



Australian Government
Department of Industry,
Innovation and Science

National Measurement Institute

Certificate of Approval NMI 5/6B/213

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.

TCS Model 682-15-SP Liquid-measuring System

submitted by Total Control Systems
2515 Charleston Place
Fort Wayne Indiana 46808
USA

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, dated July 2004.

This approval becomes subject to review on 1/01/18, and then every 5 years thereafter.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern & variants 1 to 3 approved – interim certificate issued	12/12/07
1	Pattern & variants 1 to 3 – certificate issued	22/01/08
2	Pattern & variants 1 to 3 reviewed & updated – variant 4 approved – certificate issued	20/12/11
3	Variant 5 approved – certificate issued	27/07/12
4	Variant 6 approved – certificate issued	29/09/14
5	Variant 7 approved – certificate issued	5/07/16

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with approval number 'NMI 5/6B/213' and only by persons authorised by the submitter.

Instruments incorporating a component purporting to comply with this approval shall be marked 'NMI 5/6B/213' in addition to the approval number of the instrument, 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 S1/0/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*.

A handwritten signature in black ink, appearing to read 'Dr A Rawlinson', with a horizontal line underneath.

Dr A Rawlinson

TECHNICAL SCHEDULE No 5/6B/213

1. Description of Pattern **approved on 12/12/07**

A bulk flowmetering system incorporating a Total Control Systems (TCS) model 682-15-SP (*) positive displacement flowmeter (Figure 1 and Table 1) for bulk metering of petroleum products other than LPG.

(*) The full model number of the meter is in the form '682-15-SP-4-AL-A' – refer to Table 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 (#1)
- Maximum flow rate, Q_{max} 190 L/min
- Minimum flow rate, Q_{min} 10 L/min
- Maximum pressure of the liquid, P_{min} 1050 kPa
- Minimum pressure of the liquid, P_{min} 140 kPa (#2)
- Dynamic viscosity 0.4 to 20 mPa.s (at 20°C) (#3)
- Liquid temperature range -10°C to 50°C
- Ambient temperature range -25°C 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 Components of the Flowmetering System

(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/vapour 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/vapour 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 (Figure 2)

The gas elimination device is a TCS model 630 strainer/air eliminator (or any other equivalent approved gas elimination device) fitted upstream of the flowmeter to prevent vapour 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 TCS model 682-15-SP-4-AL reciprocating piston positive displacement flowmeter (Figure 2) with a mechanical output shaft connected to a mechanical type calibration adjustment mechanism.

(vi) Calibration Device

The calibration of the meter is performed using the sealable adjustment device located directly on top of the meter and under the register location. This mechanical calibration system controls the piston lengths by adjusting the top disc that has a tab marked with a 'plus' and a 'minus' sign. One full turn in either direction equals a 3% adjustment.

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

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

(vii) Indicator

Any of the following assemblies may be used using the Veeder-Root mechanical indicators listed:

- (i) a model 788700-037 with 0.1 litre increments; or
- (ii) a model 789000-733 with integral printer and 0.1 litre increments.

The indicator may be fitted with a pre-set device and pre-set counter (Figure 3) fitted between the calibration device and indicator. The pre-set device is mechanically linked to a Total Control Systems model 650SP pre-set control valve. The required quantity is displayed on the pre-set counter and is set by using five push buttons. The maximum pre-set volume is 999999 units of measurement. During the metering operation, the display of the pre-set counter progressively returns to zero. A mechanical linkage within the pre-set device closes the pre-set valve in two stages to complete the delivery. The pre-set control valve, which may also be manually operated, is installed downstream of the meter.

A rigid extension drive from the meter to the indicator, pre-set counter and ticket printer, and/or 90° indicator stack may be used.

(viii) 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.

If a nozzle is used, the nozzle has an anti-drain valve installed either in the nozzle or immediately before it, and having a retaining pressure valve of not less than 55 kPa: the nozzle is the transfer device.

The pipework between the gas eliminator device and the transfer point shall be kept full of liquid during the measurement and shutdown periods.

1.3 Verification Provision

Provision is made for the application of a verification mark.

1.4 Sealing Provision

Provision is made for sealing access to the calibration mechanism. Refer also to approval for calculator/indicator for any additional sealing requirements.

1.5 Descriptive Markings

Each measuring system shall bear the following information, placed together either on the indicating device or on a data plate:

Pattern approval mark	NMI 5/6B/213
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 C

(#) 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 10 L".

2. Description of Variant 1 **approved on 12/12/07**

Using certain other Total Controls Systems (TCS) 682-15 series flowmeters of certain meter construction material types as listed in Table 1.

TABLE 1

The full model number of the meter is in the form '682-15-SP-4-AL-A', as set out below:

- '682' designates meter series.
- '15' designates meter capacity.
- 'SP' designates meter construction type, e.g.
 - SP ('Standard Petroleum'),
 - SPA ('Standard Petroleum A', premium grade);
 - SPD ('Standard Petroleum, Ductile iron');
 - SSD ('Stainless Steel for Diesel exhaust fluid DF or AdBlue'); or
 - AF ('All Ferrous').
- '4' designates meter accessory combinations fitted; may be any numeral '2' to '7'.
- 'AL' designates a mechanical indicator displaying in litres.
- 'A' designates air check valve fitted. 'Blank' if no air check valve is fitted.

For minimum deliveries less than 10 L the calculator/indicator displays the volume at least in increments of 0.1 L. For minimum deliveries equal to or greater than 10 L the calculator/indicator displays the volume in 0.1 L or 1 L increments.

3. Description of Variant 2 **approved on 12/12/07**

The pattern and variants for use to dispense various petrol/ethanol blends and pure ethanol ('E100').

4. Description of Variant 3 **approved on 12/12/07**

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

5. Description of Variant 4 **approved on 20/12/11**

The TCS model DMP100-*A* or RMP100-*A* (*) dual channel (overlapping) pulse generator (Figure 3a) is designed to produce pulses proportional to volume throughput, when fitted to any flowmeter listed elsewhere in this approval and interfaced with a compatible (#) NMI-approved calculator/indicator.

- (*) The model DMP100-*A* is directly mounted on the flowmeter (Figure 3b) while the model RMP100-*A* is mounted remotely via a Veeder-Root mechanical indicator output shaft. The '*' characters in the model numbers refer to features which are not metrologically significant.
- (#) 'Compatible' is defined to mean that no additions/changes to hardware/software are required for satisfactory operation of the complete system.

5.1 Field of Operation

- Pulses per shaft revolution 100 pulses/revolution/channel
- Maximum pulser shaft speed 2500 revolutions/minute
- Output pulses Positive rectangular waveform
- Maximum pulse frequency 2000 Hz
- Power supply range 6 to 30 volts DC
- Environmental class -25°C to 55°C
- Accuracy class Class 0.3 (or larger)

6. Description of Variant 5 **approved on 27/07/12**

Any model flowmeter as listed in Table 1 now approved for use to dispense AdBlue fluid AUS32 (aqueous urea solution 32.5%) or Diesel Exhaust Fluid (DEF).

7. Description of Variant 6 **approved on 29/09/14**

All models listed in Table 1 for use with the following extended field of operation:

- Dynamic viscosity 0.4 to 1200 mPa.s (at 20°C) (#3)
 - Liquid temperature range -30°C to 50°C
- (#3) The flowmeter is adjusted to be correct for the liquid for which it is to be verified as marked on the data plate.

8. Description of Variant 7 **approved on 5/07/16**

All models listed in Table 1 for use with the following extended field of operation:

- Dynamic viscosity 1.4 to 740 mPa.s (at 20°C) (#3)
 - Liquid temperature range -30°C to 50°C
 - Ambient temperature range -40°C to 55°C
- (#3) The flowmeter is adjusted to be correct for the liquid for which it is to be verified as marked on the data plate.

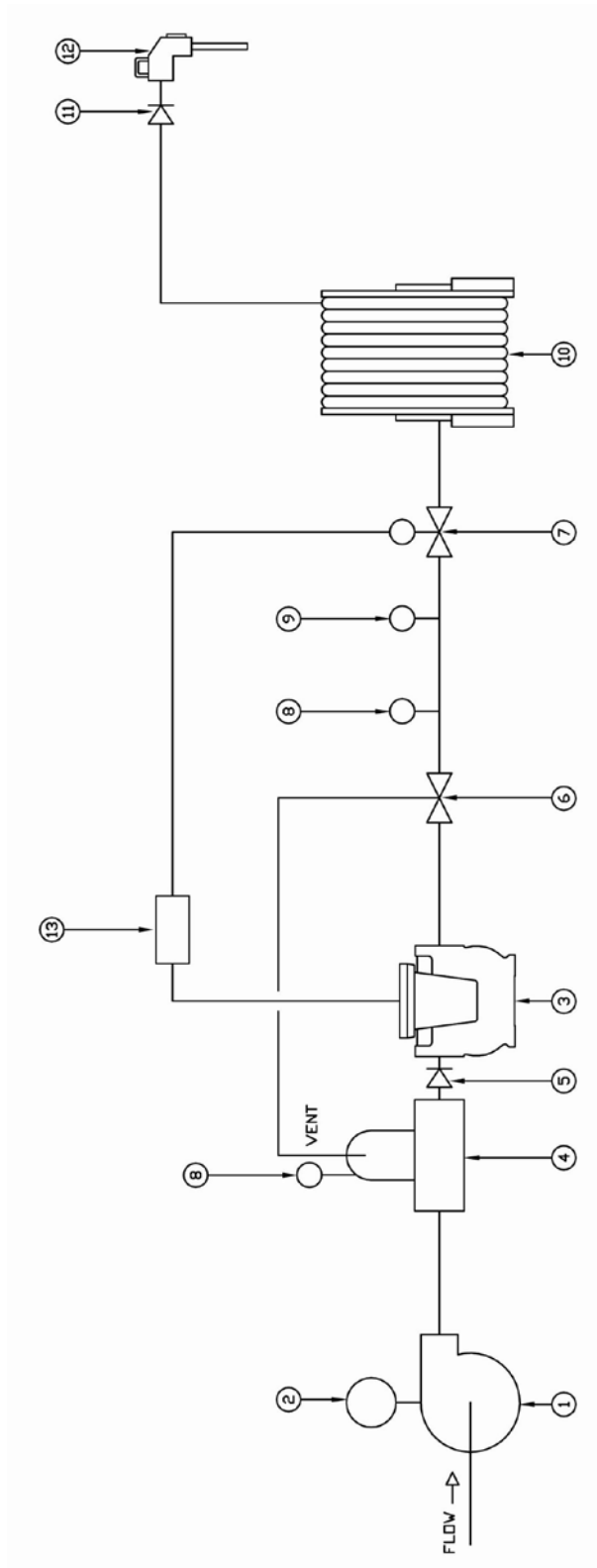
TEST PROCEDURE No 5/6B/213

Instruments shall be tested in conjunction with any tests specified in the approval documentation for the instruments to which the pattern is connected, as appropriate, and 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 indicator/controller and/or any conversion device, etc. used.

Maximum Permissible Errors

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

FIGURE 5/6B/213 – 1



- 1 – pump
- 2 – pump motor
- 3 – flowmeter
- 4 – strainer/air eliminator
- 5 – check valve
- 6 – air check valve (optional)
- 7 – flow rate control valve (optional)
- 8 – provision for pressure measurement
- 9 – provision for temperature measurement
- 10 – hose reel
- 11 – check valve
- 12 – nozzle
- 13 – indicator

TCS Model 700-35-SPA Flowmetering System

FIGURE 5/6B/213 – 2



TCS Model 682-15-SP-4-AL Flowmeter

FIGURE 5/6B/213 – 3



TCS Model DMP100-*A* Pulse Generator
Including a Typical Direct Mounting Arrangement

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