SCHEDULE 1 Regulation 2(1)

PART 1

ESSENTIAL REQUIREMENTS

1. The essential requirements are the relevant requirements relating to measuring instruments contained in Annex I and the instrument specific Annexes MI-001, MI-002 (Part II only), MI-004, MI-005, MI-006, MI-008 and MI-009, set out in Parts A-G in Part 2 of this Schedule.

Definitions

2. In this Schedule—

"climatic environments" means the conditions in which measuring instruments may be used ;

"critical change value" means the value at which the change in the measurement result is considered undesirable;

"disturbance" means an influence quantity having a value within the limits specified in the appropriate requirement but outside the specified rated operating conditions of the measuring instrument. An influence quantity is a disturbance if for that influence quantity the rated operating conditions are not specified;

"influence quantity" means a quantity that is not the measurand but that affects the result of measurement;

"material measure" means a device intended to reproduce or supply in a permanent manner during its use one or more known values of a given quantity;

"measurand" means the particular quantity subject to measurement;

"rated operating conditions" means the values for the measurand and influence quantities making up the normal working conditions of an instrument;

"direct sale" means a trading transaction if—

(a) the measurement result serves as the basis for the price to pay; and

(b) at least one of the parties involved in the transaction related to measurement is a consumer or any other party requiring a similar level of protection and;

(c) all the parties in the transaction accept the measurement result at that time and place; and

"utility" means a supplier of electricity, gas, heat or water.

Allowable Errors

3.—(1) Under rated operating conditions and in the absence of a disturbance, the error of measurement shall not exceed the maximum permissible error (MPE) value as set out in the appropriate instrument-specific requirements.

(2) Unless stated otherwise in the instrument-specific provisions, MPE is expressed as a bilateral value of the deviation from the true measurement value.

(3) Under rated operating conditions and in the presence of a disturbance, the performance requirement shall be as set out in the appropriate instrument specific requirements.

(4) Where the instrument is intended to be used in a specified permanent continuous electromagnetic field the permitted performance during the radiated electromagnetic field-amplitude modulated test shall be within MPE.

(5) The manufacturer shall specify the climatic, mechanical and electromagnetic environments in which the instrument is intended to be used, power supply and other influence quantities likely to affect its accuracy, taking account of the instrument-specific requirements.

(a) Climatic environments—

The manufacturer shall specify the upper temperature limit and the lower temperature limit from any of the values in Table 1 unless otherwise specified in Parts A to G in Part 2 of this Schedule, and indicate whether the instrument is designed for condensing or non-condensing humidity as well as the intended location for the instrument, i.e. open or closed.

Table 1

	Temperature Limits			
Upper temperature limit	30°C	40°C	55°C	70°C
Lower temperature limit	5°C	-10°C	-25°C	-40°C

(b) Mechanical environments are classified into classes M1 to M3 as follows—

(i) M1: This class applies to instruments used in locations with vibration and shocks of low significance, e.g. for instruments fastened to light supporting structures subject to negligible vibrations and shocks transmitted from local blasting or pile-driving activities, slamming doors.

M2: This class applies to instruments used in locations with significant or high levels of vibration and shock, e.g. transmitted from machines and passing vehicles in the vicinity or adjacent to heavy machines, conveyor belts.

M3: This class applies to instruments used in locations where the level of vibration and shock is high and very high, e.g. for instruments mounted directly on machines, conveyor belts.

(ii) The following influence quantities shall be considered in relation with mechanical environments—

(aa) vibration;

(bb) mechanical shock.

(c) Electromagnetic environments are classified into classes E1, E2 or E3, unless otherwise laid down in the appropriate instrument-specific provisions in Part 2 of this Schedule—

(i) E1: This class applies to instruments used in locations with electromagnetic disturbances corresponding to those likely to be found in residential, commercial and light industrial buildings.

E2: This class applies to instruments used in locations with electromagnetic disturbances corresponding to those likely to be found in other industrial buildings.

E3: This class applies to instruments supplied by the battery of a vehicle. Such instruments shall comply with the requirements of E2 and the following additional requirements—

(aa) voltage reductions caused by energising the starter-motor circuits of internal combustion engines,

(bb) load dump transients occurring in the event of a discharged battery being disconnected while the engine is running.

(ii) The following influence quantities shall be considered in relation with electromagnetic environments—

(aa) voltage interruptions;

(bb) short voltage reductions;

(cc) voltage transients on supply lines and/or signal lines;

(dd) electrostatic discharges;

(ee) radio frequency electromagnetic fields;

(ff) conducted radio frequency electromagnetic fields on supply lines and/or signal lines;

(gg) surges on supply lines and/or signal lines.

(6) Other influence quantities to be considered, where appropriate, are—

(a) voltage variation;

(b) mains frequency variation;

(c) power frequency magnetic fields;

(d) any other quantity likely to influence in a significant way the accuracy of the instrument.

(7) When carrying out the tests as envisaged in this Schedule, the following paragraphs apply—

(a) Basic rules for testing and the determination of errors—

(i) Essential requirements specified in sub-paragraphs (1) to (4) shall be verified for each relevant influence quantity. Unless otherwise specified, these essential requirements apply when each influence quantity is applied and its effect evaluated separately, all other influence quantities being kept relatively constant at their reference value.

(ii) Metrological tests shall be carried out during or after the application of the influence quantity, whichever condition corresponds to the normal operational status of the instrument when that influence quantity is likely to occur.

(b) Ambient humidity—

(i) According to the climatic operating environment in which the instrument is intended to be used either the damp heat-steady state (non-condensing) or damp heat cyclic (condensing) test may be appropriate.

(ii) The damp heat cyclic test is appropriate where condensation is important or when penetration of vapour will be accelerated by the effect of breathing. In conditions where non-condensing humidity is a factor the damp-heat steady state is appropriate.

Reproducibility

4. The application of the same measurand in a different location or by a different user, all other conditions being the same, shall result in the close agreement of successive measurements. The difference between the measurement results shall be small when compared with the MPE.

Repeatability

5. The application of the same measurand under the same conditions of measurement shall result in the close agreement of successive measurements. The difference between the measurement results shall be small when compared with the MPE.

Discrimination and Sensitivity

6. A measuring instrument shall be sufficiently sensitive and the discrimination threshold shall be sufficiently low for the intended measurement task.

Durability

7. A measuring instrument shall be designed to maintain an adequate stability of its metrological characteristics over a period of time estimated by the manufacturer, provided that it is properly installed, maintained and used according to the manufacturer's instruction when in the environmental conditions for which it is intended.

Reliability

8. A measuring instrument shall be designed to reduce as far as possible the effect of a defect that would lead to an inaccurate measurement result, unless the presence of such a defect is obvious.

Suitability

9.—(1) A measuring instrument shall have no feature likely to facilitate fraudulent use, whereas possibilities for unintentional misuse shall be minimal.

(2) A measuring instrument shall be suitable for its intended use taking account of the practical working conditions and shall not require unreasonable demands of the user in order to obtain a correct measurement result.

(3) The errors of a utility measuring instrument at flows or currents outside the controlled range shall not be unduly biased.

(4) Where a measuring instrument is designed for the measurement of values of the measurand that are constant over time, the measuring instrument shall be insensitive to small fluctuations of the value of the measurand, or shall take appropriate action.

(5) A measuring instrument shall be robust and its materials of construction shall be suitable for the conditions in which it is intended to be used.

(6) A measuring instrument shall be designed so as to allow the control of the measuring tasks after the instrument has been placed on the market and put into use. If necessary, special equipment or software for this control shall be part of the instrument. The test procedure shall be described in the operation manual.

(7) When a measuring instrument has associated software which provides other functions besides the measuring function, the software that is critical for the metrological characteristics shall be identifiable and shall not be inadmissibly influenced by the associated software.

Protection against corruption

10.—(1) The metrological characteristics of a measuring instrument shall not be influenced in any inadmissible way by the connection to it of another device, by any feature of the connected device itself or by any remote device that communicates with the measuring instrument.

(2) A hardware component that is critical for metrological characteristics shall be designed so that it can be secured. Security measures foreseen shall provide for evidence of an intervention.

(3) Software that is critical for metrological characteristics shall be identified as such and shall be secured.

(4) Software identification shall be easily provided by the measuring instrument.

(5) Evidence of a software intervention shall be available for a reasonable period of time.

(6) Measurement data, software that is critical for measurement characteristics and metrologically important parameters stored or transmitted shall be adequately protected against accidental or intentional corruption.

(7) For utility measuring instruments the display of the total quantity supplied or the displays from which the total quantity supplied can be derived, whole or partial reference to which is the basis for payment, shall not be able to be reset during use.

Information to be borne by and to accompany the instrument

11.—(1) A measuring instrument shall bear the following inscriptions:

(a) manufacturer's mark or name;

(b) information in respect of its accuracy,

plus, when applicable—

(c) information in respect of the conditions of use;

(d) measuring capacity;

(e) measuring range;

(f) identity marking;

(g) number of the EC-type examination certificate or the EC design examination certificate;

(h) information whether or not additional devices providing metrological results comply with the provisions of these Regulations.

(2) An instrument of dimensions too small or of too sensitive a composition to allow it to bear the relevant information shall have its packaging, if any, and the accompanying documents required by the provisions of these Regulations suitably marked.

(3) The instrument shall be accompanied by information on its operation, unless the simplicity of the measuring instrument makes this unnecessary. Information shall be easily understandable and shall include where relevant—

(a) rated operating conditions;

(b) mechanical and electromagnetic environment classes;

(c) the upper and lower temperature limit, whether condensation is possible or not, open or closed location;

(d) instructions for installation, maintenance, repairs, permissible adjustments;

(e) instructions for correct operation and any special conditions of use;

(f) conditions for compatibility with interfaces, sub-assemblies or measuring instruments.

(4) Groups of identical measuring instruments used in the same location or used for utility measurements do not necessarily require individual instruction manuals.

(5) Unless specified otherwise in an instrument-specific annex, the scale interval for a measured value shall be in the form 1×10^n, 2×10^n or 5×10^n, where n is any integer or zero. The unit of measurement or its symbol shall be shown close to the numerical value.

(6) A material measure shall be marked with a nominal value or a scale, accompanied by the unit of measurement used.

(7) The units of measurement used and their symbols shall be in accordance with the provisions of Community legislation on units of measurement and their symbols.

(8) All marks and inscriptions required under any requirement shall be clear, non-erasable, unambiguous and non-transferable.

Indication of result

12.—(1) Indication of the result shall be by means of a display or hard copy.

(2) The indication of any result shall be clear and unambiguous and accompanied by such marks and inscriptions necessary to inform the user of the significance of the result. Easy reading of the presented result shall be permitted under normal conditions of use. Additional indications may be shown provided they cannot be confused with the metrologically controlled indications.

(3) In the case of hard copy the print or record shall also be easily legible and non-erasable.

(4) A measuring instrument for direct sales trading transactions shall be designed to present the measurement result to both parties in the transaction when installed as intended. When critical in case of direct sales, any ticket provided to the consumer by an ancillary device not complying with the appropriate requirements of these Regulations shall bear an appropriate restrictive information.

(5) Whether or not a measuring instrument intended for utility measurement purposes can be remotely read it shall in any case be fitted with a metrologically controlled display accessible without tools to the consumer. The reading of this display is the measurement result that serves as the basis for the price to pay.

Further processing of data to conclude the trading transaction

13.—(1) A measuring instrument other than a utility measuring instrument shall record by a durable means the measurement result accompanied by information to identify the particular transaction, when:

(a) the measurement is non-repeatable; and

(b) the measuring instrument is normally intended for use in the absence of one of the trading parties.

(2) Additionally, a durable proof of the measurement result and the information to identify the transaction shall be available on request at the time the measurement is concluded.

Conformity evaluation

14. A measuring instrument shall be designed so as to allow ready evaluation of its conformity with the appropriate requirements of these Regulations.

PART 2

INSTRUMENT SPECIFIC REQUIREMENTS

Part A

Water Meters

15. The relevant requirements of Part 1 and the specific requirements of this Part apply to water meters.

Definitions

16. In this Schedule—

"minimum flowrate (Q_1)" means the lowest flowrate at which the water meter provides indications that satisfy the requirements concerning the maximum permissible errors (MPEs);

"overload flowrate (Q_4)" means the highest flowrate at which the meter operates in a satisfactory manner for a short period of time without deteriorating;

"permanent flowrate (Q_3)" means the highest flowrate at which the water meter operates in a satisfactory manner under normal conditions of use, i.e. under steady or intermittent flow conditions;

"transitional flowrate (Q_2)" means the flowrate value occurring between the permanent and minimum flowrates, at which the flowrate range is divided into two zones, the "upper zone" and the "lower zone". Each zone has a characteristic MPE.

Rated Operating Conditions

17. The manufacturer shall specify the rated operating conditions for the instrument, in particular—

(1) The flowrate range of the water.

(a) The values for the flowrate range shall fulfil the following conditions—

(i) $Q_3/Q_1 \geq$;

(ii) $Q_2/Q_1 = 1.6$;

(iii) $Q_4/Q_3 = 1.25$;

(b) For 5 years from the date of entry into force of these Regulations the ratio Q_2/Q_1may be: 1.5, 2.5, 4 or 6.3.

(2) The temperature range of the water.

(a) The values for the temperature range shall fulfil the following conditions—

(i) 0.1°C to at least 30°C, or

(ii) 30°C to at least 90°C.

(b) The meter may be designed to operate over both ranges.

(3) The relative pressure range of the water, the range being 0.3 bar to at least 10 bar at Q_3.

(4) For the power supply: the nominal value of the AC voltage supply and/or the limits of DC supply.

MPE

18.—(1) The MPE, positive or negative, on volumes delivered at flowrates between the transitional flowrate (Q_2) (included) and the overload flowrate (Q_4) is—

(a) 2% for water having a temperature ≤ 30 °C,

(b) 3% for water having a temperature > 30°C.

(2) The MPE, positive or negative, on volumes delivered at flowrates between the minimum flowrate (Q_1) and the transitional flowrate (Q_2) (excluded) is 5% for water having any temperature.

Permissible Effect of Disturbances

19.—(1) Electromagnetic immunity

(a) The effect of an electromagnetic disturbance on a water meter shall be such that—

(i) The change in the measurement result is no greater than the critical change value as defined in paragraph 19(1)(c), or

(ii) the indication of the measurement result is such that it cannot be interpreted as a valid result, such as a momentary variation that cannot be interpreted, memorised or transmitted as a measuring result.

(b) After undergoing an electromagnetic disturbance the water meter shall—

(i) recover to operate within MPE, and

(ii) have all measurement functions safeguarded, and

(iii) allow recovery of all measurement data present just before the disturbance.

(c) The critical change value is the smaller of the two following values—

(i) the volume corresponding to half of the magnitude of the MPE in the upper zone on the measured volume;

(ii) the volume corresponding to the MPE on the volume corresponding to one minute at flowrate Q_3.

(2) Durability

(a) After an appropriate test, taking into account the period of time estimated by the manufacturer, has been performed, the following criteria shall be satisfied—

(i) The variation of the measurement result after the durability test, when compared with the initial measurement result, shall not exceed—

(aa) 3 % of the metered volume between Q_1included and Q_2 excluded;

(bb) 1.5 % of the metered volume between Q_2 included and Q_4 included.

(ii) The error of indication for the volume metered after the durability test shall not exceed—

(aa) ± 6 % of the metered volume between Q_1 included and Q_2 excluded;

(bb) ± 2.5 % of the metered volume between Q_2 included and Q_4 included for water meters intended to meter water with a temperature between 0.1°C and 30°C;

(cc) ± 3.5 % of the metered volume between Q_2 included and Q_4 included for water meters intended to meter water with a temperature between 30°C and 90°C.

Suitability

20.—(1) The meter shall be able to be installed to operate in any position unless clearly marked otherwise.

(2) The manufacturer shall specify whether the meter is designed to measure reverse flow. In such a case, the reverse flow volume shall either be subtracted from the cumulated volume or shall be separately recorded. The same MPE shall apply to both forward and reverse flow.

(3) Water meters not designed to measure reverse flow shall either prevent reverse flow or shall withstand an accidental reverse flow without any deterioration or change in metrological properties.

Units of Measurement

21. Metered volume shall be displayed in cubic metres.

Putting into Use

22. The member State shall ensure that the requirements under paragraphs 17(1), (2) and (3) are determined by the distributor or the person legally designated for installing the meter, so that the meter is appropriate for the accurate measurement of consumption that is foreseen or foreseeable.

Part B

Heat Meters

23. The relevant requirements of Part 1 and the specific requirements in this Part apply to heat meters.

Definitions

24. In this Schedule—

"θ" means the temperature of the heat-conveying liquid;

"θ_{in} " means the value of θ at the inlet of the heat exchange circuit;

"θ_{out} " means the value of θ at the outlet of the heat exchange circuit;

"Δ θ" means the temperature difference θ_{in} — θ_{out} with $\Delta\theta \geq 0$;

"θ_{max} " means the upper limit of θ for the heat meter to function correctly within the MPEs;

"θ_{min} " means the lower limit of Δθ for the heat meter to function correctly within the MPEs;

"$\Delta\theta_{max}$ " means the upper limit of θ for the heat meter to function correctly within the MPEs;

"$\Delta\theta_{min}$ " means the lower limit of θ for the heat meter to function correctly within the MPEs;

"q" means the flow rate of the heat conveying liquid;

"q_s" means the highest value of q that is permitted for short periods of time for the heat meter to function correctly;

"q_p" means the highest value of q that is permitted permanently for the heat meter to function correctly;

"q_i" means the lowest value of q that is permitted for the heat meter to function correctly;

"P" means the thermal power of the heat exchange;

"P_s" means the upper limit of P that is permitted for the heat meter to function correctly.

Rated operating conditions

25. The values of the rated operating conditions shall be specified by the manufacturer as follows—

(a) for the temperature of the liquid: θ_{max}, θ_{min},

for the temperature differences $\Delta\theta_{max}$, θ_{min},

subject to the following restrictions: $\Delta\theta_{max} / \Delta\theta_{min} \geq 10$; $\Delta\theta_{min}$ = 3K or 5K or 10K,

(b) for the pressure of the liquid: The maximum positive internal pressure that the heat meter can withstand permanently at the upper limit of the temperature.

(c) for the flow rates of the liquid: q_s, q_p, q_i, where the values of q_p and q_i are subject to the following restriction: $q_p / q_i \geq 10$.

(d) for the thermal power: P_s.

Accuracy classes

26. The following accuracy classes are defined for heat meters:

(i) 1,

(ii) 2, and

(iii) 3.

MPE applicable to complete heat meters

27. The maximum permissible relative errors applicable to a complete heat meter, expressed in percent of the true value of each accuracy class, are—

For class 1: $E = E_f + E_t + E_c$, with E_f, E_t, E_c according to paragraphs 31 (a) to (c)

For class 2: $E = E_f + E_t + E_c$, with E_f, E_t, E_c according to paragraphs 31 (a) to (c)

For class 3: $E = E_f + E_t + E_c$, with E_f, E_t, E_c according to paragraphs 31 (a) to (c)

Permissible influences of electromagnetic disturbances

28.—(1) The instrument shall not be influenced by static magnetic fields and by electromagnetic fields at mains frequency.

(2) The influence of an electromagnetic disturbance shall be such that the change in the measurement result is not greater than the critical change value as laid down in sub-paragraph (3) or the indication of the measurement result is such that it cannot be interpreted as a valid result.

(3) The critical change value for a complete heat meter is equal to the absolute value of the MPE applicable to that heat meter (see paragraph 27).

Durability

29.—(1) After an appropriate test, taking into account the period of time estimated by the manufacturer, has been performed, the following criteria shall be satisfied—

(a) Flow sensors— The variation of the measurement result after the durability test, when compared with the initial measurement result, shall not exceed the critical change value.

(b) Temperature sensors—The variation of the measurement result after the durability test, when compared with the initial measurement result, shall not exceed 0.1°C.

Inscriptions on a heat meter

30. The following must be inscribed on the meter—

(a) accuracy class;

(b) limits of flow rate;

(c) limits of temperature;

(d) limits of temperature difference;

(e) place of the flow sensor installation: flow or return;

(f) indication of the direction of flow.

Sub-assemblies

31. The provisions for sub-assemblies may apply to sub-assemblies manufactured by the same or different manufacturers. Where a heat meter consists of sub-assemblies, the essential requirements for the heat meter apply to the sub-assemblies as relevant. In addition, the following apply—

(a) The relative MPE of the flow sensor, expressed in %, for accuracy classes—

(i) Class 1: $E_f = (1 + 0.01\ q_p /q)$, but not more than 5%,

(ii) Class 2: $E_f = (2 + 0.02\ q_p /q)$, but not more than 5%,

(iii) Class 3: $E_f = (3 + 0.05\ q_p/q)$, but not more than 5%,

where the error E_f relates the indicated value to the true value of the relationship between flow sensor output signal and the mass or the volume.

(b) The relative MPE of the temperature sensor pair, expressed in %—

$E_t = (0.5 + 3\ \Delta\theta_{min} /\Delta\theta)$,

where the error E_t relates the indicated value to the true value of the relationship between temperature sensor pair output and temperature difference.

(c) The relative MPE of the calculator, expressed in %—

$E_c = (0.5 + \Delta\theta_{min} /\Delta\theta)$,

where the error E_c relates the value of the heat indicated to the true value of the heat.

(d) The critical change value for a sub-assembly of a heat meter is equal to the respective absolute value of the MPE applicable to the sub-assembly (see sub-paragraphs (a), (b) or (c)).

(e) Inscriptions on the sub-assemblies—

(i) Flow sensor—

(aa) Accuracy class;

(bb) Limits of flow rate;

(cc) Limits of temperature;

(dd) Nominal meter factor (e.g. litres/pulse) or corresponding output signal;

(ee) Indication of the direction of flow;

(ii) Temperature sensor pair—

(aa) Type identification (e.g. Pt 100);

(bb) Limits of temperature;

(cc) Limits of temperature difference;

(iii) Calculator—

(aa) Type of temperature sensors:

— Limits of temperature;

— Limits of temperature difference;

— Required nominal meter factor (e.g. litres/pulse) or corresponding input signal coming from the flow sensor;

— Place of the flow sensor installation: flow or return.

Putting into use

32.—(1) Where a member State imposes measurement of residential use, it shall allow such measurement to be performed by means of any Class 3 meter.

(2) Where a member State imposes measurement of commercial and/or light industrial use, it is authorised to require any Class 2 meter.

(3) As regards the requirements under paragraph 25(a) to (d), member States shall ensure that the properties be determined by the distributor or the person legally designated for installing the meter, so that the meter is appropriate for the accurate measurement of consumption that is foreseen or foreseeable.

Part C

Measuring System for the Continuous and Dynamic Measurement of Quantities of Liquids other than Water

33.—(1) The relevant requirements of Part 1 and the specific requirements of this Part apply to measuring systems intended for the continuous and dynamic measurement of quantities (volumes or masses) of liquids other than water.

(2) If appropriate, the terms "volume" and "L" in this Part can be read as "mass" and "kg".

Definitions

34. In this Part C—

"associated measuring instrument" means an instrument connected to the calculator for measuring certain quantities which are characteristic of the liquid, with a view to making a correction and/or conversion;

"base conditions" means the specified conditions to which the measured quantity of liquid at metering conditions is converted;

"calculator" means a part of a meter that receives the output signals from the measurement transducer(s) and possibly, from associated measuring instruments and displays the measurement results;

"conversion device" means a part of the calculator which by taking account of the characteristics of the liquid (e.g. temperature, density) measured using associated measuring instruments, or stored in a memory, automatically converts—

(a) the volume of the liquid measured at metering conditions into a volume at base conditions and/or into mass, or

(b) the mass of the liquid measured at metering conditions into a volume at metering conditions and/or into a volume at base conditions;

Note*:* A conversion device includes the relevant associated measuring instrument.

"direct indication" means the indication, either volume or mass, corresponding to the measure and that the meter is physically capable of measuring;

Note: The direct indication may be converted into another quantity using a conversion device.

"flowrate range" means the range between the minimum flowrate (Q_{min}) and maximum flowrate (Q_{max});

"fuel dispenser" means a measuring system intended for the refuelling of motor vehicles, small boats and small aircraft;

"interruptible/non interruptible" means the liquid flow can/cannot be stopped easily and rapidly;

"measuring system" means a system that comprises the meter itself and all devices required to ensure correct measurement or intended to facilitate the measuring operations;

"meter" means an instrument designed to measure continuously, memorise and display the quantity at metering conditions of liquid flowing through the measurement transducer in a closed, fully charged conduit;

"minimum measured quantity (MMQ)" means the smallest quantity of liquid for which the measurement is metrologically acceptable for the measuring system;

"self-service arrangement" means an arrangement that allows the customer to use a measuring system for the purposes of obtaining liquid for his own use;

"self-service device" means 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.

Rated operating conditions

35.—(1) The manufacturer shall specify the rated operating conditions for the instrument, in particular—

(2) The flowrate range.

The flowrate range is subject to the following conditions—

(a) the flowrate range of a measuring system shall be within the flowrate range of each of its elements, in particular the meter.

(b) meter and measuring system—

Table 2

Specific measuring system	Characteristic of liquid	Minimum ratio of Q_{max} : Q_{min}
Fuel dispenser	Not liquefied gases	10:1
	Liquefied gases	5:1
Measuring system	Cryogenic liquids	5:1
Measuring systems on pipeline and systems for loading ships	All liquids	Suitable for use
All other measuring systems	All liquids	4:1

(3) The properties of the liquid to be measured by the instrument by specifying the name or type of the liquid or its relevant characteristics, for example—

(a) temperature range;

(b) pressure range;

(c) density range;

(d) viscosity range.

(4) The normal value of the AC voltage supply and/or limits of the DC voltage supply.

(5) The base conditions for converted values.

Note: Sub-paragraph (4) is without prejudice to the member States' obligations to require use of a temperature of either 15°C in accordance with Article 3(1) of Council Directive 92/81/EEC of 19th October 1992 on the harmonisation of the structures of excise duties on mineral oils(**1**) or, for heavy fuel oils, LPG and methane, another temperature pursuant to Article 3(2) of that Directive.

Accuracy classification and maximum permissible errors (MPEs)

36.—(1) For quantities equal to or greater than 2 litres the MPE on indications is:

(**1**) OJ L 316, 31.10.92, p. 12. Directive abolished by Directive 2003/96/EC (OJ L 283, 31.10.03, p.51).

Table 3

	Accuracy class				
0.3	0.5	1.0	1.5	2.5	
Measuring systems (A)	0.3%	0.5%	1.0%	1.5%	2.5%
Meters (B)	0.2%	0.3%	0.6%	1.0%	1.5%

(2) For quantities less than two litres the MPE on indications is:

Table 4

Measured volume V	MPE
V < 0.1 L	4 × value in Table 3, applied to 0.1 L
0.1 L ≤ V < 0.2 L	4 × value in Table 3
0.2 L ≤ V < 0.4 L	2 × value in Table 3, applied to 0.4 L
0.4 L ≤ V < 1 L	2 × value in Table 3
1 L ≤ V < 2 L	Value in Table 3, applied to 2 L

(3) However, no matter what the measured quantity may be, the magnitude of the MPE is given by the greater of the following two values—

(a) the absolute value of the MPE given in Table 3 or Table 4;

(b) the absolute value of the MPE for the minimum measured quantity (E_{min}).

(a) (4) (a) For minimum measured quantities greater than or equal to 2 litres the following conditions apply—

(i) Condition 1—

E_{min} shall fulfil the condition: $E_{min} \geq 2$ R, where R is the smallest scale interval of the indication device.

(ii) Condition 2—

E_{min} is given by the formula: $E_{min} = (2MMQ) \times (A/100)$, where—

(aa) MMQ is the minimum measured quantity,

(bb) A is the numerical value specified in line A of Table 3.

(b) For minimum measured quantities of less than two litres, condition 1 applies and E_{min} is twice the value specified in Table 4, and related to line A of Table 3.

(5) Converted indication—

In the case of a converted indication the MPEs are as in line A of Table 3.

(6) Conversion devices—

(a) MPEs on converted indications due to a conversion device are equal to ± (A–B), A and B being the values specified in Table 3.

(b) Parts of conversion devices that can be tested separately—

(i) Calculator

MPEs on quantities of liquid indications applicable to calculation, positive or negative, are equal to one-tenth of the MPEs as defined in line A of Table 3;

(ii) Associated measuring instruments

Associated measuring instruments shall have an accuracy at least as good as the values in Table 5—

Table 5

MPE on measurements	Accuracy classes of the measuring system				
0.3	0.5	1.0	1.5	2.5	
Temperature	± 0.3 °C	± 0.5 °C			± 1.0 °C
Pressure	Less than 1 MPa: ± 50 kPa From 1 to 4 MPa: ± 5 % Over 4 MPa: ± 200 kPa				
Density	± 1kg/m^3		± 2kg/m^3		± 5kg/m^3

These values apply to the indication of the characteristic quantities of the liquid displayed by the conversion device.

(iii) Accuracy for calculating function—

The MPE for the calculation of each characteristic quantity of the liquid, positive or negative, is equal to two fifths of the value fixed in (ii).

(7) The requirement (i) in sub-paragraph (6) applies to any calculation, not only conversion.

Maximum permissible effect of disturbances

37.—(1) The effect of an electromagnetic disturbance on a measuring system shall be one of the following—

(a) the change in the measurement result is not greater than the critical change value as defined in sub-paragraph (2), or

(b) the indication of the measuring result shows a momentary variation that cannot be interpreted, memorised or transmitted as a measuring result. Furthermore, in the case of an interruptible system, this can also mean the impossibility to perform any measurement, or

(c) the change in the measurement result is greater than the critical change value, in which case the measuring system shall permit the retrieval of the measuring result just before the critical value occurred and cut off the flow.

(2) The critical change value is the greater of MPE/5 for a particular measured quantity or E_{min}.

Durability

38. After an appropriate test, taking into account the period of time estimated by the manufacturer, has been performed, the following criterion shall be satisfied—

The variation of the measurement result after the durability test, when compared with the initial measurement result, shall not exceed the value for meters specified in line B of Table 3.

Suitability

39.—(1) For any measured quantity relating to the same measurement, the indications provided by various devices shall not deviate one from another by more than one scale interval where devices

have the same scale interval. In the case where the devices have different scale intervals, the deviation shall not be more than that of the greatest scale interval.

(2) In the case of a self-service arrangement the scale intervals of the main indicating device on the measuring system and the scale intervals of the self-service device shall be the same and results of measurement shall not deviate one from another.

(3) It shall not be possible to divert the measured quantity in normal conditions of use unless it is readily apparent.

(4) Any percentage of air or gas not easily detectable in the liquid shall not lead to a variation of error greater than—

(a) 0.5 % for liquids other than potable liquids and for liquids of a viscosity not exceeding 1 mPa.s, or

(b) 1 % for potable liquids and for liquids of a viscosity exceeding 1 mPa.s.

The allowed variation shall never be smaller than 1% of MMQ. This value applies in the case of air or gas pockets.

(5) Instruments for direct sales

(a) A measuring system for direct sales shall be provided with means for resetting the display to zero.

(b) It shall not be possible to divert the measured quantity.

(c) The display of the quantity on which the transaction is based shall be permanent until all parties in the transaction have accepted the measurement result.

(d) Measuring systems for direct sales shall be interruptible.

(e) Any percentage of air or gas in the liquid shall not lead to a variation of error greater than the values specified in sub-paragraph (4).

(6) Fuel Dispensers

(a) Displays on fuel dispensers shall not be capable of being reset to zero during a measurement.

(b) The start of a new measurement shall be inhibited until the display has been reset to zero.

(c) Where a measuring system is fitted with a price display, the difference between the indicated pride and the price calculated from the unit price and the indicated quantity shall not exceed the price corresponding to E_{min}. This difference need not be less than the smallest monetary value.

Power supply failure

40. A measuring system shall either be provided with an emergency power supply device that will safeguard all measuring functions during the failure of the main power supply device or be equipped with means to save and display the data present in order to permit the conclusion of the transaction in progress and with means to stop the flow at the moment of the failure of the main power supply device.

Putting into use

41.

Table 6

Accuracy Class	Types of Measuring system
0.3	Measuring systems on pipeline
0.5	All measuring systems if not differently stated elsewhere in this Table, in particular: — fuel dispensers (not for liquified gases), — measuring system on road tankers for liquids of low viscosity (< 20 mPa.s), — measuring systems for (un)loading ships and rail and road tankers[(1)], — measuring systems for milk, — measuring systems for refuelling aircraft.
1.0	Measuring system for liquefied gases under pressure measured at a temperature equal to or above -10°C Measuring systems normally in class 0.3 or 0.5 but used for liquids— — whose temperature is less than -10°C or greater than 50°C; — whose dynamic viscosity is higher than 1000 mPa.s; — whose maximum volumetric flowrate is not higher than 20 L/h.
1.5	Measuring systems for liquefied carbon dioxide Measuring systems for liquefied gases under pressure measured at a temperature below –10ºC (other than cryogenic liquids)
2.5	Measuring systems for cryogenic liquids (temperature below –153ºC)

(1) However, Member States may require measuring systems of accuracy class 0.3 or 0.5 when used for the levying of duties on mineral oils when (un)loading ships and rail and road tankers.

Note: However, the manufacturer may specify a better accuracy for a certain type of measuring system

Units of measurement

42. The metered quantity shall be displayed in millilitres, cubic centimetres, litres, cubic metres, grams, kilogram or tonnes.

Part D

Automatic Weighing Instruments

43. The relevant requirements of Part 1 and the specific requirements of this Part apply to the automatic weighing instruments set out below, intended to determine the mass of a body by using the action of gravity on that body.

Rated Operating Conditions

44. The manufacturer shall specify the rated operating conditions for the instrument as follows—

(a) For the measurand—

The measuring range in terms of its maximum and minimum capacity.

(b) For the electrical supply influence quantities—

(i) in case of AC voltage supply: the nominal AC voltage supply, or the AC voltage limits;

(ii) in case of DC voltage supply: the nominal and minimum DC voltage supply, or the DC voltage limits.

(c) For the mechanical and climatic influence quantities—

(i) the minimum temperature range is 30°C unless specified otherwise in this Part.

(ii) the mechanical environment classes according to Part 1, paragraph 3(5)(b) are not applicable. For instruments which are used under special mechanical strain, e.g. instruments incorporated into vehicles, the manufacturer shall define the mechanical conditions of use.

(d) For other influence quantities (if applicable)—

(i) the rate(s) of operation;

(ii) the characteristics of the product(s) to be weighed.

Suitability

45.—(1) Means shall be provided to limit the effects of tilt, loading and rate of operation such that maximum permissible errors (MPEs) are not exceeded in normal operation.

(2) Adequate material handling facilities shall be provided to enable the instrument to respect the MPEs during normal operation.

(3) Any operation control interface shall be clear and effective.

(4) The integrity of the display (where present) shall be verifiable by the operator.

(5) Adequate zero setting capability shall be provided to enable the instrument to respect the MPEs during normal operation.

(6) Any result outside the measurement range shall be identified as such, where a printout is possible.

Automatic Catchweighers

46.—(1) In addition to the requirements set out in paragraphs 44 and 45, the following specific requirements shall apply in relation to automatic catchweighers.

(2) Definitions—

"weight labeller" means an automatic catchweigher that labels individual articles with the weight value;

"weight/price labeller" means an automatic catchweigher that labels individual articles with the weight value, and price information.

(3) Accuracy Classes

(a) Instruments are divided into primary categories designated by X or Y as specified by the manufacturer.

(b) These categories are divided into four accuracy classes—

(i) XI, XII, XIII and XIV and

(ii) Y(I), Y(II), Y(a) and Y(b)

which shall be specified by the manufacturer.

(c) Category X applies to instruments used to check pre-packages made up in accordance with the requirements of Council Directive 75/106/EEC of 19 December 1974 on the approximation of the laws of the member States relating to the making-up by volume of certain pre-packaged liquids(**2**) and of Council Directive 76/211/EEC of 20th January 1976 on the approximation of the laws of the member States relating to the making-up by weight or by volume of certain pre-packaged products(**3**) applicable to pre-packages.

(d) The accuracy classes are supplemented by a factor (x) that qualifies the maximum permissible standard deviation as specified in sub-paragraph (3)(b).

(e) The manufacturer shall specify the factor (x), where (x) shall be ≤ 2 and in the form 1×10^k, 2×10^k or 5×10^k, where k is a negative whole number or zero.

(f) Category Y applies to all other automatic catchweighers.

(4) MPE

(a) Mean error Category X and MPE Category Y Instruments

Table 7

Net Load (m) in verification scale intervals (c)				Maximum permissible mean error	Maximum permissible error
XI Y(1)	XII Y(II)	XIII Y(a)	XIV Y(b)	X	Y
0 < m ≤ 50 000	0 < m ≤ 5 000	0 < m ≤ 500	0 < m ≤ 50	± 0.5 e	±1 e
50 000 < m ≤ 200 000	5 000 < m ≤ 20 000	500 < m ≤ 2 000	50 < m ≤ 200	± 1.0 e	±1.5 e
200 000 < m	20 000 < m ≤ 100 000	2 000 < m ≤ 10 000	200 < m ≤ 1 000	± 1.5 e	± 2 e

(b) Standard deviation—

Maximum permissible value for the standard deviation of a class X (x) instrument is the result of the multiplication of the factor (x) by the value in Table 8 below.

Table 8

Net Load (m)	Maximum permissible standard deviation for class X(1)
m ≤ 50g	0.48%
50 g < m ≤ 100 g	0.24 g
100 g < m ≤ 200 g	0.24 %
200 g < m ≤ 300 g	0.48 g

(**2**) OJ L 42, 15.2.75, p.1. Directive as last amended by Directive 89/676/EEC (O) L 398, 30.12.89, p. 18).
(**3**) OJ L 46, 21.2.76, p.1. Directive as last amended by the EEA Agreement.

Net Load (m)	Maximum permissible standard deviation for class X(1)
300 g < m ≤ 500 g	0.16 %
500g < m ≤ 1 000 g	0.8 g
1 000 g < m ≤ 10 000 g	0.08 %
10 000 g < m ≤ 15 000 g	8 g
15 000 g < m	0.053 %
For class XI and XII (x) shall be less than 1.	
For class XIII (x) shall be not greater than 1.	
For class XIV (x) shall be greater than 1.	

(c) Verification scale interval – single interval instruments

Table 9

Accuracy classes		Verification scale interval	Number of verification scale intervals n= Max/e	
			Minimum	Maximum
XI	Y(I)	0.001 g ≤ e	50 000	–
XII	Y(II)	0.001 g ≤ e ≤ 0.05 g	100	100 000
		0.1 g ≤ e	5 000	100 000
XIII	Y(a)	0.1 g ≤ e ≤ 2 g	100	10 000
		5 g ≤ e	500	10 000
XIV	Y(b)	5 g ≤ e	100	1 000

(d) Verification scale interval – multi-interval instruments

Table 10

Accuracy classes		Verification scale interval	Number of verification scale intervals n=Max/e	
			Minimum value[(1)] $n = Max_i/e_{(i+1)}$	Maximum $n=Max_i/e_i$
XI	Y(I)	0.001 g ≤ e_i	50 000	–
XII	Y(II)	0.001 g ≤ e_i ≤ 0.05 g	5 000	100 000
		0.1 g ≤ e_i	5 000	100 000

(1) For i = r the corresponding column of Table 9 applies with e replaced by e_r.

Accuracy classes		Verification scale interval	Number of verification scale intervals n=Max/e	
			Minimum value[1] $n = Max_i/e_{(i+1)}$	Maximum $n=Max_i/e_i$
XIII	Y(a)	0.1 g ≤ e_i	500	10 000
XIV	Y(b)	5 g ≤ e_i	50	1 000

(1) For i = r the corresponding column of Table 9 applies with e replaced by e_r.

Where:

(i) i= 1, 2, …r

(ii) i = partial weighing range

(iii) r = total number of partial ranges

(5) Measurement Range

In specifying the measurement range for class Y instruments the manufacturer shall take account that the minimum capacity shall not be less than:

(a) class Y(I): 100 e

(b) class Y(II): 20 e for 0.001 g ≤ e ≤ 0.05 g, and 50 e for 0.1 g ≤ e

(c) class Y(a): 20 e

(d) class Y(b): 10 e

(e) Scales used for grading, e.g. postal scales and garbage weighers: 5 e

(6) Dynamic setting

(a) The dynamic setting facility shall operate within a load range specified by the manufacturer.

(b) When fitted, a dynamic setting facility that compensates for the dynamic effects of the load in motion shall be inhibited from operating outside the load range, and shall be capable of being secured.

(7) Performance under influence factors and electromagnetic disturbances

(a) The MPEs due to influence factors are—

(i) For category X instruments—

(aa) for automatic operation, as specified in Tables 7 and 8;

(bb) for static weighing in non-automatic operation, as specified in Table 7.

(ii) For category Y instruments—

(aa) for each load in automatic operation, as specified in Table 7;

(bb) for static weighing in non-automatic operation, as specified in category X in Table 7.

(b) The critical change value due to a disturbance is one verification scale interval.

(c) Temperature range

(i) For class XI and Y(I) the minimum range is 5° C.

(ii) For class XII and Y(II) the minimum range is 15° C.

Automatic gravimetric filling instruments

47.—(1) In addition to the requirements set out in paragraphs 44 and 45, the following specific requirements shall apply in relation to automatic gravimetric filling instruments.

(2) Accuracy classes

(a) The manufacturer shall specify both the reference accuracy class Ref(x), and the operational accuracy class(es) X(x).

(b) An instrument type is designated a reference accuracy class Ref(x), corresponding to the best possible accuracy for instruments of the type. After installation, individual automatic gravimetric filling instruments are designed for one or more operational accuracy classes, X(x), having taken account of the specific products to be weighed. The class designation factor (x) shall be ≤, and in the form 1×10^k, 2×10^k or 5×10^k where k is a negative whole number or zero.

(c) The reference accuracy class, Ref(x) is applicable for static loads.

(d) For the operational accuracy class X(x), X is a regime relating accuracy to load weight and (x) is a multiplier for the limits of error specified for class X(1) in sub-paragraph 3(b)

(3) MPE

(a) Static weighing error

(i) For static loads under rated operating conditions, the MPE for reference accuracy class Ref(x), shall be 0.312 of the maximum permissible deviation of each fill from the average: as specified in Table 11; multiplied by the class designation factor (x).

(ii) For instruments where the fill may be made up from more than one load (e.g. cumulative or selective combination weighers) the MPE for static loads shall be the accuracy required for the fill as specified in sub-paragraph (3)(b) (i.e. not the sum of the maximum permissible deviation for the individual loads).

(b) Deviation from average fill

Table 11

Value of the mass of the fills (m) in grams	Maximum permissible deviation of each fill from the average for class X(1)
m ≤ 50	7.2%
50 < m ≤ 100	3.6 grams
100 < m ≤ 200	3.6 %
200 < m ≤ 300	7.2 grams
300 < m ≤ 500	2.4 %
500 < m ≤ 1 000	12 grams
1 000 < m ≤ 10 000	1.2 %
10 000 < m ≤ 15 000	120 grams
15 000 < m	0.8 %

Note: The calculated deviation of each fill from the average may be adjusted to take account of the effect of material particle size

(c) Error relative to pre-set value (setting errors)

For automatic gravimetric filling instruments where it is possible to pre-set a fill weight, the maximum difference between the pre-set value and the average mass of the fills shall not exceed 0.312 of the maximum permissible deviation of each fill from the average, as specified in Table 11.

(4) Performance Under Influence Factor and Electromagnetic Disturbance

(a) The MPE due to influence factors shall be as specified in sub-paragraph (3)(a).

(b) The critical change value due to a disturbance is a change of the static weight indication equal to the MPE as specified in sub-paragraph (3)(a) calculated for the rated minimum fill, or a change that would give equivalent effect on the fill in the case of instruments where the fill consists of multiple loads. The calculated critical change value shall be rounded to the next higher scale interval (d).

(c) The manufacturer shall specify the value of the rated minimum fill.

Discontinuous Totalisers

48.—(1) In addition to the requirements set out in paragraphs 44 and 45, the following specific requirements shall apply in relation to discontinuous totalisers.

(2) Accuracy Classes

Discontinuous totalisers are divided into four accuracy classes, as follows—

(i) 0.2;

(ii) 0.5;

(iii) 1; and

(iv) 2.

(3) MPE

Table 12

Accuracy class	MPE of Totalised load
0.2	± %
0.5	± %
1	± %
2	± %

(4) Totalisation scale interval

The totalisation scale interval (d_t) shall be in the range:

$0.01\ \%\ Max \leq d_t \leq \%\ Max$

(5) Minimum Totalised Load (Σ_{min})

The minimum totalised load (Σ_{min}) shall be not less than the load at which the MPE is equal to the totalisation scale interval (d_t) and not less than the minimum load as specified by the manufacturer.

(6) Zero Setting

Instruments that do not tare weigh after each discharge shall have a zero setting device. Automatic operation shall be inhibited if zero indication varies by—

(a) 1 d_t on instruments with automatic zero setting device; or

(b) 0.5 d_t on instruments with a semi-automatic, or non-automatic, zero setting device.

(7) Operator Interface

Operator adjustments and reset function shall be inhibited during automatic operation.

(8) Printout

On instruments equipped with a printing device, the reset of the total shall be inhibited until the total is printed. The printout of the total shall occur if automatic operation is interrupted.

(9) Performance under influence factors and electromagnetic disturbances

(a) The MPE due to influence factors shall be as specified in Table 13.

Table 13

Load (m) in totalisation scale intervals d_t	MPE
$0 < m \leq 500$	$\pm d_t$
$500 < m \leq 2\,000$	$\pm d_t$
$2\,000 < m \leq 10\,000$	$\pm d_t$

(b) The critical change value due to a disturbance is one totalisation scale interval for any weight indication and any stored total.

Continuous Totalisers

49.—(1) In addition to the requirements set out in paragraphs 44 and 45, the following specific requirements shall apply in relation to continuous totalisers.

(2) Accuracy Classes

Continuous totalisers are divided into three accuracy classes, as follows—

(a) 0.5;

(b) 1; and

(c) 2.

(3) Measurement Range

(a) The manufacturer shall specify the measurement range, the ratio between the minimum net load on the weighing unit and the maximum capacity, and the minimum totalised load.

(b) The minimum totalised load Σ_{min} shall not be less than—

(i) 800 d for class 0.5,

(ii) 400 d for class 1,

(iii) 200 d for class 2,

where d is the totalisation scale interval of the general totalisation device.

(4) MPE

Table 14

Accuracy class	MPE for totalised load
0.5	± 0.25%
1	± 0.5%

Accuracy class	MPE for totalised load
2	± 1.0%

(5) Speed of the Belt

The speed of the belt shall be specified by the manufacturer. For single-speed beltweighers, and variable-speed beltweighers having a manual speed setting control, the speed shall not vary by more than 5% of the nominal value. The product shall not have a different speed than the speed of the belt.

(6) General Totalisation Device

It shall not be possible to reset the general totalisation device to zero.

(7) Performance under influence factor and electromagnetic disturbance

(a) The MPE due to influence factor, for a load not less than Σ_{min}, shall be 0.7 times the appropriate value specified in Table 14, rounded to the nearest totalisation scale interval (d).

(b) The critical change value due to a disturbance shall be 0.7 times the appropriate value specified in Table 14, for a load equal to Σ_{min}, for the designated class of beltweigher, rounded up to the next higher totalisation scale interval (d).

Automatic Rail-weighbridges

50.—(1) In addition to the requirements set out in paragraphs 44 and 45, the following specific requirements shall apply in relation to automatic rail-weighbridges.

(2) Accuracy classes

Automatic rail-weighbridges are divided into four accuracy classes as follows:

(i) 0.2;

(ii) 0.5;

(iii) 1; and

(iv) 2.

(3) MPE

(a) The MPEs for weighing-in-motion of a single wagon or a total train are shown in Table 15.

Table 15

Accuracy class	MPE
0.2	± 0.1 %
0.5	± 0.25 %
1	± 0.5 %
2	± 1.0 %

(b) The MPEs for the weight of coupled or uncoupled wagons weighing-in-motion shall be one of the following values, whichever is the greatest:

(i) the value calculated according to Table 15, rounded to the nearest scale interval;

(ii) the value calculated according to Table 15, rounded to the nearest scale interval for a weight equal to 35% of the maximum wagon weight (as inscribed on the descriptive markings);

(iii) one scale interval (d).

(c) The MPEs for the weight of train weighing-in-motion shall be one of the following values, whichever is the greatest:

(i) the value calculated according to Table 15, rounded to the nearest scale interval;

(ii) the value calculated according to Table 15, for the weight of a single wagon equal to 35% of the maximum wagon weight (as inscribed on the descriptive markings) multiplied by the number of reference wagons (not exceeding 10) in the train, and rounded to the nearest scale interval;

(iii) one scale interval (d) for each wagon in the train, but not exceeding 10 d.

(d) When weighing coupled wagons; the errors of not more than 10% of the weighing results taken from one or more passes of the train may exceed the appropriate MPE given in paragraph 3(b), but shall not exceed twice the MPE.

(4) Scale interval (d)

The relationship between the accuracy class and the scale interval shall be as specified in Table 16.

Table 16

Accuracy class	Scale interval (d)
0.2	$d \leq 50$ kg
0.5	$d \leq 100$ kg
1	$d \leq 200$ kg
5	$d \leq 500$ kg

(5) Measurement range

(a) The minimum capacity shall not be less than 1 t, and not greater than the value of the result of the minimum wagon weight divided by the number of partial weighings.

(b) The minimum wagon weight shall not be less than 50 d.

(6) Performance under influence factor and electromagnetic disturbance

(a) The MPE due to an influence factor shall be as specified in Table 17.

Table 17

Load (m) in verification scale intervals (d)	MPE
$0 < m \leq 500$	± 0.5 d
$500 < m \leq 2\,000$	± 1.0 d
$2\,000 < m \leq 10\,000$	± 1.5 d

(b) The critical change value due to a disturbance is one scale interval.

Part E

Material Measures

51.—(1) The relevant essential requirements of Part 1 and the specific requirements of this Part apply to material measures of length and capacity serving measures.

(2) The requirement for the supply of a copy of declarations of conformity may be interpreted as applying to a batch or consignment rather than each individual instrument.

Material measures of length

52.—(1) Reference Conditions

(a) For tapes of length equal to or greater than five metres, the maximum permissible errors (MPEs) are to be met when a tractive force of fifty newtons or other force values as specified by the manufacturer and marked on the tape accordingly, or in the case of rigid or semi-rigid measures no tractive force is needed, is applied.

(b) The reference temperature is 20°C unless otherwise specified by the manufacturer and marked on the measure accordingly.

(2) MPE

(a) The MPE, positive or negative in mm, between two non-consecutive scale marks is (a + bL), where—

(i) L is the value of the length rounded up to the next whole metre; and

(ii) a and b are given in Table 18 below.

(b) When a terminal interval is bounded by a surface, the MPE for any distance beginning at this point is increased by the value c given in Table 18.

Table 18

Accuracy Class	a (mm)	b (mm)	c (mm)
I	0.1	0.1	0.1
II	0.3	0.2	0.2
III	0.6	0.4	0.3
D – special class for dipping tapes[(1)] Up to and including 30 m[(2)]	1.5	zero	Zero
S – special class for tank strapping tapes For each 30 m length when the tape is supported on a flat surface	1.5	zero	Zero

(1) Applies to the tape/dip weight combinations

(2) If the nominal tape length exceeds 30m, an additional MPE of 0.75 mm shall be permitted for each 30m of tape length.

(c) Dip tapes may also be of Classes I or II in which case for any length between two scale marks, one of which is on the sinker and the other on the tape, the MPE is ± 0.6 mm when application of the formula gives a value of less than 0.6 mm.

(d) The MPE for the length between consecutive scale marks, and the maximum permissible difference between two consecutive intervals, are given in Table 19 below.

Table 19

Length i of the interval	MPE or difference in millimetres according to accuracy class		
	I	II	III
i ≤ 1 mm	0.1	0.2	0.3
1 mm < i ≤ 1 cm	0.2	0.4	0.6

(e) Where a rule is of the folding type, the jointing shall be such as not to cause any errors, supplementary to those above, exceeding 0.3 mm for Class II, and 0.5 mm for Class III.

(3) Materials

(a) Materials used for material measures shall be such that length variations due to temperature excursions up to ± 8°C about the reference temperature do not exceed the MPE. This does not apply to Class S and Class D measures where the manufacturer intends that thermal expansion corrections shall be applied to observed readings where necessary.

(b) Measures made from material whose dimensions may alter materially when subjected to a wide range of relative humidity, may only be included in Classes II or III.

(4) Markings

The nominal value shall be marked on the measure. Millimetre scales shall be numbered every centimetre and measures with a scale interval greater than 2 cm shall have all scale marks numbered.

Capacity serving measures

53.—(1) The requirement for the instrument to bear information in respect of its accuracy shall not apply.

(2) Definitions

In these Regulations—

"brim measure" means a capacity serving measure for which the internal volume is equal to the nominal capacity;

"capacity" means the internal volume for brim measures or internal volume to a filling mark for line measures.

"line measure" means a capacity serving measure marked with a line to indicate nominal capacity;

"transfer measure" means a capacity serving measure from which it is intended that the liquid is decanted prior to consumption;

(3) Reference Conditions

(a) Temperature: the reference temperature for measurement of capacity is 20°C.

(b) Position for correct indication: free standing on a level surface.

(4) MPE

Table 20

	Line	Brim
Transfer of measures		
< 100 ml	± 2 ml	- 0

	Line	Brim
		+ 4 ml
≥ 100 ml	± 3 %	- 0
		+ 6%
Serving measures		
< 200 ml	± 5 %	- 0
		+ 10%
≥ 200 ml	± 5 ml + 2.5%	- 0
		+ 10 ml + 5%

(5) Materials

Capacity serving measures shall be made of material which is sufficiently rigid and dimensionally stable to maintain capacity within the MPE.

(6) Shape

(a) Transfer measures shall be designed so that a change of contents equal to the MPE causes a change in level of at least 2 mm at the brim or filling mark.

(b) Transfer measures shall be designed so that the complete discharge of the liquid being measured will not be impeded.

(7) Marking

(a) The nominal capacity declared shall be clearly and indelibly marked on the measure.

(b) Capacity serving measures may also be marked with up to three clearly distinguishable capacities, none of which shall lead to confusion one to the other.

(c) All filling marks shall be sufficiently clear and durable to ensure that MPE are not exceeded in use.

Part F

Dimensional Measuring Instruments

54. The relevant essential requirements of Part 1 and the specific requirements of this Part apply to dimensional measuring instruments.

Requirements common to all dimensional measuring instruments

55.—(1) Electromagnetic immunity

(2) The effect of an electromagnetic disturbance on a dimensional measuring instrument shall be such that—

(a) the change in measurement result is no greater than the critical change value as defined in paragraph (3); or

(b) it is impossible to perform any measurement; or

(c) there are momentary variations in the measurement result that cannot be interpreted, memorised or transmitted as a measuring result; or

(d) there are variations in the measurement result severe enough to be noticed by all those interested in the measurement result.

(3) The critical change value is equal to one scale interval.

Length measuring instruments

56.—(1) Characteristics of the product to be measured

(a) Textiles are characterised by the characteristic factor K. This factor takes the stretchability and force per unit area of the product measured into account and is defined by the following formula—

$K = \varepsilon(G + 2.2\ N/m^2)$, where—

(i) ε is the relative elongation of a cloth specimen 1 m wide at a tensile force of 10 N;

(ii) G is the weight force per unit area of a cloth specimen in N/m^2.

(2) Operating conditions

(a) Range:

Dimensions and K-factor, where applicable, within the range specified by the manufacturer for the instrument. The ranges of K-factor are given in Table 21—

Table 21

Group	Range of K	Product
I	$0 < K < 2 \times 10^{-2}\ N/m^2$	low stretchability
II	$2 \times 10^{-2}\ N/m^2 < K < 8 \times 10^{-2}\ N/m^2$	medium stretchability
III	$8 \times 10^{-2}\ N/m^2 < K < 24 \times 10^{-2}\ N/m^2$	high stretchability
IV	$24 \times 10^{-2}\ N/m^2 < K$	very high stretchability

(b) Where the measured object is not transported by the measuring instrument, its speed must be within the range specified by the manufacturer for the instrument.

(c) If the measurement result depends on the thickness, the surface condition and the kind of delivery (e.g. from a big roll or from a pile), corresponding limitations are specified by the manufacturer.

(3) MPE

(a) Instrument

Table 22

Accuracy class	MPE
I	0.125 %, but not less than 0.005 L_m
II	0.25 %, but not less than 0.01 L_m
III	0.5 %, but not less than 0.02 L_m

where L_m is the minimum measurable length, that is to say the smallest length specified by the manufacturer for which the instrument is intended to be used.

(b) The true length value of the different types of materials should be measured using suitable instruments (e.g. tapes of length). Thereby, the material which is going to be measured should be laid out on a suitable underlay (e.g. a suitable table) straight and unstretched.

(4) Other requirements

The instruments must ensure that the product is measured unstretched according to the intended stretchability for which the instrument is designed.

Area measuring instruments

57.—(1) Operating conditions

(a) Range

Dimensions within the range specified by the manufacturer for the instrument.

(b) Condition of the product

The manufacturer shall specify the limitations of the instruments due to the speed, and thickness of the surface conditions if relevant, of the product.

(2) MPE

58. Instrument

The MPE is 1.0 % but not less than 1 dm^2.

Other requirements

59.—(1) Presentation of the product

In the case of pulling back or stopping the product, it should not be possible to have an error of measurement or the display must be blanked.

(2) Scale interval

The instruments must have a scale interval of 1.0 dm^2. In addition, it must be possible to have a scale interval of 0.1 dm^2 for testing purposes.

Multi-dimensional measuring instruments

60.—(1) Operating conditions

(a) Range

Dimensions within the range specified by the manufacturer for the instrument.

(b) Minimum dimension

The lower limit of the minimum dimension for all values of the scale interval is given in Table 23.

Table 23

Scale interval (d)	Minimum dimension (min) (lower limit)
$d \leq 2$ cm	10 d
2 cm < $d \leq$ 10 cm	20 d
10 cm < d	50 d

(c) Speed of the product

The speed must be within the range specified by the manufacturer for the instrument.

(2) MPE

Instrument—

The MPE is ± 1.0 d.

Part G

Volume Conversion Devices

61. The relevant essential requirements of Part 1 and the specific requirements of this Part apply to volume conversion devices.

62. A volume conversion device constitutes a sub-assembly for the purpose of these Regulations.

Rated operating conditions

63. The manufacturer shall specify the rated operating conditions of the volume conversion device taking into account—

(a) the temperature range of the gas, with a minimum range of 40 °C;

(b) the volume conversion device shall be designed for the range of gases and supply pressures of the country of destination. In particular the manufacturer shall indicate—

(i) the gas family or group; and

(ii) the maximum operating pressure;

(c) a minimum temperature range of 50 °C for the climatic environment;

(d) the nominal value of the AC voltage supply and/or the limits of DC supply.

MPE

64. The MPEs are—

(a) 0.5 % at ambient temperature 20 ° C ± 3 °C, ambient humidity 60 % ± 15 %, nominal values for power supply;

(b) 0.7 % for temperature conversion devices at rated operating conditions;

(c) 1 % for other conversion devices at rated operating conditions.

Note: The error of the gas meter is not taken into account.

Permissible effect of disturbances

65.—(1) Electromagnetic immunity

(2) The effect of an electromagnetic disturbance on a volume conversion device shall be such that—

(a) the change in the measurement result is no greater than the critical change value as defined in sub-paragraph (4), or

(b) the indication of the measurement result is such that it cannot be interpreted as a valid result, such as a momentary variation that cannot be interpreted, memorised or transmitted as a measuring result.

(3) After undergoing a disturbance, the volume conversion device shall—

(a) recover to operate within MPE, and

(b) have all measurement functions safeguarded, and

(c) allow recovery of all measurement data present just before the disturbance.

(4) The critical change value is the quantity corresponding to half of the magnitude of the relevant MPE as defined at paragraph 64.

Suitability

66.—(1) A volume conversion device powered from the mains (AC or DC) shall be provided with an emergency power supply device or other means to ensure, during a failure of the principal power source, that all measuring functions are safeguarded.

(2) A dedicated power source shall have a lifetime of at least five years. After 90% of its lifetime an appropriate warning shall be shown.

(3) An indicating device shall have a sufficient number of digits to ensure that the quantity passed during 8,000 hours at Q_{max} by the gas meter to which the volume conversion device is to be connected does not return the digits to their initial values.

(4) The volume conversion device shall be able to be installed to operate in any position declared by the manufacturer in its installation instruction.

(5) An electronic volume conversion device shall be capable of detecting when it is operating outside the operating range(s) stated by the manufacturer for parameters that are relevant for measurement accuracy. In such a case, the conversion device must stop integrating the converted quantity, and may totalise separately the converted quantity for the time it is operating outside the operating range(s).

(6) An electronic volume conversion device shall be capable of displaying all relevant data for the measurement without additional equipment.

Units

67. Metered quantity shall be displayed in cubic metres or kilograms.

Base conditions for converted quantities

68. The manufacturer shall specify the base conditions for converted quantities.

Putting into Use

69. Any volume conversion device may be used in conjunction with any gas meter put into use in accordance with Annex MI-002 of the Directive.