

## SCHEDULE 1

Regulations 2(1) and 14(a)

### ESSENTIAL REQUIREMENTS

1. The essential requirements are the relevant requirements relating to meter measuring systems contained in Annex I and Annex MI-005, set out in this Schedule.

#### Definitions

2.—(1) In this Schedule—

“associated measuring instrument” means measuring equipment connected to the calculator for measuring certain quantities which are characteristic of the liquid fuel, with a view to make a correction and/or conversion;

“base conditions” means the specified conditions to which the measured quantity of liquid fuel 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;

“climatic environments” means the conditions in which meter measuring systems may be used;

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

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

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

and includes the relevant associated measuring instruments;

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

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

“direct sale” means a trading transaction if—

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

(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;

“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 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;

“interruptible” means the liquid fuel flow can be stopped easily and rapidly;

“measurand” means the particular quantity subject to measurement;

“ $Q_{\max}$ ” means the maximum flowrate;

“ $Q_{\min}$ ” means the minimum flowrate; and

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“rated operating conditions” means the values for the measurand and influence quantities making up the normal working conditions of an instrument.

(2) In this Schedule, volume may be read as mass.

**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 set out in paragraph 16.

(2) Unless stated otherwise, 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 paragraph 17.

(4) Where the meter measuring system 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 requirements in this Schedule.

(a) Climatic environments—

The manufacturer shall specify the upper temperature limit and the lower temperature limit from any of the values in Table 1, and indicate whether the meter measuring system is designed for condensing or non-condensing humidity as well as the intended location for the instrument, i.e. open or closed.

**Table 1**

	<i>Temperature Limits</i>			
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—

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

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—
  - (i) Electromagnetic environments are classified into classes E2 and E3 as follows—
    - 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; and
      - (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 these Regulations, 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. 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.

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- (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 meter measuring system shall be sufficiently sensitive and the discrimination threshold shall be sufficiently low for the intended measurement task.

### **Durability**

7.—(1) A meter measuring system 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.

(2) 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 2 set out in paragraph 16.

### **Reliability**

8. A meter measuring system 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 meter measuring system shall have no feature likely to facilitate fraudulent use, whereas possibilities for unintentional misuse shall be minimal.

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

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

(5) A meter measuring system 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.

(6) When an 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.

(7) 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.

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

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

- (a) 0.5 % for liquid fuel of a viscosity not exceeding 1 mPa.s; or
- (b) 1 % for liquid fuel of a viscosity exceeding 1 mPa.s,

but the allowed variation shall never be smaller than 1% of the minimum measured quantity. This value applies in the case of air or gas pockets.

(10) Instruments for direct sales—

- (a) A meter 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) Meter measuring systems for direct sales shall be interruptible.
- (e) Any percentage of air or gas in the liquid fuel shall not lead to a variation of error greater than the values specified in sub-paragraph (9).

### **Protection against corruption**

**10.**—(1) The metrological characteristics of a meter measuring system 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 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 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.

### **Information to be borne by and to accompany the meter measuring system**

**11.**—(1) A meter measuring system shall bear the following inscriptions—

- (a) manufacturer's mark or name;

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- (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 these Regulations.
- (2) The instrument shall be accompanied by information on its operation unless the simplicity of the 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 or other measuring instruments.
- (3) Groups of identical meter measuring systems used in the same location do not necessarily require individual instruction manuals.
- (4) The scale interval for a measured value shall be in the form  $1 \times 10^n$ ,  $2 \times 10^n$  or  $5 \times 10^n$ , where  $n$  is any integer or zero. The unit of measurement or its symbol shall be shown close to the numerical value.
- (5) 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.
- (6) 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 meter measuring system 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 the 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) The direct indication may be converted into another quantity using a conversion device.

### Further processing of data to conclude the trading transaction

13.—(1) A meter measuring system 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 meter measuring system 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 meter measuring system shall be designed so as to allow ready evaluation of its conformity with the appropriate requirements of these Regulations.

### Rated operating conditions

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

- (a) the flowrate range is subject to the following conditions—
  - (i) the flowrate range of a meter measuring system shall be within the flowrate range of each of its elements, in particular the meter;
  - (ii) the minimum ratio of  $Q_{\max}$ :  $Q_{\min}$  of the meter and meter measuring system is 4:1;
- (b) the properties of the liquid fuel to be measured by the instrument by specifying the name or type of the liquid fuel or its relevant characteristics, for example—
  - (i) temperature range;
  - (ii) pressure range;
  - (iii) density range;
  - (iv) viscosity range;
- (c) the nominal value of the AC voltage supply and/or limits of the DC voltage supply;
- (d) the base conditions for converted values but this paragraph 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 19 October 1992 on the harmonisation of the structures of excise duties on mineral oils(1) or, for heavy fuel oils, another temperature pursuant to Article 3(2) of that Directive.

### Accuracy classification and maximum permissible errors (MPEs)

16.—(1) The MPE on indications is set out in Table 2.

**Table 2**

	<i>Accuracy Class</i>		
	0.3	0.5	1.0
Meter measuring systems (A)	0.3%	0.5%	1%

(1) OJ No L316, 31.10.92, p.12, repealed by Directive 2003/96/EC OJ L283, 31.10.03, p.51.

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Meter (B)	0.2%	0.3%	0.6%
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(2) 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 2;
- (b) the absolute value of the MPE for the minimum measured quantity ( $E_{min}$ ).

(3) For minimum measured quantities the following conditions apply—

- (a) Condition 1 -  $E_{min}$  shall fulfil the condition:  $E_{min} \geq 2R$ , where R is the smallest scale interval of the indication device;
- (b) Condition 2 -  $E_{min}$  is given by the formula:  $E_{min} = (2MMQ) \times (A/100)$  where—
  - (i) MMQ is the minimum measured quantity;
  - (ii) A is the numerical value specified in line A of Table 2.

(4) Converted indication—

In the case of a converted indication the MPEs are as in line A of Table 2.

(5) Conversion devices—

MPEs on converted indications due to a conversion device are equal to  $\pm (A-B)$ , A and B being the values specified in Table 2.

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

(a) Calculator—

MPEs on quantities of liquid fuel indications applicable to calculation, positive or negative, are equal to one-tenth of the MPEs as defined in line A of Table 2.

(b) Associated measuring instruments—

Associated measuring instruments shall have an accuracy at least as good as the values in Table 3 and these values apply to the indication of the characteristic quantities of the liquid fuel displayed by the conversion device.

(c) Accuracy for calculating function—

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

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

**Table 3**

<i>MPE on measurements</i>	<i>Accuracy classes of the meter measuring system</i>		
	0.3	0.5	1.0
Temperature	$\pm 0.3^{\circ}\text{C}$	$\pm 0.5^{\circ}\text{C}$	
Pressure	Less than 1 MPa: $\pm 50$ kPa		
	From 1 to 4 MPa: $\pm 5$ %		
	Over 4 MPa: $\pm 200$ kPa		
Density	$\pm 1$ kg/m <sup>3</sup>		$\pm 2$ kg/m <sup>3</sup>

**Maximum permissible effect of disturbances**

17.—(1) The effect of an electromagnetic disturbance on a meter 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);
- (b) the indication of the measurement 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 meter measuring system shall permit the retrieval of the measuring result just before the critical change value occurred and cut off the flow.

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

**Power supply failure**

18. A meter measuring system shall either be provided with an emergency power 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**

19.—(1) Table 4 sets out the accuracy classes applicable to meter measuring systems but where the manufacturer specifies an accuracy class of a higher level of precision, the instrument shall fall within that accuracy class specified by the manufacturer.

(2) Nothing in this paragraph shall prevent member States from requiring the use of meter measuring systems of accuracy class 0.3 or 0.5 when used for the levying of duties on mineral oils when loading or unloading road tankers.

**Table 4**

<i>Accuracy Class</i>	<i>Types of Meter Measuring System</i>
0.3	Instruments in class 0.5 or 1.0, where specified by the manufacturer
0.5	Instruments used to measure liquid fuel in the temperature range from minus 10°C to and including 50°C
1.0	Instruments used to measure liquid fuel whose temperature is less than minus 10°C or greater than 50°C

**Units of measurement**

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