INTERNATIONAL

RECOMMENDATION

OIML R 32

Edition 1989 (E)

Rotary piston gas meters and turbine gas meters

Compteurs de volume de gaz à pistons rotatifs et compteurs
de volume de gaz à turbine

OIML R 32 Edition 1989 (E)

ORGANISATION INTERNATIONALE
DE MÉTROLOGIE LÉGALE

INTERNATIONAL ORGANIZATION
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ROTARY PISTON GAS METERS

and TURBINE GAS METERS

1 Scope

This Recommendation applies to :

1.1. rotary piston gas meters in which internal walls defining the measuring chambers are set in rotation and the number of revolutions of these walls represents a measurement of the volume of the gas passed.

1.2. turbine gas meters where the gas flow rotates a turbine wheel and the number of revolutions of this wheel represents the volume of the gas passed.

With regard to the gas meters defined above, this Recommendation complements the International Recommendation R 6 “General provisions for gas volume meters”, the provisions of which apply jointly with the requirements of this Recommendation.

2 Working range

2.1. The authorized values of the maximum flowrates and the corresponding minimum flowrates of rotary piston gas meters and turbine gas meters are given in the following Table.

Gas meter designation G	Q_{max} m^3/h	Working range			
		1:10	1:20	1:30	1:50
		Q_{min} m^3/h			
16	25	2.5	1.3	0.8	0.5
25	40	4	2	1.3	1.8
40	65	6	3	2	1.3
65	100	10	5	3	2
100	160	16	8	5	3
160	250	25	13	8	5
250	400	40	20	13	8
400	650	65	32	20	13
650	1 000	100	50	32	20
1 000	1 600	160	80	50	32

and decimal multiples of the values of the last 5 lines of the above Table.

3 Details of construction

3.1. Rotary piston gas meters

3.1.1. Rotary piston gas meters shall have a static pressure tapping at the inlet and at the outlet close to the connection (flange) for measuring the pressure absorption ; the pressure measured upstream shall constitute the metering pressure.

3.1.2. Rotary piston gas meters may include a manual device for allowing the pistons to be turned, provided that it cannot be improperly used in such a way as to interfere with the correct functioning of the gas meter.

3.1.3. Notwithstanding the requirements of point 8 of R 6, the bearings of the shafts of the rotating pistons of gas meters (Roots type) of a size greater than G 160 may be constructed in such a way as to allow them to be replaced without damaging the protective seals.

3.2. Turbine gas meters

3.2.1. Turbine gas meters shall have a pressure tapping permitting the determination (indirectly if necessary) of the pressure immediately upstream of the turbine wheel as the metering pressure.

3.2.2. If there is a nozzle upstream of the turbine wheel, the turbine gas meter may have, in addition to the pressure tapping required in point 3.2.1, a second pressure tapping immediately before this nozzle, so that the pressure drop due to the nozzle can be measured.

3.3. Pressure tappings

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

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

3.3.3. The pressure tapping for the metering pressure shall be clearly and indelibly marked "p^m" and other pressure tappings "p".

3.4. Built in conversion device

3.4.1. Rotary piston gas meters and turbine gas meters may have a built-in conversion device which converts the volume at metering temperature to that at base temperature or which converts the volume at metering conditions to that at base conditions.

3.4.2. The indicating device for the volume at base conditions shall have a sufficient number of digits to ensure that the volume passed during 2000 hours at maximum flowrate, minimum temperature and, if applicable, maximum pressure does not move or switch all the digits to their initial positions.

4 Test element

4.1. When the gas meter has a mechanical test element according to point 5.2.2 of R6, the scale interval and the scale numbering shall comply with the following Table.

Designation G for working range			maximum scale interval m^3	numbering every m^3
1:10 1:20	1:30	1:50		
		16	0.000 2	0.001
16 - 65	16 - 100	25 - 160	0.002	0.01
100 - 650	160 - 1000	250 - 1600	0.02	0.1
1000 - 10000	1600 - 10000	2500 - 16000	0.2	1
≥ 16000	≥ 16000	≥ 25000	2	10

4.2. The scale interval of the test element of the indicating device for base conditions shall be less than 0.1 % of the converted volume counted in three minutes with maximum flowrate at maximum temperature and, if applicable, minimum pressure.

5 Maximum permissible errors

5.1. Under the conditions laid down in point 6 of R 6, the maximum permissible errors are as follows :

Flowrate Q m^3/h	**Maximum permissible errors**	
	on intial verification	**in service**
$Q_{min} \le Q \le Q_t$	± 2 %	± 3 %
$Q_t \le Q \le Q_{max}$	± 1 %	± 1.5 %

Note : In service values are recommended values.

The values for the transitional flowrate Q_t are as follows :

Working range	**Q_t**
1 : 10	0.20 Q_{max}
1 : 20	0.20 Q_{max}
1 : 30	0.15 Q_{max}
1 : 50	0.10 Q_{max}

5.2. On initial verification at one set of metering conditions the gas meter shall be adjusted so that the weighted mean error (WME) is as close to zero as the adjustment and the maximum permissible errors allow.

The WME is calculated as follows :

$$WME = \frac{\sum_{i=1}^{n} (Q_i / Q_{max}) \times E_i}{\sum_{i=1}^{n} (Q_i / Q_{max})}$$

where :

Q_i/Q_{max} is a weighting factor.

E_i is the error at the flowrate Q_i as specified in point 7.2.1.

(where $Q_i = Q_{max}$ a weighting factor of 0.4 instead of 1 shall be used).

The WME shall have a value between – 0.4 % and + 0.4 %.

Note : After changing the adjustment it is not necessary to repeat all tests. It is sufficient to repeat a test at one flowrate and calculate the other new E_i values from the previous ones.

5.3. The maximum permissible errors on initial verification apply to new meters and to meters submitted for verification after the protective seals have been damaged.

5.4. When the maximum torques indicated on the gas volume meter according to points 3.2.1 and 3.2.2 of R 6 are applied to the drive shafts, the indication of the gas volume meter at Q_{min} when tested with atmospheric air (of density 1.2 kg/m^3) shall not shift more than the values given in the following Table.

Value of Q_{min}	**Permissible shift of the indication at Q_{min}**
0.02 Q_{max}	1 %
0.03 Q_{max}	1 %
0.05 Q_{max}	1 %
0.1 Q_{max}	0.5 %

6 Pattern approval

6.1. Request for pattern approval

At the same time as the pattern sample is submitted, the applicant shall place at the disposal of the Authority responsible for the examination from two to six sample meters manufactured in conformity with the pattern.

If so requested by the Authority responsible for the examination, these meters should include more than one size if simultaneous approval of those sizes is requested. Depending on the results of the tests, additional sample meters may be requested.

Notwithstanding the above provisions, the sample meters may be submitted at different times, but the decision regarding pattern approval will be given only when all these sample meters have been received and examined.

6.2. Examination

6.2.1. General

6.2.1.1. The pattern and its sample meters shall comply with the requirements of R 6 and of points 2, 3, 4 and 5 of this Recommendation.

6.2.1.2. In addition, for flowrates between 0.4 Q_{max} and Q_{max} the difference between the maximum and minimum of the error curve as a function of the flowrate Q shall not exceed 1% for each meter.

6.2.2. Disturbance test for turbine gas meters

6.2.2.1. Turbine gas meters are submitted to a test for the influence of flow disturbances as specified in Annex A.

6.2.2.2. During the test the shift of the error curve shall not exceed 0.33 %.

6.2.2.3. If the design of a turbine gas meter pattern is similar for all the pipe sizes, disturbance tests with gas meters of two sites shall suffice.

6.2.3. Durability test

6.2.3.1. The pattern and samples of rotary piston gas meters and turbine gas meters shall be submitted to a durability test. This test shall be carried out as far as possible at the maximum flowrate and with air or gas.

6.2.3.2. The duration of the durability test shall be such that each gas meter measures a volume of air or gas corresponding to 1000 hours of operation of the gas meter at the maximum flowrate ; the test shall be completed within 2 months.

6.2.3.3. After the durability test, the gas meters, when tested with air of density 1.2 kg/m^3, using the same standard instruments as those used in the test resulting from point 6.2.1.1 shall comply with the following requirements :

a) the values of the errors determined at the flowrates specified in point 7.2.1 shall not differ by more than 0.5 % from the errors noted during the test resulting from point 6.2.1.1,

b) for flowrates between 0.4 Q_{max} and Q_{max}, the difference between the maximum and minimum of the error curve as a function of the flowrate Q shall not exceed 1.5 %.

6.2.4. Gas meters with drive shafts

6.2.4.1. In the case of rotary piston gas meters and turbine gas meters having one or more drive shafts, at least three meters of each size shall be tested with air at a density of 1.2 kg/m^3 for compliance with the requirements of R 6, point 3.2.4 and of point 5.4 of this Recommendation.

In the case of rotary piston gas meters and turbine gas meters having several drive shafts, the test shall be carried out on the drive shaft which gives the least favourable result.

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

Where a pattern embraces gas meters of various sizes, the torque test need be carried out only on the meters of the smallest size, provided that the same torque is specified for the larger gas meters and that the output shafts of the latter have the same or greater output constants.

6.2.4.2. In the case of gas meters with several values for Q_{min} only the test described in point 6.2.1 for the least value of Q_{min} need be carried out. The permissible torques for the other working ranges may be calculated from that 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 gas meters is inversely proportional to the flowrate, and for turbine gas meters it is inversely proportional to the square of the flowrate.

7 Initial verification and subsequent verifications

7.1. Examination

7.1.1. Gas meters are examined and tested to ascertain whether they conform in general to their approved patterns, and comply with the requirements of R 6, as well as the requirements of this Recommendation.

7.1.2. Gas meters shall be submitted in working order and shall be provided with the required sites for the application of the verification and protective marks.

7.1.3. If gas meters are intended to incorporate ancillary devices operated by the output shafts, these devices shall be attached, unless attachment after verification is expressey authorized.

7.2. Accuracy tests

7.2.1. A gas meter shall be considered to comply with the requirements concerning the maximum permissible errors if these are met at the following flowrates :

a) for gas meters with a working range of 1:10 to 1:30 :

Q_{min}, 0.05 Q_{max} and 0.1 $_{Qmax}$ when these values are larger than Q_{min}, 0.25 Q_{max}, 0.40 Q_{max}, 0.70 Q_{max} and Q_{max},

b) for gas meters with a working range of 1:50 :

Q_{min}, 0.05 Q_{max}, 0.15 Q_{max}, 0.25 Q_{max}, 0.40 Q_{max}, 0.70 Q_{max} and Q_{max}.

If the tests are done at other flowrates, they shall be at least as effective as those mentioned above.

7.2.2. A gas meter may be verified using a gas other than air, and/or at other than near-ambient conditions.

7.3. Additional markings

The density range in which the errors are required to comply with the maximum permissible errors may be indicated on the data plate, expressed as :

$$\rho = \ldots — \ldots \text{ kg/m}^3$$

This marking may replace the range of metering pressures (point 4.1.(i) of R 6), unless the pressure marking refers to a built-in conversion device.

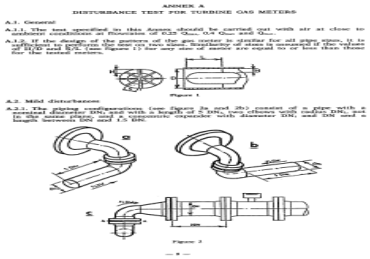
ANNEX A

DISTURBANCE TEST FOR TURBINE GAS METERS

A.1. General

A.1.1. The test specified in this Annex should be carried out with air at close to ambient conditions at flowrates of 0.25 Q_{max}, 0.4 Q_{max} and Q_{max}.

A.1.2. If the design of the pattern of the gas meter is similar for all pipe sizes, it is sufficient to perform the test on two sizes. Similarity of sizes is assumed if the values of H/D and S/L (see figure 1) for any size of meter are equal to or less than those for the tested meters.



A.2. Mild disturbances

A.2.1. The piping configurations (see figure 2a and 2b) consist of a pipe with a nominal diameter DN, and with a length of 5 DN_1, two elbows with radius DN_1, not in the came plane, and a concentric expander with diameter DN_1 and DN and a length between DN and 1.5 DN.

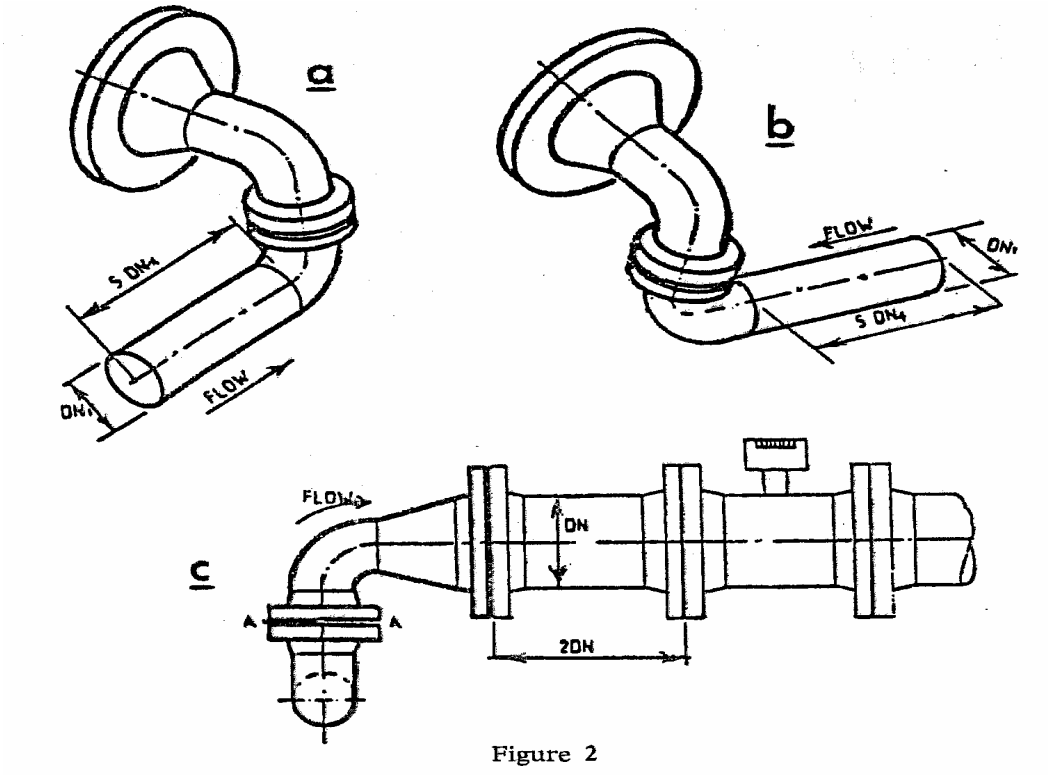


Figure 2

The values of DN_1, in relation, to the values of DN are listed in the following Table :

DN (meter) **(mm)**	**DN_1 (pipe)** **(mm)**
50	40
80	50
100	80
150	100
200	150
250	200
300	250
400	300
500	400
600	500
750	600
1000	750

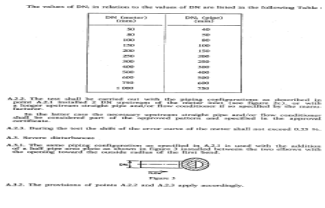
A.2.2. The test shall be carried out with the piping configurations as described in point A.2.1 installed 2 DN upstream of the meter inlet (see figure 2c), or with a longer upstream straight pipe and/or flow conditioner if so specified by the manufacturer.

In the latter case the necessary upstream straight pipe and/or flow conditioner shall be considered part of the approved pattern and specified in the approval certificate.

A.2.3. During the test the shift of the error curve of the meter shall not exceed 0.33 %.

A.3. Severe disturbances

A.3.1. The same piping configuration as specified in A.2.1 is used with the addition of a half pipe area plate as shown in figure 3 installed between the two elbows with the opening toward the outside radius of the first bend.



A.3.2. The provisions of points A.2.2 and A.2.3 apply accordingly.

ANNEX B

TEST PROCEDURES FOR ROTARY PISTON GAS METERS AND TURBINE GAS METERS

(Under consideration)

Contents