment (IC).

This IC is considered 'Wet' when the sight glass level is full.

This IC is considered 'Dry' when the sight glass level is empty.

Before and after delivery the operator is prompted to check the sight glass and enter the condition of the IC into the calculator/indicator for possible adjustments.

Levels of the IC that are not completely full or empty are considered 'NOT FOR TRADE'.

When the delivery starts and ends with the IC Wet then no adjustment is required.

When the IC at the start of delivery is Wet, and at the end of delivery is Dry, then the delivered volume is the amount delivered from the main compartment volume (as measured by the liquid level sensor) plus the amount delivered from the IC. This adjusted amount is displayed on the calculator/indicator as the delivery volume.

When the IC at the start of delivery is Dry, and at the end of delivery is Wet, then the delivered volume is the amount delivered from the main compartment volume (as measured by the liquid level sensor) less the amount kept in the IC. This adjusted amount is displayed on the calculator/indicator as the delivery volume.

When the delivery starts and ends with the IC Dry then no adjustment is required.

Any hose/pipe work connected after the transfer point (bulk connector or hose reel model) must be completely drained when the system is used for making a delivery.

### **1.3 Calculator/Indicator**

The Liquip International model DFV1xx calculator/indicator (Figure 2) or other compatible (#) NMI-approved calculator/indicator incorporates an LCD display with a resettable indicator. During a delivery the calculator/indicator frequently queries the Diptronic Liquid level sensor in the compartment for the liquid level, which is converted to the volume in the compartment for that level (using tables established during calibration). The change in liquid level after resetting the indicator to zero is then continuously displayed as a volume delivered.

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

### **1.4 Measurement Transducer**

The measurement transducer is a Liquip International model DIP130/DIP150 (for Environmental Class I) or DFV130/DFV150 (for Environmental Class N) radar gauge comprising the Diptronic headwork connected to a liquid level sensor in the form of a sensor rod mounted inside a tube with liquid entry holes at the bottom of the tube (Figure 3).

The Diptronic headwork, which contains the radar electronics, is mounted on the top of the tank with the level sensor positioned vertically at the volumetric centre of the compartment. The mounting bolts for the Diptronic headwork have provision for sealing the device in its prescribed calibration position.

The level sensor is maintained in its vertical position with the bottom of the level sensor attached to the Liquip International model DIP 300 support bracket fixed to the bottom of the tank.

The level sensor has a top datum mark that can be used for checking the correct mounting position of the measuring transducer.

The level sensor can be from 0.6 m to 2.5 m long to suit the tank size.

NOTE: A quantity delivered that is less than the Minimum Measured Quantity ( $V_{min}$ ) is considered 'NOT FOR TRADE USE'.

A delivery that ends below the Minimum Measurable Level (MML) without fully emptying the compartment to the transfer point is considered 'NOT FOR TRADE'. The system is designed to avoid this by pausing delivery before the MML and providing on-screen prompts for the operator before committing to delivering the final MML amount. If the operator were to interrupt the delivery below the MML, the system will provide a 'for trade' receipt for the amount delivered to the MML, and the amount below MML is 'NOT FOR TRADE' and would not appear on the delivery receipt.

### **1.5 Printer**

An Epson model TM-295, 24V DC printer or any other equivalent (\*) is connected to the model DFV1xx calculator/indicator for printing the initial and final volume in the tank and for printing the calculated volume transferred.

(\*) "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 including all checking facilities.

### **1.6 System Control Box(s)**

The System Control Box provides buttons for the operator to either select Product A or B and the compartment.

These buttons open specific valves corresponding to the selection.

### **1.7 Pump**

A single pump is used. This is manually switched ON or OFF by the operator.

### **1.8 Air Eliminator**

A TCS Model 730 Air Eliminator or 'Equivalent' (\*) is fitted to always keep the pipework full of liquid and to vent air and vapour from the pipeline.

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

### **1.9 Sight Glass (Optional)**

A Sight Glass may be fitted at the pump inlet for the operator to visually check the presence of product in the pipeline.

### **1.10 Two Hose Reels**

Two Hose Reels are fitted. One Hose Reel is dedicated for Product A and the other for Product B.

### **1.11 Vacuum Breaker**

A Vacuum Breaker is fitted to prevent negative pressure occurring in the pipeline and compartments.

### **1.12 Isolation Valves**

A 3-Way Valve and/or Isolation Valves are fitted to ensure that the product selected is diverted to the correct hose reel. (Refer to Figure 1).

### **1.13 DFV1\*\*EM Expansion Module (Optional)**

The DFV1\*\*EM is an addition to the DFV1\*\*series of calculator/indicator. It is an expansion module, optional slave unit used with the DFV1\*\* to add extra input/output ports for communications and auxiliary device interface. It uses the same hardware and software as the DFV1\*\*. It communicates with the master DFV1\*\* via a communication port.

### **1.14 GPS tracking module (Optional)**

The DreamTec model i-meter GPS tracking module (Figure 4) or similar models connects to the printer output of the DFV1\*\*, DIP200 series, EMH500 series or EMH600 series of calculators/indicators.

The i-meter sends information from the calculator/indicator to the source location. The i-meter transmits GPS locations and delivery data from the delivery truck. The customer can download PDF delivery notes for invoicing as well as GPS records.

### **1.15 Bluetooth module (Optional)**

A Microchip RN-240F Bluetooth module (Figure 5) or equivalent (\*) may be connected to the serial communication port to provide a wireless communication interface.

Additional devices connected using the interface shall not interact with the system in a way that would cause an incorrect indication of measurement.

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

### **1.16 Installation**

To ensure immunity from electromagnetic interference all cables are protected using ferrite beads and all devices are grounded.

### **1.17 Verification Provision**

Provision is made for the application of a verification mark (refer to Figure 6)

### **1.18 Checking Facility**

The system verifies data between the calculator/indicator and the probe by performing a checksum for every packet of data as per standard for HART protocol and the central processing unit raises an alarm if the probe does not respond.

### **1.19 Sealing Provision**

. Provision is made for the calibration button of the DFV1xx to be sealed.

### **1.20 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/232
Manufacturer's identification mark or trade mark	.....
Model number	.....
Serial number	.....
Year of manufacture	.....
Maximum temperature of the liquid $T_{max}$	..... °C
Minimum temperature of the liquid $T_{min}$	..... °C
Type of the liquid for which the system is verified	..... (#1)
Accuracy class	0.5
Environmental class	.....class

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

The minimum measured quantity ( $V_{min}$ ) is to be clearly visible in the vicinity of the indicating device, e.g. Minimum Delivery 200 L.

#### TEST PROCEDURE No 5/6B/232

The vehicle tank shall comply with the requirements of the appropriate general certificate of approval for vehicle tanks (e.g., 9/0/B) in terms of:

- Rigidity
- Internal venting (excluding diptube)
- Sump
- Piping design
- Tank markings

The Diptronic headwork, which contains the radar electronics, is mounted on the top of the tank with the level sensor positioned vertically at the centroid of the tank/compartments within 25 mm.

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.

The verification may be carried out by either delivering a traceable volume into the tank compartment, or alternatively by dispensing the liquid from the tank compartment via traceable volume measuring equipment.

Within the field of operation, the reference standards must be able to measure the volume at any level in the tank compartment with sensitivity at least three times better than a volume equivalent to 1 mm change in liquid level.

The tank profile shall be determined at an appropriate number of intervals to ensure for any combination of liquid levels in the compartment, the deliveries from the compartment greater than  $V_{min}$  are within the MPE for that delivery.

The maximum permissible errors are specified in the National Trade Measurement Regulations 2009.

The liquid measuring instrument shall be tested in accordance NITP 5.2. Test procedures clauses 4.4, 4.6, 4.13 and 4.14 are applicable to this instrument.

The following variations are applicable to NITP 5.2 clause 4.6:

- Testing is not required at different flowrates.
- The measuring system shall be tested for accuracy at an appropriate number of liquid levels across the full measuring range of the level sensor, that ensure for any combination of liquid levels in the compartment, the deliveries to or from the compartment greater than the minimum measured quantity are within the MPE for that delivery.
- Complete at least one delivery for each of the following conditions:
  - Wet (full pipework and manifold) to dry (empty pipework and manifold).
  - Dry (empty pipework and manifold) to wet (full pipework and manifold).

Note 1: Use of a smaller prover is acceptable to conduct these tests (where a prover equal to or greater than the required delivery size is unavailable). In this case multiple deliveries into prover can be used provided the accuracy (uncertainty and variations) of the reference volume is no greater than one-third of the MPE.

Note 2: Where a delivery into a prover is completed without reaching the measurable scale of the prover, it is acceptable to use a second reference volume to facilitate a prover reading provided the accuracy (uncertainty and variations) of the reference volume is no greater than one-third of the MPE.

E.g., measure a volume from a master meter to top up and reach a readable level on the prover.



FIGURE 5/6B/232 – 1

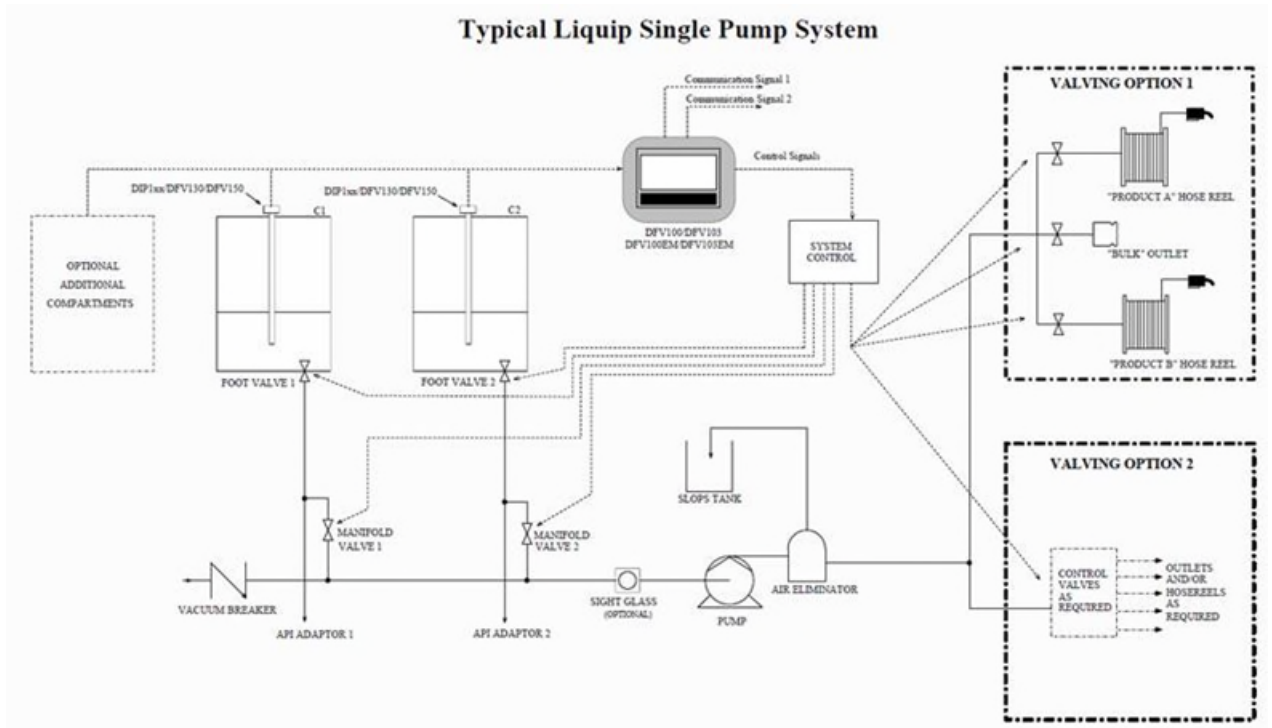
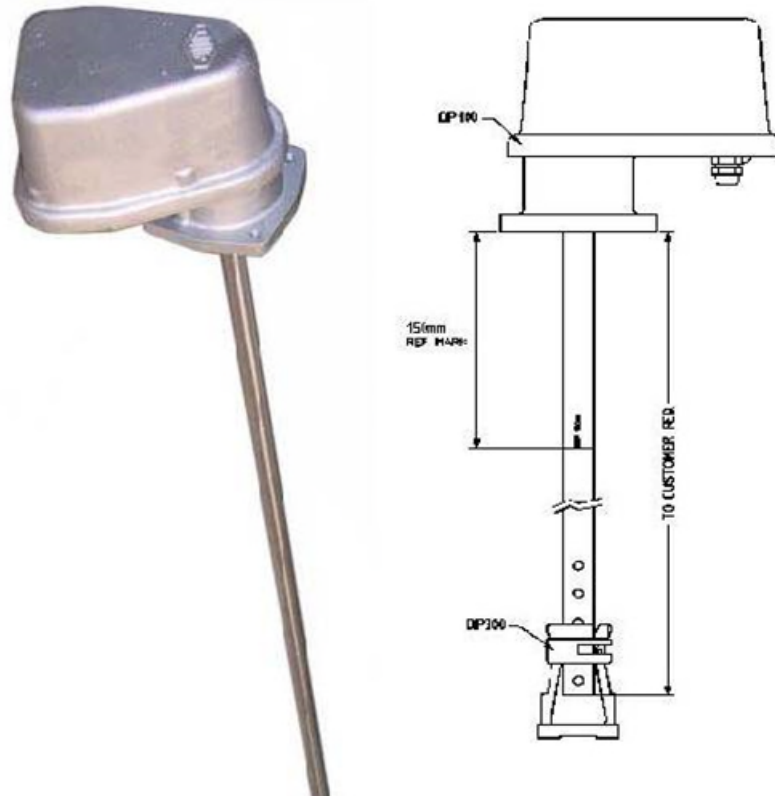


FIGURE 5/6B/232 – 2



DFV1xx Calculator/Indicator

FIGURE 5/6B/232 – 3



Model DIP130/DIP150/DFV130/DFV150 Radar Gauge

FIGURE 5/6B/232 – 4



DreamTec Model i-meter GPS Tracking Module

FIGURE 5/6B/232 – 5



Microchip RN-240F Bluetooth module

FIGURE 5/6B/232 – 6

<b>LIQUIP INTERNATIONAL SWIFT</b>							
TANK MANUFACTURER <input style="width: 150px;" type="text"/>		TANK NUMBER <input style="width: 150px;" type="text"/>					
NMI APPROVAL No: 5/6B/232			PRODUCT <input style="width: 50px;" type="text"/> <input style="width: 50px;" type="text"/>				
FRONT OF TANK			REAR OF TANK				
COMPARTMENT		1	2	3	4	5	6
TOTAL CAPACITY	litres						
MAX. MEASURABLE LEVEL	litres						
MIN. MEASURABLE LEVEL	litres						
MIN. DELIVERY (MMQ)	litres						
		○	○	○	○	○	○

2 mm dia. Holes are drilled out as required for each calibrated compartment and fitted with lead seals through the appropriate hole. The seals are stamped with the verification marks which includes the verifier's company ID, individual ID and date of verification.

~ End of Document ~