Australian Government
Department of Industry, Innovation and Science

National Measurement Institute

Certificate of Approval
NMI 5/6B/207

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.
Liquid Controls Model LC3 Liquid-measuring System

Submitted by Liquid Controls
105 Albrecht Drive
Lake Bluff IL 60044-2242
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 Measuring Systems for Liquids Other than Water, dated June 2011.

This approval becomes subject to review on 1 October 2022, and then every 5 years thereafter.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern & variants1 approved – certificate issued	29/09/2005
1	Change notice Pattern reviewed – certificate issued	14/08/2011
2	Variant 2– Pattern reviewed – certificate issued	18/12/2017

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI 5/6B/207' 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 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

TECHNICAL SCHEDULE No 5/6B/207

1. Description of Pattern approved on 29/02/05

A bulk-flowmetering system incorporating a Liquid Controls model LC3-CS-PHL-C-4XX-E turbine flowmeter interfaced to a Contrec model 1010A calculator/indicator or any other compatible approved calculator/indicator and approved for metering petroleum products other than liquefied petroleum gas. May also be known as a Sponsler model SP3 instrument.

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} 2650 L/min
- Minimum flow rate, Q_{min} 265 L/min
- Maximum pressure of the liquid, P_{min} 1800 kPa
- Minimum pressure of the liquid, P_{min} 140 kPa (#2)
- Dynamic viscosity at 20°C 0.5 to 20 mPa.s (#3)
- Liquid temperature range -10 to 50°C (#4)
- Ambient temperature range -25 to 55°C
- Accuracy class 0.5

(#1) The calculator/indicator is set to indicate volume at least in 1 L increments.
(#2)The flowmeter is adjusted to be correct for the liquid for which it is to be verified/certified as marked on the data plate.
(#3) As specified for the gas elimination device for effective operation.
(#4) Limited also by the calculator/indicator volume conversion for temperature to 15°C facility.

1.2 Components of the Flowmetering System (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 to prevent air from entering the pipework.

(ii) Pump

The pump is required to have sufficient capacity to allow flow rates of at least three times the minimum flow rate specified for the flowmeter. If the pump is not for the exclusive use of the flowmeter, the pump shall be of sufficient capacity to ensure that flow rate through each meter is maintained above its respective specified minimum flow rate and the pressure is maintained above the minimum backpressure recommended for each meter for all combinations of alternative uses of the pump.

A positive displacement type, centrifugal type, or submersible turbine type pump may be installed in a flooded suction configuration.

Systems with positive displacement pumps are installed so that the pump stops when the liquid level in the supply tank is low. If the pump is above the liquid level of the supply tank, the system 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 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 (particularly during shut-down period) in the pipework upstream of the flowmeter.

(iii) Non-return Valve

A non-return valve between the pump and the meter, or an arrangement of the components and piping to keep the system (up to the transfer point) full of liquid at all times.

(iv) Gas Elimination Device

The gas elimination device, comprising a Liquid Controls model F-30 strainer (Figure 2) fitted with a model A8180 air/vapour eliminator (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 shutdown 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) Flow Straighteners

The flowmeter is installed between straight lengths of pipe.
The upstream pipe is either a straight pipe of 20 pipe diameters in length, or of 10 pipe diameters in length if fitted with internal tubes having a length equivalent to 2 pipe diameters and each tube having a diameter 1/5 of the pipe diameter. Alternatively (or in addition) a flow conditioning plate (‘strait’, Figure 3) is installed at the inlet of the turbine flowmeter.

(vi) Measurement Transducer

The measurement transducer is a Liquid Controls model LC3-CS-PHL-C-4XX-E 75 mm (3”) turbine flowmeter (Figure 4) fitted with dual Sponsler model SC13-74G pick-off coils which produce an electrical output signal proportional to the volume throughput. The pick-off signal is conditioned by a Spectec 4021 or 4022 series signal pre-amplifier with a frequency range of 3 to 10 kHz. The pre-amplifier requires a DC power source in the range 6 to 36 V, and produces an output square wave having either 0 to 5 V or 0 to Vs (supply voltage) depending on the selected terminal.

The measurement transducer is mounted either horizontally or vertically between the flow straighteners and is required to be verified/certified in that position using the liquid it is intended to measure.

The nominal K-factor for the measurement transducer is 12.2 pulses/litre and the calibration/adjustment is made via the calculator/indicator.

Provision is made in the pipework to verify the temperature and pressure of the liquid flowing through the measurement transducer.

Note: Although this approval does not cover pipeline applications, the measurement transducer is suitable for accuracy class 0.3.

(vii) Calculator/Indicator

The output from the dual signal pre-amplifier is interfaced to a Contrec model 1010A calculator/indicator (as described in the documentation of approval NMI S313A), or any other compatible approved calculator/indicator.

(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 is in the form of a positive shut-off component, which clearly defines the beginning and end of volume measurement and may be a manually or automatically operated valve used to control the flow rate.
The pipework between the gas elimination device and the transfer device is maintained 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 and Notices

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

Pattern approval mark	5/6B/207	
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		
Nominal K-factor	….. Pulses/Litre	(#)

(#) These 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 500 L". Alternatively, if the calculator/indicator incorporates a programmable batch pre-set function, the pre-set is limited to deliveries equal to or greater than the minimum delivery specified for the flowmeter.

2. Description of Variant 1 approved on 29/02/05

Using certain other Liquid Controls flowmeters as listed in Table 1. Flowmeters may also be known as Sponsler instruments, in which case the 'LC' prefix in the model number is replaced by 'SP', e.g. the pattern (#, model LC3-CS-PHL-C-4XX E) becomes a model SP3-CS-PHL-C-4XX-E.

TABLE 1

Flowmeter Model Number	Nominal Bore (mm)	Maximum Flow (Q_{max}) (L/min)	Minimum Flow (Q_{min}) (L/min)	Minimum Delivery (L)	Nominal K-factor (p/L)
LC2½-CS-PHL-C-4XX-E	64	1500	150	200	19.8
LC3-CS-PHL-C-4XX-E (#)	75	2650	265	500	12.2
LC4-CS-PHL-C-4XX-E	100	4540	454	500	5.47

3. Description of Variant 2 approved on 18/12/17

With Stainless Steel flanges and optional internal flow conditioning plates, the model numbers will have a "D" to indicate Stainless Steel flange and 'DI" for Stainless Steel Flange with flow conditioning plate. In conjunction with Table 1 refer to example below:

LC3-CS-PHL-C-4XX-E, C is for Carbon Steel Flange

LC3-CS-PHL-D-4XX-E, D is for Stainless Steel Flange

LC3-CS-PHL-DI-4XX-E, DI is for Stainless Steel Flange and internal flow conditioning plate.

TEST PROCEDURE

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

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.

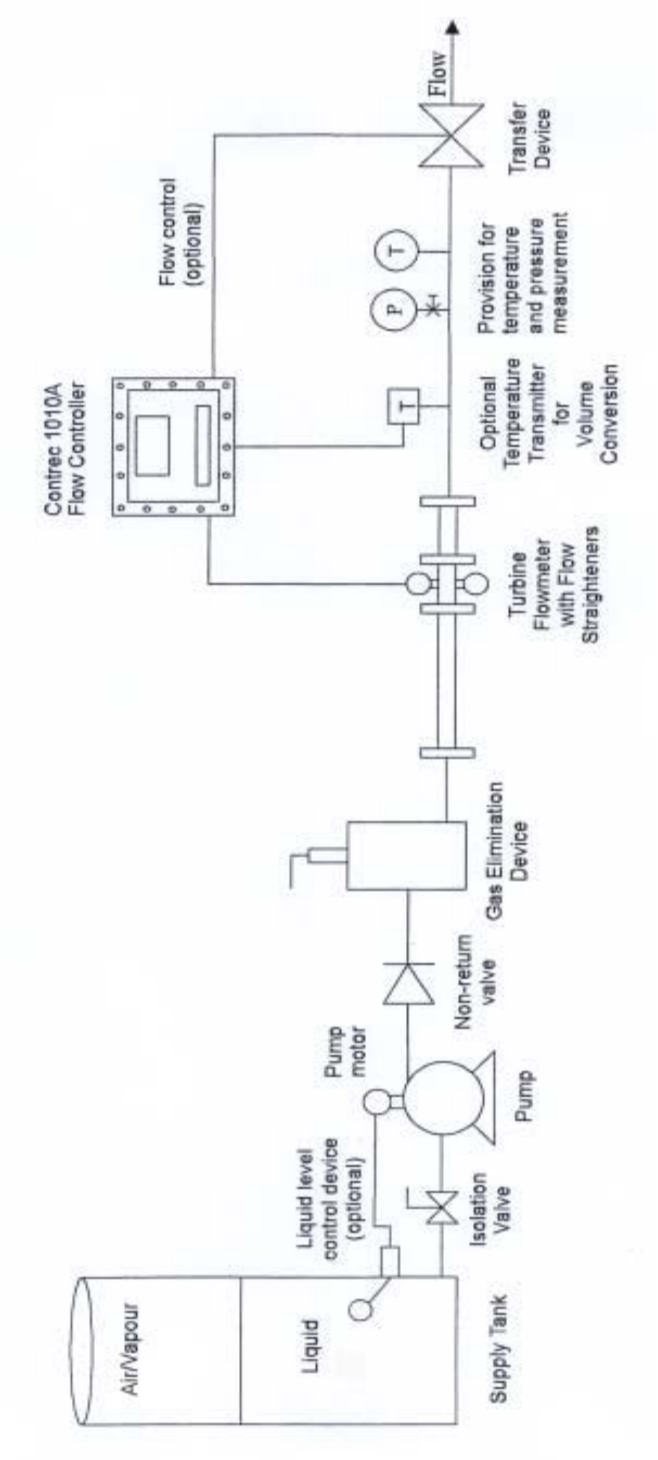
A suitable Test Procedure may be obtained from NMI

Instruments should be tested using a suitable test procedure.

Maximum Permissible Errors

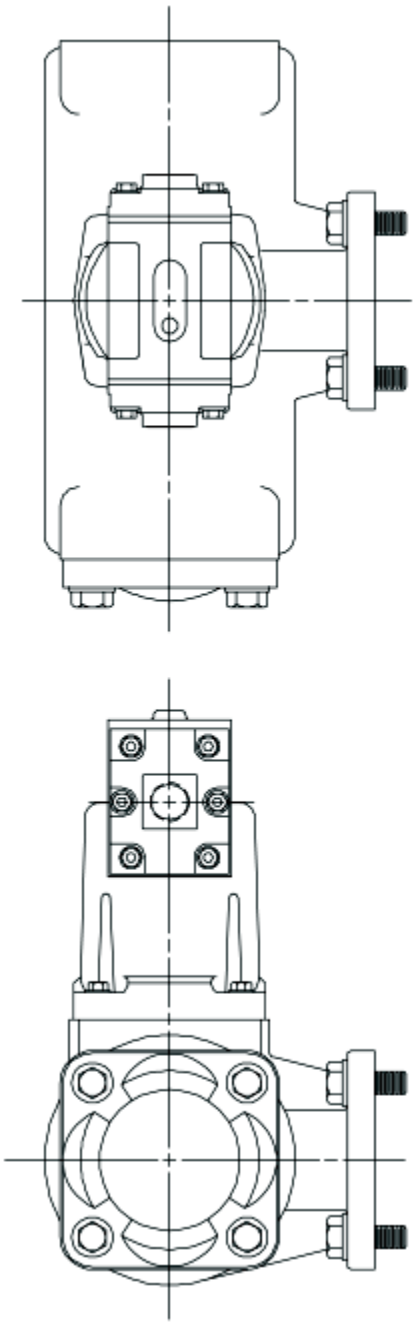
The maximum permissible errors are specified in the *National Trade Measurement Regulations 2009*.

FIGURE 5/6B/207 – 1



Typical Liquid Controls Liquid-measuring System

FIGURE 5/6B/207 – 2



Liquid Controls Model F-30 Strainer and Air Eliminator

FIGURE 5/6B/207 – 4

Liquid Controls Model LC3 or Sponsler Model SP3 Flowmeter

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