



Australian Government
Department of Industry and Science

National Measurement Institute

Supplementary Certificate of Approval

NMI S170C

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.

Acme Model 6000 Control System for Liquid-measuring Systems

submitted by Acme Fluid Handling Pty Ltd
 32 Greens Road
 Dandenong VIC 3175

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 **1/07/17**, and then every 5 years thereafter.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern approved – certificate issued	13/06/07
1	Pattern reviewed & updated – variants 1& 2 approved – certificate issued	27/09/12
2	Pattern & variant 2 amended (software versions) – certificate issued	7/08/15

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI S170C' and only by persons authorised by the submitter.

Instruments incorporating a component purporting to comply with this approval shall be marked 'NMI S170C' 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*.



Dr A Rawlinson

TECHNICAL SCHEDULE No S170C

1. Description of Pattern **approved on 13/06/07**

An Acme model 6000 controller/indicator (Figure 1) for use with compatible (#) approved liquid-measuring systems in vehicle-mounted installations.

(#) 'Compatible' is defined to mean that no additions/changes to hardware/software are required for satisfactory operation of the complete system including all checking facilities.

1.1 Field of Operation

The field of operation is determined by the following characteristics:

- Maximum input pulse rate 2500 Hz
- Linearity correction facility maximum input pulse rate 2500 Hz
- Input voltage range:
 - for the calculator/indicator 12 V to 28 V DC
 - for the printer 20.4 V to 28.6 V DC
- Environment temperature range -10°C to 55°C (i.e. Class N)
- Liquid temperature range:
 - liquids except anhydrous ammonia -10°C to 50°C
 - anhydrous ammonia 0°C to 40°C
- Density range for volume conversion to 15°C:
 - for generalised products and crude oils 0.610 to 1.076 kg/L
 - for LPG 0.500 to 0.600 kg/L
 - for anhydrous ammonia 0.6386 to 0.5795 kg/L
- Accuracy class
 - for generalised petroleum products Class 0.5
 - for LPG Class 1.0

The calculator/indicator has two output sockets for the connection of auxiliary devices such as printer(s), and/or a computer for retrieving data from the calculator/indicator.

1.2 Design/Features

The Acme model 6000 calculator/indicator (Figure 1) has a liquid crystal display and is approved for use with Acme version Sr.1.180 or Sr.1.212 or **1.2xxx** software.

Instruments may be fitted with a batch pre-set facility, and have the following displays:

- (i) Volume display (re-settable) programmable in either:
 - 0.1 L to 99999.9 L; or
 - 1 L increments to 999999 L.
- (ii) Totaliser: 999999 in 1 L or 10 L increments.

1.3 Set-up Functions

The following functions are accessed by pressing the calibration switch situated at the back of the calculator/indicator and concealed by a cover fixed by a sealed screw.

- Density setting
- Reset of totals
- K-factor
- Linearity factors
- Temperature calibration
- Temperature conversion product selection
- Vehicle identification number

1.4 Non-linearity Correction Facility

The k-factor can be set within the range 0.0001 to 50,000 pulses/litre (p/L). When the linearity correction facility is enabled, up to 10 k-factors can be entered as a function of frequency in the range 0 to 2.5 kHz generated by the measurement transducer.

1.5 Batch Pre-set Facility

The batch pre-set can be changed by first pressing the DISPLAY button; the word PRESET will appear on the calculator/indicator followed by the current stored pre-set value. While the stored value is being displayed press the PRESET button; the calculator/indicator is now in 'edit' mode and the pre-set value can be changed. Once the desired pre-set value is entered, press the DISPLAY button to exit the 'edit' mode. The calculator/indicator will display the word SET indicating that the batch pre-set has changed. The maximum pre-set value is 99999.9 in 0.1 litre increments.

NOTE: The pre-set facility is not for trade use.

1.6 Volume Conversion for Temperature Facility

- (i) For the products listed below, the electronic volume conversion for temperature facility may be enabled to convert the measured volume to volume at 15°C. The conversion is based on the following ASTMIP- API Petroleum Measurement Tables, metric editions:
 - Table 54 for LPG;
 - Table 54B for Generalised Petroleum Products; or
 - Table 54A for Crude Oils.
- (ii) For anhydrous ammonia, the electronic volume conversion for temperature facility may be enabled to convert the measured volume to volume at 15°C (or mass). The calculator/indicator can be configured to indicate in volume (L) or mass (kg). The volume conversion factors for temperature and the density applicable to the measurement are given in Tables 1 and 2 attached herein.

NOTE: A printer is mandatory when the volume conversion for temperature facility is activated. When the volume conversion facility is not in use, a printer is optional.

1.7 Temperature Transmitter

For temperature measurement applications, an Acme model TP100 or TP100FP (with flame proof head) 100 ohm RTD transmitter temperature probe is used.

1.8 Pulse Generator

The 6000 controller/indicator is approved for use with an Acme model EPU 200 pulse generator or any other compatible (#) approved measurement transducer. The pulse generator is approved for a maximum frequency output of 87.5 Hz, i.e. a pulse rate of 15 pulses per shaft revolution of the pulse generator. The shaft speed of the pulse generator is 350 revolutions per minute. The pulse generator is also described in the documentation of approval NMI S189B.

The 6000 calculator/indicator is also approved for use with a compatible (#) approved Acme turbine flowmeter or any other compatible (#) approved measurement transducer.

1.9 Printer

The 6000 calculator/indicator may be connected to an Epson model TM 295 printer or equivalent (*) which operates on a nominal 24 volts DC supply, for providing the delivery details and the manually-entered density for which the conversion device is set.

(*) '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.

NOTE: In case of 12 V vehicle installations, an additional power supply is necessary for the printer. The power supply may be a simple voltage doubler or equivalent.

1.10 Flow Control Valve

Any compatible (#) solenoid-operated flow control valve may be located downstream of the flowmeter, and interfaced to the instrument for controlling the delivery process and to stop measurements in the event of errors detected by the checking facility.

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

1.11 Checking Facilities

The 6000 calculator/indicator incorporates the following checking facilities:

- When the transducer is disconnected from the calculator/indicator or it is out of quadrature, 'error 13' will be displayed on the calculator/indicator;
- If the temperature or the density is out of range, 'error 12' will be displayed.
- If the printer is disconnected, 'Co.Err' will be displayed.
- If the printer is out of paper, 'PAPER' will be displayed.

- A display check function can be initiated by pressing the TEST button, which causes all segments to turn on and then after 5 seconds the indication will return to the last volume delivered.
- The indication is retained on power failure. The totaliser value is stored in the non-volatile memory. When power is restored, the printer (if connected) will automatically print the last delivered volume.

1.12 Verification Provision

Provision is made for the application of a verification mark.

1.13 Sealing Provision

Provision is made for access to the calibration adjustments to be sealed by as shown in Figure 1.

1.14 Markings and Notices

Instruments are marked with the following data, together in one location:

Pattern approval sign	NMI S170C
Manufacturer's name or mark	Acme
Manufacturer's designation (model)
Serial number
Year of manufacture
Accuracy class
Operating (air) temperature range (or Environmental class	-10°C to 50°C class N)
Liquid temperature range (*)°C to ...°C

- (*) Required for anhydrous ammonia when volume conversion for temperature is activated.

When the volume conversion for temperature facility is activated, the indicator reading face shall be marked 'Reference temperature 15°C' or 'Litres at 15°C'.

The minimum measured quantity specified for the liquid-measuring system is marked on the face of the indicator in the form 'Minimum Delivery 20 L'. Alternatively, instruments can be programmed with a minimum pre-set value that is equal to or greater than the minimum measured quantity specified for the liquid-measuring system.

2. Description of Variant 1

approved on 13/09/12

The model 6000 calculator/indicator may be connected to an Epson printer or equivalent (*) and a hand-held computer using software version 1212 or 1.25xxx.

The hand-held computer may be used to change the density setting. The software won't allow a delivery to be started until the density setting has been received from the computer.

- (*) '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.

3. Description of Variant 2

approved on 13/09/12

The model 6000 calculator/indicator may be connected to a Zebra model GX420D printer or a Blaster or a Blaster LX, or equivalent (*) using software version 1.240 or **1.27xxx** and which operates on a nominal 24 volts DC supply, for providing the delivery details and the manually-entered density for which the conversion device is set.

(*) '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.

NOTE: In case of 12 V vehicle installations, an additional power supply is necessary for the printer. The power supply may be a simple voltage doubler or equivalent.

TEST PROCEDURE No S170C

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. 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 applicable are those specified below and those applicable to the fuel dispensers to which the instrument approved herein is fitted, as stated in the approval documentation for the fuel dispensers or in Schedule 1 of the *National Trade Measurement Regulations 2009*.

Tests

To view the software version number:

1. Press the 'display' key until '-CoDE-' is displayed.
2. The word CODE will briefly be displayed on the indicator followed by the software version number. The software version number shall be visible for approximately five seconds before the display returns to volume display.

The maximum permissible errors applicable are those specified below and those specified for the flow metering system in which the pattern is fitted, as stated in the approval documentation for the system.

For checking the linearity correction facility, refer to the operating manual.

Recommended Procedure For Systems With Volume Conversion Facility Enabled.

1. Carry out not less than three deliveries.
2. Record the displayed volume at 15°C (converted volume), and provided that the DISPLAY feature has been enabled, use the DISPLAY button to view and record the following:
 - volume at operating conditions (i.e. the unconverted volume);
 - density setting; and
 - average temperature of the liquid.
3. Use the appropriate volume conversion for temperature tables and apply the conversion factor to the displayed unconverted volume to obtain the calculated converted volume.
4. Check that the density setting is within ± 0.001 kg/L of the density measured by a reference hydrometer for accuracy class 0.5 applications, and ± 0.002 kg/L for class 1.0 applications.
5. Check that the displayed average temperature of liquid is within $\pm 0.5^\circ\text{C}$ of the temperature measured by a reference thermometer (applicable to both accuracy class 0.5 and class 1.0 applications).
6. Check that the calculated converted volume and the converted volume obtained from the reference standard equipment is within the maximum permissible errors specified for the flowmeter.
7. Check that the converted volume displayed by the calculator/indicator is within $\pm 0.4\%$ for accuracy class 1.0 applications, and $\pm 0.2\%$ for class 0.5 applications, of the calculated converted volume.

TABLE 1 – ANHYDROUS AMMONIA

Conversion Factors to 15°C

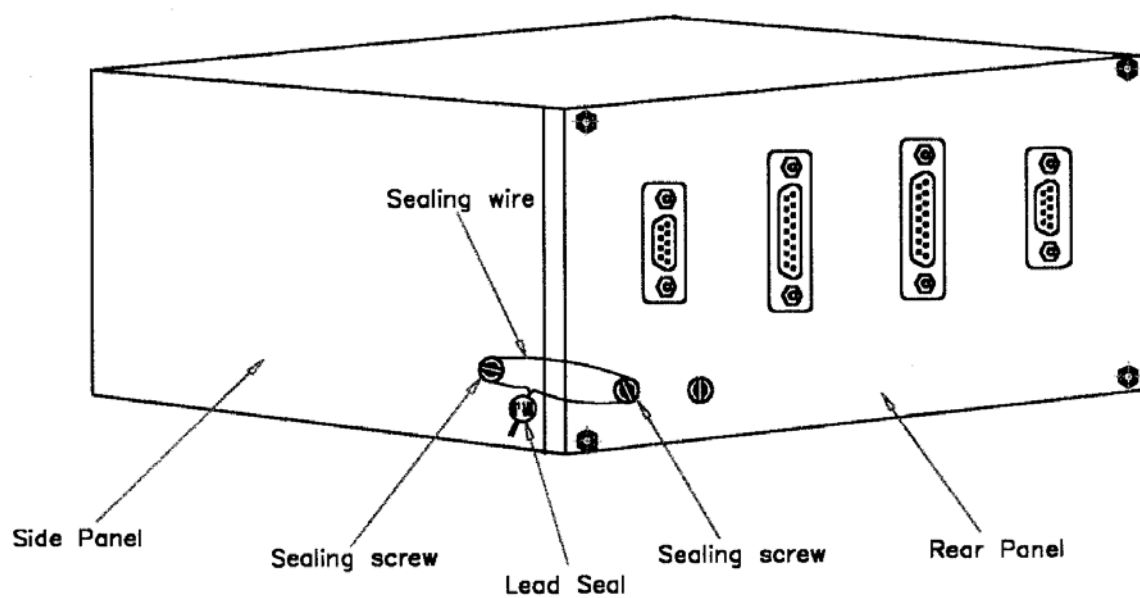
Degrees °C	0	0.2	0.4	0.6	0.8
0	1.0341	1.0336	1.0332	1.0327	1.0323
1	1.0318	1.0314	1.0309	1.0305	1.0301
2	1.0296	1.0292	1.0287	1.0283	1.0278
3	1.0274	1.0269	1.0265	1.0260	1.0256
4	1.0252	1.0247	1.0243	1.0238	1.0234
5	1.0229	1.0225	1.0220	1.0216	1.0211
6	1.0207	1.0202	1.0197	1.0193	1.0188
7	1.0184	1.0179	1.0175	1.0170	1.0166
8	1.0161	1.0157	1.0152	1.0148	1.0143
9	1.0138	1.0134	1.0129	1.0125	1.0120
10	1.0116	1.0111	1.0106	1.0102	1.0097
11	1.0093	1.0088	1.0083	1.0079	1.0074
12	1.0070	1.0065	1.0060	1.0056	1.0051
13	1.0047	1.0042	1.0037	1.0033	1.0028
14	1.0023	1.0019	1.0014	1.0009	1.0005
15	1.0000	0.9995	0.9991	0.9986	0.9981
16	0.9977	0.9972	0.9967	0.9963	0.9958
17	0.9953	0.9948	0.9944	0.9939	0.9934
18	0.9930	0.9925	0.9920	0.9915	0.9911
19	0.9906	0.9901	0.9896	0.9892	0.9887
20	0.9882	0.9877	0.9873	0.9868	0.9863
21	0.9858	0.9853	0.9849	0.9844	0.9839
22	0.9834	0.9829	0.9825	0.9820	0.9815
23	0.9810	0.9805	0.9801	0.9796	0.9791
24	0.9786	0.9781	0.9776	0.9771	0.9767
25	0.9762	0.9757	0.9752	0.9747	0.9742
26	0.9737	0.9732	0.9728	0.9723	0.9718
27	0.9713	0.9708	0.9703	0.9698	0.9693
28	0.9688	0.9683	0.9678	0.9673	0.9668
29	0.9664	0.9659	0.9654	0.9649	0.9644
30	0.9639	0.9634	0.9629	0.9624	0.9619
31	0.9614	0.9609	0.9604	0.9599	0.9594
32	0.9589	0.9584	0.9579	0.9574	0.9569
33	0.9563	0.9558	0.9553	0.9548	0.9543
34	0.9538	0.9533	0.9528	0.9523	0.9518
35	0.9513	0.9508	0.9503	0.9497	0.9492
36	0.9487	0.9482	0.9477	0.9472	0.9467
37	0.9461	0.9456	0.9451	0.9446	0.9441
38	0.9436	0.9430	0.9425	0.9420	0.9415
39	0.9410	0.9404	0.9399	0.9394	0.9389
40	0.9384				

TABLE 2 – ANHYDROUS AMMONIA

Density in kg/m³

Degrees °C	0	0.2	0.4	0.6	0.8
0	638.6	638.3	638.0	637.7	637.5
1	637.2	636.9	636.7	636.4	636.1
2	635.8	635.6	635.3	635.0	634.7
3	634.5	634.2	633.9	633.6	633.3
4	633.1	632.8	632.5	632.2	632.0
5	631.7	631.4	631.1	630.9	630.6
6	630.3	630.0	629.7	629.5	629.2
7	628.9	628.6	628.3	628.1	627.8
8	627.5	627.2	626.9	626.7	626.4
9	626.1	625.8	625.5	625.2	625.0
10	624.7	624.4	624.1	623.8	623.5
11	623.3	623.0	622.7	622.4	622.1
12	621.8	621.6	621.3	621.0	620.7
13	620.4	620.1	619.8	619.6	619.3
14	619.0	618.7	618.4	618.1	617.8
15	617.5	617.3	617.0	616.7	616.4
16	616.1	615.8	615.5	615.2	614.9
17	614.6	614.4	614.1	613.8	613.5
18	613.2	612.9	612.6	612.3	612.0
19	611.7	611.4	611.1	610.8	610.6
20	610.3	610.0	609.7	609.4	609.1
21	608.8	608.5	608.2	607.9	607.6
22	607.3	607.0	606.7	606.4	606.1
23	605.8	605.5	605.2	604.9	604.6
24	604.3	604.0	603.7	603.4	603.1
25	602.8	602.5	602.2	601.9	601.6
26	601.3	601.0	600.7	600.4	600.1
27	599.8	599.5	599.2	598.9	598.6
28	598.3	598.0	597.7	597.4	597.1
29	596.8	596.5	596.1	595.8	595.5
30	595.2	594.9	594.6	594.3	594.0
31	593.7	593.4	593.1	592.8	592.4
32	592.1	591.8	591.5	591.2	590.9
33	590.6	590.3	590.0	589.6	589.3
34	589.0	588.7	588.4	588.1	587.8
35	587.4	587.1	586.8	586.5	586.2
36	585.9	585.6	585.2	584.9	584.6
37	584.3	584.0	583.6	583.3	583.0
38	582.7	582.4	582.0	581.7	581.4
39	581.1	580.8	580.4	580.1	579.8
40	579.5				

FIGURE S170C – 1



Acme Model 6000 Controller/Indicator (Including Sealing)

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