



The National Weights & Measures Laboratory

**TEST CERTIFICATE
NUMBER GB-1116**

Issued by: National Weights and Measures Laboratory
Stanton Avenue
Teddington
Middlesex TW11 0JZ
United Kingdom

Notified Body Number 0126

In accordance with The equipment has been examined against the requirements of OIML R117 Measuring systems for liquids other than water.

Applicant: Veeder Root
125 Powder Forest Drive
PO Box 2003
Simsbury
Connecticut
USA

In respect of: The model of an electronic meter register for meter measuring systems
Manufacturer: Veeder Root
Type: EMR³

Characteristics: Suitable for the volume and price calculation, temperature correction and indication of quantities of liquid passing through a meter.

Documentation: The National Weights and Measures Laboratory holds documents appertaining to this test certificate.

Remarks: The EMR³ electronic meter register has been tested and found to comply with OIML R117. A summary of the tests performed in support of this Test Certificate is provided in the Appendix to the Descriptive Annex.

Signature: *M. Fortune*
M. Fortune
for Chief Executive
National Weights and Measures Laboratory

Reference: STD 10262

Date: 20 December 2001

TEST CERTIFICATION NO GB-1116

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TEST CERTIFICATION NO GB-1112

Descriptive Annex

1 INTRODUCTION

A Veeder Root EMR3 electronic register for use with meter measuring systems was examined for conformance to OIML International Recommendation for Measuring Systems for Liquids Other than Water, R117, Edition 1995 (E). Performance testing was carried out by various test houses, all of which are accredited by accreditation bodies that have international mutual recognition agreements. The test results are summarised in Appendix 2.

2 DESCRIPTION

2.1 The EMR3 system replaces mechanical registers, calibration gears and/or adjuster mechanisms and manual receipts with an automated system. The EMR3 system comprises of the Register Head (display), the Interconnect Box and a printer. The system works in conjunction with a meter to accurately measure liquid deliveries, control liquid flow and print priced receipts. It is electrically powered by a 24 V dc supply.

2.2 EMR3 Register Head (Display)

Electronic pulses from the meter may be passed to the EMR3, or it may be fitted with an optional internal pulser unit mechanically linked to the meter. The EMR3 processes the pulses, converting them into volume using stored calibration values. The unit may also calculate the cost and tax of the delivery. Up to 50 transaction records may be stored in non-volatile memory. The results of the delivery are displayed on the EMR3 and may also be printed on a remote printer. The Head may be fitted with an optional alphanumeric keypad for ease of data entry.

Temperature compensation may also be effected using an optional temperature probe. An approved temperature correction algorithm is stored in the EMR3 for automatic correction when in the temperature correction mode.

2.3 EMR3 Interconnect Box

The Interconnect box provides intrinsically safe power to the register and it is also the control interface between the register and the rest of the measuring system. Internal relays interface the system electronics to the system pneumatics.

2.4 Pulser

The internal pulser is an optical pulser manufactured by Oak Grigsby (USA), part number 94Q100-B3-00350.

Other internal pulsers or direct pulse inputs may be used provided the Register Head is recalibrated using instruments traceable to national metrological standards.

2.5 Electronic Temperature Probe

This is a two-wire thermistor having a sensitivity of ± 0.2 °C, which is used as an associated measuring instrument. It is manufactured by US Sensor Corporation and has part number USP2119.

Other temperature probes may be used in place of the above thermistor provided they meet the accuracy requirements of OIML R117 paragraph 2.7.2.

2.6 Printer

The printer is an Epson TM-U295 slip printer. It is used for printing delivery tickets showing the date and time of a delivery, the ticket number, the quantity delivered, the price and other operator entered details. The nature and format of the ticket record is set up using the Register menu system.

Any simple recipient printer may be used in place of the Epson TM-U295 printer if:

- i. it bears the CE mark for conformity to the EMC Directive 89/336/EEC;
- ii. it is not capable of transmitting any data or instructions into the EMR3 other than for releasing the printout, checking for correct data transmission;
- iii. it prints delivery results and other data as received from the EMR3 without any modification or further processing.

3 OPERATION

Pricing and set-up information are entered into the Register Head using the Head keyboard or the optional alphanumeric keypad. When START is pressed, the Interconnect Box outputs signals to various components of the system to control their integrated operation.

The rotary motion of the meter is transformed into electrical pulses by the pulser mounted inside the Head. The Head converts these pulses into volume using the stored calibration data. At the same time, it corrects the volume to standard temperature if the temperature correction mode is enabled. When the desired quantity of liquid has been measured and if the preset mode is enabled, the Head signals the Interconnect Box to stop the liquid flow. Alternatively, flow can be stopped by pressing the FINISH button.

If the 'enable printer' function is enabled, a ticket is automatically printed when the FINISH button is pressed, otherwise the transaction is stored. The delivery is terminated by pressing FINISH a second time.

4 TECHNICAL CHARACTERISTICS

System Power	10 to 30 V at 5 amps
Operating Temp	-40 to +70 C

5 INTERFACES

5.1 The EMR3 Register Head has the following interfaces:

- a. Interconnection Box (RS 485)
- b. Temperature probe

5.2 The Interconnection Box has the following interfaces:

- a. Register Head (RS 485)
- b. Printer (RS 485)
- c. Power Supply

6 TESTING

The results of testing against the general requirements of OIML R117 are given at Appendix 1. The results of testing against the requirements of OIML R117 Annex are given at Appendix 2. The EMR3 complies with all the relevant requirements.

7 SOFTWARE

7.1 Software Version Number

7.1.1 Register Head 349785-001-XXX

7.1.2 Interconnect Box 349784-001- XXX

7.1.3 The legally relevant software, as represented by the middle section (001) in the above version numbers, may not be changed without the prior approval of the National Weights and Measures Laboratory. XXX represents the version number pertaining to the manufacturer's part of the software and may be freely altered.

7.2 Software security

Recalibration and the amendment of calibration constants, labels, etc, may only be done when in the EMR3 Register Head is in the C&C mode. Entry to the C&C mode for amendment is accomplished by opening a microswitch housed inside the sealed Register Head. Alternatively, the microswitch may be replaced by inserting a wire link in the terminal block also inside the Head.

8 ADJUSTMENT AND SEALING

8.1 Calibration Factor

Calibration is effected in the C&C mode and may be done manually or automatically. Additionally, calibration may be done at each of 8 different flow rates. The number entered scales the pulses for the volume metered. After calibration, this number cannot be altered without breaking the seal on the Register Head.

8.2 Temperature correction

The temperature correction algorithm is stored in the Register Head and is not accessible by normal means. The temperature probe is calibrated at 0°C via the C&C mode with the probe immersed in a water/ice mixture. After calibration, this setting cannot be altered without breaking the seal on the Register Head.

8.3 Sealing

8.3.1 The securing mark may be either:

- A mark of the manufacturer and/or the manufacturer's agent, or
- An official mark of a verification officer.

8.3.2 The retaining screws securing the lid of the Register Head are drilled through, wired together and a lead seal applied. The Interconnect Box is secured likewise.

9 ILLUSTRATIONS

- Figure 1 EMR3 Register Head
Figure 2 EMR3 Interconnect Box
Figure 3 Temperature probe
Figure 4 Printer

10 TEST CERTIFICATE HISTORY

ISSUE No.	DATE	DESCRIPTION
GB-1116 1 (initial issue)	20 December 2001	Test certificate first issued.
GB-1116 2	29 July 2002	Correction :- 'X' inserted in '+' column for item A.4.10, page 29



Figure 1 EMR³ Register Head

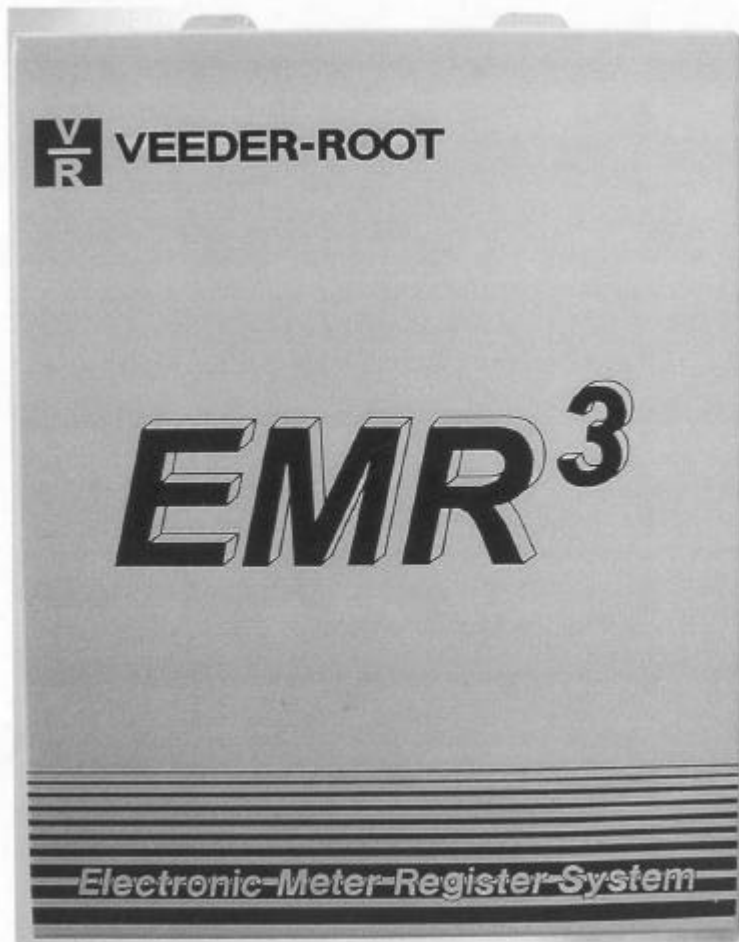


Figure 2 EMR3 Interconnect Box



Figure 3 Temperature probe



Figure 4 Printer

**APPENDIX 1 TO DESCRIPTIVE ANNEX
OF NWML TEST CERTIFICATE GB-1116**

OIML R117 CHECKLIST

Measuring Instrument: Veeder Root EMR3 – road tanker electronic register

Software Version Numbers

Head no: 349785-001-XXX
IB no: 349784-001-XXX

Note: Item numbering below refers to OIML R117 Measuring systems for liquids other than water.

+	-	Meaning
x		if the instrument has passed the test
	x	if the instrument has failed
/	/	if the test is not applicable

	Requirement	+	-	Comments
Clause 2	GENERAL PROVISIONS			
2.2	Ancillary Devices			
2.2.1	Primary indications are accessible to the parties interested in a transaction up to the settlement of the transaction.	X		
2.2.3	Uncontrolled ancillary devices which display a measurement to the user shall bear a legend which is clearly visible to the user. Such a legend shall be present on each printout likely to be made available to the customer	/	/	
2.3	Field of Operation			
	Markings applied legibly and indelibly on the dial of the indicating device or on a special data plate	X		
	Pattern approval sign			
	Manufacturer's identification mark or trade mark designation	X		
	Serial number	X		
	Year of manufacture	X		
	minimum measured quantity (MMQ)	/	/	Depends on meter attached
	Maximum flow rate (Qmax)	/	/	
	Minimum flow rate (Qmin)	/	/	
	Maximum pressure	/	/	
	Minimum pressure	/	/	
	Temperature range	X		-40 to +70°C
	Accuracy class if other than 0.5	X		Depends on accuracy of temperature probe fitted
	Environmental class (B,C or I)	X		Class I
	Minimum downstream pressure (meters only)	/	/	

	Requirement	+	-	Comments
2.3.2	a. The format of the minimum measured quantity shall be $1,2,5 \times 10^n$.	/	/	
	b. The minimum measured quantity of a measuring system shall not be less than the largest minimum measured quantity of any one of its constituent elements.	/	/	
2.3.3	The maximum flowrate of the measuring system shall normally be equal to at least 4 times the minimum flowrate of the meter	/	/	
2.3.4	a. The field of operation of a measuring system shall be within the fields of measurement of each of its constituent elements.	/	/	
	b. When 2 or more meters are mounted in parallel, the limiting flowrates (Q_{max} , Q_{min}) are taken into consideration to verify if the measuring system is within the specification.	/	/	
2.3.1(2.19 .1)	Markings	/	/	
	Markings applied legibly and indelibly on the dial of the indicating device or on a special data plate	/	/	
	Pattern approval sign	/	/	
	Manufacturer's identification mark or trade mark designation			
	serial number			
	year of manufacture			
	minimum measured quantity (MMQ)	/	/	
	maximum flow rate (Q_{max})	/	/	
	minimum flow rate (Q_{min})	/	/	
	maximum pressure	/	/	
	minimum pressure liquids	/	/	
	temperature range	/	/	
	Accuracy class, if other than 0.5	/	/	
	Environmental class (B,C or I)	/	/	
	minimum downstream pressure	/	/	
2.19.3	When volume at base conditions is indicated, these base conditions are clearly mentioned in the vicinity of the result of measurement, in the form: $T_b = \dots \text{ }^\circ\text{C}$ (or K) $P_b = \dots \text{ Mpa}$ (or kPa or Pa or bar)	X		Label attached under the display stating the reference temperature.
2.7	Converted Indications			
2.7.1	The magnitude of the maximum permissible errors on a conversion device verified separately shall not be less than the greater of <ul style="list-style-type: none"> • $\frac{1}{2}$ scale interval of the indicating device for converted indications • half of the value corresponding to the minimum specified volume deviation 	/	/	

	Requirement	+	-	Comments
2.7.2	Accuracy of associated measuring instruments	X		
2.7.3	The maximum permissible error for the calculation of each characteristic quantity of the liquid = 2/5 value in 2.7.2. It shall not be less than ½ scale interval of the indicating device for converted indications	/	/	
2.7.4	Maximum permissible errors - converted mass indication: a. Meter. MPE = $[b^2=(A-B)^2]^{1/2}$ where A & b are specified in Table 2	/	/	
	Measuring System. Line A of Table applies	/	/	
	The MPE shall not be less than the mass corresponding to the minimum specified deviation.	/	/	
2.8	Maximum permissible errors on calculators			
	MPE = 1/10 MPE defined in line A of Table 2 The MPE shall not be less than ½ scale interval of the measuring system			
2.9	Indications			
2.9.1	The volume indication is cubic millimetres, centimetres, decimetres, metres or in litres, kilolitres, or megalitres. Mass is indicated in grams, kilograms or tonnes.	X		Indicated as "Litres"
	The symbol or the name of the unit appears in the immediate vicinity of the indication.	X		
2.9.2	Measuring systems shall be provided with an indicating device giving the quantity measured at metering conditions. If fitted with a conversion device, the measuring system shall be fitted (in addition to the device indicating measurements at metering conditions) with a device indicating measurements at base conditions.	/	/	See 2.9.3
2.9.3	If one display is used for the indicated volume at metering conditions and volume at base conditions, the nature of the displayed quantity is clear.	X		Toggle between quantity at base & metered conditions using ± buttons. Base volume reading is indicated by a thermometer symbol
2.9.5	Difference between volume indications of more than one indicating device ≥ 1 scale interval of indicating device with the greatest scale interval. The primary indications and scale intervals on indicating and printing devices are identical.	/	/	

	Requirement	+	-	Comments
2.9.6	Use of the same indicating device for several measuring systems.	/	/	
2.10.1	The gas elimination device should restrict errors due to air or gases to: <ul style="list-style-type: none"> • 0.5% of the quantity measured for non-potable liquids and liquids with a viscosity not exceeding 1 mPa.s 	/	/	
	<ul style="list-style-type: none"> • 1% of the quantity measured for potable liquids and liquids with a viscosity exceeding 1 mPa.s 	/	/	
	This quantity need not be less than 1% of the minimum measured quantity	/	/	
2.10.2	Pumped flow - A gas separator shall be provided when the pressure at the pump inlet may fall below either the atmospheric pressure or the SVP of the liquid.	/	/	
2.10.3	Non-Pumped flow - If the pressure of the liquid is likely to be lower than the atmospheric pressure while remaining greater than the SVP, an appropriate device shall prevent entry of air into the meter.	/	/	
2.10.4	Viscous liquids (dynamic viscosity > 20 mPa.s at 20 °C) The pump shall be arranged so that the inlet pressure > atmospheric pressure.	/	/	
2.10.5	The gas removal pipe shall be sealed open if closure valve is manually operated.	/	/	
2.10.6	Anti-swirl device fitted?	/	/	
2.10.7.1	If the gas eliminator shuts down no measurement shall be possible until the air is eliminated.	/	/	
2.10.7.2	Operational limits for a gas elimination device specified?	/	/	
2.10.8	Special provisions applicable to gas separators	/	/	
2.10.8.1	Within the error limits of 2.10.1, a gas separator in a system without a gas indicator shall eliminate air under the following test conditions:	/	/	
	a. without air or gases, the measuring system shall operate at Q_{max} and P_{min} specified for the gas separator	/	/	
	b. (i) Any proportion of air by volume if separator $Q_{max} \leq 333$ L/min	/	/	
	(ii) 30% of air by volume (at atmospheric pressure) if separator $Q_{max} > 333$ L/min	/	/	
2.10.8.2	Within the error limits of 2.10.1, a gas separator in a system with a gas indicator shall eliminate air under the following test conditions:	/	/	
	a. without air or gases, the measuring	/	/	

	Requirement	+	-	Comments
	system shall operate at Q_{max} and P_{min} specified for the gas separator			
	b. (i) 20% of air for liquids (non-potable) with a viscosity ≤ 1 mPa.s	/	/	
	(ii) 10% of air for potable liquids and liquids with a viscosity > 1 mPa.s	/	/	
	The gas indicator must show air bubbles if: • the proportion of air $>$ above percentages	/	/	
	• the gas separator does not meet the mpe's	/	/	
2.10.9	Special provisions applicable to gas extractors	/	/	
	a. A gas extractor or special gas extractor shall remove pockets of air equal to MMQ (measured at atmos. pressure). mpe $\leq 1\%$ x MMQ	/	/	
	b. A special gas extractor shall continuously separate a volume of air mixed with the liquid equal to $5\% Q_{max}$	/	/	
2.11	Gas Indicator	/	/	
	Must be downstream of the meter	/	/	
	Can have a vent if it is a high point	/	/	
	No pipe may be connected to the vent			
2.13	Complete filling of the measuring system	/	/	
2.13.2	Variations in temperature on the pipework between the meter and the transfer point shall be $\leq 1\%$ MMQ due to variations in temp equal to: • $10\text{ }^{\circ}\text{C}$ - exposed pipes	/	/	
	• $2\text{ }^{\circ}\text{C}$ - insulated or underground pipes	/	/	
	The coefft of thermal expansion for the liquid shall be 1.10^{-3} per $^{\circ}\text{C}$	/	/	
2.14	Draining	/	/	
2.14.1	Empty hose systems - draining devices shall operate automatically for MMQ's $< 10,000$ L	/	/	
2.14.2	Full hose systems - the nozzle shall not retain a volume of liquid > 0.4 MSVD, particularly with viscous liquids	/	/	
2.15	Variations in the internal volume of full hoses	/	/	
	Increase in volume from a coiled hose, not under pressure, to an uncoiled hose, under pressure, ≤ 2 x MSVD, with no liquid flowing	/	/	
	If there is no hose reel, increase in volume \leq MSVD	/	/	
2.16	Branches & Bypasses	/	/	

	Requirement	+	-	Comments
2.16.1	The measured liquid must not be diverted downstream of the meter.	/	/	
2.16.2	In a system equipped with flexible pipes, a non-return valve shall be incorporated in rigid pipework immediately downstream from the selector valve.	/	/	
2.16.3	Any connections for bypassing the meter shall be closed by means of a blanking disk or double closing device with a monitoring valve in between.	/	/	
	They shall be sealed or have an automatic monitoring alarm.	/	/	
2.17	Control & Closing Mechanisms	/	/	
2.17.1	A flow-limiting device is required if supply conditions can overload the meter.	/	/	
2.17.2	The various positions of controls of multi-way valves shall be located by notches, stops, etc			
2.18	Various Provisions	/	/	
2.18.1	Any filters shall not disturb the measuring operation	/	/	
2.18.2	The means for LPG vapour recovery shall not create inaccuracy > mpe	/	/	
2.20	SEALING DEVICES AND STAMPING PLATE			
2.20.1	Seals are easily accessible and prevent access to components which allow alteration of the measurement result without damaging the seals including the stamping plate	X		
2.20.2	Seals are mechanical (e.g. wire and lead seal) or electrical (password protection).	X		Wire and lead seal applied to the bolts securing the lids of the Register and Interconnect Box.
Clause 3	REQUIREMENTS FOR ANCILLARY DEVICES OF A MEASURING SYSTEM			
3.1.1.3	GENERAL			
	The ratio between the maximum and the minimum flow rate (speed) of the meter/indicator is	/	/	
	<ul style="list-style-type: none"> At least equal to ten for specified liquids having a viscosity less than 20 mPa.s at measurement temperature, other than liquefied gases. 	/	/	
	<ul style="list-style-type: none"> ≥ five for specified liquids having a viscosity equal to or greater than 20 mPa.s and for meters for liquefied gases. 	/	/	
3.1.3	Sensor/Indicator Connections			
	The connections between the flow sensor and the indicating device are reliable and durable under rated operating conditions.	X		EMR3 Register Head may be fitted with an internal pulser physically linked to the meter.

	Requirement	+	-	Comments
3.1.4	Adjustment device			
	Modification via a simple command. If it is a digital device, then consecutive values of the ratio shall not differ by more than 0.0005 for class 0.3 and 0.001 for other classes.	X		
3.2	Volume Indicating Device			
3.2.1.1	Reading precise, easy and unambiguous by simple juxtaposition. Decimal sign clear.	X		
3.2.1.2	Scale interval: 1×10^n , 2×10^n or 5×10^n	X		
3.2.1.4	<ul style="list-style-type: none"> Continuous indicating device: MSVD \geq the larger of either 2 mm on the scale, or 1/5 of scale interval 	/	/	
	<ul style="list-style-type: none"> Discontinuous indicating device: MSVD \geq Volume corresponding to 2 scale intervals. 	/	/	Scale interval = 0.01 L.
3.2.2	Mechanical Indicating Device	/	/	
3.2.2.1	Element with graduation entirely visible (except element corresponding to the maximum range of the indicator): one revolution corresponds to 10^n authorised units of volume.	/	/	
3.2.2.2	Element with graduation entirely visible: one revolution of the element corresponds to scale intervals of the following element.	/	/	
3.2.2.3	Element with only part of graduation visible through a window (except first element) has discontinuous movement.	/	/	
3.2.2.4	The advance by one figure of any element having discontinuous movement is completed when the preceding element passes from 9 to 0.	/	/	
3.2.2.5	Window Dimension for the first continuous moving element is $\geq 1.5 \times$ (distance between two graduated scale marks).	/	/	
3.2.2.6	Width of scale mark is $\geq 1/4$ of scale spacing. Apparent scale spacing ≥ 2 mm. Figures height is ≥ 4 mm unless specified.	/	/	
3.2.3	Electronic Indicating Device			
	Continuous display of volume during the period of measurement	X		
3.2.4.2	Zero setting device makes the result disappear then display zeros only.	X		
3.2.4.3	No indication of any result during zeroing (other than the result to be zeroed or zeros).	X		
3.2.4.4	Continuous indicating device: residual indication after zeroing $\leq 1/2$ of MSVD.	/	/	
3.2.4.5	Discontinuous indicating device: indicate zero without any ambiguity.	X		
3.3	Price Indicating Device			

	Requirement	+	-	Comments
3.3.2	Unit price adjustable and indicated before measurement by a displaying device; unit price shall be valid for the whole transaction. If set from peripheral equipment, elapsed time between changing unit price and before next measurement starts: at least 5 secs.	X		Unit price is indicated before a measurement and continues to be indicated during delivery when in the price display mode. In the volume display mode, it is not displayed.
3.3.3	Provisions in class 3.2 relating to volume indicating devices apply to price indicating devices ie: (mutatis mutandis)			
(3.2.1.1)	Reading precise, easy and unambiguous by simple juxtaposition. Decimal sign clear.	X		
(3.2.2.4)	The advance by one figure of any element having discontinuous movement is completed when the preceding element passes from 9 to 0.	X		
(3.2.4.3)	No indication of any result during zeroing (other than the result to be zeroed or zeros).	X		
3.3.4	Currency unit or its symbol appears in the immediate vicinity of the indicating device.	X		States "pounds"
3.3.5	Zero setting devices of price indication and volume indication: zeroing of either of them automatically involves zeroing the other.	X		
3.3.6	<ul style="list-style-type: none"> Continuous indicating device: MSPD is \geq both the price corresponding to 2 mm on the scale and price corresponding to 1/5 of scale interval. This price shall not be less than 1p. 	X		
	<ul style="list-style-type: none"> Discontinuous indicating device: MSPD is \geq the price corresponding to 2 scale intervals. The scale interval shall not be less than 1p. 	/	/	Scale interval = 1p.
3.3.7	The difference between the indicated price and the price calculated from the unit price and the indicated volume \leq MSPD.	X		Zero error observed on testing
3.3.8	Continuous indicating device: residual indication after zeroing is \geq 1/2 of MSPD (not necessarily less than 1p).	/	/	
3.3.9	Discontinuous indicating device: After zeroing indicates zero without any ambiguity.	X		
3.4	Printing Devices			
3.4.1	Printed scale interval:	/	/	
	<ul style="list-style-type: none"> \geq smallest scale interval of the indicating devices 	/	/	
	<ul style="list-style-type: none"> Is of the same form as indicating device 	X		
	<ul style="list-style-type: none"> \leq to the MSVD or MSPD 	X		
3.4.2	All necessary units appear on the print docket.	X		

	Requirement	+	-	Comments
3.4.3	If connected to more than one measuring system: print identification of that system.	/	/	
3.4.4	If repetition of printing is possible: copies are marked clearly.	X		Marked "Duplicate ticket"
3.4.5	If volume determination by difference between two printed values: withdrawal of ticket during measurement impossible.	/	/	
3.4.6	If both printer and indicating device have zeroing facilities: when either device is zeroed the other (s) are automatically zeroed.	/	/	
3.4.8	Printed price scale interval: 1×10^n , 2×10^n or 5×10^n monetary unit, and not $> \text{MSPD}$.	X		
3.4.9	If a price-indicating device is not fitted, the difference between the printed price and the calculated price (from indicated volume) is \leq the MSPD.	/	/	
3.5	Memory Device			
3.5.3	It is possible to delete memorised data only when both the following conditions are met:			
	<ul style="list-style-type: none"> data are deleted in the same order as the recording order and the rules established for the particular application are respected 	X		Records are automatically deleted on a first in, first out basis when the register is full. Capacity = 200 records.
	<ul style="list-style-type: none"> deletion is carried out by special command 	/	/	Cannot delete records manually
3.5.4	It is impossible in normal use to modify stored values.	X		
3.6	Pre-Setting Device			
3.6.1	The pre-set quantity is indicated prior to the start of measurement.	X		
3.6.2	If several independent controls: scale interval corresponding to one control equals range of control of the next lower order.	/	/	
3.6.4	Figures of pre-setting display are clearly distinguishable from those of volume indicator	X		
3.6.5	Indication of the selected quantity during delivery remains unaltered or returns progressively to zero. For an electronic pre-setting device the pre-set value may be set via special commands, zero indication replaces this value prior to measurement.	X		Returns progressively to zero
3.6.6	Difference between the pre-set volume and the indicated volume is \geq the MSVD	/	/	Requires a complete hydraulic system
3.6.7	Unit of pre-set volume same as that of volume indicator Marking of unit of volume or its symbol on pre-setting mechanism	X		

	Requirement	+	-	Comments
3.6.8	Scale interval of pre-setting device \geq the scale interval of the indicating device	X		0.01 L (same)
3.6.10	(mutatis mutandis for price pre-setting devices)			
(3.6.4)	Figures of pre-setting display clearly distinguishable from those of price indicator	X		
(3.6.5)	Indication of the selected quantity during delivery remains unaltered or returns progressively to zero. For an electronic pre-setting device the pre-set value may be set via special commands provided a zero indication replaces this value prior to measurement.	X		The price preset sets a corresponding volume preset. During delivery, the volume preset decrements and controls the delivery. In the currency mode, during delivery, the preset price is replaced by the unit price.
(3.6.6)	Difference between the pre-set price and the indicated volume is \leq the MSPD	/	/	
(3.6.7)	Unit of pre-set price same as that of price indicator.	X		
	This unit or its symbol shall be marked on the pre-setting mechanism	X		
(3.6.8)	Scale interval of pre-setting device \geq scale interval of price indicator	X		
3.7	Conversion Device			
3.7.2	The calculation of the conversion factor shall be made according to the applicable International Recommendations or Standards (OIML R63) or other methods accepted for national use.	X		
3.7.3	The parameters that characterise the measured liquid shall be measured using associated measuring instruments. This is not necessary if their influence on the conversion factor is less than 1/10 of the mpe in 2.5.1.	X		
3.7.4	Associated measuring devices shall comply with applicable international recommendations & standards, and are within MPEs (2.7.2).	X		Temperature probe tested is accurate to $\pm 0.5^{\circ}\text{C}$ (Class 0.5)
3.7.5	Associated measuring devices are installed as close to the meter as possible. Changes due to location are ≥ 0.2 of the MPE for the system. These instruments do not effect the correct operation of the meter(s)	/	/	
3.7.6	All unmeasured parameters which are necessary for the conversion are stored in the calculator. These parameters can be indicated or printed.	X		
	A seal prevents the alteration of any mechanical conversion device which cannot print or display its unmeasured par	/	/	

	Requirement	+	-	Comments
3.7.7	In addition to the volume/mass/price at metering and base conditions, measured quantities (eg temperature, pressure density) shall be accessible for each measurement.	X		Temperature accessed via stored records.
	Scale intervals for density, pressure, temperature are $\leq 0.25.MPE$ for associated measuring instrument.	X		Temperature probe scale interval = $0.1^{\circ}C$. $0.25.mpe = 0.125^{\circ}C$
3.8	Calculator			
3.8	All parameters that are subject to legal control shall be present in the calculator at the beginning of the measurement operation	X		
3.8	If the calculator permits the coupling of peripheral equipment, and these are connected, the instrument continues to operate correctly. The metrological functions are incapable of being effected by this connection.	X		Temperature probe is hard-wired in.
Clause 4	SPECIFIC REQUIREMENTS FOR MEASURING SYSTEMS EQUIPPED WITH ELECTRONIC DEVICES			
4.1	General Requirements			
4.1.5	When a significant fault occurred and was detected by the checking facilities, the information relating to the measured volume contained within the instrument can be retrieved.			
4.2	Power Supply Device			
4.2.1	If flow is not interrupted during a principal power supply device failure, an emergency power supply device is provided by the system to safeguard all measuring functions during that failure.	/	/	
4.2.2	If 4.2.1 is not met, the data contained at the moment of failure is saved and displayable on an indicating device subject to legal metrology control unit transaction conclusion. The absolute MPE for the indication in this case is increased by 5% of the MMQ	X		
4.3	Checking Facilities			
4.3.2	Checking Facilities for the Measurement Transducer			
4.3.2.1	When each pulse represents an elementary volume, at least security level B defined by ISO 6551 is required.			
	Checking facilities of type P. Checking interval not exceeding the duration of measurement of amount of liquid equal to MSVD.			

	Requirement	+	-	Comments
	Possibility of testing the operation of checking facilities during pattern approval and verification by			
	<ul style="list-style-type: none"> • disconnecting the transducer; or 			
	<ul style="list-style-type: none"> • interrupting one of the sensor's pulse generators; or 	X		
	<ul style="list-style-type: none"> • by interrupting the electrical supply of the transducer 			
4.3.2.2	If an electromagnetic meter where signal aptitude is proportional to the instrument: type P or I. If type I, the checking occurs at least every 5 minutes.	/	/	
4.3.3	Checking facilities for the calculator			
4.3.3.1	Checking facilities for operation of type P or I, Checking interval for type I at least every 5 minutes or at each delivery for type I fuel dispensers	X		
4.3.3.2	Checking facilities for validity of calculation of type P. Existence of a means for controlling continuity of the calculation program.	/	/	
4.3.4	Checking facilities for indicating device			
4.3.4.1	Checking facilities of type P or if indication can be determined from other primary indication, type I.	/	/	
4.3.4.2	The checking facility for the indicating device shall include type I or P checking of the electronic circuits used for the indicating device. This checking shall meet the requirements in 4.3.1.2.			Does a) below
a)	Indicator checking tests for fuel dispensers:	/	/	
	<ul style="list-style-type: none"> • displaying all elements 	X		
	<ul style="list-style-type: none"> • blanking all elements 	X		
	<ul style="list-style-type: none"> • displaying "zeros" 	X		
	Minimum duration of each sequence: 0.75 sec	X		
b)	Another measuring system: as above or any other authentic test cycle which indicates all possible states for each element of the display.	/	/	
4.3.4.3	Possible during verification to test the operation of the checking facility by either:	/	/	
	<ul style="list-style-type: none"> • by disconnecting all or part of the indicating device or; 			
	<ul style="list-style-type: none"> • by an action which simulates a failure in the display, such as using a test button. 			

	Requirement	+	-	Comments
4.3.5	Checking facilities for ancillary device Checking facilities for type I or P. Checking includes presence of paper and of electronic control circuits. Possibility of testing the operation of checking facilities during pattern approval and verification (via a test button). Where action is a warning: given on or by the ancillary device.	X		If there is no paper in the printer, the current delivery can be completed
4.3.6	Associated measuring instruments: type P checking facility. (see clause 4.3.6 from document. 101 for examples).	X		Disconnecting temperature probe gives message "Temperature probe failure" if in temperature compensation mode.
Clause 5	REQUIREMENTS SPECIFIC TO CERTAIN TYPES OF MEASURING INSTRUMENTS	/	/	
5.1	Fuel dispensers	/	/	
5.1.4	Device for resetting the volume indicator to zero present. Height of figures of column indicator with zero setting device ≥ 10 mm. If price indicator, presence of zero setting device. Price indicator height ≥ 4 mm (as in 3.2.2.6).	/	/	
5.1.5	Next delivery inhibited until nozzle(s) replaced and indicator reset to zero.	/	/	
5.1.7	Any printing operation prevents the continuation of the delivery until a reset to zero has been performed. The printing operation does not change the quantity indicated on the indication device.	/	/	
5.1.8	Fuel dispenser interruptible.	/	/	
5.1.9	Minimum duration of operation of display after power failure ≥ 15 min continuously and automatically, or \geq min in one or several periods controlled manually during 1 hour after failure. Delivery interrupted by power failure: impossible to continue deliver.	/	/	
5.1.10	Delay time between measurement value and	/	/	
5.1.1.2	Hidden volume at the beginning of the delivery $\leq 2 \times$ MSVD hidden price at the beginning of the delivery $\leq 2 \times$ MSVD.	/	/	
5.2	Road tanker, low viscosity liquids (except potable liquids).	/	/	
5.2.7	If fitted with a ticket printing device: printing operation prevents the continuation of delivery until a reset to zero has been performed (except for devices determining the delivered volume from two consecutive indications).	/	/	

	Requirement	+	-	Comments
5.2.8.4	Measuring systems operated by means of gas pressure include a pressure gauge which indicates the pressure in the tank. The dial of this gauge indicates MPE range.	/	/	
5.4	SYSTEMS FOR LIQUEFIED GASES UNDER PRESSURE (not LPG dispensers)	/	/	
5.4.4	Temperature measuring devices are verified, positioned close to the meter and have a scale interval $\leq 0.5^{\circ}\text{C}$. Pressure measuring devices are verified and adequately sealed if necessary.	/	/	
5.6	Ship loading and pipeline systems	/	/	
5.6.1	The maximum to minimum flow rate ratio \leq that specified in 3.1.1.3 provided an automatic checking device is fitted to verify that the flow rate is within the restrictive measuring range. Type P checking device is used.	/	/	
5.6.3	Reverse flow of the liquid to be measured in the measuring system is prevented by a suitable device (unless otherwise approved).	/	/	
5.7	Fuel dispensers for liquefied gases under pressure (LPG)			
5.7.1	mutatis mutandis (fuel dispensers)	/	/	
(5.1.4)	Device for resetting the volume indicator to zero present. height of figures of volume indicator with zero setting device ≥ 10 mm if price indicator, presence of zero setting device. Price indicator height ≥ 4 mm (as in 3.2.2.6)	/	/	
(5.1.7)	Any printing operation prevents the continuation of the delivery until a reset to zero has been performed. The printing operation does not change the quantity indicated on the indication device.	/	/	
(5.1.8)	Fuel dispenser interruptible.	/	/	
(5.1.9)	Minimum duration of operation of display after power failure ≥ 15 min continuously and automatically, or ≥ 5 min in one or several periods controlled manually during 1 hour after failure	/	/	
	Delivery interrupted by power failure: impossible to continue delivery if power failure has lasted more than 15 seconds.	/	/	
(5.1.10)	Delay time between measurement value and indicated values ≤ 500 ms.	/	/	

	Requirement	+	-	Comments
(5.1.12)	Hidden volume at the beginning of the delivery $\leq 2 \times \text{MSVD}$. Hidden price at the beginning of the delivery $\leq 2 \times \text{MSPD}$.	/	/	
5.7	Fuel Dispensers for Liquefied Gases Under Pressure (LPG), (Continued)			
5.7.3	Temperature measuring devices are verified, positioned close to the meter and have a scale interval $\leq 0.5^\circ\text{C}$. Pressure measuring devices are verified and adequately sealed if necessary.	/	/	
5.7.5	Next delivery inhibited until nozzle(s) replaced and indicator reset to zero	/	/	
5.7.8	Safety features do not effect the instruments performance	/	/	
5.7.9	The system contains a conversion device. It is possible to verify separately the indications of volume at metering conditions and associated measuring instruments.	/	/	
5.7.10	Deliveries are automatically stopped or prevented from starting if the valves in the vapour return lines are closed. Unless the valves are sealed in the open position.	/	/	
5.8	SYSTEMS FOR THE REFUELLING OF AIRCRAFT			
5.8.1.3	The system is interruptible.	/	/	
5.8.2.1	mutatis mutandis fuel dispensers.	/	/	
(5.1.4)	Device for resetting the volume indicator to zero present Height of figures of volume indicator with zero setting device ≥ 10 mm. If price indicator, presence of zero setting device. Price indicator height ≥ 4 mm (as in 3.2.2.6).	/	/	
(5.1.5)	Next delivery inhibited until nozzle(s) replaced and indicator reset to zero.	/	/	
(5.1.6)	When maximum flow rate (Q_{\max}) ≤ 3.6 m ³ /h.MMQ ≤ 5 L	/	/	
(5.1.7)	Any printing operation prevents the continuation of the delivery until a reset to zero has been performed. The printing operation does not change the quantity indicated on the indication device.	/	/	
(5.1.8)	Fuel dispenser interruptible.	/	/	
(5.1.9)	Minimum duration of operation of display after power failure ≥ 15 min continuously and automatically, or ≥ 5 min in one or several periods controlled manually during 1 hour after failure. Delivery interrupted by power failure: impossible to continue delivery if power failure has lasted more than 15 s.	/	/	

	Requirement	+	-	Comments
(5.1.10)	Delay time between measurement value and indicated values ≤ 500 ms.	/	/	
(5.1.12)	Hidden volume at the beginning of the delivery $\leq 2 \times$ MSVD. Hidden price at the beginning of the delivery $\leq 2 \times$ MSPD.	/	/	
5.8.3.2	For aircraft refuelling tanker measuring systems: mutatis mutandis 5.2.7.	/	/	
(5.2.7)	If fitted with a ticket printing device: printing operation prevents the continuation of delivery unit a reset to zero has been performed (except for devices determining the delivered volume from two consecutive indications.	/	/	
5.9	BLEND DISPENSERS			
5.9.1	mutatis mutandis (fuel dispensers).	/	/	
(5.1.4)	Device for resetting the volume indicator to zero present. Height of figures of volume indicator with zero setting device ≥ 10 mm. If price indicator, presence of zero setting device. Price indicator height ≥ 4 mm (as in 3.2.6)	/	/	
(5.1.6)	When maximum flow rate (Q_{\max}) ≤ 3.6 m ³ /h, MMQ ≤ 5 L	/	/	
(5.1.7)	Any printing operation prevents the continuation of the delivery until a reset to zero has been performed. The printing operation does not change the quantity indicated on the indication device.	/	/	
(5.1.8)	Fuel dispenser interruptible.	/	/	
(5.1.9)	Minimum duration of operation of display after power failure ≥ 15 min continuously and automatically, or ≥ 5 min in one or several periods controlled manually during 1 hour after failure.	/	/	
	Delivery interrupted by power failure: impossible to continue delivery if power failure has lasted more than 15 s.	/	/	
(5.1.10)	Delay time between measurement value and indicated values ≤ 500 ms.	/	/	
(5.1.12)	Hidden volume at the beginning of the delivery $\leq 2 \times$ MSVD. Hidden price at the beginning of the delivery $\leq 2 \times$ MSPD.	/	/	
5.9.2	Start of next delivery impossible until nozzle(s) replaced and indicating device reset to zero.	/	/	
5.9.3	To permit compliance with the requirement in 5.9.4 or 5.9.5 to be verified, it is necessary:	/	/	
	<ul style="list-style-type: none"> For multigrade-dispensers to measure the volumes of both components. 	/	/	

	Requirement	+	-	Comments
	<ul style="list-style-type: none"> For petrol-oil-dispensers to measure either the volumes of oil and petrol or the volumes of oil and mixture. 	/	/	
	<ul style="list-style-type: none"> For both types to make the separate collection of both components feasible during verification. 	/	/	
5.9.4	For multigrade-dispensers the designations of the various mixtures being indicated as the ratio of volumes of the two components (for example 1:1), the real ratio of the volumes of two components are within the limits of $\pm 5\%$,	/	/	
	ie the real ratio $k_{\text{real}} = V_2/V_1$ of volumes of both components determined during the verification are equal to the nominal (indicated) ratio k_{nom} within the limits:	/	/	
	$k_{\text{min}} = k_{\text{nom}} - 0.05 k_{\text{nom}}$ and $k_{\text{max}} = k_{\text{nom}} + 0.05 k_{\text{nom}}$	/	/	
5.9.5	For petrol-oil-dispensers: If V_1 is the minority volume components in the mixture and V_2 the majority component, the real volumetric ratio related to the minority component, expressed as a percentage [$T = 100 \times V_1 / (V_1 + V_2)$], is equal to the nominal ratio within plus or minus:	/	/	
	<ul style="list-style-type: none"> 5% in relative value. 	/	/	
	<ul style="list-style-type: none"> 0.2% absolute, whichever is greater. 	/	/	
	In other words, T being the real volumetric ratio as a percentage, and T_{nom} the nominal volumetric ratio as a percentage, the following is satisfied:	/	/	
	<ul style="list-style-type: none"> $\geq T - T_{\text{nom}} \geq / T_{\text{nom}} \leq 0.05$ if the nominal volumetric ratio is at least 4%, and 	/	/	
	<ul style="list-style-type: none"> $\geq T - T_{\text{nom}} \leq \leq 0.2\%$ if the nominal volumetric ratio is less than 4%. 	/	/	
5.10	Self-Service Fuel Dispensers	/	/	
5.10.1.2	If more than one dispenser, an identification number accompanies the primary indication provided by the device.	/	/	
5.10.1.3	The primary indications of the indicating device and the printing device are the same. The scale intervals of the primary indicator, printing devices and memory devices are the same.	/	/	
5.10.1.4	Printing devices on the self-service arrangement shall not reproduce the indications of a dispenser as the difference between two printed values.	/	/	
5.10.1.5	Extra indicated information cannot be confused with metrological information.	/	/	

	Requirement	+	-	Comments
5.10.1.6	The control is capable of indicating the status of the dispensers (eg. running, authorised or unauthorised) that are connected to the self-service device and in the case of multiple modes of service and/or type of payment also that particular status of the measuring system.	/	/	
5.10.1.7	A change in the type of payment and/or mode of operation is not effective until the current measurement is completed.	/	/	
5.10.1.8	At least one primary indication is available to the customer until at least the settlement of the transaction.	/	/	
5.10.1.9	If the self-service arrangement totalises the delivered volumes for different registered customers, the MMQ is not effected by the scale interval used for such totalisations.	/	/	
5.10.2	Attended Service Mode	/	/	
	If the dispenser indicating device provides the only primary indication the customer is informed that the next authorisation of a particular dispenser is impossible prior to current transaction settlement.	/	/	
5.10.2.1.1	When an additional primary indication is provided by the device, an installation for reproducing volume and/or unit price is also installed. The additional installations consist of:	/	/	
	<ul style="list-style-type: none"> • A printing device for the issue of a receipt to the customer 	/	/	
	<ul style="list-style-type: none"> • An indicating device for the benefit of the supplier together with a display for the benefit of the customer. 	/	/	
	If the dispenser can be authorised prior to settlement, a reproduction of the volume and price is possible.	/	/	
5.10.2.1.2	For self-service devices with temporary storage of measurement data of dispensers:	/	/	
	(a) storage of data is restricted to one delivery per dispenser	/	/	
	(b) the primary indication is accompanied by a clear mark representing the sequence. For example, the number 1 or 2 or the letter A or B:	/	/	
	(c) when a primary indication of the device is out of service, the self-service arrangement may continue its operation provided that temporary storage is no longer used, and that the dispenser indicating device remains the primary indication.	/	/	

	Requirement	+	-	Comments
5.10.2.1.3	When a separate primary indication device provided for the customer becomes uncoupled or if checking facilities detect a malfunction, the temporary storage mode is prohibited and the dispenser indicator remains the primary indication.	/	/	
5.10.2.2.2	A printed or hand written receipt of the pre-paid amount is provided when in pre-payment, attended service mode.	/	/	
5.10.3	Unattended Service Mode	/	/	
5.10.3.1.1	The self-service arrangement provides additional primary indications by means of:	/	/	
	<ul style="list-style-type: none"> • A printing device for the issue of a receipt to the customer; and 	/	/	
	<ul style="list-style-type: none"> • A device (printing or memory device) on which measurement data are registered for the benefit of the supplier. 	/	/	
5.10.3.1.2	When the printing or memory devices fail to provide any indication or become unserviceable, the customer is automatically warned before the operation commences.	/	/	
	Passing from attended to unattended service mode is not possible before correct operation of the arrangement is concluded as feasible by the checking facilities.	/	/	
5.10.3.1.3	If used by registered customers, the provisions of 5.10.3.1.1 and 5.10.3.1.2 do not apply to measurements. An additional individual volume totaliser is considered to provide a primary indication.	/	/	
5.10.3.1.4	Micro-processors, which upon disturbance influence measurement operation, are equipped with means for controlling the continuity of the processor program and ensuring the discontinuation of the current delivery when the processor program is not ensured.	/	/	
	The next mode of payment will only take place if the continuity of the processor program is re-established.	/	/	

	Requirement	+	-	Comments
5.10.3.1.5	When a power supply failure occurs, the delivery data is memorised. The requirements of 5.19. apply (5.1.9): Minimum duration of operation of display after power failure ≥ 15 min continuously and automatically, or ≥ 5 min in one or several periods controlled manually during 1 hour after failure. Delivery interrupted by power failure: impossible to continue delivery if power failure has lasted more than 15 s.	/	/	
5.10.3.2	Delayed-payment			
	The printed and/or memorised indications as mentioned in 5.10.3.1 contain sufficient information for checking. The following are also displayed: the measured quantity, the price to pay and information to identify the particular transaction (eg. the dispenser number, location, date, time).	/	/	
5.10.3.3	Pre-payment in unattended service mode	/	/	
5.10.3.3.1	Following the termination of each delivery, the printed and/or memorised indications are available and clearly indicate the amount which has been pre-paid as well as the price corresponding to the liquid obtained. These printed and/or memorised indications may be divided into two parts:	/	/	
	(a) one part provided prior to the delivery on which the pre-paid amount is shown and recognisable as such:	/	/	
	(b) one part provided following the termination of delivery, provided that it is clear from the information provided on both parts that they are related to the same delivery.	/	/	
5.10.3.3.2	The requirements of 3.6 are applicable.	/	/	
5.11	Other Self service Arrangements			
	If the system is designed such that the transaction is not settled prior to leaving the loading site (in implicit agreement with the supplier), additional primary indications are provided. These being:	/	/	
	• A printing device for the issue of a receipt to the customer	/	/	
	• A device on which measurement data are registered for the benefit of the supplier.	/	/	

	Requirement	+	-	Comments
	These indications contain sufficient information for checking including measured quantity, and information to identify the particular transaction eg. the system number, location, date, time, etc.	/	/	
	Zeroing of the system is impossible until measurement data are memorised or printed out.	/	/	
ANNEX A	PERFORMANCE TESTS FOR ELECTRONIC MEASURING SYSTEMS			See Appendix 2 below
A.4.1	Dry Heat (non condensing)	X		
A.4.2	Cold	X		
A.4.3	Damp heat, cyclic (condensing)	X		
A.4.4	Vibration (sinusoidal)	X		
A.4.5	Power voltage variation (a.c. mains)	/	/	
A.4.6	Short time power reductions (a.c. mains)	/	/	
A.4.7	Bursts	/	/	
A.4.8	Electrostatic discharge	X		
A.4.9	Electromagnetic susceptibility	X		
A.4.10	Disturbances on d.c. voltage powered equipment	X		
	Power supply voltage variation	X		
	Do ISO 7637 (conducted immunity)	X		
ANNEX B	TESTING OF GAS ELIMINATION DEVICES	/	/	
B.1	Gas elimination device on its own	/	/	
B.1.2	Gas separators	/	/	
B.1.3	Gas extractors	/	/	
B.1.4	Special gas extractors	/	/	
B.2	Gas elimination devices forming part of a measuring system during pattern approval	/	/	
B.2.1	Gas separators	/	/	
B2.2	Gas extractors and special gas extractors	/	/	
B.3	Gas elimination devices forming part of a measuring system during verification	/	/	
	Test without verifying the MPE's of individual units	/	/	

**APPENDIX 2 TO DESCRIPTIVE ANNEX
OF NWML TEST CERTIFICATE GB-1116**

SUMMARY OF TESTS CARRIED OUT

R117	+	-	Report Number	Test House	Accreditation Authority
General Requirements			Appendix 1 above	NWML	UKAS
Annex A					
A.4.1 Dry heat	X		DRY062601	Lucent	A2LA
A.4.2 Cold	X		CLD062601	Lucent	A2LA
A.4.3 Damp heat	X		DMP071201	Lucent	A2LA
A.4.4 Vibration	X		N 0391	SIRA	UKAS
A.4.7 Bursts (EN 61000-4-4 (1995-01)	X		EFT091101	Lucent	A2LA
A.4.8 Electrostatic discharge (EN61000-4-2)	X		ESD081501	Lucent	A2LA
A.4.9 Electromagnetic susceptibility (EN61000-4-3)	X		EMS062601	Lucent	A2LA
A.4.10 (i) Voltage variation on dc powered equipment,	X		STD 10262	NWML	UKAS
A.4.10 (ii) ISO 7637 (conducted immunity),	X		80011726	Intertek Testing Services	UKAS
Accuracy	X		STD 10262	NWML	UKAS
EN55011 Tests					
Radio interference characteristics. Class A: Industrial & commercial					
Radiated emissions	X		CSP062901	Lucent Technologies	A2LA
FCC Part 15 Tests					
Radiated emissions	X		FCC062901	Lucent Technologies	A2LA