

Sealings made of foam rubber or freely foamed**Sources**

- DIN 7715-1 of Feb. 1977 - rubber parts, tolerable off-size, articles made of hard rubber
- DIN ISO 3302-1 of Oct. 1999 – Rubber-tolerances of finished products
- DIN EN ISO 1307 of Jan. 1996 - rubber and plastic tubes for industrial use - inner diameter and length tolerance
- DIN 7715-5 of Nov. 1979 - rubber parts, tolerable off-size, plates and plate articles made of soft rubber (elastomer)
- DIN EN ISO 1923 of June 1995 - foam rubber - determination of linear measures
- DIN ISO 815 of March 2000 – Elastomer; Determination of compression set
- DIN EN ISO 845 of June 1995 - foam rubber made of rubber and plastics - determination of gross density
- DIN 53579-1 of March 1987- test of soft elastic foam rubber; hardness test on finished parts; impression test on formed parts
- DIN ISO 11752 of Nov. 2004 – Flexible cellular polymeric materials – Moulded and extruded sponge or expanded cellular rubber products – Compressibility test on finished parts
- DIN 53 505 of June 1987 - test of rubber, elastomeres and plastics, hardness test according to Shore A and Shore D

1. Sampling

Samples are taken out of individual lots according to statistic quality control regularities in order to test sealings in following individual tests.

2. Shade of colour and surface quality (visual test)**2.1 Shade of colour**

Prescribed shade of colour to be checked by comparison with colour charts or samples.

2.2 Surface quality

Sealing must have a closed outer skin without small cavities or cracks.

Sealings made of foam rubber or freely foamed**3. Dimensions****3.1 Diameter (foam rubber)**

Based upon DIN EN ISO 1923 the diameter of a sealing string is measured at 5 spots (joint excluded) with measuring accuracy of 0.1 mm.

3.2 Height (free foamed seal)

Sealing height of a free foamed seal is measured either based on DIN EN ISO 1923 at 5 spots of the sealing removed from groove or as difference measure between upper and lower lid level. A tolerance of $\pm 5\%$ for metal and $\pm 10\%$ for plastic containers is admissible.

3.3 Width, height

For every nominal size the admissible tolerance is according to the following table:

Nominal size in mm	Admissible Tolerance in mm
up to 6.0	+/- 0.4
up to 10.0	+/- 0.5
up to 18.0	+/- 0.6

3.4 Flat length

Sealing is cut opposite joint and measured free of tension with an accuracy of 1 mm. Admissible tolerances are defined in the following table:

Flat length in mm	Admissible Tolerance in mm
up to 1000	+/- 5
up to 1500	+/- 8
up to 2000	+/- 10
up to 2500	+/- 15

4. Mass per meter

Cut and measured according to number 3.4 the sealing is weighed. Mass in g is converted into g/m and rounded up to 1 g/m. For the different nominal string diameters the following figures are prescribed:

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Nominal string diameter in mm	Mass in g/m for hard sealing	Mass in g/m for soft sealing	Admissible tolerance in g/m
5.0	16	11	± 3
6.0	21	15	± 3
7.0	28	23	± 3
8.0	38	28	± 3
8.5	41	32	± 3
9.0	48	37	± 4
10.0	62	46	± 4
12.0	90	68	± 6

5. Joint spot**5.1 Finish**

Joint spot finish is evaluated by visual inspection. Sealing string ends should be cut vertically to longitudinal axis and glued together with a maximum misalignment of 0.5 mm. Every sealing must have only one joint.

5.2 Durability (foam rubber)

For the test a 100 mm section is cut out of open sealing so that the joint spot is in the middle of the section's length. The section then is axially loaded with a mass, which is assigned to the diameter, thus subjected to tensile stress for 10 minutes at room temperature. Joint spot thereby must not be slightly or fully torn. Testing masses according to following table:

Nominal diameter in mm	Testing mass in kg
up to 6.0	1.0
up to 7.0	1.5
up to 8.0	2.0
up to 9.0	2.5
up to 10.0	3.0
up to 11.0	3.5
up to 12.0	4.0

An example for a durability test set up is given in picture 1.

Sealings made of foam rubber or freely foamed**6. Compressibility**

Sealings are strained radially between two smooth and even pressure plates at room temperature on three spots according or on a section 100 mm long (joint spot excluded). After the straining period the height of the compressed sealings is measured and the compressibility (z) in %, rounded to 0.1 %, is calculated according to following formula:

$$z = (h_0 - h_1) / h_0 \times 100$$

h_0 = actual diameter or height of string without strain in mm, rounded to 0.1 mm (according to number 3.1 or 3.2).

h_1 = height of sealing after straining period in mm, rounded up to 0.1 mm.

Test result is the average of the three individual measurements, rounded up to 1 %.

6.1 Foam rubber

For the different nominal string-diameters the following figures are prescribed:

Nominal string diameter in mm	Compressibility in % for hard sealing	Compressibility in % for soft sealing	Admissible tolerance in %
5.0	46	59	for all
6.0	45	57	dia-
7.0	40	55	meters
8.0	35	54	± 5
8.5	33	53	
9.0	32	52	
10.0	30	48	
12.0	25	40	

6.2 Freely foamed sealings

For freely foamed sealings is:

$$z = 20 - 45 \%$$

7. Compression strain rest

Three sealing sections of 120 mm length (without joint spot) are strained radially between two smooth and even pressure plates according to picture 3 (DIN 53 517 page 1) at 70° C for 24 hours (foam rubber) or at 23° C (freely foamed). Then the strain is removed from the sections and without further strain they are stored at room temperature for 30 minutes (foam rubber) or 10 min (freely foamed). After storage period the sealing height is measured in direction of previous strain and the compression strain rest (DVR) in %, rounded up to 0.1 % is calculated according to following formula:

$$\text{DVR} = (h_0 - h_2)/(h_0 - h_1) \times 100$$

h_0 = actual string diameter or height without strain in mm, rounded up to 0.1 mm (according to number 3.1 or 3.2).

h_1 = sealing height after radial compression to 50 % of string diameter in mm, rounded up to 0.1 mm.

h_2 = sealing height after strain and storage of 30 or 10 minutes, measured in strain direction in mm, rounded up to 0.1 mm.

Test result is the average of the three individual measurements, rounded up to 1 %.

For all sealings is required:

$$\text{DVR} < 40 \%$$

8. Resistance to contents

Sealings resistance to contents is to be checked by filler.