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# COUNCIL DIRECTIVE

## of 26 July 1971

## on the approximation of the laws of the Member States relating to gas volume meters

(71/318/EEC)

(OJ L 202, 6.9.1971, p. 21)

Amended by:

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| | | No | page | date |
| ►**M1** | Commission Directive 74/331/EEC of 12 June 1974 | L 189 | 9 | 12.7.1974 |
| ►**M2** | Commission Directive 78/365/EEC of 31 March 1978 | L 104 | 26 | 18.4.1978 |
| ►**M3** | Commission Directive 82/623/EEC of 1 July 1982 | L 252 | 5 | 27.8.1982 |

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# COUNCIL DIRECTIVE

## of 26 July 1971

## on the approximation of the laws of the Member States relating to gas volume meters

(71/318/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 100 thereof;

Having regard to the proposal from the Commission;

Having regard to the Opinion of the European Parliament [1];

Having regard to the Opinion of the Economic and Social Committee [2];

Whereas in the Member States the construction and methods of control of gas volume meters are subject to mandatory provisions which differ from one Member State to another and consequently hinder trade in such instruments; whereas it is therefore necessary to approximate these provisions;

Whereas the Council Directive of 26 July 1971 [3] on the approximation of the laws of the Member States relating to provisions both for measuring instruments and methods of metrological control has laid down the EEC type approval and EEC initial verification procedures; whereas, in accordance with that Directive, the technical requirements for the design and functioning of gas volume meters should be laid down;

HAS ADOPTED THIS DIRECTIVE:

*Article 1*

This Directive applies to the following gas volume meters:

1. Volumetric meters:
   - — meters with deformable walls;
   - — meters with rotary pistons.
2. Non-volumetric meters:
   - — turbine meters.

*Article 2*

Those meters which may bear EEC marks and symbols are described in the Annex to this Directive. They shall be subject to EEC type approval and shall be submitted to EEC initial verification.

*Article 3*

No Member State may refuse, prohibit, or restrict the placing on the market or entry into service of gas volume meters bearing the EEC type approval symbol and the EEC initial verification mark.

*Article 4*

1. Member States shall put into force the laws, regulations and administrative provisions needed in order to comply with this Directive within eighteen months of its notification, and shall forthwith inform the Commission thereof.

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(1) OJ No C 65, 5.6.1970, p. 30.
(2) OJ No C 131, 29.10.1970, p. 7.
(3) OJ No L 202, 6.9.1971, p. 1.

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2. Member States shall ensure that the texts of the main provisions of national law which they adopt in the field covered by this Directive are communicated to the Commission.

*Article 5*

This Directive is addressed to the Member States.

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*ANNEX*

CHAPTER I

## A. DEFINITION OF CERTAIN TERMS USED IN THE ANNEX

1. **Range of load**

The range of load of a gas meter is bounded by the maximum flow $Q_{max}$ and the minimum flow $Q_{min}$.

2. **Cyclic volume of a volumetric meter**

'Cyclic volume V of a volumetric meter' means the volume of gas corresponding to a cycle of operation of the meter, that is to say to the whole of the movements of the moving components of the meter at the end of which all these components except the indicator and the intermediate transmissions return, for the first time, to their original position.

It is calculated by multiplying the value of the volume represented by a complete revolution of the test element, by the transmission ratio of the measuring device to the index counter.

3. **Operating pressure and reference pressure**

3.1. *Operating pressure*

The operating pressure of a gas meter is the difference between the pressure of the gas at the inlet of the meter and the atmospheric pressure.

3.2. *Reference pressure*

The reference pressure $p_r$ of a gas meter is the gas pressure to which the indicated volume of gas is related.

The pressure tapping for measuring the reference pressure is laid down in Chapter III.

4. **Pressure absorption**

The pressure absorption of a gas meter is the difference between the pressures measured at the inlet and outlet of the meter during the flow of a gas.

5. **Output drive constant**

The constant of an output drive is the value of the volume represented by a complete turn of the shaft of this drive; this value is calculated by multiplying the value of the volume represented by a complete turn of the test element by the transmission ratio of the index counter to this shaft.

## B. GENERAL PROVISIONS FOR GAS VOLUME METERS

1. **General**

1.1. Chapter I of this Annex lays down the general provisions which must be satisfied by all gas volume meters covered by Article 1 of this Directive.

1.2. Chapters II and III of this Annex lay down the special provisions relating to the meters concerned.

2. **Construction**

2.1. *Materials*

The meters must be manufactured of solid materials with low internal stresses, which change little with age, and which are sufficiently resistant to corrosion and attack by the various gases which are normally distributed or by any of their condensates.

2.2. *Soundness of meters*

The cases of meters must be gas-tight at the maximum operating pressure.

2.3. *Protection against interference*

The meters must be so constructed that any interference which could affect the accuracy of measurement is impossible without damaging the verification marks or protective seals.

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2.4. *Direction of gas flow*

For meters whose indicating devices function positively only for one direction of flow, this direction must be indicated by an arrow.

This arrow is not required if the direction of gas flow is fixed by the construction.

2.5. *Metrological properties*

At a flow equal to $Q_{max}$ a meter must be able to operate continuously for the time laid down in Chapter II of III without any change in its metrological performance beyond the limits specified in those chapters.

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3. **Additional devices**

3.1. Gas volume meters may be fitted with:

(a) prepayment devices;

(b) integral pulse generators the outlets of which must bear an indication of the value of one pulse in the form:

'1 imp. $\hat{=}$ … $m^3$ (or $dm^3$)' or

'1 $m^3$ $\hat{=}$ … imp.'.

These additional devices, where fitted, are regarded as forming an integral part of the meter; they should be connected to the gas volume meter at the time of EEC initial verification. There are no separate requirements regarding their effects on the measuring properties of the meters.

3.2. Gas meters may be fitted with output drive shafts which should be taken to include drive shafts or other facilities for operating detachable additional devices. The torque which the gas meters are required to produce in order to drive the additional devices fitted must not bring about any changes in the meter indication greater than the values specified in Sections II.5.2.1 and III.5.2.1.

3.2.1. If there is only one drive shaft, it must be characterized by an indication of its constant in the form '1 tr $\hat{=}$ … $m^3$ (or $dm^3$)', of the maximum permissible torque in the form '$M_{max}$ = … N.mm' and of the direction of rotation.

3.2.2. If there are several drive shafts, each shaft must be characterized by the letter M with subscript in the form '$M_1$; $M_2$; … $M_n$', as well as by an indication of its constant in the form '1 tr $\hat{=}$ … $m^3$ (or $dm^3$)' and of the direction of rotation.

The following formula must appear on the meter, preferably on the data plate:

$k_1 M_1 + k_2 M_2 + \ldots + k_n M_n \leq A$ N.mm,

in which:

A represents the numerical value of the maximum permissible torque applied to the drive shaft with the highest constant, where the torque is applied only to this shaft; this shaft must be characterized by the symbol $M_1$;

$k_i$ (i = 1; 2; … n) represents a numerical value determined as follows:

$$k_i = \frac{C_1}{C_i};$$

$M_i$ (i = 1; 2; … n) represents the torque applied to the drive shaft characterized by the symbol $M_i$;

$C_i$ (i = 1; 2; … n) represents the constant for the drive shaft characterized by the symbol $M_i$.

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3.2.3. When not connected to a detachable additional device, the exposed ends of the drive shafts must be suitably protected.

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3.2.4. The connection between the measuring device and the intermediate gearing must not be broken or altered if a torque equal to three times the permissible torque as laid down in Sections I.B.3.2.1 and I.B.3.2.2 is applied.

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4. **Inscriptions**

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4.1. Each meter must bear the following inscriptions, either on the dial plate or on a special data plate or divided between the two:

(a) the EEC type-approval mark;

(b) the identification mark or name of the manufacturer;

(c) the number and year of manufacture of the meter;

(d) the size designation of the meter: this has the form of a capital G followed by a number which is laid down in Chapter II or III;

(e) the maximum flow expressed as: $Q_{max}$ … $m^3/h$;

(f) the minimum flow expressed as: $Q_{min}$ … $m^3/h$ (or $dm^3/h$);

(g) the maximum operating pressure expressed as: $p_{max}$ … MPa (or kPa or Pa or bar or mbar);

(h) for volumetric meters, the nominal value of the cyclic volume expressed as: $V$ … $m^3$ (or $dm^3$);

(i) where appropriate, the inscriptions mentioned in Sections I.B.3.1 and I.B.3.2; these inscriptions may, however, be made on other plates or on the meter itself.

These inscriptions must be clearly visible, easily legible and indelible under the normal conditions of use of the meter.

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4.2. The metrological service which issues the type approval may decide the cases in which the nature of the gas must also be specified on the badge plate.

4.3. The meter may also carry the commercial designation, a special series number, the name of the gas distributor, a mark indicating that it conforms to a European standard, and an indication relating to any repairs made. Unless specially authorised, any other indication or inscription is prohibited.

5. **Counter and test element**

5.1. *Counter*

5.1.1. The counters must be in the form of drums; however, the last element may be excepted from this rule. The drums must be calibrated in cubic metres or decimal multiples or submultiples of the cubic metre. The symbol $m^3$ must be marked on the index plate.

5.1.1.1. The drums indicating the submultiples of the cubic metre if provided must be clearly distinguishable from the other drums, and separated from them by a clearly marked decimal point.

5.1.1.2. In cases in which the last drum is figured in decimal multiples of a cubic metre, the index plate must be marked with either:

(a) one or more fixed zero's as appropriate after the last drum; or

(b) the indication '× 10, × 100, × 1000 etc.' in such a way that the reading is always made in cubic metres.

5.1.2. The counter must have sufficient numbered drums to be able to indicate within one unit of the last drum, the volume passed during an operating period of one thousand hours at maximum flow rate.

5.2. *Test element*

5.2.1. Meters must be designed in such a way that checking can be done with sufficient accuracy. For this purpose they must incorporate in their design an integral test unit or arrangements permitting the connection of a portable test unit.

5.2.2. The integral test element may be the last element of the counter in one of the two following forms:

(a) a continuously revolving drum carrying a graduated scale;

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(b) a pointer passing over a fixed dial having a graduated scale or a disc carrying a graduated scale moving past a fixed reference mark.

5.2.3. On the graduated scales of these test elements the unit of the graduations must be indicated clearly and unambiguously in $m^3$ or decimal submultiples of the $m^3$; the beginning of the scale must be indicated by the figure zero.

5.2.3.1. The interval between scale divisions must be constant throughout the scale and not less than 1 millimetre.

5.2.3.2. The value of the scale divisions must be in the form $1 \times 10^n$, $2 \times 10^n$, or $5 \times 10^n$ $m^3$, n being a whole positive or negative number or zero.

5.2.3.3. The graduation lines must be fine and uniform. In cases in which the division is of the form $1 \times 10^n$ or $2 \times 10^n$ $m^3$, all the lines representing multiples of 5, and in the case of a division of the form $5 \times 10^n$ $m^3$, all the lines representing multiples of 2, must be distinguished by a greater length.

5.2.4. ►M1 The pointer or the reference mark must be sufficiently thin to permit certain and easy reading.

The test element may have a removable reference mark and be of a size sufficient to permit photo-electric scanning. The reference mark must not conceal the graduation; if necessary, it may replace the figure 0. It must not interfere with the accuracy of reading. ◄

5.3. *Diameters of drums and dials*

The diameters of drums must be at least 16 millimetres.

The diameter of the graduated scales mentioned in Chapter I B 5.2.2. b must be at least 32 millimetres.

5.4. *Reading of the counter*

The counter must be so designed that it can be read by simple juxtaposition of the figures.

5.5. *Advance of figures*

The advance by one figure at any part of the index must be completed whilst the figure of the immediately next lower range describes the last tenth of its course.

5.6. *Removal of the counter*

Meters must be so designed that the counter may be removed easily during examination.

6. **Maximum permissible errors**

6.1. The measuring errors are expressed as a relative value by the ratio, as a percentage, of the difference between the volume indicated and the volume actually passed by the meter, to the latter volume.

6.2. These errors relate to the measurement of volumes of air having a reference density of 1·2 $kg/m^3$. Under normal atmospheric conditions the ambient air in a test laboratory may be considered to satisfy this condition.

6.3. The maximum permissible errors are specified in Chapters II and III; they are valid for the authorised direction of flow.

7. **Pressure absorption**

7.1. *Maximum permissible values*

The maximum permissible values of pressure absorption are specified in Chapters II and III.

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8. **Location of verification marks and seals**

8.1. The location of the marks and seals must be so chosen that dismantling of the part sealed by one of the marks or seals will result in damage thereto.

8.2. When the inscriptions mentioned in item I.B. 4.1 are affixed on a special data plate, and if this plate is not to be a permanent fixture, one of the marks or seals must be so located that it is damaged if the

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special plate is removed, the object being to prevent removal of the said plate.

8.3. Locations should be provided for verification marks or seals:

(a) on all plates carrying an inscription required by this Annex with the exception of plates which are permanent fixtures;

(b) on all parts of the meter which cannot otherwise be protected against interference liable to:

— affect or alter the indication on the indicating device of the meter,

— alter or break the connection between the measuring device and the indicating device,

— remove or displace metrologically important parts of the meter;

(c) on the connection with the detachable additional devices or on the protective devices referred to in item I.B. 3.2.3.

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9. **EEC type-approval and EEC initial verification**

EEC type-approval and EEC initial verification of gas volume meters shall be carried out in accordance with the requirements of the Council Directive of 26 July 1971 on the approximation of the laws of the Member States relating to common provisions for both measuring instruments and methods of metrological control.

9.1. *EEC type-approval*

9.1.1. Applications for EEC type-approval for gas meters must be accompanied by the following documents:

— a description of the meter giving the technical characteristics and the principle of its operation,

— a perspective drawing or photograph of the meter,

— a nomenclature of parts with a description of the constituent materials of such parts,

— an assembly drawing with identification of the component parts listed in the nomenclature,

— a dimensioned drawing,

— a plan showing the location of verification marks and seals,

— a plan of the indicating device, with adjustment mechanisms,

— a dimensioned drawing of metrologically important components,

— a plan of the dial plate and of the inscriptions arrangements,

— where appropriate, a plan of the additional devices referred to in Section I.B.3.1,

— where appropriate, a table setting out the characteristics of the drive shafts (Section I.B.3.2),

— a list of the documents submitted,

— a declaration specifying that the meters manufactured in conformity with the type meet the requirements for safety, particularly those concerning the maximum operating pressure as indicated on the data plates.

9.1.2. The following particulars shall appear on the EEC type-approval certificate:

— the name and address of the person to whom the EEC type-approval certificate is issued,

— the type and/or commercial designation,

— the principal technical and metrological characteristics, such as the minimum flow, maximum operating pressure, nominal internal diameter of the connecting pieces and, in the case of volumetric gas meters, the nominal value of the cyclic volume,

— the EEC type-approval mark,

— the period of validity of the EEC type-approval,

— in the case of meters equipped with drive shafts:

(a) the characteristics of the shaft as set out in Section I.B.3.2.1 (where there is only one drive shaft),

(b) the characteristics of each shaft and the formula given in Section I.B.3.2.2 (where there are two or more drive shafts),

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— information on the location of EEC type-approval marks, EEC initial verification marks and seals (where appropriate, in the form of photographs or drawings),

— a list of the documents accompanying the EEC type-approval certificate,

— any special comments.

9.2. *EEC initial verification*

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9.2.1. Gas meters submitted for EEC initial verification shall be in working order. EEC initial verification is no guarantee of the proper functioning or accuracy of reading of additional devices as referred to in items I.B. 3.1 or I.B. 3.2. No EEC verification marks or EEC seals shall be affixed to such additional devices, save for the connections provided for in Item I.B. 8.3. c.

10. **Verification marks and seals**

10.1. *Affixture*

Meters having undergone successfully the verification tests:

— shall be provided with an EEC initial verification mark,

— shall receive EEC seals in the locations mentioned in item I.B. 8.3.

10.2. *Purpose*

The affixing of EEC initial verification marks and seals on a gas meter certifies solely that the meter satisfies the requirements of this Directive.

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CHAPTER II

## PROVISIONS RELATING TO GAS VOLUME METERS WITH DEFORMABLE WALLS

1. **Field of application**

The present Chapter applies, together with the provisions of Chapter I, to gas meters in which the measurement of gas passed through is effected by means of measuring chambers with deformable walls.

2. **Range of capacity and designation**

2.1. The following table gives the authorised values for maximum flow, the upper limits of the corresponding minimum flows, and the minimum values of cyclic volumes, corresponding to the designation (G) of the meters:

| G | $Q_{max}$ $m^3/h$ | $Q_{min}$ $m^3/h$ (Maximum value) | V $dm^3$ (Minimum value) |
|---|---|---|---|
| 1·6 | 2·5 | 0·016 | 0·7 |
| 2·5 | 4 | 0·025 | 1·2 |
| 4 | 6 | 0·040 | 2·0 |
| 6 | 10 | 0·060 | 3·5 |
| 10 | 16 | 0·100 | 6·0 |
| 16 | 25 | 0·160 | 10 |
| 25 | 40 | 0·250 | 18 |
| 40 | 65 | 0·400 | 30 |
| 65 | 100 | 0·650 | 55 |
| 100 | 160 | 1·000 | 100 |
| 160 | 250 | 1·600 | 200 |
| 250 | 400 | 2·500 | 400 |
| 400 | 650 | 4·000 | 900 |
| 650 | 1000 | 6·500 | 2000 |

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2.2. If for a type of meter the value of $Q_{min}$ is lower than the number given in the table of item 2.1 of this Chapter, the numerical value of this $Q_{min}$ must be expressed by a number in column 3 of this table or by a decimal submultiple of this number.

2.3. Meters having a cyclic volume less than the value given in the table of item 2.1 of this Chapter may be approved provided that the model satisfies the requirements of the endurance test mentioned in this connection in item 7.2.5 of this Chapter.

3. **Details of construction**

3.1. For each of the meters the difference between the calculated value of the cyclic volume V and the value of this volume specified on the meter must not exceed 5% of the latter.

3.2. Meters G 1·6 to G 6 inclusive may be provided with a device to prevent operation of the counter when the gas flows in a non-authorised direction.

4. **Test element**

4.1. For meters G 1·6 to G 6 inclusive the test element is manufactured as indicated in item 5.2.2 of Chapter I. For meters G 10 to G 650 inclusive the test element is:

— either manufactured as in item 5.2.2 of Chapter I;

— or is detachable.

4.2. When the test element is manufactured as in item 5.2.2 of Chapter I B the value of the scale division of the element and its graduation must satisfy the requirements of the type as shown in the following table:

| Designation of meter | Maximum value of the scale | Figured in |
|---|---|---|
| G 1·6 to G 6 inc. | 0·2 $dm^3$ | 1 $dm^3$ |
| G 10 to G 65 inc. | 2 $dm^3$ | 10 $dm^3$ |
| G 100 to G 650 inc. | 20 $dm^3$ | 100 $dm^3$ |

4.3. For meters of which the test element is manufactured as in item 5.2.2 of Chapter I B, the typical deviation for a series of at least thirty successive measurements, carried out at a flow of the order of 0·1 $Q_{max}$, and under the same conditions, of a volume of air specified below must exceed the values in the following table:

| Designation of meter | Volume of air to be measured | Maximum permissible typical deviation |
|---|---|---|
| G 1·6 to G 4 inc. | 20 V | 0·2 $dm^3$ |
| G 6 | 10 V | 0·2 $dm^3$ |
| G 10 to G 65 inc. | 10 V | 2 $dm^3$ |
| G 100 to G 650 inc. | 5 V | 20 $dm^3$ |

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The volume of air to be measured may be replaced by the volume which corresponds approximately with a whole number of revolutions of the test element.

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5. **Maximum permissible errors**

5.1. *General Provisions*

5.1.1. The maximum permissible errors, positive or negative, are given in the following table:

| Flow Q | Maximum permissible error in EEC initial verification |
|---|---|
| $Q_{min} \leq Q < 2\ Q_{min}$ | 3% |

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| Flow Q | Maximum permissible error in EEC initial verification |
|---|---|
| 2 $Q_{min} \leq Q \leq$ $Q_{max}$ | 2% |

5.1.2. In EEC initial verification the errors for a meter for flows Q between 2 $Q_{min}$ and $Q_{max}$ must not all exceed 1% if they are all of the same sign.

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5.2. *Special provisions*

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5.2.1. When the maximum torques indicated on the gas meter pursuant to item I.B. 3.2.1 or I.B. 3.2.2 are applied to the drive shafts, the indication of the gas meter at $Q_{min}$ must not vary by more than 1·5 %, without prejudice to item II. 6.3.2.

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6. **Pressure absorption**

6.1. *Total pressure absorption*

The total pressure absorption with a flow of air of density 1·2 kg/m³ at a flow rate equal to $Q_{max}$ must not exceed on average:

| Designation of meter | Maximum permissible value of average total pressure absorption in EEC initial verification | |
|---|---|---|
| | $N/m^2$ | mbar |
| G 1·6 to G 10 inc. | 200 | 2 |
| G 16 to G 40 inc. | 300 | 3 |
| G 65 to G 650 inc. | 400 | 4 |

6.2. *Mechanical pressure absorption*

The mechanical pressure absorption, that is to say the absorption of pressure with a flow of air of density 1·2 kg/m³ at a flow between $Q_{min}$ and 2 $Q_{min}$ must not exceed:

| Designation of meter | Maximum permissible value of mechanical pressure absorption in EEC initial verification | |
|---|---|---|
| | $N/m^2$ | mbar |
| G 1·6 to G 40 inc. | 60 | 0·6 |
| G 65 to G 650 inc. | 100 | 1·0 |

The above values relate to the maximum of the mechanical pressure absorption.

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6.3. *Special provisions*

6.3.1. For meters for which the operating pressure exceeds 0·1 MPa (1 bar) the provisions of Section II.6.2 regarding mechanical pressure absorption shall apply, but the total pressure absorption of these meters as referred to in Section II.6.1 shall not be taken into consideration.

6.3.2. The fitting of additional devices must not cause the mechanical pressure absorption of the gas meters to increase by more than 20 Pa (0·2 mbar).

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7. **EEC type approval**

7.1. As well as the type sample the applicant must place initially at the disposal of the competent authority two to six further sample meters manufactured in accordance with the type sample.

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The number is to be spread over several G sizes at the request of the competent authority if the application for approval covers meters of different sizes.

If the results of the tests are not wholly satisfactory further sample meters may be called for.

7.1.1. A derogation from this provision may be allowed in that these sample meters be placed at the disposal of the competent authority at a later date. However, the decision regarding type approval will not be taken until all samples have been fully examined.

7.1.2. The sample meters shall remain the property of the applicant and will be returned to him after type approval has been granted.

7.2. *The examination*

7.2.1. The type sample and the sample meters must satisfy the requirements of Chapter I and items 2, 3, 4, 5 and 6 of this Chapter.

7.2.2. In addition, over the range, the difference between the maximum and the minimum of errors as a function of the flow rate Q must not exceed 3% for each meter.

7.2.3. The type sample and the sample meters shall be subjected to an endurance test. This test is carried out:

7.2.3.1. For meters G 1·6 to G 10 inclusive: at the maximum meter capacities and with air: however, for meters on which the badge plate specifies the gas to be metered, the test may be effected wholly or partly with this gas.

7.2.3.2. For meters G 16 to G 650 inclusive: so far as possible at the maximum capacity of the meter with air or with gas.

7.2.4. The duration of the endurance test for meters of which the cyclic volume is equal to or greater than the values mentioned in the Table of item 2.1 of this Chapter shall be:

7.2.4.1. For meters G 1·6 to G 10 inclusive: 1000 hrs. The test may be interrupted but must be completed within sixty days.

7.2.4.2. For meters G 16 to G 650 inclusive: such that each meter will measure a volume of air or of gas corresponding to an operation of 1000 hrs at the maximum output of the meter; the test must be completed within the six-month period.

7.2.5. For meters of which the cyclic volume is less than the values specified in the table of item 2.1 of this Chapter, the duration of the endurance test must be of a duration of 2000 hrs and must be carried out on a greater number of meters than that specified in item 7.1 of this Chapter, according to the description of the meter and its general characteristics.

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7.2.6. After the endurance test, the meters (with the exception, at most, of one of them if the tests are carried out on a minimum of three meters) must satisfy the following requirements:

(a) over the flow range the difference between the maximum and minimum errors as a function of the flow Q must not exceed a value of 4% for each meter;

(b) the error values must not differ by more than 1·5% of the initial corresponding values;

For the Qmin rate this error applies only to variations in the negative sense;

(c) the mechanical pressure drop must not have increased by more than 20 $N/m^2$ (0·2 millibars).

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7.2.7. In the case of meters with one or more drive shafts, at least three meters of each G size must be tested with air at a density of 1·2 $kg/m^3$ (see Section I.B.6.2) for compliance with the requirements of Section I.B.3.2.4 and of Sections II.5.2.1 and II.6.3.2.

In the case of meters with several drive shafts, the test must be carried out on the shaft which gives the most unfavourable result.

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For meters of the same G size, the lowest torque value obtained in the tests shall be used as the maximum permissible torque value.

Where a type embraces meters of various G sizes, the torque test need only be carried out on meters of the smallest G size, provided that the same torque is specified for the larger meters and that the drive shaft of the latter has the same or a greater constant.

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7.3. *Modification of a model already approved*

If the request for approval concerns a modification to a model already approved, the metrology service which approved the primary model shall decide, according to the nature of the modification, whether and to what extent the provisions of items 7.1, 7.2.3, 7.2.4 and 7.2.5 of this Chapter are applicable.

8. **EEC initial verification**

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8.1. *Accuracy tests*

A meter is considered to satisfy the requirements concerning maximum permissible errors if these requirements are met at the following flow rates:

(a) at a flow rate of Qmin;

(b) at a flow rate of the order of ⅕ Qmax;

(c) at a flow rate of Qmax.

If the examination is conducted under different conditions, the guarantees must be at least equal to those obtained by the tests mentioned above.

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CHAPTER III

## PROVISIONS CONCERNING GAS METERS WITH ROTARY PISTONS OR TURBINES

1. **Field of application**

The present Chapter applies, together with the provisions of Chapter I, to:

1.1. *Rotary piston gas meters*

— in which the measurement of gas passed is effected by means of measuring chambers with rotary walls.

1.2. *Turbine gas meters*

— in which the axial flow of gas rotates a turbine wheel and the number of revolutions of the wheel represents the volume of gas passed.

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2. **Range of capacities**

2.1. Gas volume meters shall have only the ranges shown in the following

| G designation | $Q_{max}$ ($m^3/h$) | Range | | |
|---|---|---|---|---|
| | | Small | Medium | Large |
| | | $Q_{min}$ ($m^3/h$) | | |
| 16 | 25 | 5 | 2·5 | 1·3 |
| 25 | 40 | 8 | 4 | 2 |
| 40 | 65 | 13 | 6 | 3 |
| 65 | 100 | 20 | 10 | 5 |
| 100 | 160 | 32 | 16 | 8 |
| 160 | 250 | 50 | 25 | 13 |
| 250 | 400 | 80 | 40 | 20 |
| 400 | 650 | 130 | 65 | 32 |

▼M2

| G designation | $Q_{max}$ ($m^3/h$) | Range | | |
|---|---|---|---|---|
| | | Small | Medium | Large |
| | | $Q_{min}$ ($m^3/h$) | | |
| 650 | 1 000 | 200 | 100 | 50 |
| 1 000 | 1 600 | 320 | 160 | 80 |

and decimal multiples of the last five lines.

▼B

3. **Details of construction**

3.1. *Rotary Piston Meters*

▼M3

3.1.1. Meters must incorporate both upstream and downstream in the gas circuit a static pressure tapping for measuring the pressure absorption; the pressure measured upstream shall constitute the reference pressure.

▼B

3.1.2. The meters may incorporate a manual arrangement for turning the pistons provided that it cannot be used in such a way as to interfere with the correct operation of the meter.

3.1.3. The bearings of the shafts of the rotary pistons of meters of sizes G160 and above may be constructed in such a way as to provide access to them without breaking the protective seals.

3.2. *Turbine Meters*

3.2.1. The meters must incorporate a pressure tapping permitting, if necessary indirectly, the determination of the pressure immediately upstream of the turbine wheel as a reference pressure.

3.2.1.1. If there is a device for throttling the gas flow upstream of the rotor, the meter may incorporate, as well as the pressure tapping required by item 3.2.1 of this Chapter, another pressure tapping immediately before the throttle to permit determination of the pressure drop across the throttling device.

▼M3

3.3. *Pressure tappings*

3.3.1. Bores for pressure tappings must have a diameter of at least 3 mm. In the case of slit-shaped pressure tappings, slits must have a width of at least 2 mm and a cross-section in the direction of flow of at least 10 $mm^2$.

3.3.2. Pressure tappings must be provided with a means of closure so as to make them gas-tight.

3.3.3. The pressure tapping for the reference pressure must be clearly and indelibly marked '$p_r$' and the other pressure tapping 'p'.

▼M2

4. **Test element**

4.1. In accordance with the provisions of Section I.B.5.2.2 (a) and (b) the scale unit of the test element must not exceed the following values:

| | |
|---|---|
| for G 16 to G 65 inclusive | 0·002 $m^3$ |
| for G 100 to G 650 inclusive | 0·02 $m^3$ |
| for G 1 000 to G 6 500 inclusive | 0·2 $m^3$ |
| for G 10 000 and over | 2·0 $m^3$ |

4.2. The interval between numbers on the scale of the test element must not exceed:

| | |
|---|---|
| for G 16 to G 65 inclusive | 0·01 $m^3$ |
| for G 100 to G 650 inclusive | 0·1 $m^3$ |

▼M2

| | |
|---|---|
| for G 1 000 to G 6 500 inclusive | 1·0 $m^3$ |
| for G 10 000 and over | 10·0 $m^3$ |

5. **Maximum permissible errors**

5.1. *General provisions*

5.1.1. The maximum permissible errors, positive and negative, are given in the following table:

| Flow Q | Maximum permissible error in EEC initial verification |
|---|---|
| $Q_{min} \leq Q < 0{\cdot}2\ Q_{max}$ | 2 % |
| $0{\cdot}2\ Q_{max} \leq Q \leq Q_{max}$ | 1 % |

5.1.2. The errors must not all exceed half the maximum permissible error if they are all of the same sign.

5.2. *Special provisions*

5.2.1. When the maximum torques indicated on the gas volume meter pursuant to Sections I.B.3.2.1 and I.B.3.2.2 are applied to the drive shafts, the indication of the gas volume meter at $Q_{min}$ must not vary by more than the values given in the following table:

| $Q_{min}$ | Variations in indication at $Q_{min}$ |
|---|---|
| $0{\cdot}05\ Q_{max}$ | 1 % |
| $0{\cdot}1\ Q_{max}$ | 0·5 % |
| $0{\cdot}2\ Q_{max}$ | 0·25 % |

▼B

6. **EEC type approval**

6.1. As well as the type sample, the applicant must place initially at the disposal of the competent authority two to six sample meters manufactured in accordance with the type sample.

At the request of the competent authority this number shall be spread over several G sizes in the case of a request for approval covering meters of different sizes.

If the results of the tests are not wholly satisfactory supplementary samples may be called for.

6.1.1. A derogation from this provision may be allowed in that these sample meters may be placed at the disposal of the competent authority at a later date. However, the decision regarding type approval will not be taken until all samples have been fully examined.

6.1.2. The sample meters shall remain the property of the applicant and be returned to him after type approval has been granted.

6.2. *Examination*

6.2.1. The examination will include in particular the determination of the errors of each meter, by a test with air of density 1·2 $kg/m^3$. Each test result shall be taken into separate consideration.

6.2.1.1. The error curve of each of the meters must remain within the band given by the limits of the maximum permissible errors of EEC initial verifications over the range of flow rates for which approval is requested.

6.2.1.2. The difference between the maximum value and minimum value of the errors for each of the meters must not exceed 1% over the range from $0{\cdot}5\ Q_{max}$ to $Q_{max}$.

▼B

6.2.2. The meters shall then be subjected to an endurance test with air or gas.

6.2.2.1. So far as possible the endurance test shall be carried out at the maximum capacity of the meter. The period of operation shall be such that each meter measures a volume of air or gas corresponding to operation for 1000 hrs at its maximum capacity, without this total period of test exceeding six months.

6.2.2.2. After this endurance test, the meters shall be examined again with air of density 1·2 kg/m$^3$ using the same standard equipment as in the test referred to in item 6.2.1 of this Chapter.

Under these test conditions:

(a) The values of the errors determined at the flows specified in item 7.1 of this Chapter for each meter (with the exception of not more than one) should not differ by more than 1% from the errors found in the test referred to in item 6.2.1 of this Chapter;

(b) the difference between the maximum value and the minimum value of the error curve should not exceed, for each of the meters (with the exception of not more than one) 1·5% over the range 0·5 $Q_{max}$ to $Q_{max}$.

▼M2

6.2.3. Meters with drive shafts

6.2.3.1. In the case of meters with one or more drive shafts, at least three meters of each G size must be tested with air at a density of 1·2 kg/m$^3$ (see Section I.B.6.2) for compliance with the requirements of Sections I.B.3.2.4 and III.5.2.1.

In the case of meters with several drive shafts, the test must be carried out on the shaft which gives the most unfavourable result.

For meters of the same G size, the lowest torque value obtained in the tests shall be used as the maximum permissible torque value.

Where a type embraces meters of various G sizes, the torque test need only be carried out on meters of the smallest G size, provided that the same torque is specified for the larger meters and that the output shaft of the latter has the same or a greater constant.

6.2.3.2. In the case of meters with several values for $Q_{min}$, only the test described in Section III.6.2.3.1 for the smallest $Q_{min}$ value need be carried out. The permissible torques for the other flow ranges may be calculated from this test result.

Conversion to other $Q_{min}$ values is governed by the following rules:

(a) where the flow is constant, the variation in the error is proportional to the torque;

(b) where the torque is constant, the variation in the error for rotary-piston meters is inversely proportional to the flow and for turbine meters it is inversely proportional to the square of the flow.

▼B

7. **EEC initial verification**

▼M3

7.1. *Accuracy tests*

A meter is considered to satisfy the requirements concerning the maximum permissible errors if the requirements are met at the following flow rates:

▼**M3**

$Q_{min}$, 0·10 $Q_{max}$ (if this value is greater than $Q_{min}$), 0·25 $Q_{max}$, 0·40 $Q_{max}$, 0·70 $Q_{max}$ and $Q_{max}$.

If the examination is conducted under different conditions, the guarantees must be at least equal to those obtained by the tests mentioned above.

▼**B**

7.2. The values specified in item 7.1 of this Chapter may be varied by ±5%.