Regulation on requirements to material measures

Established by the Norwegian Metrology Service dd.dd.yyyy in accordance with the Units of measurement, measurement and standard time Act of 26 January 2007 no 4 § 35, cf. § 7 and § 10, and § 8, § 19 and § 30 and regulation December 20th 2007 no. 1723 on measuring units and measurements § 2-2 and § 5-2 second subsection.

Chapter 1 – Introductory provisions

§ 1. *Scope*

The regulation prescribes the requirements which applies to material measures, cf. regulation December 20th 2007 no. 1723 on measuring units and measurements chapter 3 and supplementary provisions on control and approval in service.

The requirements of this regulation applies when

a) such material measures are sold or offered for sale, cf. regulation on measuring units and measurements § 3-1 and when
b) the measurement result of such material measures will be used in economic transactions , cf. regulation on measuring units and measurements § 3-4.

This regulation does not prescribe requirements to electromagnetic disturbance. Electromagnetic disturbance is regulated by regulation August 10th 1995 no. 713 on electric equipment.

§ 2. *Definitions*

In this regulation, the following definitions apply:

a) *Material measure of length:* A measuring instrument comprising scale marks whose distances are given in legal units of length.
b) *Measurand:* the particular quantity subject to measurement
c) *Influence quantity:* A quantity that is not the measurand but that affects the result of measurement
d) *Rated operating conditions:* The values for the measurand and influence quantities making up the normal working conditions of the material measure
e) *Disturbance:* An influence quantity having a value within the limits specified in the appropriate requirement but outside the specified rated operating conditions of the material measure. An influence quantity is a disturbance if for that influence quantity the rated operating conditions are not specified.
f) *Critical change value:* The value at which the change in the measurement result is considered undesirable.

g) *Material measure:* A device which in service is intended to reproduce or supply in a permanent manner one of a given quantity.
h) *Climatic environments:* The conditions in which measuring instruments may be used. To cope with climatic differences between the Member States of the EEC, a range of temperature limits has been defined.

§ 3. *Requirements to material measures*

Material measures shall as a minimum fulfill the essential requirements established in chapter 2. Maximal permissible errors for material measures is established in § 28.

Material measures which have been national type examinated during a former legislation, shall in service fulfill the requirements which applied when the material measure was national type examinated, including the requirements for measurement accuracy in service.

Material measures which are not lawfully conformity marked or has a valid national type examination and national verification, is not allowed in service.

§ 4. *Surveillance and approval of sale of material measures*

Material measures which are sold or offered for sale shall have a valid conformity assessment according to the provisions in regulation on measuring units and measurements chapter 4.

§ 5. *Surveillance of a material measure in service*

A material measure is subject to periodic surveillance. The surveillance period for a material measure is three years.

Testing of material measure in conjunction with the surveillance shall be carried out according to relevant parts of the applicable OIML R35 and the procedures of the Norwegian metrology service, unless the Norwegian metrology service considers that the testing should be carried out in a more appropriate and metrologically justifiable manner.

Chapter 2 Requirements to material measures

Section I- General requirements

§ 6. *Metrological protection and level of quality*

A material measure shall provide a high level of metrological protection in order that any party affected can have confidence in the result of measurement, and shall be

designed and manufactured to a high level of quality in respect of the measurement technology and security of the measurement data.

§ 7. *Intended use and foreseeable misuse*

The solutions adopted in the pursuit of the requirements shall take account of the intended use of the material measure and any foreseeable misuse thereof.

§ 8. *Allowble errors*

Under rated operating conditions and in the absence of a disturbance, the error of measurement shall not exceed the maximum permissible error value as laid down in section II. Unless stated otherwise in section II, the maximum permissible error is expressed as a bilateral value of the deviation from the true measurement value.

Under rated operating conditions and in the presence of a disturbance, the performance requirement shall be as laid down in section II.

Where the material measureis 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 the maximum permissible error.

§ 9. *Influence quantities*

The manufacturer shall specify the climatic, mechanical and electromagnetic environments in which the material measureis intended to be used, power supply and other influence quantities likely to affect its accuracy, taking account of the requirements laid down in section II.

§ 10. *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 material measureis designed for condensing or non-condensing humidity as well as the intended location for the instrument is open or closed.

Table 1

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

§ 11. *Mechanical environments*

Mechanical environments are classified into the following classes:

Table 2

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, etc.
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, etc.
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, etc.

The following influence quantities shall be considered in relation with mechanical environments:

a) Vibration

b) Mechanical shock.

§ 12. *Electromagnetic environments*

Unless otherwise laid down in section II, electromagnetic environments are classified into the following classes:

Table 3

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: voltage reductions caused by energising the starter-motor circuits of internal combustion engines, and load dump transients occurring in the event of a discharged battery being disconnected while the engine is running.

The following influence quantities shall be considered in relation with electromagnetic environments:

a) Voltage interruptions
b) Short voltage reductions
c) Voltage transients on supply lines and/or signal lines, electrostatic discharges,
d) Radio frequency electromagnetic fields
e) Conducted radio frequency electromagnetic fields on supply lines and/or signal lines
f) Surges on supply lines and/or signal lines.

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.

§ 13. *Basic rules for testing and the determination of errors*

Essential requirements specified in § 8 shall be verified for each relevant influence quantity. Unless otherwise specified in section II, 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.

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 material measurewhen that influence quantity is likely to occur.

§ 14. *Ambient humidity*

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

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.

§ 15. *Reproducibility*

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 maximum permissible error.

§16. *Repeatability*

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 maximum permissible error.

§ 17. *Discrimination and sensitivity*

A material measure shall be sufficiently sensitive and the discrimination threshold shall be sufficiently low for the intended measurement task.

§ 18. *Durability*

A material measure 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.

§ 19. *Reliability*

A material measure 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.

§ 20. *Suitability*

A material measure shall be:

a) 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.
b) Robust and its materials of construction shall be suitable for the conditions in which it is intended to be used.
c) 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 measuring instrument. The test procedure shall be described in the operation manual.
d) Insensitive to small fluctuations of the value of the measurand, or it shall take appropriate action, when the measuring instrument is designed for measurement of values of measurand that are constant over time

A material measure shall have no feature likely to facilitate fraudulent use, whereas possibilities for unintentional misuse shall be minimal.

When a material measure 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.

§ 21. *Protection against corruption*

If the material measure gets connected to another device, direct or by any remote device that communicates with it, shall its metrological characteristics not be influenced in any inadmissible way.

The hardware components that are critical for metrological characteristics shall be designed so that they can be secured. Security measures foreseen shall provide for evidence of an intervention.

Software that is critical for metrological characteristics shall be identified as such and shall be secured. Software identification shall be easily provided by the measuring instrument. Evidence of an intervention shall be available for a reasonable period of time.

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.

§ 22. *Information to be borne by and to accompany the multi-dimensional instrument*

A material measure shall bear the manufacturer's mark or name and information in respect of its accuracy. When applicable the measuring instrument shall also bear the following information:

a) Relevant information in respect of the conditions of use

b) Measuring capacity

c) Measuring range

d) Identity marking

e) Number of the EC-type examination certificate or the EC design examination certificate

f) Information whether or not additional devices providing metrological results comply with the regulations on legal metrological control.

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 this regulation.

Information on its operation shall accompanied the material measure, unless the simplicity of the instrument makes this unnecessary. Information shall be easily understandable and shall include where relevant:

a) Rated operating conditions

b) Electromagnetic environment

c) The upper and lower temperature limit, if 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.

All marks and inscriptions required shall be clear, unambiguous, non-erasable and non-transferable. Groups of identical material measure do not require individual instruction manuals.

§ 23. *Specification of measured value*

Unless specified in secion II, the scale interval for a measured value shall be in the form 1×10n, 2×10n, or 5×10n, where n is any integer or zero. The unit of measurement or its symbol shall be shown close to the numerical value.

The units of measurement and symbols used shall be in accordance with regulations on measuring units and measurements.

Additionally, the material measure of length can show other units of measurement then those specified in the regulation on measuring units and measurements chapter 2.

§ 24. *Indication of 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.

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

§ 25. *Further processing of data to conclude the trading transaction*

The material measure shall record by a durable means the measurement result accompanied by information to identify the particular transaction, when the measurement is non-repeatable and the measuring instrument is normally intended for use in the absence of one of the trading parties.

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.

§ 26. *Conformity evaluation*

A material measure shall be designed so as to allow ready evaluation of its conformity with the appropriate requirements of this regulation.

Section II - Specific requirements

§ 27. *Reference Conditions*

For tapes of length equal to or greater than five metres, the maximum permissible errors 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.

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

§ 28. *Maximum permissible errors*

The maximum permissible error, positive or negative in mm, between two non-consecutive scale marks is (a + bL), where L is the value of the length rounded up to the next whole meter, and a and b are given in table 1 below. If a terminal

interval is bounded by a surface, the maximum permissible error for any distance beginning at this point is increased by the value c given in table 4.

Table 4

Accuracy class	A(mm)	B	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 Up to and including 30 m	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

Accuracy class D applies to tape/dip weight combinations. If the nominal tape length exceeds 30 m, an additional mpe of 0,75 mm shall be permitted for each 30 m tape length.

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 maximum permissible error is ± 0,6 mm when application of the formula gives a value of less than 0,6 mm.

The maximum permissible error for the length between consecutive scale marks, and the maximum permissible difference between two consecutive intervals, are given in table 5 below.

Table 5

Maximum permissible error or difference in millimeters 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

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.

§ 29. Materials

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 maximum permissible error. 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.

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.

§ 30. 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.

Chapter 3 - Concluding provisions

§ 31. *Infringement penalty*

Violation of the provisions of this regulation may lead to order of infringement penalty, determined by the provisions of regulation on measuring units and measurements chapter 7.

§ 32. *Entry into force*

This regulation enters into force on xx.