



Australian Government
**National Measurement
Institute**

12 Lyonpark Road, North Ryde NSW 2113

**Cancellation
Certificate of
Approval No 5/6B/204**

Issued by the Chief Metrologist under Regulation 60
of the
National Measurement Regulations 1999

This is to certify that the approval for use for trade granted in approval 5/6B/204
in respect of the

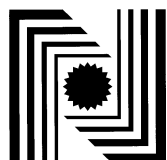
Liquid Controls Model M40 Liquid-measuring System

submitted by Liquid Controls
105 Albrecht Drive
Lake Bluff IL 60044-2242
USA

has been cancelled in respect of new instruments as from 1 September 2005.

Signed by a person authorised by the Chief Metrologist
to exercise his powers under Regulation 60 of the
National Measurement Regulations 1999.

A handwritten signature in black ink, appearing to be 'J. H. T.', is located in the bottom right corner of the document.



National Standards Commission

12 Lyonpark Road, North Ryde NSW

Certificate of Approval

No 5/6B/204

Issued 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

Liquid Controls Model M-40-1 Liquid-measuring System

submitted by Liquid Controls Inc
 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.

CONDITIONS OF APPROVAL

This approval becomes subject to review on 1 September 2004, and then every 5 years thereafter.

Instruments purporting to comply with this approval shall be marked NSC No 5/6B/204 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 Commission 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 the Commission's Document NSC P 106.

The Commission reserves the right to examine any instrument or component of an instrument purporting to comply with this approval.

Auxiliary devices used with this instrument shall comply with the requirements of General Supplementary Certificate No S1/0/A.

DESCRIPTIVE ADVICE

Pattern: approved 13 January 2003

- A Liquid Controls model M-40-1 liquid-measuring system which is approved for accuracy class 0.5 for liquids other than water, having a dynamic viscosity between 0.5 and 20 mPa.s.

Variants: approved 13 January 2003

1. Using certain other Liquid Controls meters as listed in Table 1.
2. As a pipeline liquid-measuring system for accuracy class 0.3.
3. As a mobile liquid-measuring system.
4. As a drum-filling liquid-measuring system.

Technical Schedule No 5/6B/204 describes the pattern and variants 1 to 4.

FILING ADVICE

The documentation for this approval comprises:

Certificate of Approval No 5/6B/204 dated 17 January 2003

Technical Schedule No 5/6B/204 dated 17 January 2003 (incl. Table 1 and Test Procedure)

Figures 1 to 4 dated 17 January 2003

TECHNICAL SCHEDULE No 5/6B/204

Pattern: Liquid Controls Model M-40-1 Liquid-measuring System
Submittor: Liquid Controls Inc
105 Albrecht Drive
Lake Bluff IL 60044-2242
USA

1. Description of Pattern

A liquid-measuring system using a Liquid Controls model M-40-1 positive displacement meter (Figure 1 and Table 1) which is approved for accuracy class 0.5 for liquids other than water, having a dynamic viscosity between 0.5 and 20 mPa.s and stored at atmospheric pressure. The meter is adjusted to be correct for the liquid for which it is to be verified/certified.

The system is approved for maximum and minimum flow rates of 1700 and 170 L/min, respectively. The minimum measured quantity is 200 litres.

1.1 Field of Operation

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

- | | |
|--|-----------------|
| • Minimum measured quantity, V_{min} | 200 L |
| • Maximum flow rate, Q_{max} | 1700 L/min |
| • Minimum flow rate, Q_{min} | 170 L/min |
| • Maximum pressure of the liquid, P_{max} | 1034 kPa |
| • Dynamic viscosity at 20°C | 0.5 to 20 mPa.s |
| • Maximum temperature of the liquid, T_{max} | 50°C |
| • Minimum temperature of the liquid, T_{min} | -10°C |
| • Environmental class | class C |

1.2 Truck-loading Liquid-measuring System

(i) Tank

The supply tank may be situated either above or below ground and may incorporate a device for stopping deliveries when the liquid level in the supply tank is low.

(ii) Pump

The pump is fitted in a positive suction head (flooded suction) installation, i.e. below the liquid level in the supply tank (Figure 1).

Positive displacement type, centrifugal type, or submersible turbine type pumps may be used. Systems, which incorporate submersible turbine type pumps, may in addition include centrifugal type pumps fitted above the liquid level in the supply tank as supplementary pumps.

If the pump is not for the exclusive use of the meter, the flow rate through the meter must stay within the appropriate flow rate range for all combinations of alternative uses of the pump.

(iii) Non-return Valve

A non-return valve is fitted between the pump and the meter, or the components and piping are arranged to prevent reverse flow of the liquid and to keep the system full of liquid at all times.

(iv) Gas Elimination Device

The gas elimination device consists of a Liquid Controls F or FS standard series strainer and an A81 series gas extractor, fitted as close as practicable to the meter inlet. The gas elimination device is approved on the condition that the pump is operated under a positive suction head.

The gas elimination device may be modified for use as a strainer only where the tank has automatic alarming of low-liquid level, or has a float-operated shut-off valve to prevent gas entering the system.

(v) Meter

A Liquid Controls model M-40-1 positive displacement meter (Figure 2) is used.

The meter consists of a housing in which two displacement rotors and a blocking rotor turn in a synchronised relationship. Each rotor is supported on either end by a bearing plate through which the shafts protrude.

At one end of each rotor shaft is a timing gear. The blocking rotor gear has twice the number of teeth of each of the displacement rotor gears and rotates at half their revolutions.

A thermowell is provided downstream of the meter, and provision is made for measuring the pressure at the meter.

(vi) Calibration Device

The calibration of the meter is performed using the adjustment device located directly behind the sealable LC (Liquid Controls) emblem faceplate. The calibration device provides a variable transmission between the meter element and the indicator so that the drive between the meter and indicator can be varied until the meter throughput corresponds to the volume shown by the indicator. The adjustment device is graduated in divisions of 1%, 0.1% and 0.02%

(vii) Indicating System

Any of the following assemblies may be used:

- (a) A Veeder-Root 7886 or 7887 series zero-start indicator (Figure 3) driven by the calibration device; or
- (b) A Veeder-Root 7890 series zero-start indicator with a model 788811-001 accumulative ticket printer or a model 788810-001 zero start ticket printer mounted on top of the indicator (Figure 4); or

- (c) Either (a) or (b) with a pre-set device incorporating a Veeder-Root 7889 series (Figure 4) or a Liquid Controls D41** series pre-set counter, fitted between the calibration device and the indicator.

(**) Approved models have a 30, 40, 50 or 60 suffix.

The pre-set device serves to deliver a pre-set volume of liquid by means of a Liquid Controls model V15 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 99999 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.

The unit of measurement marked on the pre-set counter is the same as on the zero-start indicator.

The pre-set counter is marked PRE-SET INDICATION NOT IN USE FOR TRADE.

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

Note: Approved printers are fitted with the internal right-hand wheel for printing the unit of measurement.

(viii) Transfer Device

The transfer device is one of the following:

- (a) Top-loading arrangement - the highest point of the pipework forms a weir at a fixed level from which the delivery pipe drains to the outlet for all configurations of the hose or loading arm whilst in operation. A syphon breaker is installed to ensure complete draining of the pipework downstream of the weir.
- Alternatively, an anti-drain valve which retains a pressure of not less than 55 kPa may be installed at the delivery point of the pipework or hose; or
- (b) Bottom-loading arrangement – a dry-break coupling located at the delivery point of the pipework or hose.

1.3 Verification/Certification Provision

Provision is made for the application of a verification/certification mark.

1.4 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	NSC No 5/6B/204
Manufacturer's identification mark or trade mark	.....
Meter model	.....
Serial number of the instrument	.....
Year of manufacture	.....
Accuracy class (in the form 0.3 or 0.5)	.....
Maximum flow rate (Q_{max})	..... L/min
Minimum flow rate (Q_{min})	..... L/min
Minimum measured quantity (V_{min})	..... L
Maximum pressure (P_{max})	..... kPa
Environmental class	class C
Type of liquid for which the system is verified (*)	.....

Notices as specified elsewhere in this Technical Schedule.

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

1.5 Sealing Provision

Provision is made for sealing the following components:

- (a) The covers of the meter housing;
- (b) The calibrating mechanism;
- (c) The indicating mechanism and pre-set mechanism (if fitted); and
- (d) At least one of the vent pipes from the gas eliminator to prevent it from being closed or obstructed in any way.

2. Description of Variants

2.1 Variant 1

Using certain other Liquid Controls meters as listed in Table 1.

TABLE 1

Meter Model (*)	Cyclic Volume (L/rev)	Flow Rate (L/min)		Minimum Measured Quantity V_{min} (L)	Pre-set Valve Model (#)
		Q_{min}	Q_{max}		
M-5	0.309	19	227	20	V-7
M-7	0.681	38	380	50	V-7
M-10	0.681	57	570	100	V-7
M-15	1.839	76	760	100	V-15
M-25	1.839	114	1140	200	V-15
M-30	5.102	132	1320	200	V-15
M-40	5.102	170	1700	200	V-15
M-60	14.874	227	2270	500	V-S
M-80	14.874	303	3030	500	V-S
MS-7	0.681	38	380	50	V-7
MS-10	0.681	57	570	100	V-7
MS-15	1.839	76	760	100	V-7
MS-25	1.839	114	1140	200	V-15
MS-30	5.102	132	1320	200	V-15
MS-40	5.102	170	1700	200	V-15
MS-75	14.874	265	2650	500	V-S
MS-120 (150 mm)	23.973	189	3790	500	V-S
MS-120 (200 mm)	23.973	380	4540	500	V-S

(*) Note that the meter models listed are basic model numbers only – the full model numbers may have a variety of additional alphanumeric characters, e.g. MSA-120-CX-1, where:

‘M’ designates meter.

‘S’ designates steel case; ‘blank’ if other than steel.

‘A’ designates working pressure; may be ‘AA’ (1896 kPa), ‘A’ (2068 kPa), ‘B’ (4964 kPa), ‘C’ (9928 kPa) or ‘blank’.

‘120’ designates the capacity of the meter; other capacities are listed in Table 1.

‘C’ designates accessory combinations fitted to the meter, e.g. pre-set valve, gas eliminator, strainer, printer; may be any character ‘A’ to ‘P’.

‘X’ designates that an air check valve is fitted, if ‘blank’ no air check valve fitted.

‘1’ designates the material of the measuring element; may be any number ‘1’ to ‘20’.

(#) Model of the pre-set operated control valve used, when the meter is fitted with a pre-setting facility.

2.2 Variant 2

As a pipeline liquid-measuring system for accuracy class 0.3. The system is similar to the pattern, but has the transfer device in the form of a positive shut-off component such as a manually or automatically operated control valve located downstream of the meter with no intermediate outlet.

Only the Liquid Controls models M-40, M-60, or M-80 and models MS-40, MS-75, or MS-120 meters in Table 1, are approved for accuracy class 0.3, pipeline applications.

A sampling device intended to determine the properties of the liquid to be measured may be utilised, provided that in the results of the measurement, the volume of the sample is taken into account, if the sample is greater than 0.1 times the maximum permissible error of the measuring system.

In addition to the gas elimination device described for the pattern, pipeline installations may include a bulk plant gas eliminator with either single or dual heads and an air or gas pressure actuated check valve which is designed to stop all flow through the meter when air or gas is present.

2.3 Variant 3

As a mobile liquid-measuring system (excluding for aircraft refuelling) which includes the following:

- Liquid Controls models M-5, M-7, MS-7, M-10, MS-10, M-30, M-40 and M-60 meters fitted with a Liquid Controls model F7 High Capacity gas eliminator/strainer; or
- Liquid Controls models M-15, MS-15, M-25 and MS-25 meters fitted with a Liquid Controls model F15 High Capacity gas eliminator/strainer.

Both of the above systems also include a spring-loaded check valve between the gas eliminator/strainer and the meter.

A Liquid Controls F standard series strainer with an A81 series gas eliminator, and an air or gas actuated check valve assembly may be used to prevent gas flow, instead of the F-7 or F-15 High Capacity gas eliminator/strainer.

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 to 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 spring-loaded check valve is relieved, the valve opens allowing flow of liquid through the meter.

The system may comprise the pump, together with a pressure control valve (if necessary), and a flexible hose and hose reel. In this case, 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, or the components and piping are arranged 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.

2.4 Variant 4

As a drum-filling liquid-measuring system which includes the following:

- A Liquid Controls model M-5 or M-7 meter as listed in Table 1.
- A Liquid Controls standard model F7 strainer and an A81 series gas eliminator.
- A Liquid Controls V-7 series pre-set control valve.
- A Veeder-Root 7889 series pre-set counter.
- A Veeder-Root 7890 series zero start indicator with a model 788811-011 accumulative ticket printer or a model 788810-001 zero start ticket printer.
- A 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 pre-set mechanism is approved to repeat fixed deliveries of either 60, 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 and need NOT be marked PRE-SET INDICATION NOT IN USE FOR TRADE.

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

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; the nozzle is the transfer device.

TEST PROCEDURE

Instruments should be tested in accordance with any relevant tests specified in the Uniform Test Procedure using the type of liquid with which they will be used and which is marked on the instrument. 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

For accuracy class 0.3:

The maximum permissible errors applicable are:

- $\pm 0.2\%$ for calibration of the meter; and
- $\pm 0.3\%$ for verification/certification of the measuring system.

For accuracy class 0.5:

The maximum permissible errors applicable are:

- $\pm 0.3\%$ for calibration of the meter; and
- $\pm 0.5\%$ for verification/certification of the measuring system.

Hose Dilation Test

The maximum permissible errors applicable for hose dilation are:

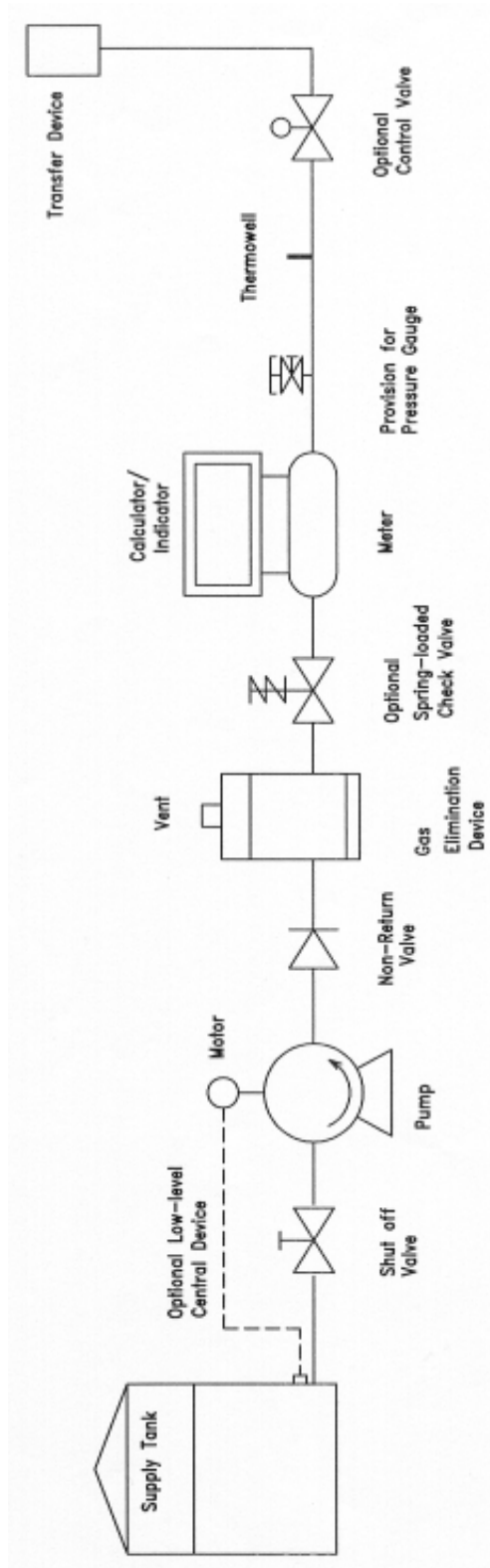
- $\pm(0.01 \times \text{Minimum Measured Quantity})$ litres for systems without a hose reel; and
- $\pm(0.02 \times \text{Minimum Measured Quantity})$ litres for systems with a hose reel.

Elimination of Air or Gas

The maximum permissible errors applicable for the elimination of air or gas are:

- $\pm 0.5\%$ for liquids having a dynamic viscosity not exceeding 1 mPa.s (e.g. petrol);
- and
- $\pm 1\%$ for liquids having a dynamic viscosity exceeding 1 mPa.s (e.g. kerosene).

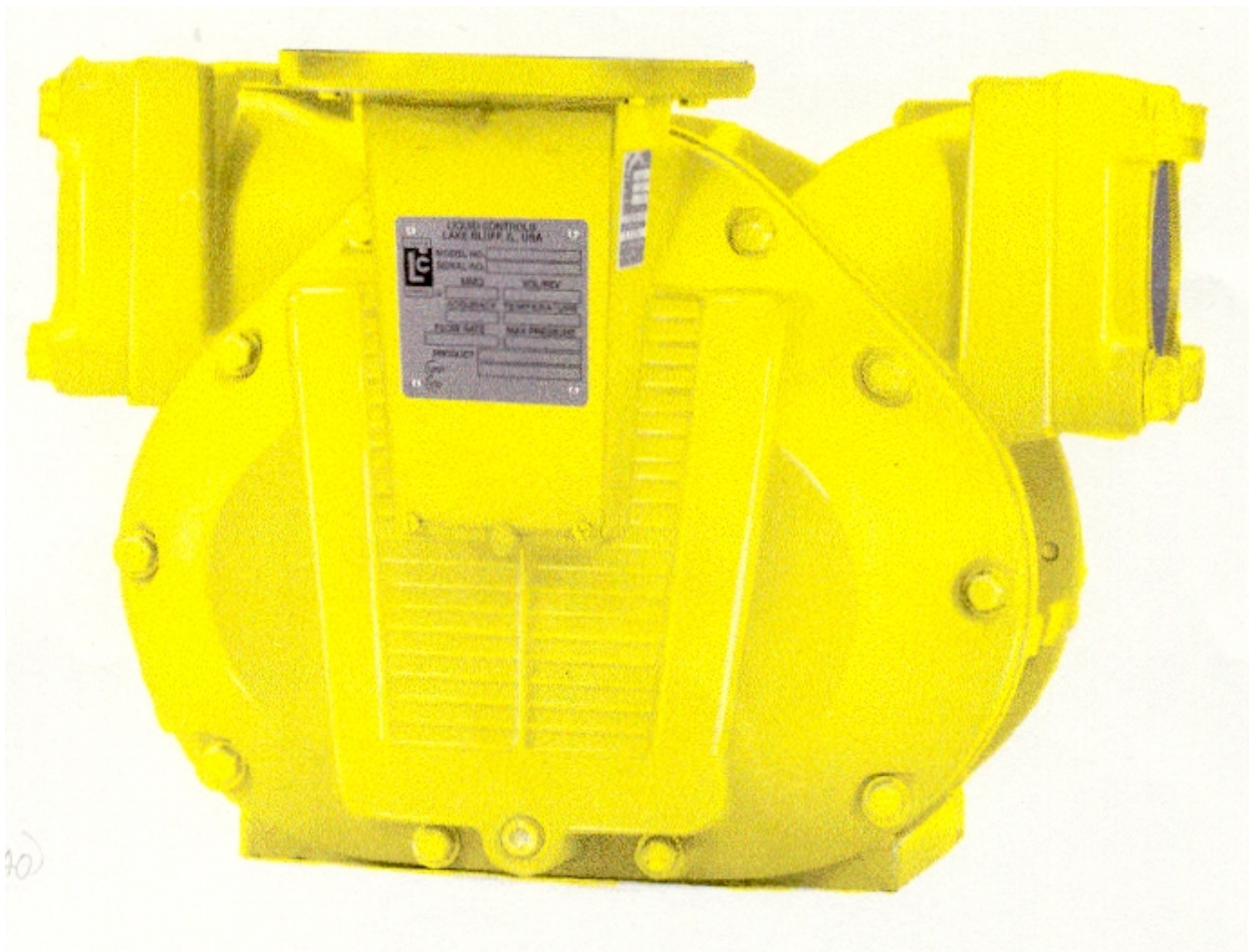
FIGURE 5/6B/204 - 1



Typical Liquid-measuring System

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FIGURE 5/6B/204 - 2



Liquid Controls Model M-40-1 Meter

FIGURE 5/6B/204 - 3



Veeder-Root 788* Series Zero-start Indicator

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FIGURE 5/6B/204 - 4



Veeder-Root 7890 Series Indicator With Printer and Pre-set Device