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The Czech Metrology Institute

Okružní 31, 638 00

Brno

The Czech Metrology Institute (CMI) as a body having subject-matter and local jurisdiction in laying down metrological and technical requirements on legally controlled measuring instruments and laying down methods for testing type approval and verifying legally controlled measuring instruments pursuant to Section 14, Paragraph 1 of Act No. 505/1990 Coll., on metrology, as amended, and pursuant to the provisions of Section 172 and the following, of Act No. 500/2004 Coll., Rules of Administrative Procedure, as amended (hereinafter referred to as RAP), initiated administrative proceedings by virtue of office on September 1, 2009 pursuant to Section 46 of the RAP, and on the base of background materials, issues the following:

I.

GENERAL MEASURES

Number: 0111-OOP-C001-09

Ref. no. 0313/001/09/Pos.,

laying down metrological and technical requirements on legally controlled measuring instruments, including testing methods for type approval of legally controlled measuring instruments and verifying legally controlled measuring instruments:

“metal volumetric vessels”

1. Basic terms

For the purposes of these general measures the terms and definitions of the VIM¹⁾ and the following shall be applicable:

1.1 volumetric vessel: a vessel only for measuring one specific volume of liquid, which is gradually poured from the vessel into another vessel

¹⁾ International Vocabulary of Metrology – Basic and General Concepts and Associated Terms (VIM)

1.1.1 metal volumetric vessel: a vessel with opaque walls that is intended above all for measuring the volume of opaque liquids other than water (e.g. liquid food products, liquid fuels, oils, additives, fertilizers, liquid chemicals)

1.2 Indicating volumetric vessel for liquids: a vessel whose nominal volume is determined by a volume mark

1.3 terminal volumetric vessel for liquids: a vessel whose nominal volume is restricted by the plane created by its upper edge

1.4 nominal volume: the volume for which the volumetric vessel has been made for and which is marked upon it

1.5 volume allowance: the distance of the volume mark determining the nominal volume from the upper edge of the indicating volumetric vessel for liquids

1.8 volumetric space: the space demarcated by the walls, bottom of the vessel and:

- a) for indicating volumetric vessels the volume mark,
- b) for terminal volumetric vessels the upper edge of the vessel

2 Metrological requirements

2.1 Established working conditions

The reference temperature is (20 ± 5) °C and the reference pressure is atmospheric pressure.

2.2 Limits of error

The actual volume of the volumetric vessel may differ from the nominal volume at most by the limits of error, see Table 1.

Table 1 – Limits of error

Volume of the volumetric vessel	Limit of error	
	%	portion of nominal volume
≤ 50 ml	± 1.0	$\pm 1/100$
50 ml < to ≤ 500 ml	± 0.5	$\pm 1/200$
500 ml < to ≤ 30 l	± 0.25	$\pm 1/400$
30 l <	± 0.2	$\pm 1/500$

3 Technical requirements

3.1 The size of the measuring instrument and overall dimensions

3.1.1 Permissible shapes of volumetric vessels are visible in Figure 1.

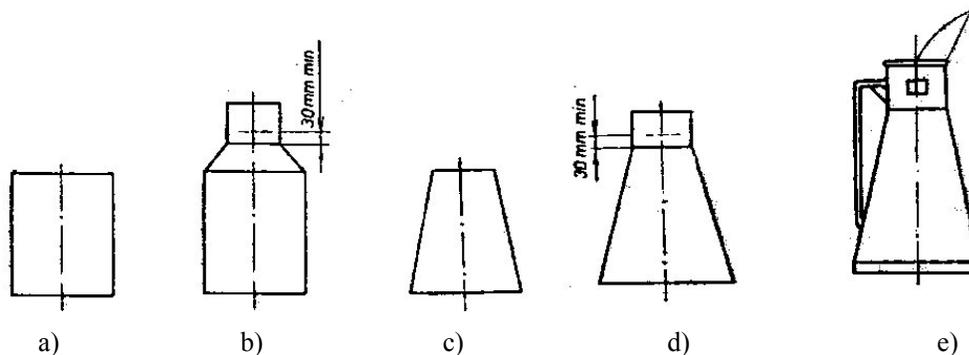


Figure 1 – Volumetric vessel shapes

3.1.2 The plane through the upper and lower edge of a volumetric vessel, volume marks and the bottom of the volumetric vessel must be mutually parallel and perpendicular to the axis of the volumetric vessel. A volumetric vessel must be stable on a horizontal surface and its rotational axis must be vertical.

3.1.3 Indicating volumetric vessels with volumes of 10 ml to 2 l and terminal volumetric vessels with volumes of 100 ml to 1 l may only take the shape of a right cylinder (Figure 1, shape “a”).

A set range of volumes including the main dimensions of cylindrical volumetric vessels with nominal volumes of up to 2 l is listed in Table 2. The height of the volumetric vessel is equal to approximately two times the diameter of the vessel.

Indicating volumetric vessels with nominal volumes of 5 l or more may have any shape as drawn on Figure 1. A set range of volumes including the main dimensions of volumetric vessels with nominal volumes of 5 l or more is listed in Table 3.

For cylindrical volumetric vessels as well as indicating volumetric vessels, different nominal volume values than those in Tables 1 and 2 may be used, if it is a custom of the field in question.

Table 2 - Range of cylindrical vessel volumes

Nominal volume	Inner diameter	Diameter limits of error	Volume allowance of indicating volumetric vessels
ml	mm	mm	mm
10	18	± 1	6 to 10
20	23	± 1	
50	32	± 1	
100	40	± 1	8 to 12
200	50	± 1	
300	58	± 1.25	10 to 15
500	68	± 1.5	
1 000	87	± 1.75	
2 000	108	± 2	

Table 3 – Suggested range of volumes of other vessel shapes

Nominal volume	Inner diameter	Diameter limits of error	Volume allowance	Minimum height of the neck
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L	mm	mm	mm	mm
5	100	± 2	15 to 30	50
10	125	± 3		
15	145	± 3		
20	160	± 3	25 to 50	60
25	172	± 3		
30	180	± 3		
50	200	± 4		

3.1.4 For the diameter at the bottom, limits of error of ± 3 of the calculated diameter apply.

3.1.5 For volumetric vessels with narrow cylindrical necks (Figure 1, b) and d)) the plane corresponding to the correct volume, i.e. volume marks, must be at least 30 mm above the bottom edge of the neck.

3.2 Construction

3.2.1 The construction of a volumetric vessel must be solid and resistant to wear and impact during regular use. If needed the upper, and/or lower edge of a volumetric vessel must be reinforced, e.g. with a reinforcing band.

Volumetric vessels larger than 5 l may be externally reinforced with a lining as well.

3.2.2 If a volumetric vessel is made of more parts, their seams may not create breaks that would hinder the vessel from being easily and completely emptied, or that would make perfect washing and cleaning more difficult.

3.2.3 If a lined bottom is made of two pieces, they must be permanently joined so that the bottom cannot be dislodged. Volumetric vessels with nominal volumes of 2 l or less must have a bottom that is at least 2 mm above the bottom edge of the vessel.

Volumetric vessels with nominal volumes of 5 l or more must have the bottom protected with a band, or with a brace, as well.

3.2.4 If a volumetric vessel with a nominal volume of 2 l or less has a lined bottom made of one piece and is of adequately strong metal plating the bottom may be reinforced by slightly arching the bottom into the vessel.

Volumetric vessels with nominal volumes of 5 l or higher made of one piece may have a slightly outward arching bottom; however they must also be protected by a band.

3.2.5 Indicating volumetric vessels in the shape of a cylinder, truncated cone, or a truncated cone with a cylindrical neck may have a permanently attached spout on the upper edge, which overhangs the upper edge of the vessel.

For volumetric vessels for oil the spout may completely, or partially, penetrate the volumetric space, as long as the area of the plane created by the volume marks is not increased by more than 1/5 by the spout.

3.2.6 The interior of the volumetric vessel may be equipped with a protective coating or paint, compatible with the volumetric vessel material and the measured liquid. If the vessel is enameled, the enamel must be light colored, and inside of the volumetric vessel only white.

3.3 Volumetric space:

3.3.1 For indicating volumetric vessels the volumetric space must be marked at the height of the correct level of the liquid:

- with two diametric lines on the inner wall of the vessel for volumetric vessels with nominal volumes of 2 l or less,
- with two diametric or three evenly divided volume marks around the circumference of the inner wall of the vessel for volumetric vessels with nominal volumes of 5 l or more.

3.3.2 Marking the nominal volume must be done in a manner that is permanent, distinct and clear (e.g. engraving, scouring, grinding, etching, or in another permanent manner).

3.3.3 The thickness of the line may not exceed 0.5 mm and its length must be:

- 10 mm for volumetric vessels with nominal volumes of 200 ml or less,
- (15 to 20) mm for volumetric vessels with nominal volumes of 300 ml or more.

3.3.4 For enameled volumetric vessels the volume mark must be made with a color that is markedly different from the color of the enamel. This mark shall consist of a line with a half-circle with a radius of 2 mm facing towards the upper edge of the vessel (—●—).

3.3.5 If the line is cut, it must have a drop of tin soldered above its center, whose diameter may not exceed 1.5 mm (—●—) and the bottom border of the drop may not touch the line.

3.3.6 The nominal volume of the measured liquid for volumetric vessels with lines is determined by the position of the upper edge rising above the surface of the liquid (meniscus) towards the center of the line's thickness.

3.3.7 Volume marks pursuant to Article 3.3.1, Subparagraph b) may have shapes pursuant to Figure 2.

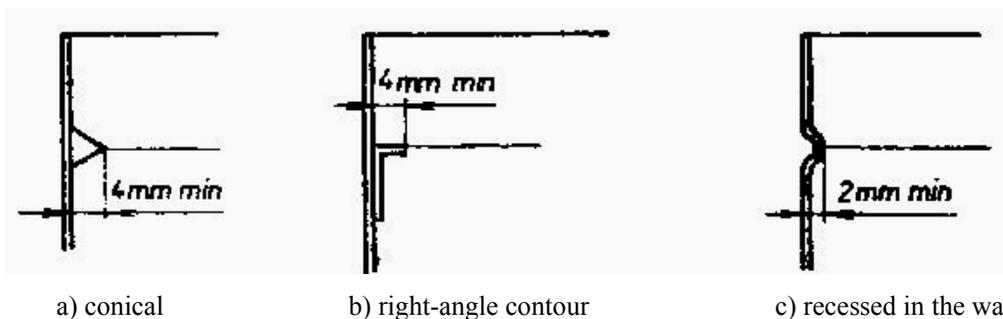


Figure 2 – Possible shapes of volume marks

3.3.8 Volume marks may not be alterable and their attachment to the vessel wall must allow for an official mark on the outside of the vessel. Parts extending into the volumetric space must be adequately strong and their size proportional to the size of the vessel (the length of designs b) and c) about 12 mm to 15 mm).

3.3.9 The nominal volume of a measured liquid is determined for designs in accordance to Figure 2:

- by the peak of the cone,
- by the upper surface of the section,
- by the edge of surface rising above the plane coinciding with the upper surface of the recess.

3.3.10 The nominal volume of the measured liquid for terminal volumetric vessels is determined by the plane of the surface of the liquid coinciding with the upper edge of a volumetric vessel.

3.3.11 The nominal volume must be listed on volumetric vessels with a numerical value and the appropriate unit of measurement.

3.3.12 The nominal volume must be either directly marked in the material of the external wall of a vessel or for volumetric vessels with nominal values of 10 l or more may be marked on a separate label firmly attached to the outer surface of the vessel, whose non-detachability must be ensured by two 8mm diameter drops of tin.

3.4 Material

3.4.1 Volumetric vessels must be made of solid and invariable metal materials with a suitable surface treatment in accordance with the purpose of use (e.g. food, corrosive materials, etc.).

3.4.2 The material of volumetric vessels for liquid food products must meet the requirements of special legislation¹⁾.

3.4.3 Brass, or zinc-coated metal plating, is permissible only for volumetric vessels of 5 l or larger, which are not intended for measuring food products. On the outer surface of the lining however there must be lettering under the volume marking indicating for which liquids it may be used, and this must not interfere with the smoothness of the inner wall surface, or a metal label must be attached.

4 Marking measuring instruments

Volumetric vessels must be marked with this information:

- a) mark of the manufacturer,
- b) nominal volume and units of measure,
- c) type approval mark,
- d) liquid marking (if a volumetric vessel is intended solely for a specific liquid),
- e) limits of error (if they differ from the values listed in Table 1),
- f) other information pursuant to the requirements of the user (they may not conflict with information in points a) to e)).

5 Type approval of measuring instruments

Type approval is used for volumetric vessels subject to this requirement that are not for determining the volume of liquids sold for immediate consumption.

5.1 Number of samples to be tested

The number of samples needed for type testing shall be established by the tester.

5.2 Visual inspection

During a visual inspection volumetric vessels shall be checked to see if they are in accordance with submitted documents and special attention must be paid to checking the accuracy of the markings, the design of the volume marks and marking the volume.

¹⁾ Decree No. 38/2001 Coll., on hygienic requirements on products intended for contact with foodstuffs and food, as amended by Decree No. 186/2003 Coll.

Volumetric vessels may not be mechanically damaged or deformed and must be completely clean.

5.3 Functional test

The functional test for type approval of volumetric vessel includes:

- checking dimensions,
- tightness testing,
- ascertaining the volume of the volumetric space.

5.3.1 Testing equipment accuracy requirements

For checking the volume and dimensions normal laboratory equipment and the following shall be used:

- standard volumetric flasks with volumes of 10 ml to 20 l, accurate to -0.02 %,
- a graduated cylinder (shape I) with a volume of 100 ml, accuracy class A, limits of error ± 0.5 ml,
- a 25ml graduated pipette, accuracy class A, limit of error 0.1 ml, 0.2ml graduation,
- a glass thermometer (0 to 30) °C graduated by (0.2 or 0.5) °C,
- dimensional gauges of the diameters of volumetric vessels with nominal volumes from 10 ml to 2 l,
- dimensional gauges of the volume allowance of volumetric vessels with nominal volumes from 10 ml to 2 l (see Figure 3),
- calipers accurate to 0.02 mm and graduated by 0.01 mm,
- 300mm steel flat scale, divided into mm units,
- a stopwatch or watch capable of measuring time in seconds.

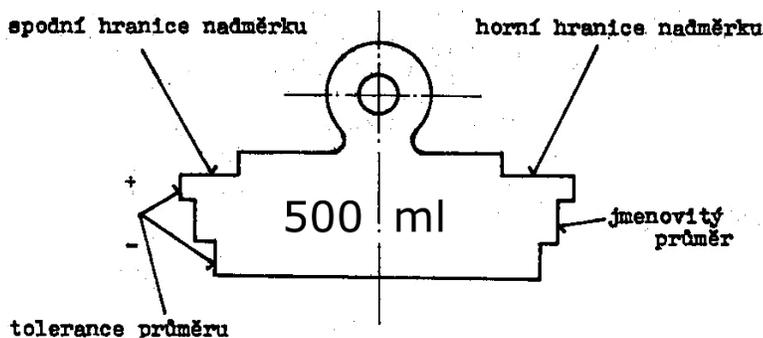


Figure 3 – Dimensional gauges of the volume allowance

spodní hranice nadměrku	lower boundary of the volume allowance
tolerance průměru	diameter tolerance
horní hranice nadměrku	upper boundary of the volume allowance
jmenovitý průměr	nominal diameter

5.3.2 Checking dimensions

The construction and the dimensions of the volumetric vessel shall be checked whether they meet the requirements and correspond with technical documentation.

5.3.3 Tightness inspection

During the tightness test of a volumetric vessel, a vessel filled to the volume mark may not display any signs of leakage.

5.3.4 Ascertaining the volume of the volumetric space

5.3.4.1 Generally

Volume shall be ascertained either with the volumetric method (with water or other suitable alternate liquid), or the weight method (with distilled water, or water of a known density), wherein the test liquid for measuring volumetric vessels intended for measuring drinks or food products must be non-toxic and hygienically clean.

The temperature of the water used for testing must be $(20 \pm 5) ^\circ\text{C}$.

Volumetric vessels are vessels for measuring a specific volume of a liquid that is gradually poured from the vessel to another vessel, therefore they must be, together with the reference vessel, moistened and left in a diagonal position with the bottom up for excess water to drop out before testing.

5.3.4.2 Volumetric method

The actual volume of the volumetric space of a vessel is ascertained after being poured from an accurately filled volumetric vessel to a reference volumetric vessel.

5.3.4.3 Weight (gravimetric) method

A volumetric vessel accurately filled with distilled water or water of a known density shall be weighed and after the water has been poured out and excess water has dropped out the vessel shall be weighed again, during which the inner surface of the volumetric vessel must be dry.

The ascertained weight difference shall be calculated for the volume of the volumetric vessel according to the formula:

$$V = \frac{\Delta m}{\rho}$$

where V is the volume of water, in liters;

Δm is the weight difference between a full and empty volumetric vessel, in kilograms;

ρ is the volume density of the water at a temperature of $(20 \pm 5) ^\circ\text{C}$, in kilograms per liter.

6 Initial verification

Initial verification shall be made for volumetric vessels, which are not for determining the volume of liquids sold for immediate consumption.

The following tests are conducted for initial verification of measuring instruments:

- a) visual inspection;
- b) dimensions check;
- c) accuracy test.

6.1 Visual inspection

During a visual inspection volumetric vessels submitted for verification shall be checked to see if they are in accordance with type approval and special attention must be paid to checking the accuracy of the markings, the design of the volume marks and marking the volume.

Volumetric vessels may not be mechanically damaged or deformed and must be completely clean.

Volumetric vessels that do not pass the visual inspection shall be disqualified for further testing.

6.2 Functional test

6.2.1 Testing equipment accuracy requirements

For checking the volume and dimensions normal laboratory equipment and the measuring instruments pursuant to 5.3.1 shall be used.

6.2.2 Checking dimensions

The diameters of volumetric vessels with nominal volumes of up to 2 l and their volume allowances shall be checked through the help of dimensional gauges, see Figure 3. Volumetric vessels with nominal volumes over 2 l shall be checked with length gauges, see article 6.2.1 g) and h).

For terminal volumetric vessels the evenness of the upper edge shall be checked with a glass plate, which, after placement, must be in contact with edge of the vessel along its entire circumference.

If it is suspected that a volumetric vessel is not adequately rigid, the vessel filled with water to the volume mark shall be pressed between the palms, and there should be no clear change in the surface height.

Volumetric vessels that do not pass the dimensions check shall be disqualified from further testing.

6.2.3 Accuracy test

The accuracy of the volume of a volumetric vessel shall be tested with the volumetric method comparing its volume with the volume of a reference volumetric vessel of corresponding size.

7 Follow-up verification

Follow-up verification shall be conducted in the same scope as the initial verification.

8 Notified standards

The CMI shall make notifications for the purposes of specifying metrological and technical requirements on measuring instruments and for the purposes of specifying testing methods for type approval and verification, arising from these general measures, Czech technical standards, other technical standards and international technical standards, or standards of foreign organizations, or other technical documentation containing detailed technical requirements (hereinafter referred to as “notified standards”). A list of these notified standards with them allotted to the appropriate measures shall be notified by the CMI together with publically accessible general measures (on the website www.cmi.cz).

Fulfilling the notified standards or fulfilling their parts in the scope and under the conditions of the laid down general measures is considered to be the fulfillment of the requirements laid down by these measures, to which these standards or their parts apply.

II. JUSTIFICATION

The CMI issues for the implementation of Section 24c of Act No. 505/1990 Coll., on metrology, as amended, these general measures, laying down metrological and technical requirements on legally controlled measuring instruments and testing methods for verifying these legally controlled measuring instruments.

Decree No. 345/2002 Coll., laying down measuring instruments to compulsory verification and measuring instruments subject to type approval, as amended, includes metal volumetric vessels among measuring instruments subject to type approval and verification in the annex “A list of types of legally controlled measuring instruments”.

Thus the CMI issues for the implementation of Section 24c of Act No. 505/1990 Coll., on metrology, as amended, for this specific type of measuring instrument “metal volumetric vessel” these general measures laying down metrological and technical requirements for metal volumetric vessels and testing methods for type approval and verifying these legally controlled measuring instruments.

III.

ENTRY INTO FORCE

These general measures shall enter into force fifteen days after they have been published (Section 24d of Act No. 505/1990 Coll. on metrology, as amended).

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RNDr. Pavel Klenovský

General Director

Certified by: Ing. Miroslav Pospíšil

Posted on:

Signature of an authorized person, confirming its posting:

Withdrawn on:

Signature of an authorized person, confirming its withdrawal:

Entry into force:

Signature of an authorized person, marking entry into force: