

- on the scale or to one-fifth of the scale interval (of the first element for mechanical indicating devices), whichever is greater,
- (ii) for discontinuous indicating device, the volume corresponding to two scale intervals.
- (ii) Mechanical indicating device
- (a) When the graduation of an element is entirely visible, the value of one revolution of that element shall be in the form  $10^n$  authorized units of volume; this rule however, does not apply to the element corresponding to the maximum range of the indicating device.
- (b) On an indicating device having several elements, the value of each revolution of an element whose graduation is entirely visible must correspond to the scale interval of the following element.
- (c) An element of the indicating device may have continuous or discontinuous movement, but when elements other than the first have only part of their scales visible through the windows, these elements shall have discontinuous movement.
- (d) The advance by one figure of any element having discontinuous movement shall occur and be completed when the preceding element passes from 9 to 0.
- (e) When the first element has only a part of its scale visible through a window and has a continuous movement, the dimension of that window shall be at least equal to 1.5 times the distance between two consecutive graduated scale marks.
- (f) All scale marks shall have the same width, constant along the line and not exceeding one quarter of the scale spacing. The apparent scale spacing shall be equal to or greater than 2 mm. The apparent height of the figures shall be equal to or greater than 4 mm, unless otherwise specified in the requirements for particular measuring systems.
- (iii) Electronic indicating device
- The continuous display of volume during the period of measurement is only mandatory in the case of direct selling to the public. However, if interrupting the display of volume interrupts the action of some checking facilities that are mandatory or necessary to ensure correct measurement, the volume passing through the meter during each interruption shall be smaller than or equal to the minimum measured quantity.
- (iv) Zero setting device for volume indicating device
- (a) A volume indicating device may be provided with a device for setting the indication to zero either by manual operation or by means of an automatic system.
- (b) The zero setting device shall not permit any alteration of the measurement result shown by the volume indicating device (other than by making the result disappear and displaying zeros).
- (c) Once the zeroing operation has begun it shall be impossible for the volume indicating device to show a result different from that of the measurement which has just been made, until the zeroing operation has been completed.
- Indicating devices on fuel dispensers and electronic measuring systems shall not be capable of being reset to zero during measurement. On other measuring systems, either this provision shall be fulfilled or a clearly visible notice shall be provided on the indicating device stating that this operation is prohibited.
- (d) On continuous indicating devices, the residual indication after return to zero shall not be more than half the minimum specified volume deviation.
- (e) On discontinuous indicating devices, the indication after return to zero shall not be zero without any ambiguity.
- (3) Price indicating device
- (i) A volume indicating device with aligned figures and zero setting may be

complemented with a price indicating device, also with aligned figures and zero setting.

- (ii) The selected unit price shall be displayed by an indicating device before the start of the measurement. The 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 5 s. 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) The provisions in paragraph 3.(2) relating to volume indicating devices apply also, by analogy, to the price indicating devices.

- (iv) The monetary unit used, or its symbol, shall appear in the immediate vicinity of the indication.

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

- (vi) The minimum specified price deviation shall be greater than or equal to the following value:—

- for continuous indicating devices, the price corresponding to 2 mm on the scale or to one-fifth of the scale interval (of the first element for mechanical indicating devices), whichever is greater,
- for discontinuous indicating devices, the price corresponding to two scale intervals.

However, the interval of one-fifth of the scale interval or of 2 mm in the case of the first hyphen or the scale interval in the case of the second hyphen needs not correspond to a value less than that of the smallest coin in circulation in the country in which the equipment is used.

- (vii) The difference between the indicated price and the price calculated from the unit price and the indicated volume shall not exceed the minimum specified price deviation.

However, this difference need not be less than the smallest monetary value as defined in paragraph 3(3)(vi).

Moreover, this requirement does not apply when the unit price has been changed between two measurements.

- (viii) On continuous indicating devices, the residual indication after zeroing shall not exceed half the minimum specified price deviation. However, this indication need not be less than the smallest monetary value as defined in paragraph 3(3)(vi).

- (ix) On discontinuous indicating devices, the indication after zeroing shall be zero without any ambiguity.

#### (4) Printing device

- (i) The printed scale interval shall be in the form of  $1 \times 10^n$ ,  $2 \times 10^n$  or  $5 \times 10^n$  authorized units of volume,  $n$  being a positive or negative whole number, or zero, and shall not be greater than the minimum specified volume deviation.

The printed scale interval shall not be smaller than the smallest scale interval of the indicating devices.

- (ii) The volume printed shall be expressed in one of the units authorized for the indication of volume.

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

- (iii) The printing device may also print information identifying the measurement such as: sequence number, date, identification of the dispenser, type of liquid, etc.

If the printing device is connected to more than one measuring system, it must print the identification of the relevant system.

- (iv) 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".

- (v) If the volume is determined by the difference between two printed values, even if one is expressed in zeros, it shall be impossible to withdraw the ticket from the printing device during measurement.

- (vi) Where the printing device and volume indicating device each have a zeroing

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  $1 \times 10^n$ ,  $2 \times 10^n$  or  $5 \times 10^n$  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.

- (vii) The pre-set quantities and the quantities shown by the volume indicating device shall be expressed in the same unit. This unit (or its symbol) shall be marked on the pre-setting mechanism.
- (viii) The scale interval of the pre-setting device shall not be less than the scale interval of the indicating device.
- (ix) Pre-setting devices may incorporate a device to permit the flow of liquid to be stopped quickly when necessary.
- (x) Measuring systems with a price indicating device may also be fitted with a price pre-setting device which stops the flow of the liquid when the quantity delivered corresponds to the pre-set price. The requirements in paragraph 3(6)(i) to 3(6)(ix) apply by analogy.

#### (7) Conversion device

- (i) Measuring systems may be fitted with a conversion device as defined in paragraph 1(12) of Part 1. The provisions of the paragraph 3(7) mainly apply to electronic conversion devices in which conversion calculations are made numerically by an electronic computer. Analogous provisions could apply by analogy to mechanical conversion devices.
- (ii) The calculation of the conversion factor shall be made according to these specifications.
- (iii) As a rule, the parameters which characterize the measured liquid and which intervene in the conversion formula shall be measured using associated measuring instruments. However, some of these parameters may be not measured, or associated measuring instruments may be not subject to control when their influence on the conversion factor is negligible (less than one-tenth of the maximum permissible error as specified in paragraph 2(5)(i).

For example, in many cases it is possible to make a conversion to volume in base conditions by measuring temperature only, when pressure and density vary little.

- (iv) Associated measuring instruments shall comply with applicable International Recommendations and Standards. In addition, maximum permissible errors for

these instruments are those specified in paragraph 2(7)(ii).

- (v) Associated measuring instruments shall be installed near the meter so as to determine the relevant quantities as they exist in the meter in a sufficiently accurate way.

The changes in indication due to the location of the measuring points shall not exceed 0.2 times the maximum permissible error for the measuring system. Subject to fulfilment of this requirement, the same associated measuring instruments may be used for making conversions (and corrections) for several meters.

These instruments shall not affect the correct functioning of the meter(s).

**Note :** These requirements are checked by calculation.

- (vi) All the parameters which are not measured and which are necessary for the conversion shall be present in the calculator at the beginning of the measurement operation. It must be possible to print or to indicate them from the calculator.

For a mechanical conversion device that cannot print or indicate these values, a seal must be broken to change any setting.

- (vii) In addition to the volume at metering conditions and the volume in base conditions or the mass, which shall be displayed according to paragraph 2(9)(ii) the values of other measured quantities (density, pressure, temperature) shall be accessible for each test measurement.

Scale intervals for density, pressure and temperature shall be smaller than or equal to one quarter of the maximum permissible errors fixed in paragraph 2(7)(ii) for associated measuring instruments.

#### (8) Calculator

All parameters necessary for the elaboration of indications that are subject to legal metrology control, such as unit price, calculation table, correction polynomial, etc. shall be present in the calculator at the beginning of the measurement operation.

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. Measuring systems equipped with 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(5) under rated operating conditions.

(a) Interruptible electronic measuring systems shall be designed and manufactured such that, when they are exposed to the disturbances specified in paragraph 4 of Annexure A.

- 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.

(b) Non-interruptible measuring systems shall be designed and manufactured in such a way that no significant faults occur when they are exposed to the disturbances specified in paragraph 4 of Annexure A.

(ii) It is the responsibility of the manufacturer to decide whether a given pattern of measuring system is interruptible or not, taking into account the applicable rules of security. However, measuring systems for direct selling to the public shall be interruptible.

When, at the time of pattern approval, it is not possible to specify the future utilization of the instrument, the requirements in paragraph 4(1)(i)(b) apply.

(iii) The requirements in paragraph 4(1)(i) shall be met durably. For this purpose electronic measuring systems shall be provided with the checking facilities specified in 4(3).

(iv) A pattern of a measuring system is presumed to comply with the requirements in paragraph 4(1)(i) and paragraph 4(1)(iii) if it passes the inspection and tests specified in paragraph 6(1)(xi)(a) and paragraph 6(1)(xi)(b).

(v) Measuring systems shall permit the retrieval of the information relating to the measured volume contained within the instrument when a significant fault occurred and was detected by checking facilities.

##### (2) Power supply device

(i) When the flow is not interrupted during the failure of the principal power supply device, the measuring system shall be provided with an emergency power supply device to safeguard all measuring functions during that failure.

(ii) When the flow is interrupted during the failure of the principal power supply device, the provisions in paragraph 4(2)(ii) shall be met, or data contained at the moment of the failure shall be saved and displayable on an indicating device subject to legal metrology control for sufficient time to permit the conclusion of the current transaction.

The absolute value of the maximum permissible error for the indicated volume in this case is increased by 5% of the minimum measured quantity.

##### (3) Checking facilities

(i) Action of checking facilities

The detection by the checking facilities of significant faults shall result in the following actions, according to the type:

- (a) Checking facilities of type N: a visible or audible alarm for the attention of the operator.
- (b) Checking facilities of type I or P:
  - (aa) for non-interruptible measuring systems:

- automatic correction of the fault, or
- stopping only the faulty device when the measuring system without that device continues to comply with the regulations, or
- a visible or audible alarm for the operator; this alarm shall continue until the cause of the alarm is suppressed. In addition, when the measuring system transmits data to peripheral equipment, the transmission shall be accompanied by a message indicating the presence of a fault.

**Note :** The third hyphen is not applicable for the disturbances specified in Para 4 of Annexure A. In addition, the instrument may be provided with devices to estimate the amount of liquid having passed through the installation during the occurrence of the fault. The result of this estimate shall not be capable of being mistaken for a valid indication.

- (bb) for interruptible measuring systems, in particular for fuel dispensers:
- automatic correction of the fault, or
  - stopping only the faulty device, when the measuring system without that device continues to comply with the regulations, or
  - 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.

- (a) When the signals generated by the flow sensor are in the form of pulses, each pulse representing an elementary volume, at least security level B defined by ISO 6551 *Cabled transmission of electric and/or electronic pulsed data* is required.

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 liquid equal to the minimum specified volume deviation.

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

- (aa) by disconnecting the transducer, or
- (bb) by interrupting one of the sensor's pulse generators, or
- (cc) by interrupting the electrical supply of the transducer.

- (b) For electromagnetic meters only, where the amplitude of the signals generated by the measurement transducer is proportional to the flowrate, the following procedure may be used:

A simulated signal with a shape similar to that of the measurement signal is fed into the input of the secondary device, representing a flowrate between the minimum and maximum flowrate of the meter. The checking facility shall check the primary and the secondary device. The equivalent digital value is checked to verify that it is within predetermined limits given by the manufacturer and consistent with the maximum permissible errors.

This checking facility shall be of type P or I. In the latter case, the checking shall occur at least every five minutes.

**Note :** Following this procedure, additional checking facilities (more than two electrodes, double signal transmission etc.) are not required.

- (c) For other technologies checking facilities providing equivalent levels of security remain to be developed.

## (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, except in the case of fuel dispensers, for which it shall occur at each delivery. The objective of the checking is to verify that:

(aa) the values of all permanently memorized instructions and data are correct, by such means as—

- summing up all instructions and data codes and comparing the sum with a fixed value,
- line and column parity bits (LRC and VRC),
- cyclic redundancy check (CRC 16),
- double independent storage of data,
- storage of data in "safe coding", for example protected by checksum, line and column parity bits,

(bb) 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" (checksum, 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. These checking facilities shall either have the form as defined in paragraph 4(3)(iv)(a) or the form as defined in paragraph 4(3)(iv)(b).

(a) 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 a fuel dispenser it is possible to determine the price to pay from the volume and the unit price).

Means may include, for example:

(aa) for indicating devices using incandescent filaments or LEDs, measuring the current in the filaments,

(bb) for indicating devices using fluorescent tubes, measuring the grid voltage,

(cc) for indicating devices using electromagnetic shutters, checking the impact of each shutter,

(dd) 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.

(b) The checking facility for the indicating device shall include type I or type P checking of the electronic circuits used for the indicating device (except the driving circuits of the

display itself); this checking shall meet the requirements in paragraph 4(3)(i)(a).

It shall also provide visual checking of the entire display which shall meet the following description:—

(aa) for fuel dispensers:

- displaying all the elements ("eights" test)
- blanking all the elements ("blank" test)
- displaying "zeros"
- Each step of the sequence shall last at least 0.75 second.

(bb) for all other measuring systems, the test sequence as described under (a) or any other automatic test cycle which indicates all possible states for each element of the display.

This visual checking facility shall be of type I for fuel dispensers and of type N for other measuring systems, but it is not mandatory for a malfunction to result in the actions described in paragraph 4(3)(i).

(c) 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.

(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:

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

It shall be possible during pattern 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. Requirements specific to certain types of measuring systems**

### **(1) Fuel dispensers**

Except where otherwise specified, the requirements in this sub-clause do not apply to LPG dispensers.

- (i) By design, the ratio between the maximum flowrate and the minimum flowrate for these systems shall be at least ten; on site, this ratio may be smaller provided that it is not less than five.
- (ii) When the measuring system includes its own pump, a gas elimination device shall be installed, immediately upstream of the meter inlet. Where a gas indicator is fitted, it shall not have a venting device as mentioned in paragraph 2(11).
- (iii) When the measuring system is intended for installation in a centrally pumped system, or for a remote pump, the general provisions in paragraph 2(10) shall be applied.

If it is not intended to install a gas elimination device the manufacturer or



installer has to prove that there is no risk for air intake or gas release. In this case the minimum level in the storage tank must be automatically secured and any leakage shall be checked [see also paragraph 2(10)(ii)].

- (iv) Fuel dispensers shall be equipped with a device for resetting the volume indicating device to zero.

The minimum height for the figures of the resettable volume indicator is 10 mm.

If these systems also include a price indicating device, this indicating device shall be fitted with a zero resetting device. The minimum height for the price indicator remains 4 mm [paragraph 3(2)(ii)(f)].

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

When two or more nozzles can be used simultaneously or alternately, and after the utilized nozzles have been replaced, the next delivery shall be inhibited until the indicating device has been reset to zero. Moreover, by design, the provisions in the first paragraph of paragraph 2(16)(i) shall be fulfilled.

The above requirements do not apply when an auxiliary hand pump is used.

- (vi) Measuring systems having a maximum flowrate not greater than 3.6 m<sup>3</sup>/h shall have a minimum delivery not exceeding 5 L.
- (vii) When the measuring system is fitted with a ticket printing device which is subject to control, this printing device shall comply with the relevant requirements in 3.4. In addition, any printing operation shall prevent the continuation of the delivery until a reset to zero has been performed. However, the printing operation shall not change the quantity indicated on the indicating device.
- (viii) Fuel dispensers shall be interruptible.
- (ix) In addition to requirements in paragraph 4(2)(ii), electronic fuel dispensers shall be such that the minimum duration of operation of the display shall be either—
- (a) at least 15 min continuously and automatically after the failure of the principal electrical supply, or

- (b) a total of at least 5 min in one or several periods controlled manually during one hour after the failure.

**Note :** If a test during pattern approval is necessary to verify that the fuel dispenser fulfils this requirement, the instrument has to be supplied with electric power normally for the 12 hours which preceded the test. Before this supply the battery (if provided) may be unloaded.

In addition, fuel dispensers 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 s.

- (x) Electronic fuel dispensers shall be such that the delay time between the measurement value and the corresponding indicated value shall not exceed 500 ms.

Several fuel dispensers may have a common indicating device if and only if the first provision in paragraph 2(9)(vi) is met.

- (xi) The checking of the operation of the calculator, as described in paragraph 4(3)(iii)(a), shall be performed at least once for each delivery.

- (xii) It is not required to display volumes, and prices if applicable, that correspond to a small number of scale intervals at the beginning of the delivery, and to start the display with that volume and the corresponding price.

The volume thus hidden shall not be greater than two times the minimum specified volume deviation. The hidden price shall not be greater than the price corresponding to that volume.

- (2) *Measuring systems on road tankers for the transport and delivery of liquids of low viscosity ( $\leq 20$  MPa.s) and stored at atmospheric pressure with the exception of potable liquids*

- (i) The provisions hereafter apply to measuring systems mounted on road tankers or transportable tanks.

- (ii) Tanks equipped with measuring systems may comprise one or more compartments.
- (iii) The compartments of road tankers shall be fitted with an anti-swirl device, except when the measuring system is fitted with a gas separator which complies with paragraph 2(10)(viii).
- (iv) When a tank comprises more than one compartment, each compartment shall be provided with an individual (manual or automatic) closing device in each outlet line.
- (v) In conformity with national-regulations on their use, each measuring system shall be allocated to a specific product or to a range of products for which the meter has been approved.
- The pipework shall, as far as possible, be designed so that products cannot become mixed in the measuring system.
- (vi) Subject to the requirements in paragraph 2(16), a measuring system mounted on a road tanker may include empty or full hoses or both. Where several hoses are intended to operate alternatively, the changing of the delivery path shall be impossible during a measurement operation. To this end, the change of the delivery path may be linked to the resetting to zero of the volume indicating device.
- (vii) The volume indicating device shall include a zero resetting device complying with paragraph 3(2)(iv).
- When the measuring system is fitted with a ticket printing device, any printing operation shall prevent the continuation of the delivery until a reset to zero has been performed, except for printing devices determining the delivered volume by means of two consecutive indications.
- (viii) Measuring systems mounted on road tankers may be designed to operate by pump only, or by gravity only, or with the choice of either pump or gravity, or by gas pressure.
- (a) Measuring systems fed by pump only may operate either empty hose or full hose.
- (b) If there is a risk that the requirements in paragraph 2(10)(ii) related to the absence of air or gas cannot be complied with, the meter shall have one of the following gas elimination devices upstream of it:
- a suitable gas separator conforming to paragraph 2(10)(viii),
  - a special gas extractor, conforming to paragraph 2(10)(ix),
  - a gas extractor, conforming to paragraph 23(10)(ix).
- When, in a measuring system, the pressure at the outlet of the meter can be lower than the atmospheric pressure while remaining higher than the saturated vapour pressure of the measured product, the above devices shall be combined with an automatic system for slowing down and stopping the flow to prevent any air from entering the meter.
- When the pressure at the outlet of the meter cannot be lower than atmospheric pressure (this is especially the case for systems operating solely full hose), the use of automatic devices for slowing down and stopping the flow is not required.
- (c) The special gas extractor shall be fitted with a sight glass.
- (d) Measuring systems operating solely by gravity shall comply with the following requirements.
- (e) The equipment shall be so constructed that the total contents of the compartment(s) can be measured at a flowrate greater than or equal to the minimum flowrate of the measuring system.
- (f) If there are connections with the gas phase in the tank of the road

tanker, appropriate devices shall prevent any gas from entering the meter.

- (g) The requirements in paragraph 2(10)(iii) concerning non-pumped flow shall apply.

A pump downstream of the transfer point for increasing the flowrate may be authorized if the foregoing provisions are complied with. This pump shall not cause a fall in pressure in the meter.

- (h) For measuring systems which include a manual release to the atmosphere immediately downstream of the transfer point, a gas indicator is mandatory.
- (i) Measuring systems capable of being operated either by gravity or by pump shall comply with the requirements in paragraph 5(2)(viii)(a) and 5(2)(viii)(b).
- (j) Measuring systems operated by means of gas pressure may operate empty hose or full hose. The pipework which links the meter to the device intended to prevent any gas from entering the meter as specified in point paragraph 2(10)(iii) shall have no constriction or component likely to cause a pressure loss which could generate gas pockets by releasing the gas dissolved in the liquid.

These systems shall include a pressure gauge which indicates the pressure in the tank. The dial of this gauge shall indicate the range of permissible pressures.

*(3) Measuring systems for the unloading of ships' tanks and of rail and road tankers using an intermediate tank*

- (i) Measuring systems designed to measure volumes of liquids during the unloading of ships' tanks and of rail and road tankers may include an intermediate tank in which the liquid level determines the transfer point. This intermediate tank may be designed to ensure the elimination of gas.

The cross section of the intermediate tank shall be such that a volume equal to the

minimum specified volume deviation corresponds to a difference in level of at least 2 mm.

- (ii) In the case of road and rail tankers, the intermediate tank shall automatically ensure a constant level, visible or detectable, at the beginning and at the end of the measurement operation. The level is considered to be constant when it settles within a range corresponding to a volume of no more than the minimum specified volume deviation.

- (iii) In the case of ships' tanks, it is not necessary to provide for the automatic maintenance of a constant level. Where such a provision is not made, it shall be possible to measure the contents in the intermediate tank.

If the ship's tank is unloaded by means of pumps located in the bottom of the ship, the intermediate tank may be used only at the beginning and at the end of the measurement operation.

*(4) Measuring systems for liquefied gases under pressure (other than LPG dispensers)*

- (i) Only full hose measuring systems are authorized.
- (ii) A pressure maintaining device, located downstream of the meter, shall ensure that the product in the meter remains in a liquid state during the measurement. The necessary pressure may be maintained either at a fixed value or at a value adjusted to suit the measurement conditions.

- (a) When the pressure is maintained at a fixed value, this value shall be at least equal to the vapour pressure of the product at a temperature 15°C above the highest possible operating temperature. It shall be possible to protect the adjustment of the pressure maintaining device with a seal.

- (b) When the pressure is adjusted to suit the measurement conditions, this pressure shall exceed the vapour pressure of the liquid during the measurement by at least 100 kPa (1 bar). This adjustment shall be automatic.

- (c) For stationary measuring systems for industrial use, the competent metrology service may authorize

manually-adjustable pressure maintaining devices. The pressure at the meter outlet shall then be at least equal to the vapour pressure of the product at a temperature 15°C above the temperature of the measurement. It is then necessary to attach a diagram to the measuring system, giving the vapour pressure of the measured product as a function of its temperature. If it is anticipated that these measuring systems may have to operate unsupervised over long periods, the temperature and pressure shall be registered continuously by means of appropriate instruments.

- (iii) A gas elimination device shall be fitted upstream of the meter. However, if it is demonstrated that no vapour release will occur during measurements a gas elimination device is not mandatory. This demonstration shall include tests under the worse conditions.

- (a) The gas separator shall comply with the general requirements in paragraph 2(10)(i), either for the liquefied gas itself or for a liquid of higher viscosity.

However, because of the low viscosity of liquefied gases and due to the difficulty of control, it is accepted that when the length of the pipework linking the meter to the feed tank does not exceed 25 m, a gas separator may be approved if its useful volume is at least equal to 1.5% of the volume delivered in one minute at maximum flowrate. When the length of this pipework exceeds 25 m, the useful volume of the gas separator shall be at least equal to 3% of the volume delivered in one minute at maximum flowrate.

The gas outlet pipe of the separator may be connected to the space in the feed tank which contains the gaseous phase, or to an independent pressure maintaining device set to a pressure from 50 to 100 kPa (0.5

to 1 bar) lower than the pressure at the meter outlet. This pipe may incorporate a shut-off valve, which meets the requirements in paragraph 2(10)(v).

- (b) The volume of the condenser tank depends on the volume of the pipework between the supply tank valve and the pressure maintaining valve, downstream of the meter. The volume of this condenser tank shall be at least equal to twice the reduction in volume of the liquid which is likely to occur between these valves if the temperature drops by a value conventionally fixed at 10°C for exposed pipes and 2°C for insulated or underground pipes.

To calculate the contraction, the coefficient of thermal expansion shall be rounded to  $3 \times 10^{-3}$  per degree Celsius for propane and propylene and  $2 \times 10^{-3}$  per degree Celsius for butane and butadiene. For other products with a high vapour pressure, the values of the coefficient to be adopted shall be specified by the competent metrology service.

The condenser tank shall be fitted with a manual blow off valve. It shall be fitted at the high point in the pipework of the measuring system of which it is part.

The volume resulting from the above calculation may be divided between several condenser tanks located at high points in the pipework.

- (iv) A thermometer well or, when this thermometer well is not imposed by specific professional practices, another means for measuring temperature, shall be provided close to the meter. The thermometer used shall have a scale interval not exceeding 0.5°C and shall be verified.

Provisions shall be made for fitting a pressure measuring device between the meter and the pressure maintaining device. This measuring

device shall be available for verification. If necessary, provisions for sealing shall be made.

- (v) When the volume is measured using a system mounted on a road tanker, any connection between the gaseous phases of the vehicle's tank and of the receiving tank is prohibited unless it is essential for completing a measurement, in which case a non-return valve is mandatory.

For other measuring systems for liquefied gas, such connections are permitted when the volumes of gas transferred via these connections are measured by means of suitable measuring instruments.

- (vi) Safety valves may be incorporated in measuring systems in order to prevent abnormally high pressures. If they are located downstream of the meter, they shall open to the atmosphere or be connected to the receiving tank.

In no case shall the safety valves located upstream of the meter be connected to the valves located downstream by pipes which bypass the meter.

- (vii) When the conditions of operation require the use of detachable hoses, these hoses shall remain full if their volumes are greater than the minimum specified volume deviation.

Detachable full hoses shall be fitted with special connections for full hoses, so-called couplers or self-sealing valves. Manually operated blow-off devices shall be provided at the ends of these hoses, if necessary.

- (viii) The control valve of the double closing device mentioned in paragraph 2(16)(iii) for pipework bypassing the meter, if provided, may be closed for safety reasons. In this case, any leakage shall be monitored by a pressure gauge located between the two shut off valves or by any other equivalent system.

- (ix) For measuring systems mounted on road tankers the volume indicating device and its printing device, if provided, shall comply with the requirements in paragraph 5(2)(vii).

- (x) The provisions in paragraph 5(4) also apply for measuring systems for liquefied carbon dioxide with the following exceptions:

- only empty hose measuring system [are authorized (see paragraph 5(4)(i)),
- the connection between the gaseous phases of the vehicle's tank and of the receiving tank is authorized if (i) a device is installed to allow compensation of the delivered quantity by an amount relating to the quantity of vapour returned in the gas line, or (ii) compensation is made by automatic or manual calculation. However, in both cases, flow from the delivery tank to the receiving tank by means of the gas return line shall be securely prevented [see paragraph 5(4)(v)],
- the requirements of paragraph 5(4)(vii) are not mandatory for these systems.

#### (5) *Measuring systems for milk*

- (i) The following requirements apply to transportable measuring systems which are mounted on road tankers and used for the collection of milk, to fixed measuring systems used for the reception of milk at the dairy, and to fixed or transportable measuring systems used for the delivery of milk.
- (ii) The transfer point in reception installations is defined by a constant level in a tank upstream of the meter. It must be possible to check this constant level before and after each measurement. The level shall be established automatically.
- (a) When the meter is fed by means of a pump, the constant level tank may be placed either upstream of the pump or between the pump and the meter.
- (b) If the constant level tank is placed upstream of the pump, the tank itself may be fed by gravity, by emptying milk churns, by means of an auxiliary pump or by means of a vacuum system.

If the milk is introduced by means of a pump or a vacuum system, a gas

- elimination device is necessary. This device may be combined with the constant level tank.
- (c) If the constant level tank is placed between the pump and the meter, this tank shall ensure that gas is eliminated.
- (d) Notwithstanding the requirements of paragraph 2(13)(iii), the meter may be fed by means of a vacuum system. In this case, the pressure inside the pipework connecting the constant level tank to the meter will be lower than atmospheric pressure and the tightness of the joints of this connection must be particularly well ensured. It must be possible to check the tightness and a notice plate drawing attention to this checking shall be provided.
- (e) In all installations for reception, the pipework upstream of the constant level device shall empty completely and automatically under the rated operating conditions.
- (f) The constant level is monitored by means of a sight glass or a level indicating device. The level is considered to be constant when it settles within a range defined by two marks at least 15 mm apart and corresponding to a difference in volume of no more than twice the minimum specified volume deviation.
- (g) If, in order to meet the above condition, devices for reducing the flowrate are incorporated in the measuring system, the flowrate during the period of reduced flowrate shall be at least equal to the minimum flowrate of the meter.
- (h) If, in a reception installation at a dairy, the measured liquid flows to a level lower than that of the meter, a device shall automatically ensure that the pressure at the outlet of the meter remains above atmospheric pressure.
- (i) If a volume of liquid is required to fill the measuring system prior to the first measurement, it shall be indicated on the data plate of the measuring system so that it can be taken into account, by calculation, in the first measurement of a reception period. The first volume measured by the measuring system during a reception period shall be equal to or greater than the volume which is necessary for the complete filling of the measuring system.
- (iii) Measuring systems used for delivery shall comply with the general requirements in clause 2 and with those in clause 3.
- (iv) Notwithstanding the general requirements in paragraph 2(10) concerning the elimination of air or gases, the gas elimination devices shall comply with the requirements in paragraph 2(10)(i) solely under the conditions of use, i.e. with entry of air at the beginning and end of each measuring operation of delivery.
- The mounting of delivery installations shall be such that the pressure of the liquid at the level of the joint to the supply tank is always greater than atmospheric pressure.
- (v) The volume indicating device of a transportable measuring system and its printing device, if provided, shall comply with the requirements in paragraph 5(2)(vii).
- (6) Measuring systems on pipeline and systems for loading ships*
- (i) The ratio between the maximum flowrate and the minimum flowrate of the meter of the measuring system may be less than the value specified in the relevant paragraph in paragraph 3(1)(i)(c).
- In this case, the measuring system shall be fitted with an automatic checking device to verify that the flowrate of the liquid to be measured is within the restricted measuring range of the measuring system.
- This checking device shall be of type P and shall meet the requirements in paragraph 4(3)(i)(b).
- The maximum and minimum flowrates may be determined in relation to the liquid to be measured and manually introduced into the calculator.
- (ii) Prevention of gas flow
- The measuring system shall be provided with a means of eliminating any air or gas contained in the liquid unless the entry of air into the liquid or release of gas from

the liquid is prevented by the configuration of the pipework or by the arrangement and operation of the pump(s).

(iii) Special conditions of installation

Reserve flow of the liquid to be measured in the measuring system shall be prevented by a suitable device, unless otherwise approved.

(iv) Sampling device

The measuring system may include a sampling device intended to determine the properties of the liquid to be measured.

It is not necessary to take into account the volume of the sample in the results of the measurement if this sample is less than 0.1 times the maximum permissible error of the measuring system.

(v) Testing devices

Measuring systems in pipelines should be provided with devices allowing verification of the systems in situ. However, this principle may be waived provided that:

- the meters are verified on a control test station with liquids having the same characteristics as those to be measured at the place of installation. The verification is carried out on the measurement transducer only, associated with a compatible and equivalent indicating device, provided that all the elements having a direct mechanical link with the measurement transducer and being able to influence the measurement are verified at the same time,
- the meters benefiting from this exemption shall be subject to periodic calibration controlled and fixed by the metrology service, and
- to complete the verification, the measuring systems concerned shall be subjected to a qualitative check of function and installation, in situ.

Subject to this exemption, the measuring systems shall be constructed so that a standard of appropriate size can be fitted for testing the meters. When a test can only be carried out with the pumps running, which normally does not allow for testing with the meter stopped at the start and at the end of the test, the standard shall be suitable for continuous operation (for

example, volume standard with a flow diverting mechanism, pipe prover etc.).

Moreover, these capacities shall represent at least 10,000 scale intervals of the indicating device of the meter to be verified or of the auxiliary indicating device used for the test or 10,000 electrical pulses of the measurement transducer. However, a lower capacity may be permitted if a visual or automatic interpolation allows one to ascertain the indication of the meter with an error smaller than or equal to one per ten thousand of this capacity.

Furthermore, it shall be possible to carry out a metrological test of the associated measuring instruments which may be incorporated and which aim at measuring density, viscosity, pressure and temperature, under actual operating conditions.

*(7) Fuel dispensers for liquefied gases under pressure (LPG dispensers)*

- (i) Requirements in paragraph 5(1)(i), 5(1)(iv) and 5(1)(vii) to 5(1)(xii) are applicable to LPG dispensers for motor vehicles. However, the ratio between the maximum flowrate and the minimum flowrate shall be at least five by design.
- (ii) Requirements in paragraph 5(4)(i), 5(4)(ii), 5(4)(ii)(a), 5(4)(ii)(b), 5(4)(iii), 5(4)(iii)(a) and 5(4)(iii)(b) are applicable to LPG dispensers for motor vehicles.
- (iii) The manufacturer or the owner of the measuring system shall provide a thermometer well or an equivalent means for measuring the temperature close to the meter. The thermometer used shall have a scale interval not exceeding 0.5°C and shall be verified.
- (iv) Connection between the gas phases of the feed tank and of the vehicle's tank is prohibited.
- (v) When only one nozzle can be used during a delivery, and after the nozzle has been replaced, the next delivery shall be inhibited until the indicating device has been reset to zero.

When two or more nozzles can be used simultaneously or alternately, and after the utilized nozzles have been replaced, the next delivery shall be inhibited until the indicating device has been reset to zero.

Moreover, by design, the provisions in the first paragraph of 2(16)(i) shall be fulfilled.

Moreover, in both cases, when the flow is stopped by emergency means and a predetermined delay is exceeded, the current delivery shall be stopped and the next delivery shall be preceded by a reset to zero.

- (vi) A non-return valve, located between the gas elimination device and the meter, is mandatory. The pressure loss caused by it shall be sufficiently low to be considered negligible.
- (vii) Hoses shall be fitted with special connections for full hoses, so-called couplers or self-sealing valves.
- (viii) Safety features shall not affect the metrological performance.
- (ix) When the measuring system is provided with a conversion device, it shall be possible to verify separately the indications of volume at measuring conditions and associated measuring instruments.
- (x) Closing valves in vapour return lines shall automatically result in stopping the delivery or preventing the start of the next delivery, unless these valves have been sealed in the open position.
- (xi) The construction of the nozzle shall be such that, at the moment of coupling or uncoupling, the loss of liquid does not exceed the minimum specified volume deviation.

*(8) Measuring systems intended for the refuelling of aircraft*

The requirements of this sub-clause also apply to the refuelling of helicopters.

(i) General

- (a) Measuring systems intended for refuelling aircraft are full hose measuring systems.
- (b) The gas elimination device function may be performed by a microfilter water elimination device provided that provisions in paragraph 2(10) are fulfilled.
- (c) They shall be interruptible measuring systems.

(ii) Stationary measuring systems

- (a) The requirements applicable to fuel dispensers apply to stationary measuring systems intended for the refuelling of aircraft, except those in paragraph 5(1)(i).
- (b) These systems may include their own pumps or be designed for installation in a centrally pumped system.
- (c) The microfilter-water elimination device shall be fitted upstream of the gas elimination device when these devices are separate one from another.

(iii) Mobile measuring systems

- (a) General
- (b) If more than one transfer point is provided, interlocks should prevent the usage of two or more together unless the arrangement is such that it would be difficult to use them on different aircrafts at the same time.
- (c) They may be designed for defuelling aircraft provided that the connecting point for defuelling is located upstream of the gas elimination device. A weir-type sight glass is not mandatory.  
Interlocks may also be necessary to prevent bypassing metered liquid through the return line back to the supply tank while delivering fuel to the aircraft.
- (d) Where the microfilter-water elimination device may be used to perform the function of the gas elimination device, it may be verified by an examination of documents only if provisions in paragraph 2(10) are fulfilled.

- (e) Each installation shall be provided with or accompanied by—
  - instructions for use,
  - a liquid circulation plan,
  - a description of necessary operations for use,
  - a description of control and connecting devices positions related to their use.
- (f) Aircraft refuelling tanker measuring systems



The requirements in paragraphs 5(2)(ii), 5(2)(iii), 5(2)(iv), 5(2)(vi), 5(2)(vii) and 5(2)(viii)(a) apply.

**Note :** For good practice in the use of the system, when the aircraft refuelling tanker measuring system is fitted with a device used to perform the gas extractor or special gas extractor function, a manometer should be provided upstream of the pump in order to detect depressions when they occur. Its indications should be easily visible by the operator.

- (g) Aircraft hydrant measuring systems
- (h) The gas elimination device may be a device performing the function of a gas extractor when the underground pipe—
- is designed for easy elimination of the air contained in the pipe with appropriate devices,
  - is fitted with special connecting devices for full hoses,
  - is supplied so that, in designed supply conditions, no gaseous formation can occur or enter the underground pipe.
- (i) When the aircraft hydrant measuring system is equipped with a device for froth recovery and re-injection, it shall be located upstream of the gas elimination device and it shall not permit permanent introduction of gas into the meter.
- (j) Depressurization valves for the hoses so that connection and disconnection can be easily made, shall be accompanied with interlocks to prevent metered liquid from being diverted.

*(9) Blend dispensers*

- (i) The requirements in paragraph 5(1)(i) to 5(1)(iv) and 5(1)(vi) to 5(1)(xii) are applicable to both parts of the multigrade-dispenser and to the gasoline part of the gasoline-oil-dispenser. However, by design, the ratio between the maximum flowrate and the minimum flowrate may be at least five in the case of multigrade-dispensers.
- (ii) When only one nozzle can be used during a delivery, and after the nozzle has been

replaced, the next delivery shall be inhibited until the indicating device has been reset to zero.

When two or more nozzles can be used simultaneously or alternately, and when the utilized nozzles have been replaced, the next delivery shall be inhibited until the indicating device has been reset to zero. Moreover, by design, the provisions in the first paragraph of paragraph 2(16)(i) shall be fulfilled.

- (iii) The requirements in paragraph 5(9)(iv) through paragraph 5(9)(viii) do not apply if the designations of the various mixtures do not allow conclusions to be drawn concerning the ratio of volumes of the two components.

Examples for such designations:

- number of stars (2, 3, 4 stars),
- octane-number (92, 95, 98 octane),
- two-stroke-mixture (without designation such as 5%).

Moreover, the requirement in paragraph 5(9)(iv) or 5(9)(v) only applies where the measuring system provides the indication of the mixed volume and the price of the mixture depends on the blending ratio. It does not apply where the measuring system provides—

- an indication of the mixed volume and the price does not depend on the blending ratio, or
- a volume indication for each component of the mixture and does not provide an indication of the mixed volume.

To permit compliance with the requirement in paragraph 5(9)(iv) or paragraph 5(9)(v) to be verified, it is necessary—

- for multigrade-dispensers to measure the volumes of both components,
  - for gasoline-oil-dispensers to measure either the volumes of oil and gasoline or the volumes of oil and mixture,
  - for both types to make the separate collection of both components feasible during verification.
- (iv) The accuracy of the blending ratio for multigrade-dispensers shall be as follows:—

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 shall be within the limits of  $\pm 5\%$ , i.e. the real ratio  $k_{\text{real}} = V_2/V_1$  of volumes of both components determined during the verification shall be equal to the nominal (indicated) ratio  $k_{\text{nom}}$  within the limits:

$$k_{\text{min}} = k_{\text{nom}} - 0.05 k_{\text{nom}} \text{ and } k_{\text{max}} = k_{\text{nom}} + 0.05 k_{\text{nom}}$$

### Examples:

Designation	3:1	1:1	1:3
$K_{\text{nom}}$	0.333	1.00	3.00
$K_{\text{min}}$	0.316	0.95	2.85
$K_{\text{max}}$	0.350	1.05	3.15

- (v) The accuracy of the blending ratio for gasoline-oil-dispensers shall be as follows:—

If  $V_1$  is the volume of the minority component in the mixture and  $V_2$  the volume of the majority component, the real volumetric ratio related to the minority component, expressed as a percentage  $[T = 100 \times V_1/(V_1+V_2)]$ , shall be equal to the nominal ratio within a limit of plus or minus:

- 5% in relative value,
- 0.2% absolute, whichever is greater.

In other words, T being the real volumetric ratio as a percentage, and  $T_{\text{nom}}$  the nominal volumetric ratio as a percentage, the following must be satisfied:—

$$|T - T_{\text{nom}}| / T_{\text{nom}} \leq 0.05.$$

if the nominal volumetric ratio is at least 4%, and

$$|T - T_{\text{nom}}| \leq 0.02\%.$$

if the nominal volumetric ratio is less than 4 per cent.

- (vi) If the blend dispenser is capable of delivering more than one mixture with the same nozzle, the installation of two hoses and a special blending device close to the transfer point is required.

If the blend dispenser can deliver only one mixture per nozzle, the blending device may be installed inside the dispenser, using a single hose per nozzle.

- (vii) If the blend dispenser is capable of delivering one or both single components (in addition to the mixtures) with a common nozzle, a device shall prevent the liquid flow through the unused part of the blend device.

- (viii) The lubricating oil part of a gasoline-oil-dispenser shall be designed so as to prevent air bubbles in the oil passing through the oil measuring device. There shall also be a device to detect the presence of oil. In the absence of oil, delivery has to be stopped by means, e.g. of:

- an intermediate oil reservoir and a device which stops the delivery when the oil reservoir is empty,
- a pressure detecting device which stops the delivery in the case of an oil pressure drop.

### (10) Self-service arrangement with fuel dispensers

The following requirements apply to measuring systems covered by paragraph 5(1), 5(7) or 5(9) when fitted with self-service arrangements.

#### (i) General requirements

- (a) Marking, sealing and connection of the components are left to appropriate authority approving the pattern.

- (b) Where the self-service device serves two or more dispensers, each dispenser shall be provided with a dispenser identification number that shall accompany any primary indication provided by the self-service device.

- (c) The primary indications on indicating devices and printing devices of the self-service arrangement shall not indicate any mutual differences.

The scale intervals of the primary indication on indicating devices and the printing devices and memory devices of the self-service arrangement shall be the same.

- (d) Printing devices on the self-service arrangement shall not reproduce the indications of a dispenser as the difference between two printed values.

- (e) Indication of information that is not subject to metrological control is allowed, provided that it cannot be

confused with metrological information.

- (f) The control device of the self-service device should be capable of indicating the status of the dispensers (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.
- (g) A change of the type of payment and/or mode of operation shall not be effective before the end of the current measurement operation.
- (h) 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.
- (i) In the case of a self-service arrangement that totalizes the delivered volumes for different registered customers over the course of time, the minimum measured quantity is not affected by the scale interval used for such totalizations.
- (ii) Attended service mode

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

- (a) Attended post-payment
- (b) Where the self-service arrangement includes a device that provides an additional primary indication (additional to those of the indicating device of the dispenser), it shall consist of at least one installation for the reproduction of the volume and/or the price indicated by the dispenser indicating device, consisting of—
- a printing device for the issue of a receipt of the customer, or
  - an indicating device for the benefit

of the supplier together with a display for the benefit of the customer.

**Note:** As a consequence of paragraph 3(4)(vi), the reproduction of the volume and price is necessary when the dispenser can be authorized before the settlement of the transaction.

- (c) For self-service devices with temporary storage (temporary storage mode) of measurement data of dispensers the following requirements apply:—
- (a) temporary storage of measurement data shall be restricted to one delivery for each dispenser,
- (b) 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,
- (c) 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 dispenser indicating device remains the primary indication,
- (d) 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 dispenser indicating device remains the primary indication,
- (e) pre-payment in attended service mode,
- (f) the requirements of paragraph 3(6) are applicable,
- (g) a printed or hand-written receipt of the pre-paid amount shall be provided.

## (iii) Unattended service mode

## (a) General

(b) The self-service arrangement shall provide additional primary indications by means of—

- a printing device for the issue of a receipt of the customer, and
- a device (printing or memory device) on which measurement data are registered for the benefit of the supplier.

(c) When the printing devices or memory device, as required by paragraph 5(10)(iii)(b), 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.

(d) Where the self-service arrangement is used by registered customers, the provisions of paragraph 5(10)(iii)(b) and 5(10)(iii)(c) do not apply to measurements related to such customers. An additional individual volume totalizer is considered to provide a primary indication.

(e) Micro-processors, which upon disturbance or interference influence the measurement operation, shall be equipped with means for controlling the continuity of the processor programme 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 programme is re-established.

(f) When a power supply failure occurs, the delivery data shall be memorized. The requirements of 5(1)(ix) apply.

## (g) Delayed-payment

The printed and/or memorized indications as mentioned in 5.10.3.1 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 dispenser number, location, date, time).

(h) Pre-payment in unattended service mode.

(i) Following the termination of each delivery, the printed and/or memorized indications as intended in paragraph 5(10)(iii)(a) shall be made available, clearly indicating the amount which has been pre-paid and the price corresponding to the liquid 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.

(j) The requirements of 3(6) are applicable.

## (11) Other self-service arrangements

Measuring systems, especially those for loading road or rail tankers, may be designed in such a way that the transaction is not settled when the customer leaves the loading site, in implicit agreement with the supplier.

In this case, national or international regulations may prescribe that the self-service arrangement 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.

The printed and/or memorized indications shall contain sufficient information for further checking and at least the measured quantity and information to identify the particular transaction (e.g. the system number, location, date, time).