

that resetting one of them to zero also resets the other.

- (vii) The printing device may print, in addition to the measured quantity, either the corresponding price or this price and the unit price.

In the case of "direct selling to the public" it may also print only the price to be paid (without the volume) when it is connected to a volume indicating device and to a price indicating device both of which are visible to the purchaser.

The figures, the monetary unit used or its symbol and the decimal sign, if any, shall be printed by the device.

- (viii) The printed price scale interval shall be in the form 1×10^n , 2×10^n or 5×10^n monetary units, n being a positive or negative whole number, or zero; it shall not exceed the minimum specified price deviation. However, it need not be less than the smallest monetary value specified in paragraph 3(3)(vi).

- (ix) If the volume indicating device is not fitted with a price indicating device, the difference between the printed price and the price calculated on the basis of the indicated volume and the unit price shall comply with the requirements in paragraph 3(3)(vii).

- (x) Electronic printing devices are also subject to the requirements in paragraph 4(3)(v).

(5) Memory device

- (i) Measuring systems may be fitted with a memory device to store measurement results until their use or to keep a trace of commercial transactions, providing proof in case of a dispute. Devices used to read stored information are considered as included in the memory devices.
- (ii) The medium on which data are stored must have sufficient permanency to ensure that the data are not corrupted under normal storage conditions. There shall be sufficient memory storage for any particular application.
- (iii) When the storage is full, it is permitted to delete memorized data when both the following conditions are met:
- data are deleted in the same order as the recording order and the rules established for the particular application are respected,

- deletion is carried out after a special manual operation.

- (iv) Memorization shall be such that it is impossible in normal use to modify stored values.

- (v) Memory devices shall be fitted with checking facilities according to paragraph 4(3)(v). The aim of the checking facility is to ensure that stored data correspond to the data provided by the calculator and that restored data correspond to stored data.

(6) Pre-setting device

- (i) The selected quantity is pre-set by operating a device provided with scales and scale marks or a numerical device which indicates that quantity. The preset quantity shall be indicated before the start of the measurement.
- (ii) Where pre-setting is effected by means of several controls which are independent of each other, the scale interval corresponding to one control shall be equal to the pre-setting range of the control of the next lower order.
- (iii) Pre-setting devices may be so arranged that the repetition of a selected quantity does not require a new setting of the controls.
- (iv) Where it is possible to view simultaneously the figures of the display device of the pre-setting device and those of the volume indicating device, the former shall be clearly distinguishable from the latter.
- (v) Indication of the selected quantity may, during measurement, either remain unaltered or return progressively to zero. However, for an electronic pre-setting device it is acceptable to indicate the present value on the indicating device for volume or price by means of a special operation with the restriction that this value shall be replaced by the zero indication for volume or price before the measurement operation can start.
- (vi) In the case of a prepaid or pre-ordered delivery, the difference found under normal operating conditions, between the pre-set quantity and the quantity shown by the volume or price indicating device at the end of the measurement operation, shall not exceed the minimum specified volume or price deviation.

4. Inscription

- (a) Every taximeter shall bear the following indications:—
- (i) name and address of the manufacturer or his trade mark.
 - (ii) the constant 'k' in rev/km. or imp/km.
- (b) Every taximeter shall have places to permit :
Affixation of marks of initial and periodical verifications.
- (c) In the vicinity of the windows of all indicating devices the meanings of the values shown shall be given clearly, legibly and unambiguously.
- (d) The name or the symbol of the monetary unit shall be alongside the fare indication for the journey and the indication of extras to be paid.

5. Maximum permissible errors

- (a) During drive by distance the maximum dispersion of the indications shall not exceed :
- (i) for the initial distance, 2 per cent of the true value. However, for initial distances less than 1000 metres, the dispersion may be up to 20 metres;
 - (ii) for distances succeeding the initial distance 2 per cent of the true value.
- (b) During drive by time the maximum dispersion of the indications shall not exceed—
- (i) for the initial time : 3 per cent of the true value however, for initial times less than 10 minutes, this error may be up to 20 seconds,
 - (ii) for times succeeding the initial time: 3 per cent of the true value.
- (c) The adaption shall be carried out under the standard test conditions such that the constant 'K' of the taximeter differs by less than 1 per cent from the characteristic number 'W' of the vehicle on which it is mounted.

6. Protection and guarantee seals

- (a) The under mentioned part of the taximeter shall be so constructed that they can be sealed with lead or by marks of protection and guarantee:
- (i) the case enclosing the internal mechanism of the taximeter;

- (ii) the case of adjusting device (if this device is outside the case of the taximeter);
- (iii) the covers of electrical or mechanical devices forming the connection between the entrance of the taximeter and the corresponding part provided on the vehicle for alignment with the instrument, including the detachable parts of the adjusting device.

- (b) A plate of approved size and pattern shall be attached to the taximeter gear box or to the taximeter itself in such a manner that it cannot be removed without either removing the seals affixed by the testing authority or opening the taximeter or taximeter gear box. The plate shall show in raised or sunken words and figures, the type of cab on which the taximeter is to be used.

These seals shall be such that all access to protected components particularly the components of adjustment is impossible without damaging the seal.

7. Standard test conditions for the vehicle

- (a) The load carried by the vehicle corresponds to the weight of four adult persons including the driver.
- (b) The tyres are inflated to the pressure prescribed by the vehicle manufacturer and are in good condition (e.g., conforming to the road safety rules).
- (c) The vehicle is moving, under its own power, on level ground in a straight line, at a speed less than 40 km/h.

8. Test methods

To determine compliance with distance tolerances a distance test of the taximeter shall be conducted utilizing anyone of the following test methods:—

- (a) *Road test method*—A road test consists of driving the vehicles over a precisely measured road course.
- (b) *Fifth wheel test method*—This test consists of driving the vehicle over any reasonable road course and determining the distance actually travelled through the use of a mechanism known as "fifth wheel" that is attached to the vehicle and that independently measures and indicates the distance.

- (c) *Simulated road test method*—This test consists of determining the distance travelled by computation from rolling circumference and wheel turn data.

9. Test procedure

- (a) The distance test of a taximeter, whether (a), (b) or (c) shall include at least duplicate runs of sufficient length to cover at least the third money drop or one km., whichever is greater, and shall be at a speed approximating the average speed travelled by the vehicle in normal service.
- (b) If the taximeter is equipped with a mechanism through which charges are made for time intervals, a test shall be conducted to determine whether there is interference between the time and distance mechanism. During this test, the vehicle is operated at a speed of 3 or 4 km./h faster than changeover speed.

PART IX

COMPRESSED GASEOUS FUEL (CNG) MEASURING SYSTEMS FOR VEHICLES

HEADING—A

1. Scope

(1) These specifications lay down the metrological and technical requirements applicable to compressed gaseous fuel measuring systems for vehicles. It also specifies the requirements for the approval of constituent elements of the measuring systems (meter, etc.). Measuring systems for liquid petroleum gas are not in the scope of this specification as the fluid is at liquid state.

(2) In general, the measuring systems that are covered by this specification are intended for the refuelling of roadside motor vehicles, small boats, aircraft and for trains.

In principle, these specifications apply to all measuring systems fitted with a meter as defined in paragraph 1, sub-paragraph (1) (continuous measurement), whatever be the measuring principle of the meters or their application.

TERMINOLOGY

1. Measuring system and its constituents

(1) Meter

An instrument intended to measure continuously, memorizes and display the quantity of gas passing through the measurement transducer at metering conditions.

Note: A meter includes at least a transducer, a calculator (including adjustment or correction devices, if present) and an indicating device.

(2) Measurement transducer

A part of the meter which transforms the flow of the gas to be measured into signals which are passed to the calculator. It may be autonomous or use an external power source.

Note: For the purposes of these specifications, the measurement transducer includes the flow or quantity sensor.

(3) Calculator

A part of the meter that receives the output signals from the transducer(s) and, possibly, from associated measuring instruments, transforms them and, if appropriate, stores in memory the results until they are used. In addition, the calculator may be capable of communicating both ways with peripheral equipment.

(4) Indicating device

A part of the meter, which displays continuously the measurement results.

Note: A printing device which provides an indication at the end of the measurement is not an indicating device.

(5) Ancillary device

A device intended to perform a particular function, directly involved in elaborating, transmitting or displaying measurement results.

Main ancillary devices are:—

- (a) zero setting devices,
- (b) repeating indicating device,
- (c) printing device,
- (d) memory device,
- (e) price indicating device,
- (f) totalizing indicating device, pre-setting device, and
- (g) self-service device.

(6) Additional device

A part or a device, other than an ancillary device, required to ensure correct measurement or intended to facilitate the measuring operations, or which could in any way affect the measurement.

Main additional devices are:—

- (a) filter,
- (b) device used for the transfer point,
- (c) anti-swirl device,
- (d) branches or bypasses,
- (e) valves, and
- (f) hoses.

(7) Measuring system

A system which comprises the meter itself and all the ancillary devices and additional devices.

(8) Compressed gaseous fuel measuring systems for vehicles

A measuring system intended for the refuelling of motor vehicles with compressed gaseous fuel.

(9) Pre-setting device

A device which permits the selection of the quantity to be measured and which automatically stops the flow of the gas at the end of the measurement of the selected quantity.

Note: The pre-set quantity may be the mass or the related price to pay.

(10) Adjustment device

A device incorporated in the meter, that only allows shifting of the error curve generally parallel to itself, with a view to bringing errors within the maximum permissible errors.

(11) Associated measuring instruments

Instruments connected to the calculator or the correction device, for measuring certain quantities which are characteristics of the gas, with a view to making corrections.

(12) Correction device

A device connected to or incorporated in the meter for automatically correcting the mass, by taking into account the flow rate or the characteristics of the gas to be measured (viscosity, temperature, pressure) and the pre-established calibration curves or both.

(13) Transfer point

A point at which the gas is defined as being delivered.

2. Self service measuring systems**(1) Self-service arrangement**

An arrangement that allows the customer to use a measuring system for the purpose of obtaining gas for his own purchase.

(2) Self-service device

A specific device that is part of a self-service arrangement and which allows one or more measuring systems to perform in this self-service arrangement.

Note: The self-service device includes all the elements and constituents that are mandatory so that a measuring system performs in a self-service arrangement.

The arrangement is made of a self-service device and connected measuring systems.

(3) Attended service mode

An operating mode of a self-service arrangement in which the supplier is present and controls the authorization for the delivery.

(4) Unattended service mode

An operating mode of a self-service arrangement in which the self-service arrangement controls the authorization for a delivery, based on an action of the customer.

Note: In unattended service mode, the end of the measurement operation is the end of the registration (printing and/or memorizing) of information concerning the measurement operation.

(5) Pre-payment

A type of payment in attended or unattended service mode requiring payment for a quantity of gas before the delivery commences.

(6) Attended post-payment (or post-payment)

A type of payment in attended service mode requiring payment for the delivery but before the customer leaves the site of the delivery.

(7) Unattended post-payment (or delayed payment)

A type of payment in unattended service mode in which payment for the delivered quantity is required after the delivery, but in which the transaction is not settled when the customer leaves the site, following an implicit agreement with the supplier.

(8) Authorization of a measuring system

An operation that brings the measuring system into a condition suitable for the commencement of the delivery.

3. Metrological characteristics**(1) Primary indication**

An indication (displayed, printed or memorized) which is subject to legal metrology control.

Note: Indications other than primary indications are commonly referred to as secondary indications.

(2) Absolute error of measurement

The result of a measurement minus the (conventional) true value of the measurand.

(3) Relative error

The absolute error of measurement divided by the (conventional) true value of the measurand.

(4) Maximum permissible errors

The extreme values permitted by the specification for an error.

(5) Minimum measured quantity of a measuring system

The smallest mass of gas for which the measurement is metrologically acceptable for that system.

Note: In measuring systems intended to deliver, this smallest mass is also referred to as the *minimum delivery*.

(6) Minimum specified mass deviation

The absolute value of the maximum permissible error for the minimum measured quantity of a measuring system.

(7) Minimum specified price deviation

The price to pay corresponding to the minimum specified mass deviation.

(8) Repeatability error

For the purposes of this specification, the difference between the largest and the smallest results of successive measurements of the same quantity carried out under the same conditions.

(9) Intrinsic error

The error of a measuring system determined under reference conditions.

(10) Initial intrinsic error

The intrinsic error of a measuring system as determined prior to all performance tests.

(11) Fault

The difference between the error of indication and the (initial) intrinsic error of a measuring system.

(12) Significant fault

For the mass, a fault means magnitude of which is greater than the larger of these two values :—

- (ii) one-tenth of the magnitude of the maximum permissible error for the measuring system and for the measured mass,

- (iii) the minimum specified mass deviation.

For the price to pay, the price corresponding to the significant fault for the mass.

Note: No fault is allowed for the unit price.

The following are not considered to be significant faults :—

- (v) faults arising from simultaneous and mutually independent causes in the measuring instrument itself or in its checking facilities;

- (vi) transitory faults being momentary variations in the indication, which cannot be interpreted, memorized or transmitted as a measurement result.

(13) Durability

The capability of the measuring system to keep its performance characteristics over a period of use, for electronic purposes.

4. Tests and test conditions**(1) Influence quantity**

A quantity which is not the subject of the measurement but which influences the value of the measurand or the indication of the measuring system.

(2) Influence factor

An influence quantity having a value within the rated operating conditions of the measuring system, as specified in these specifications.

(3) Disturbance

An influence quantity having a value outside the specified rated operating conditions of the measuring system.

Note: An influence quantity is a disturbance if for that influence quantity the rated operating conditions are not specified.

(4) Rated operating conditions

Conditions of use, giving the range of values of influence quantities for which the metrological characteristics are intended to be within the maximum permissible errors.

(5) Reference conditions

A set of specified values of influence factors fixed to ensure valid inter comparison of results of measurements.

(6) Performance test

A test intended to verify whether the measuring system under test (EUT) is capable of accomplishing its intended functions.

(7) Endurance test

A test intended to verify whether the meter or the measuring system is able to maintain its performance characteristics over a period of use.

(8) Bank

A test reservoir or a set of test reservoirs manifolded together which forms part of a multi-segment gas storage system. The segments operate at different pressure levels from one another in refuelling systems fitted with or using a sequential control device.

Note: Testing by using banks generate transient flow rates.

(9) Sequential control device

A device which allows switching from a bank to another one. This device may be included in a measuring system or may be part of the refuelling station.

5. Electronic or electrical equipment**(1) Electronic device**

A device employing electronic sub-assemblies and performing a specific function.

Note: Electronic devices, as defined above, may be complete measuring systems or part of measuring systems.

(2) Electronic sub-assembly

A part of an electronic device, employing electronic components and having a recognizable function of its own.

(3) Electronic component

The smallest physical entity which uses electron or hole conduction in semi-conductors, gases, or in a vacuum.

(4) Checking facility

A facility which is incorporated in a measuring system and which enables significant faults to be detected and acted upon.

Note: The checking of a transmission device aims at verifying that all the information which is transmitted is fully received by the receiving equipment.

(5) Automatic checking facility

A checking facility operating without the intervention of an operator.

(6) Permanent automatic checking facility (type P)

An automatic checking facility operating during the entire measurement operation.

(7) Intermittent automatic checking facility (type I)

An automatic checking facility operating at least once, either at the beginning or at the end of each measurement operation.

(8) Power supply device

A device which provides the electronic devices with the required electrical energy, using one or several sources of a.c. or d.c.

HEADING—B**1. General requirements****(1) Constituents of a measuring system**

A meter itself is not a measuring system. A measuring system includes at least—

- (a) a meter,
- (b) a transfer point,
- (c) a gas circuit with particular characteristics which must be taken into account.

The measuring system may be provided with other ancillary and additional devices [paragraph 2 sub-paragraph (2)].

If several meters intended for separate measuring operations have common elements (calculator filter, etc.) each meter is considered to form, with the common elements, a measuring system.

A measuring system shall include only one meter.

(2) Ancillary and additional devices

(i) Ancillary devices may be a part of the calculator or of the meter, or may be peripheral equipment, connected through an interface to the calculator. These devices shall bear a legend which is clearly visible to the user to indicate that they are not controlled when they display a measurement result visible to the user. Such a legend shall be present on each print-out likely to be made available to the customer.

(ii) By definition, additional devices likely to be installed in a measuring system shall not corrupt the metrological behaviour of the measuring apparatus.

(3) Field of operation

(i) The field of operation of a measuring system is determined by the following characteristics:—

- minimum measured quantity,
- measuring range limited by the minimum flow rate, Q_{\min} and the maximum flow rate, Q_{\max} ,
- maximum pressure of the gas, P_{\max} ,
- minimum pressure of the gas, P_{\min} ,
- if appropriate, nature and characteristics of the gases to be measured,
- maximum temperature of the gas, T_{\max} ,
- minimum temperature of the gas, T_{\min} ,
- environment class

The environmental class may be different according to devices of the measuring system, provided each device is used according to its own environmental class. In particular this is applicable to some parts of a self-service device which can be used at different temperatures than the rest of the measuring system.

[भाग II—खण्ड 3(i)]

- (ii) The minimum measured quantity of a measuring system shall have the form 1×10^n , 2×10^n or 5×10^n authorised units of mass, where n is a positive or negative whole number, or zero.

The minimum measured quantity shall satisfy the conditions of use of the measuring system. Except in exceptional cases, the measuring system shall not be used for measuring quantities, less than this minimum measured quantity.

Measuring systems having a maximum flow rate not greater than 30 kg/min shall have a minimum measured quantity not exceeding 2 kg.

Measuring systems having a maximum flow rate larger than or equal to 30 kg/min but not greater than 100 kg/min shall have a minimum measured quantity not exceeding 5 kg.

- (iii) The measuring range shall satisfy the conditions of use of the measuring system; the latter shall be designed so that the flow rate is between the minimum flow rate and the maximum flow rate, except at the beginning and at the end of the measurement or during interruptions.

In normal conditions of use, the measuring system shall not be capable of delivering quantities at flow rates smaller than the minimum flow rate. The measuring range of a measuring system shall be within the measuring range of each of its elements.

The ratio between the maximum flow rate and the minimum flow rate shall be at least fifteen.

- (iv) A measuring system shall exclusively be used for measuring gas having characteristics within its field of operation, as specified in the model approval certificate. The field of operation of a measuring system shall be within the fields of measurement of each of its constituent elements, in particular the meter.

(4) Indications

- (i) Measuring systems shall be provided with

an indicating device giving the mass of gas measured. If the system is fitted with a price indicating device, then—

1(4)(i)(a) indications of unit price and price to be paid are related only to mass.

1(4)(i)(b) these indications are displayed only when displaying the mass.

- (ii) Mass shall only be indicated in kilogram. The symbol or the name of the unit shall appear in the immediate vicinity of the indication.

- (iii) A measuring system may have several devices indicating the same quantity. Each shall meet the requirements of this specification if subject to control. The scale intervals of the various indications shall be the same.

- (iv) For any measured quantity relating to the same measurement, the indications provided by various devices shall not deviate one from another.

- (v) The use of the same indicating device for the indications of several measuring systems (which then have a common indicating device) is authorized provided that it is impossible to use any two of these measuring systems simultaneously, and that the measuring system providing the indication is clearly identified.

- (vi) The scale interval shall be in the form 1×10^n , 2×10^n or 5×10^n authorized units of mass, where n is a positive or negative whole number, or zero.

The scale interval shall be equal to or smaller than half the minimum specified mass deviation.

However non-significant scale intervals should be avoided. Thus does not apply to price indications.

- (vii) When relevant, the provisions relating to mass indications apply also to price indications by analogy, and to secondary indications of other quantities as well.

(5) Suitability of additional devices

- (i) Measuring systems shall incorporate a transfer point. This transfer point is located down stream of the meter.

- (ii) No means shall be provided by which any measured gas can be diverted down stream of the meter during the filling operation.

- (iii) Two or more delivery transfer points may

be permanently installed and operated simultaneously or alternately provided so that any diversion of gas to other than the intended receiving receptacle(s) cannot be readily accomplished or is readily apparent. Such means include, for example, physical barriers, visible valves or indications that make it clear which transfer points are in operation, and explanatory signs, if necessary.

- (iv) When only one transfer point can be used during a delivery, and after the transfer point has been replaced, the next delivery shall be inhibited until the indicating device has been reset to zero.

When two or more transfer points can be used simultaneously or alternately, and after the utilized transfer points have been replaced, the next delivery shall be inhibited until the indicating device has been reset to zero. Moreover, by design, the provisions of paragraph 2 sub-paragraph (5) clause (iii) shall be fulfilled.

- (v) The system shall be designed in order to ensure that the measured quantity is delivered. In particular if the hose downstream of the meter is likely to be depressurized between two deliveries, this shall lead for instance to systematic correction or re-pressurizing before counting.

Whatever is the operating principle, in particular what constitutes the hose or the transfer point, in the worst measuring conditions, the mass which is measured but not delivered shall be smaller than or equal to half the minimum specified mass deviation.

Note: The purpose of this provision is not to allow a systematic deviation. This shall be verified by design examination, tests or calculation.

- (vi) If there is a risk that the supply conditions can overload Q_{max} of the meter, a flow limiting device shall be provided. It shall be possible to seal it.
- (vii) A pressure gauge shall be permanently installed on the measuring system in order to check P_{max} and P_{min} .

2. Metrological requirements for measuring systems and meters

(1) Maximum permissible errors and other metrological characteristics

- (i) Without prejudice to paragraph 2 sub-paragraph (1) clause (iii) the maximum

permissible relative errors on mass indications, positive or negative, at model approval are,

— $\pm 1\%$ of the measured quantity for the meter alone, and

— $\pm 1.5\%$ of the measured quantity for the complete measuring system.

- (ii) The maximum permissible relative errors on mass indications, positive or negative, at initial verification or subsequent verifications and when these verifications are performed under rated operating conditions on-site of use, are $\pm 2\%$ of the measured quantity for the complete measuring system.

- (iii) The maximum permissible errors applicable to the minimum measured quantity are twice the corresponding values stated in paragraph 2, sub-paragraph (1), clause (i).

So the minimum specified mass deviation (E_{min}) for the measuring system is given by the formula:

$$E_{min} = 3 \times M_{min} / 100$$

Where M_{min} is the minimum measured quantity having the form specified in paragraph 1, sub-paragraph (3), clause (ii).

Note: The minimum specified mass deviation is an absolute maximum permissible error.

- (iv) Whatever the measured quantity may be, the magnitude of the maximum permissible error (expressed as an absolute error) for the complete system is never less than the minimum specified mass deviation.

- (v) For any quantity equal to or greater than 1000 scale intervals, the repeatability error of the meter shall not be greater than $\pm 0.6\%$.

- (vi) Within their field of operation, meters shall present a magnitude of the difference between the initial intrinsic error and the error after the endurance test equal to or less than $\pm 1\%$.

The requirement on repeatability applies after the endurance test.

(2) Conditions for applying maximum permissible errors

- (i) Maximum permissible errors apply for all gas, all temperatures and all pressures of

the gas, and all flow rates for which the system or the meter is intended to be approved.

A measuring system or a meter shall be capable of fulfilling all requirements without adjustment or modification during the relevant evaluation procedure.

- (ii) When stated in the model approval certificate, a verification of a measuring system or of a meter intended to measure gas may be carried out with air (or with another fluid). In this case and if necessary, the pattern approval certificate provides a smaller range or a shift for maximum permissible errors, so that maximum permissible errors are fulfilled for gas.

3. Requirements for meters and ancillary devices of a measuring system

The meter and ancillary devices of a measuring system shall meet the following requirements, whether or not they are subject to a separate model approval:—

(1) Meter

(i) Field of operation

The field of operation of a meter is determined at least by the following characteristics:—

- minimum measured quantity,
- measuring range limited by the minimum flow rate, Q_{\min} , and the maximum flow rate, Q_{\max} ,
- maximum pressure of the gas, P_{\max} ,
- if appropriate, nature and characteristics of the gases to be measured,
- maximum temperature of the gas, T_{\max} ,
- minimum temperature of the gas T_{\min} .

The temperature range shall be $+10^{\circ}\text{C}$ to $+40^{\circ}\text{C}$.

(ii) Metrological requirements

See paragraph 2 under Heading—B.

(iii) Connections between the flow sensor and the indicating device

The connections between the flow sensor and the indicating device shall be reliable and, for electronic devices, durable.

(iv) Adjustment device

Meters may be provided with an adjustment device which permits modification of the ratio between the

indicated mass and the actual mass of gas passing through the meter, by a simple command.

When this adjustment device modifies this ratio in a discontinuous manner, the consecutive values of the ratio shall not differ by more than 0.001.

Adjustment by means of a by pass of the meter is prohibited.

(v) Correction device

Meters may be fitted with correction devices; such devices are always considered as an integral part of the meter. The whole of the requirements which apply to the meter, in particular the maximum permissible errors specified in paragraph 3 sub-paragraph (1) clause (iii) of Heading—B, are therefore applicable to the corrected mass.

In normal operation, non-corrected mass shall not be displayed.

The aim of a correction device is to reduce the errors as close to zero as possible.

Note: The use of this device for adjusting the errors of a meter to values other than as close as practical to zero is forbidden, even when these values are within the maximum permissible errors.

The correction device shall not allow the correction of a pre-estimated drift in relation to times or mass, for example.

The accuracy of associated measuring instruments shall be good enough to permit that the requirements on the meter be met as specified in paragraph 2, sub-paragraph (3) of Heading—B.

Associated measuring instruments shall be fitted with checking devices, as specified in paragraph 4, sub-paragraph (3) clause (vi) of Heading—B.

(2) Indicating device

- (i) Measuring systems shall be equipped with digital indicating devices. The decimal sign shall appear distinctly.

- (ii) The continuous display of mass during the period of measurement is mandatory.

- (iii) The height for the figures of the indicating device shall be equal to or greater than 10 millimetre.

(3) Zero setting device

- (i) Measuring systems shall be equipped with a device for resetting the mass indicating device to zero.
 - (a) The zero setting device shall not permit any alteration of the measurement result shown by the mass indicating device (other than by making the result disappear and displaying zeros).
 - (b) Once the zeroing operation has begun it shall be impossible for the mass indicating device to show a result different from that of the measurement which has just been made, until the zeroing operation has been completed.

The measuring system shall not be capable of being reset to zero during measurement.

- (ii) If the system also includes a price indicating device, this indicating device shall be fitted with a zero resetting device.

The zero setting devices of the price indicating device and of the mass indicating device shall be designed in such a way that zeroing either indicating device automatically involves zeroing the other.

- (iii) If the measuring system is fitted with a printing device, any printing operation shall not be possible in the course of a measurement and further delivery shall only be possible after a reset to zero has been performed. However, the printing operation shall not change the quantity indicated on the indicating device.
- (iv) If the measuring system is designed so that registration of mass could occur without any effective flow rate, a device shall register this apparent flow rate and compensate the measurement result for it.

(4) Price indicating device

- (i) A mass indicating device may be complemented with a price indicating device which displays both the unit price and the price to be paid.

The monetary unit used or its symbol shall appear in the immediate vicinity of the indication.

- (ii) The selected unit price shall be displayed by an indicating device before the start

of the measurement to unit price shall be adjustable; changing the unit price may be carried out either directly on the measuring system or through peripheral equipment.

The indicated unit price at the start of a measurement operation shall be valid for the whole transaction. A new unit price shall only be effective at the moment a new measurement operation may start.

A time of at least five seconds shall elapse between indicating a new unit price and before the next measurement operation can start, if the unit price is set from peripheral equipment.

- (iii) Only rounded errors pertaining to the least significant digit of the price to be paid are authorized.

(5) Printing device

- (i) The mass printed shall be expressed in multiples or sub-multiples of kilogram for the indication of mass.

The figures, the unit used or its symbol and the decimal sign, if any, shall be printed on the ticket by the device.

- (ii) The printing device may also print information identifying the measurement such as: sequence number, date, identification of the measuring system, type of gas, etc. If the printing device is connected to more than one measuring system, it must print the identification of the relevant system.
- (iii) If a printing device allows repetition of the printing before a new delivery has started, copies shall be clearly marked as such, for example by printing "duplicate".
- (iv) The printing device shall print, in addition to the measured quantity, either the corresponding price and the unit price.
- (v) The printing devices are also subject to the requirements in paragraph 4, subparagraph (3), clause (v) of Heading—B.

(6) Memory device

- (i) Measuring systems may be fitted with a memory device to store measurement results until their use or to keep a trace of commercial transactions, providing proof in case of a dispute. Devices used to read stored information are considered as included in the memory devices.

(ii) The medium on which data are stored must have sufficient permanency to ensure that the data are not corrupted under normal storage conditions. There shall be sufficient data memory storage for any particular application and for roadside measuring systems data storage for at least one month corresponding to normal use shall be available.

(iii) When the storage is full, it is permitted to delete memorized data when both the following conditions are met:—

- (a) data are deleted in the same order as the recording order and the rules established for the particular application are respected,
- (b) deletion is carried out after a special manual operation.

(iv) Memorization shall be such that it is impossible in normal use to modify stored values.

(v) Memory devices shall be fitted with checking facilities according to paragraph 4, sub-paragraph (3), clause (v) of Heading—B. The aim of the checking facility is to ensure that stored data correspond to the data provided by the calculator and that restored data correspond to stored data.

(7) Pre-setting device

- (i) The selected quantity is pre-set by operating a digital device which indicates that quantity. The pre-set quantity shall be indicated before the start of the measurement.
- (ii) Where it is possible to view simultaneously the figures of the display device of the pre-setting device and those of the mass indicating device, the former shall be clearly distinguishable from the latter.
- (iii) Indication of the selected quantity may, during measurement, either remain unaltered or return progressively to zero.
- (iv) The difference found under normal operating conditions, between the pre-set quantity and the quantity shown by the mass indicating device at the end of the measurement operation, shall not exceed the minimum specified mass deviation.
- (v) The pre-set quantities and the quantities shown by the mass indicating device shall

be expressed in the same unit. This unit or its symbol shall be marked on the pre-setting device.

(vi) The scale interval of the pre-setting device shall be equal to the scale interval of the indicating device.

(vii) Pre-setting devices may incorporate a device to permit the flow of gas to be stopped quickly when necessary.

(viii) Measuring systems with a price indicating device may also be fitted with a price pre-setting device which stops the flow of the gas when the quantity delivered corresponds to the pre-set price. The requirements in clauses (i) to (vii) of subparagraph (7) of paragraph 3 of Heading—B apply by analogy.

(8) Calculator

- (i) The maximum permissible errors, positive or negative, on the gas quantity indications applicable for the calculators when they are checked separately shall be 0.05 per cent of the true value.
- (ii) All factors necessary for the elaboration of indications such as unit price, calculation table, correction polynomial, etc. shall be present in the calculator at the beginning of the measurement operation.
- (iii) The calculator may be provided with interfaces permitting the coupling of peripheral equipment. When these interfaces are used, the instrument shall continue to function correctly and its metrological functions shall not be capable of being affected.

4. Technical requirements for electronic devices

(1) General requirements

- (i) Electronic measuring systems shall be designed and manufactured such that their errors do not exceed the maximum permissible errors as defined in paragraph 2 sub-paragraph (1) under rated operating conditions.
- (ii) Electronic measuring systems shall be designed and manufactured such that, when they are exposed to the disturbances:

— either (a) significant faults do not occur,

- or (b) significant faults are detected and acted upon by means of checking facilities.

This provision may apply separately to:

- each individual cause of significant fault and/or,
- each part of the measuring system.

(iii) The requirements in paragraph 4, sub-paragraph (1), clause (i) and paragraph 4, sub-paragraph (1), clause (ii) of Heading—B shall be met durably. For this purpose, electronic measuring systems shall be provided with the checking facilities specified in paragraph 4, sub-paragraph (3) of Heading—B.

(iv) Electronic measuring systems shall be such that the delay time between the measurement value and the corresponding indicated value shall not exceed 500 milli second.

(v) A model of a measuring system is presumed to comply with the requirements in sub-paragraph (1) of paragraph 4 of this Heading if it passes the examination and tests specified in paragraph 7, sub-paragraph (1) clause (ix) sub-clauses (a) and (b) of Heading—B.

(2) Power supply device

(i) A measuring system shall be provided with an emergency power supply device allowing

- either (a) to safeguard all measuring functions during a failure of the principal power supply,
- or (b) that data contained at the moment of a failure leading to stopping the flow are saved and displayable on an indicating device for sufficient time to permit the conclusion of the current transaction.

The absolute value of the maximum permissible error for the indicated mass, in the second case, is increased by 5 per cent of the minimum measured quantity.

(ii) In case of a failure leading to stopping the flow, measuring systems shall be such that the minimum duration of operation of the display shall be either

- continuously and automatically at least 15 minutes following immediately the failure of the principal electrical supply, or
- a total of at least 5 minutes in one or several periods controlled manually during one hour following immediately the failure.

Note : During model approval the instrument has to be supplied with electric power normally for 12 hours which preceded the test. Before this supply the battery (if provided) may be uncharged.

In addition, measuring systems shall be designed so that an interrupted delivery cannot be continued after the power supply device has been re-established if the power failure has lasted more than 15 seconds.

(3) Checking facilities

(I) Action of checking facilities

The detection by the checking facilities of significant faults shall result in the following actions:—

- (a) automatic correction of the fault, or
- (b) stopping only the faulty device, when the measuring system without that device continues to comply with the regulations, or
- (c) stopping the flow.

(II) Checking facilities for the measurement transducer

The objective of these checking facilities is to verify the presence of the transducer, its correct operation and the correctness of data transmission.

These checking facilities shall be of type P and the checking shall occur at time intervals not exceeding the duration of the measurement of an amount of gas equal to the minimum specified mass deviation.

It shall be possible during model approval and initial verification to check that these checking facilities function correctly—

- (a) by disconnecting the transducer, or
- (b) by interrupting one of the sensor's pulse generators, or
- (c) by interrupting the electrical supply of the transducer.

(iii) *Checking facilities for the calculator*

The objective of these checking facilities is to verify that the calculator system functions correctly and to ensure the validity of the calculations made.

There are no special means required for indicating that these checking facilities function correctly.

- (a) The checking of the functioning of the calculation system shall be of type P or I. In the latter case, the checking shall occur at least every five minutes in the course of a delivery but at least once during a delivery.

The objective of the checking is to verify that—

- (a-1) the values of all permanently memorized instructions and data are correct, by such means as

- summing up all instruction and data codes and comparing the sums with a fixed value,
- line and column parity bits,
- cyclic redundancy check,
- double independent storage of data,
- storage of data in "safe coding", for example protected by check sum, line and column parity bits.

- (a-2) all procedures of internal transfer and storage of data relevant to the measurement result are performed correctly, by such means as

- write-read routine,
- conversion and re-conversion of codes,
- use of "safe coding" (check sum, parity bit),
- double storage.

- (b) The checking of the validity of calculations shall be of type P. This consists of checking the correct value of all data related to the measurement whenever these data are internally stored or transmitted to peripheral equipment through an interface; this check may be carried out by such means as parity bit, check sum or double storage. In

addition, the calculation system shall be provided with a means of controlling the continuity of the calculation program.

(iv) *Checking facility for the indicating device*

The objective of this checking facility is to verify that the primary indications are displayed and that they correspond to the data provided by the calculator. In addition, it aims at verifying the presence of the indicating devices, when they are removable. The control may be performed according to either the first possibility in paragraph 4, sub-paragraph (3), clause (iv) sub-clause (b) or the second possibility in paragraph 4, sub-paragraph (3), clause (iv) sub-clause (c) of Heading—B.

- (a) It shall be possible during verification to determine that the checking facility of the indicating device is working, either

- by disconnecting all or part of the indicating device,
- or by an action which simulates a failure in the display, such as using a test button.

- (b) The first possibility is to control automatically the complete indicating device. The checking facility of the indicating device is of type P; however, it may be of type I if a primary indication is provided by another device of the measuring system, or if the indication may be easily determined from other primary indications (for example, in the case of the presence of a price indicating device it is possible to determine the price to pay from the mass and the unit price).

Means may include, for example

- for indicating devices using incandescent filaments or light emitting diode, measuring the current in the filaments,
- for indicating devices using fluorescent tubes, measuring the grid voltage,
- for indicating devices using electromagnetic shutters, checking the impact of each shutter,
- for indicating devices using multiplexed liquid crystals, output checking of the control voltage of

segment lines and of common electrodes, so as to detect any disconnection or short-circuit between control circuits.

- (c) The second possibility is on the one hand to check automatically the electronic circuits used for the indicating device except the driving circuits of the display itself and on the other hand to check the display.

The automatic checking facility of the electronic circuits used for the indicating device is of type P; however, it may be of type I if a primary indication is provided by another device of the measuring system, or if the indication may be easily determined from other primary indications (for example, in the case of the presence of a price indicating device it is possible to determine the price to pay from the mass and the unit price).

The checking facility of the display shall provide visual checking of the entire display which shall meet the following description:—

- displaying all the elements ("eights" test if appropriate)
- blanking all the elements ("blank" test)
- displaying "zeros"

Each step of the sequence shall last at least 0.75 second.

This visual checking facility shall be of type I but it is not mandatory for a malfunction to result in the actions described in paragraph 4, subparagraph (3), clause (i) of Heading-B.

- (v) *Checking facilities for ancillary devices*

An ancillary device (repeating device, printing device, self-service device, memory device, etc.) with primary indications shall include a checking facility of type I or P. The object of this checking facility is to verify the presence of the ancillary device, when it is a necessary device, and to verify the correct transmission of data from the calculator to the ancillary device.

In particular, the checking of a printing device aims at ensuring that the printing

controls correspond to the data transmitted by the calculator. At least the following shall be checked:—

- (a) presence of paper, and
- (b) the electronic control circuits (except the driving circuits of the printing mechanism itself).

It shall be possible during model approval and other verifications to check that the checking facility of the printing device is functioning by an action simulating a printing fault, such as using a test button.

Where the action of the checking facility is a warning, this shall be given on or by the ancillary device concerned.

- (vi) *Checking facilities for the associated measuring instruments*

Associated measuring instruments shall include a checking facility of type P. The aim of this checking facility is to ensure that the signal given by these associated instruments is inside a pre-determined measuring range.

Examples:

- four wire transmission for resistive sensors,
- frequency filters for density meters,
- control of the driving current for 4—20 mA pressure sensors.

5. Technical requirements, for measuring systems with self-service arrangement

(1) General requirements

- (i) Where the self-service device serves two or more measuring systems, each measuring system shall be provided with a measuring system identification number that shall be accompanied by a primary indication provided by the self-service device.
- (ii) Indication of information that is not subject to metrological control is allowed, provided that it cannot be confused with metrological information.
- (iii) The control device of the self-service device should be capable of indicating the status of the measuring system (e.g. running, authorized or unauthorized) 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.

- (iv) A change of the type of payment and/or mode of operation shall not be effective before the end of the current measurement operation.
- (v) The self-service arrangement, including provisions related to clearly defined methods of operation, shall be such that at least one primary indication for the benefit of the customer must be available at least up to the settlement of the transaction to enable the delivered quantity and the price to pay to be checked.
- (vi) In the case of a self-service arrangement that totalizes the delivered mass for different registered customers over the course of time, the minimum measured quantity is not affected by the scale interval used for such tantализations.

(2) *Attended service mode*

If the measuring system indicating device provides the only primary indication, provisions shall be made to inform the customer that the next authorization of a particular measuring system can only be given by the supplier after settlement of the current transaction.

(i) *Attended post-payment*

- (a) Where the self-service arrangement includes a device that provides an additional primary indication (additional to those of the indicating device of the measuring system), it shall consist of at least one installation for the reproduction of the mass and/or the price indicated by the measuring system indicating device, consisting of
 - a printing device for the issue of a receipt to the customer, or
 - an indicating device for the benefit of the supplier together with a display for the benefit of the customer.

- (b) For self-service devices with temporary storage (temporary storage mode) of measurement data of measuring system the following requirements apply:—

(b-1) temporary storage of measurement data shall be restricted to one delivery for each measuring system,

(b-2) the primary indication shall be accompanied by a clear mark representing the sequence. For example, the number 1 or 2 or the letter A or B,

(b-3) when a primary indication of the self-service device is out of service, the self-service arrangement may continue its operation provided that it no longer uses any temporary storage, and that the measuring system indicating device remains the primary indication.

- (c) Where the mandatory primary indication for the benefit of the customer is provided by a device in the form of a separate constructional unit and this unit becomes uncoupled, or if the checking facilities detect a malfunction, the temporary storage mode shall be prohibited and the measuring system indicating device remains the primary indication.

(ii) *Pre-payment in attended service mode*

- (a) The requirements of paragraph 3, sub-paragraph (7) of Heading-B are applicable.
- (b) A printed or hand-written receipt of the pre-paid amount shall be provided.

(3) *Unattended service mode*

(i) *General*

- (a) The self-service arrangement shall provide additional primary indications by means of
 - a printing device for the issue of a receipt to the customer, and
 - a device (printing or memory device) on which measurement data are registered for the benefit of the supplier.

- (b) When the printing devices or memory device, as required in paragraph 5, sub-paragraph (3), clause (i), sub-clause (a) are not able to provide any indication or become unserviceable, the customer shall be clearly warned by automatic means before the operation commences.

Passing from attended to unattended service mode shall not be possible before correct operation of the arrangement is concluded as feasible by the checking facilities, including compliance with the above provision.

(c) Where the self-service arrangement is used by registered customers, the provisions of sub-clauses (a) and (b) of clause (i) of sub-paragraph (3) of paragraph 5 do not apply to measurements related to such customers. An additional individual mass totalizer is considered to provide a primary indication.

(d) Micro-processors, which upon disturbance or interference influence the measurement operation, shall be equipped with means for controlling the continuity of the processor program and for ensuring the discontinuation of the current delivery when the continuity of the processor program is no longer ensured.

The next effective acceptance of notes, cards or other equivalent mode of payment shall only take place if the continuity of the processor program is re-established.

(e) When a power supply failure occurs, the delivery data shall be memorized. The requirements of paragraph 4, sub-paragraph (2), clause (ii) of Heading-B shall apply.

(ii) *Delayed payment*

The printed and/or memorized indications as mentioned in paragraph 6 sub-paragraph (3) clause (i) of Heading-B shall contain sufficient information for further checking and at least, the measured quantity, the price to pay and information to identify the particular transaction (e.g., the measuring system number, location, date, time).

(iii) *Pre-payment in unattended service mode*

(a) Following the termination of each delivery, the printed and/or memorized indications as intended in paragraph 5, sub-paragraph (3), clause (i) of Heading-B shall be made available, clearly indicating the amount which has been pre-paid and the price corresponding to the gas obtained.

These printed and/or memorized indications may be divided into two parts as follows:—

(a) one part provided prior to the delivery on which the pre-paid amount is shown and recognizable 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.

(b) The requirements of paragraph 3 sub-paragraph (7) are applicable.

6. Markings and sealing

(1) *Marking*

(i) Each measuring system, component or sub-system for which model approval has been granted shall bear, placed together legibly and indelibly either on the dial of the indicating device or on a special data plate, the following information:—

(a) model approval sign,

(b) manufacturer's identification mark or trademark,

(c) designation selected by the manufacturer, if appropriate,

(d) serial number and year of manufacture,

(e) characteristics as defined in paragraph 1, sub-paragraph (3), clause (i) and paragraph 3, sub-paragraph (1), clause (i) of Heading—

(f) where relevant, the maximum allowed speed for the sequential control device (the tested one).

Note: The indicated characteristics should be the actual characteristics of use, if they are known when the plate is affixed. When they are not known, the indicated characteristics are those allowed by the model approval certificate.

However, the minimum and the maximum temperatures of the gas shall appear on the data plate only when they differ from -10 degree Centigrade and $+40$ degree Centigrade respectively.

The minimum measured quantity of the measuring system shall in all cases be clearly visible on the dial of any indicating device visible to the user during the measurement.

When a measuring system can be transported without being dismantled, the markings required for each component may also be combined on a single plate.

- (ii) Any information, markings or diagrams specified shall be clearly visible on the dial of the indicating device or within proximity to it. The markings on the dial of the indicating device of a meter forming a part of a measuring system shall not contravene those on the data plate of the measuring system.

(2) *Sealing devices and stamping plate:*

(i) *General*

Sealing is preferably carried out by means of lead seals. However, other types of sealing are permitted on fragile instruments or when these seals provide sufficient integrity, electronic seals for instance.

The seals shall, in all cases, be easily accessible.

Sealing should be provided on all parts of the measuring system which cannot be materially protected in any other way against operations liable to affect the measurement accuracy.

Sealing devices shall prohibit changing of any parameter that participate in the determination of measurement results (parameters for correction and conversion in particular).

A plate, referred to as the stamping plate, aimed at receiving the control marks, shall be sealed or permanently attached on a support of the measuring system. It may be combined with the data plate of the measuring system referred to in paragraph 6, sub-paragraph (1) of Heading-B.

(ii) *Electronic sealing devices*

- (a) When access to parameters that participate in the determination of results of measurement is not protected by mechanical sealing devices, the protection shall fulfil the following provisions:—

(a-1) access shall only be allowed to authorized people, by means of a special device (hard key, etc.). Only a code is not considered as fulfilling this provision;

(a-2) it shall be possible for at least the last hundred interventions to be memorized; the record shall include the date with time and characteristic elements identifying the authorized person making the intervention [see (a) above] and the value of the parameters changed the traceability of these interventions shall be assured for at least

two years, if it is not over-written on the occasion of a further intervention; if deletion of a previous intervention must occur to permit a new record, the oldest record shall be deleted.

- (b) For measuring systems with parts which may be disconnected one from another by the user and which are interchangeable, the following provisions shall be fulfilled:—

(b-1) it shall not be possible to access parameters that participate in the determination of results of measurements through disconnected points unless the provisions in paragraph 6, sub paragraph (2), clause (ii), sub clause (a) of Heading-B are fulfilled;

(b-2) interposing any device which may influence the accuracy shall be prevented by means of electronic and data processing securities or, if not possible, by mechanical means.

- (c) For measuring systems with parts which may be disconnected one from another by the user and which are not interchangeable, the provisions in paragraph 6, sub-paragraph (2), clause (ii) sub-clause (b) of Heading-B apply. Moreover, these measuring systems shall be provided with devices which do not allow them to operate if the various parts are not associated according to the manufacturer's configuration.

Note: Disconnections which are not allowed to the user may be prevented, for example by means of a device that prevents any measurement after disconnecting and reconnecting.

7. *Metrological control*

When a test is conducted, the expanded uncertainty on the determination of errors on indications of mass shall be less than one-fifth of the maximum permissible or tolerance applicable for that test on model approval and one-third of the maximum permissible error applicable for that test on other verifications.

However, this provision may not be fulfilled for tests at the minimum measured quantity or twice this value.

Note: The expanded uncertainty includes components of uncertainties that are in relation to the instrument to be verified, in particular its scale interval and, if applicable, the periodic variation. However the repeatability error of the meter or device to be verified shall not be included in the uncertainty.

(1) Model approval**(i) General**

Measuring systems subject to legal metrology control shall be subjected to model approval.

The test aims at verifying that the measuring system complies with the provisions of paragraph 2 sub-paragraph (1), clauses (ii) and (iii) within the field of operation. The test will be conducted as per the procedure outlined in Annexure.

ANNEXURE

Tests for determination of error of compressed gaseous fuel measuring system fitted with mass flow meter at the time of verification/re-verification.

1. Determine the tare weight of empty Compressed Natural Gas cylinder using weighing instrument of appropriate capacity, with verification scale interval of 10 g or less.
2. Thereafter the cylinder be connected to the Compressed Gaseous fuel measuring system be filled to the extent of approximately 10 kilogram.
3. From the initial and final weight of the cylinder, the weight of the CNG actually filled in the cylinder (T) is determined.
4. From the initial and the final readings of the measuring system, the CNG filled as indicated by the system (I) be determined.
5. The percentage of error of the measuring system is given by the formula :

$$\text{Error in percentage} = \frac{I - T}{T} \times 100$$

NINTH SCHEDULE**PROCEDURE FOR CARRYING OUT CALIBRATION OF VEHICLE TANKS, ETC.**

[See Rule 14]

PART I**CALIBRATION OF VEHICLE TANKS FOR PETROLEUM PRODUCTS AND OTHER LIQUIDS****1. Definitions**

(a) *Vehicle tank*—An assembly used for measurement and delivery of liquids comprising a tank which may or may not be sub-divided into compartments, mounted upon a vehicle together with its necessary piping, valves, meters, etc.

(b) *Compartment*—The entire tank, when this is not sub-divided; otherwise any one of these sub-divisions of a tank designed to hold liquid.

(c) *Calibration*—Verification and stamping of the capacity of the vehicle tank or its compartments.

(d) *Dip stick*—A square or rectangular metal bar of brass or any other suitable hard material used to determine the depth of the liquid in the tank.

(e) *Ullage stick*—A T-shaped metal bar of brass or other suitable material used to determine the depth of the level of liquid from the proof level.

(f) *Ullage indicator*—A device bolted to the inside of a manhole neck ring with the indicator set to any desired level to which liquid in the tank is required to be filled.

(g) *Proof level*—Reference level to which all depth measurements shall be related.

(h) *Dip pipe*—A pipe rigidly attached at the top of the tank extending vertically downward up to approximately 15 cm from the bottom of the tank. The pipe shall have perforations at the top above the maximum liquid level.

2. Testing medium

(a) *Compartment testing*—Water or other appropriate liquid shall be used as a testing medium in determining the capacity of vehicle tank compartment.

(b) *Meter testing*—A vehicle tank meter shall be tested with a liquid of the same character or of approximately the same viscosity as the liquid to be measured through the meter.

3. Equipment and tools

The following equipment and tools are required for calibration of vehicle tank.

(a) *Proving measures*—When available, shall be checked for accuracy against an appropriate working standard measure.

(b) *Calibrated bulk meter*—An accurate meter fitted with a pre-set valve, air eliminator and strainer, which has been checked for accuracy against an appropriate working standard measure.

(c) A set of standard commercial measures.

(d) Other equipment and tools, viz. hose pipe, scriber, punch, try square, tyre pressure gauge, hammer, etc.

4. Calibration procedure

(a) Vehicle tanks used as measures shall be calibrated as capacity measures. In the case of meter equipped tanks the meter shall be treated as a separate measuring instrument for purpose of calibration.

(b) The compartment capacity or capacities shall be taken as including the capacities of the delivery lines leading from the emergency, safety or master valve to the outlet valve (discharge valve)