



TECHNICAL REQUIREMENTS

- for moulded parts and semi-finished elements made of thermoplastic, thermoset material and elastomers (synthetic material and rubber)
- for embedding compounds
- for adhesives

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1. Fundamentals

- **Technische Weisungen für den Pflicht-Schutzraumbau (TWP)**
Technical directives for the construction of private air raid shelters (TWP).
- **Technische Weisungen für die Schutzanlagen der Organisation und des Sanitätsdienstes (TWO)**
Technical directives for protected installations for organisations and medical services (TWO).
- **Technische Weisungen für spezielle Schutzräume (TWS)**
Technical directives for special air raid shelters (TWS).
- **Technische Weisungen für die Schocksicherheit von Einbauteilen in Zivilschutzbauten (TW-Schock)**
Technical directives concerning the shock resistance of components installed in constructions of the civil defence (TW Schock).
- **Weisungen des BZS betreffend die Typenprüfung von prüfpflichtigem Material für Zivilschutzbauten**
Civil defence directives concerning the compulsory type-testing and testing of components for constructions of the civil defence.
- **Weisungen des BZS betreffend Qualitätssicherung von prüfpflichtigem Material für Zivilschutzbauten**
Civil defence directives concerning the quality assurance of components subjected to the compulsory testing for constructions of the civil defence.

2. Complementary prescriptions

- **Vorschrift L 363 016 des AC-Laboratorium Spiez:
Prüfung von Faltenschläuchen NW 125 zu Kleinbelüftungsanlagen des Zivilschutzes**
Regulation L 363 016 of AC-Laboratorium Spiez:
Testing of flexible hoses ND 125 for small ventilating installations for the civil defence.
- **Vorschrift L 363 117 des AC-Laboratorium Spiez:
Prüfung von Faltenschläuchen NW 175 zu Ventilatoren VA 300 des Zivilschutzes**
Regulation L 363 117 of AC-Laboratorium Spiez:
Testing of flexible hoses ND 175 for blower VA 300 for the civil defence.
- **Vorschrift L 363 037 des AC-Laboratorium Spiez:
Funktionsprüfung an Türdichtungsprofilen für Schutzraumabschlüsse**
Regulation L 363 037 of AC-Laboratorium Spiez:
function testing of door seal profiles for shelter
- **Vorschrift L 363 004 des AC-Laboratorium Spiez:
Messung der Kampfstoffbeständigkeit von flächigen Polymerwerkstoffen**
Regulation L 363 004 of AC-Laboratorium Spiez:
Measurement of the resistance against chemical warfare agents of flat Polymere material.
- **Qualitätsinspektions- und Abnahmevorschrift L 036 369 des AC-Laboratorium Spiez**
Regulation L 036 369 of AC-Laboratorium Spiez. Quality inspection and approval

3. Elastomers

3.1. Basic requirements

Together with the request for obtaining an elastomer approval, the following information must be included.

- mixture number
- elastomer basis
- exact address of the mixture manufacturer
- exact date and time of the vulcanisation of the sample plate
- manufacturer's mixture test results and evidence that the requirements described hereafter are fulfilled:
- vulcanisation diagram of the mixture

The following material must also be provided:

- 7 sample plates 2 mm thick, minimum dimensions 130 mm x 130 mm
- 2 sample plates 6 mm thick, minimum dimensions 130 mm x 130 mm
- 6 standardized test specimens for the residual deformation under compression as per DIN 53517, Specimen I.

Elastomer materials, which are used as moulded parts and semi-finished products in shelters, have to fulfill the following minimum requirements when they are vulcanised in the form of plates:

3.1.1. Mechanical and physical properties

The test defined below must not be performed earlier than 72 hours following the vulcanisation of the sample plate and standard test specimen. Before being tested, the sample plates must be stocked for a minimum of 24 hours in a standardized temperature and relative humidity environment defined as 23 °C and 50 % r.h. (DIN 500 14, class 2).

3.1.1.1. Tensile strength test; DIN 53504 / ISO 37

specimen	=	standard slab S2
test velocity	=	200 mm min ⁻¹
state of material	=	delivery state

average value out of 6 samples in one direction and average value out of 6 samples in the opposite direction.

minimum tensile strength	=	6.0 Nmm ⁻²
minimum elongation at break	=	200 %

3.1.1.2. Compression set; DIN 53517 / ISO 815

specimen	=	test specimen I
test temperature	=	*
test time	=	24 ^{+0 -2} hours
deformation	=	25 %
material state	=	delivery state

* 70 °C for natural- styrene-butadienes- and chloroprenes elastomers

150 °C for fluoro- and silicone elastomers

100 °C for all other elastomer types

Average value out of 3 samples

maximum residual compression deformation	=	25 %
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3.1.1.3. Residual tensile deformation; DIN 53518

specimen	=	standard bell strip
test temperature	=	23 °C
test time	=	24 ^{+0 -2} hours
elongation	=	standard elongation corresponds to max. 30 % of elongation at break
material state	=	delivery state
average value out of 3 samples		

maximum residual tensile deformation	15 %
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3.1.1.4. Tear propagation test

Several test methods exist. For the approval the manufacturer must apply one of the methods described below. In the AC-Laboratorium Spiez, all 3 test methods are used.

3.1.1.5. Tear propagation test as per DIN 53507 / ISO 34 Method A

specimen	=	test specimen A
test velocity	=	500 mm min ⁻¹
state of material	=	delivery state

average value out of 6 samples in one direction and average value out of 6 samples in the perpendicular direction.

Minimum tear propagation resistance	=	2.0 Nmm ⁻¹
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3.1.1.6. Tear propagation test as per ISO 816 (Delft)

specimen	=	standard
test velocity	=	500 mm min ⁻¹
state of material	=	delivery state

average value out of 6 samples in one direction and average value out of 6 samples in the perpendicular direction

Minimum tear propagation force	=	15 N
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3.1.1.7. Tear propagation test as per DIN 53515 (Graves)/ISO 34 Method B

specimen = standard
test velocity = 500 mm min⁻¹
state of material = delivery state

average value out of 6 samples in one direction and average value out of 6 samples in the perpendicular direction

Minimum tear propagation resistance	=	10 Nmm ⁻¹
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3.1.1.8. Hardness; DIN 53505

specimen = standard
test method = Shore A
state of material = delivery state

average value out of 10 measurements

Hardness	=	XX ^{±5} Shore A
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*XX means that the **value** is determined from the sample plates.*

3.1.2. Ageing characteristics of elastomer material

The purpose of the tests described hereafter is to establish the ageing characteristics of the elastomer material to be approved. They ought to guarantee that the moulded parts or semi-finished parts manufactured with these materials will have a very long life time.

The test defined below must not be performed earlier than 72 hours following the vulcanisation of the sample plates and standard test specimen. Before being tested, the sample plates must be stocked for a minimum of 24 hours in a standardized temperature and relative humidity environment defined as 23 °C and 50 % r.h. (DIN 500 14, class 2).

3.1.2.1. Artificial ageing; DIN 53508 / ISO 188

storage time = 7 and 28 days
storage temperature = *

* 70 °C for natural- styrene-butadienes- and chloroprenes elastomers
150 °C for fluoro- and silicone elastomers
100 °C for all other elastomer types

3.1.2.1.1. Data modification from the traction strength test DIN 53504 / ISO 37

specimen = standard test piece S2
test velocity = 200 mm min⁻¹
state of material = after artificial ageing

average value out of 6 samples in one direction and average value out of 6 samples in the perpendicular direction

after a storage time of 7 days

modification of tensile strength	=	max. 30 %
modification of elongation at break	=	max. 30 %

after a storage time of 28 days

modification of tensile strength	=	max. 50 %
modification of elongation at break	=	max. 50 %

3.1.2.1.2. modification of the hardness as per DIN 53505

specimen	=	finished article
test method	=	Shore A
state of material	=	after artificial ageing

average value out of 10 measurements, after a storage time of 7 days

modification of hardness	=	maximum ± 10 Shore A
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3.1.2.2. Determination of crack resistance under the influence of ozone; DIN 53509 / ISO 1431 1+2

pre-stressing time	=	72 hours
test time	=	72 hours
test temperature	=	40 °C
test humidity	=	55 % rel. humidity
ozone concentration	=	50 pphm
shape of sample	=	dumb-bell (as per standard)

20 % elongation	=	no cracks
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3.1.3. Particular requirements for elastomers

The test defined below must not be performed earlier than 72 hours following the vulcanisation of the sample plates and standard test specimen. Before being tested, the sample plates must be stocked for a minimum of 24 hours in a standardized temperature and relative humidity environment defined as 23 °C and 50 % r.h. (DIN 500 14, class 2).

3.1.3.1. Resistance against chemical warfare agents; L 363 004

specimen	=	specimen
diameter	=	68 mm
thickness	=	2 mm
state of material	=	delivery state

average value out of 5 samples

break-through time	=	min. 6 hours
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3.2. Additional requirements for application in special areas

3.2.1. Application as sealing material resistant to oil and grease

If the material must resist to oil and grease, only the following types of elastomer can be used:

- Acrylonitrilbutadiene rubber NBR with a minimum content of 28 % ACN*
- hydrated Acrylonitrilbutadiene rubber HNBR
- Epichlorohydrin rubber ECO
- Fluororubber FPM
- Fluorosilicone rubber FVMQ

* ozone resistance is not required here

3.2.2. Application as expanded moulded part or semi-finished element

The expanded elastomers must fulfill the following points of the basic requirements:

- 3.1.1.1. tensile strength test, but as per DIN 53571/ISO 1798 (test specimen A)
- 3.1.2.1. artificial ageing
- 3.1.2.2. Ozone ageing

In addition the expanded materials must fulfill the following particular requirements:

3.2.2.1. Compression set; DIN 53572/ISO 1856

specimen	=	standard
test temperature	=	23 °C
test time	=	72 ^{+0 -0.5} hours
deformation	=	50 ^{±2} %
material state	=	delivery state

Average out of 3 samples

Maximum compression set	=	25 %
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3.3. Requirements for moulded parts and semi-finished elements

3.3.1. General requirements

Together with the sample plates, the following material has to be provided:

- moulded parts such as gaskets, bellows, flexible hoses etc. 20 pieces

In case of large dimensions, the quantity may be reduced to 5 pieces

- semi-finished elements such as cords, profiles etc. 5 meters

If the characteristics of moulded parts such as gaskets, bellows, flexible hoses etc. and semi-finished elements such as cords, profiles etc. can be measured at all, they have to fulfill the identical minimum requirements as the finished elements, as mentioned in:

- 3.1.1.1. Tensile strength test
- 3.1.1.2. Compression set
- 3.1.1.3. Residual tensile deformation
- 3.1.1.4. Tear propagation test
- 3.1.2.1. Artificial ageing (only 7 days)
- 3.1.2.2. Ozone ageing

For the expanded materials and semi-finished elements, only the following points are considered:

- 3.1.1.1. Tensile strength test
- 3.1.1.2. Compression set
- 3.1.2.1. Artificial ageing
- 3.1.2.2. Ozone ageing

In addition, the hardness is measured on the finished element at a spot defined on a drawing, and determined as follows:

3.3.1.1. Hardness DIN 53505

If the material thickness exceeds 2 mm

- specimen = finished part
- test method = Shore A
- material state = delivery state
- average value out of 10 measurements

Hardness	= XX ^{±5} Shore A
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3.3.1.2. Hardness DIN 53519 Page 2 / ISO 48

If the material is thinner than 2 mm

specimen = finished part
test method = micro hardness IRHD
material state = delivery state
average value out of 10 measurements

Hardness	=	$XX^{\pm 5}$ IRHD
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3.3.1.3. Compressive strength DIN 53577 / ISO 3386

For expanded material

specimen = standard
test velocity = 100 mm min⁻¹
evaluation at 40 % deformation
average out of 3 samples

Compressive strength	=	$XX.X^{\pm 3}$ Nmm ⁻²
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XX means that the values are established on the moulded or semi-finished element and constitute the basis for further tests and verification as well as the basis for the determination of tolerances.

3.4. Additional requirements for application as door-seal profiles

According to appendix 9A, two types of doors are distinguished; armoured doors PT (large door seal profile) and pressure doors DT (small door seal profile).

In order to get the approval, 10 additional metres of profile have to be submitted which will undergo a practical test as per regulation L 363 037. Furthermore, the following tests and requirements must be fulfilled:

3.4.1. Flame retardancy treatment

The elastomer material has to be inherently flame retardant as for example Chloroprene rubber CR, or it has to be treated with flame retardant additives.

Requirement to be fulfilled:

Hardness Shore A (DIN 53505) after storage for 2 hours at 200 °C	max. 90 Shore A
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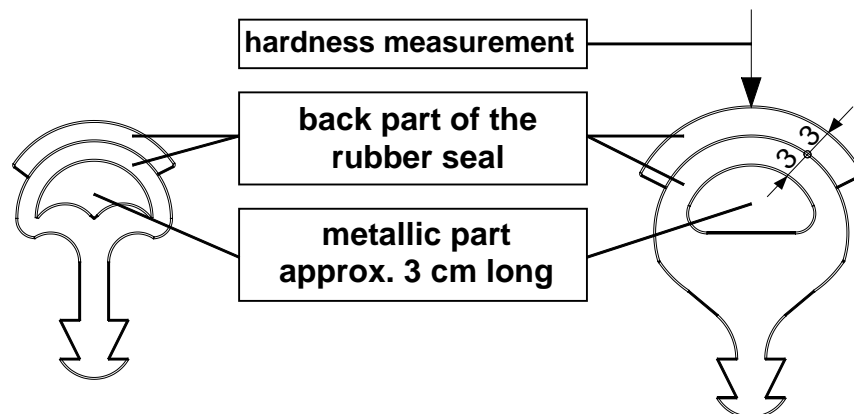
3.4.2. Low-temperature behaviour

Hardness increase Shore A (DIN 53505) after storage for 48 hours at -20 °C, measured at -20 °C	max. 20 Shore A.
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3.4.3. Hardness as per DIN 53505

For door sealing profiles the general requirements as per 3.3.1.1. and 3.3.1.2. are replaced by the following test.

Test specimen as per sketch below:



test method = Shore A
 material state = delivery state

average out of 10 measurements

Hardness	= 52 ^{±5} Shore A
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3.5. Application as flexible hoses and/or bellows

The quantities for the type testing of material subjected to tests for constructions of the civil defence, are mentioned in the directives of the Swiss Federal Office of Civil Protection.

The flexible hoses and/or bellows must consist of stabilized and dimensionally stable material. They must fulfill the requirements as per:

- | |
|--|
| <ul style="list-style-type: none">- principal dimensions- air flow resistance- flexibility test (only for ND 125 mm) |
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according to appendix 9 B

4. Embedding compounds

Together with the request for obtaining an approval, the following information must be given about the embedding compound:

- material designation
- Type of material (exact designation including trade name)
- method of stabilization (product and quantity)
- additional filling substances and masterbatch etc.
- manufacturer of the embedding compound
- certificate for the batch, from which the submitted embedding compound was produced (from manufacturer)

For testing purposes the following must be provided:
100 g embedding compound and 7 sample plates 2 mm thick,
dimensions min. 130 mm x 130 mm

Only cold or warm crosslinked vulcanized products are considered. Basically the embedding compounds must resist to hydrolysis (no embedding compound based on pure Polyesterpolyurethane will be considered), and have to fulfill the following points of the basic requirements:

- 3.1.1.1. Tensile strength test
- 3.1.1.2. Compression set
- 3.1.2.1. Artificial ageing
- 3.1.2.2. Ozone ageing

Also the adhesion must be so strong that, after tearing off, a minimum of 50 % of the embedded compound remains on the adherend surface.

5. Moulded and semi-finished elements in thermoplastic and thermoset material

For moulded and semi-finished elements only thermoplastic and thermoset materials are considered, which are basically stable or additionally **stabilized** for a long life time. No material susceptible to stress cracking is allowed.

Together with the request for obtaining an approval, the following information must be given about the product:

- material designation
- type of material (exact designation including trade name)
- stabilization method (product and quantity)
- additional filling substances and masterbatch etc.
- manufacturer of the thermoplastic and thermoset material
- certificate for the batch, from which the moulded parts submitted are produced (material manufacturer)
- manufacturer of the moulded or semi-finished element
- tool number with indication of the number of cavities
- if possible, information about media which would produce stress cracks in the material to be tested

For testing purposes the following must be provided:
50 moulded parts per cavity and 100 g granules from the same batch or lot from which the moulded parts are made.

For moulded and semi-finished elements, not the moulding compound is approved but the corresponding moulded or semi-finished element.

6. Adhesives

Only adhesives which are resistant to hydrolysis and fit for a long life time are considered.

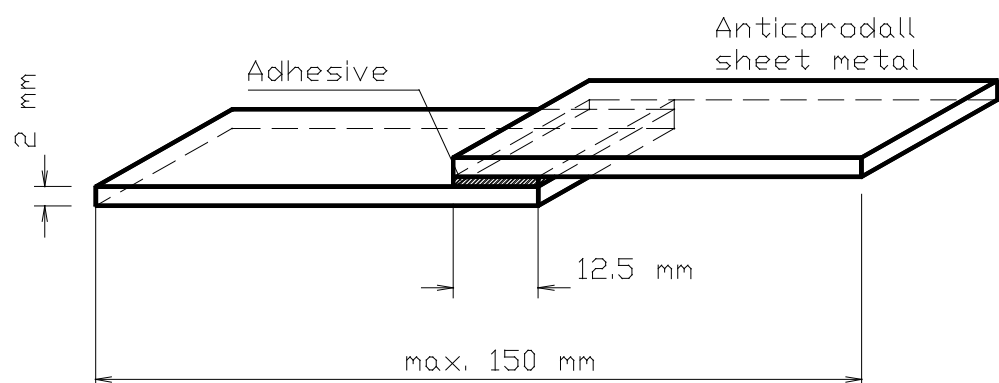
The adhesives must not produce stress cracking when in contact with synthetic parts

Together with the request for obtaining an approval, the following information must be given about the product:

- designation of the adhesive
- type of material (exact designation including trade name)
- manufacturer of the adhesive
- data sheet and description of the main components of the adhesive to be tested

For testing purposes, the following must be provided:

10 glued samples, 10 g adhesive as well as 30 samples for the shear strength test as shown below:



The 30 samples are tested as follows:

- 10 shear strength tests in the delivered state
- 10 shear strength tests after storage at 70 °C during 28 days
- 10 shear strength tests after storage at 40 °C and 90% rel. humidity during 28 days

6.1. Shear strength

specimen : as shown in fig. above
test velocity : 500 mm min⁻¹
average value out of 10 samples

shear strength in the delivered state	= XX.X Nmm ⁻²
Modification of the shear strength after storage in warm environment	= max. - 20 %
Modification of the shear strength after storage in humid environment	= max. - 20 %

XX.X means that the values are established on the moulded or semi-finished element and constitute the basis for further tests and verifications as well as the basis for the determination of tolerances.

7. Marking

Moulded and semi-finished elements in thermoplastic and thermoset material must be marked in a well visible and lasting way with the following information:

- abbreviated material designation
- manufacturer code
- fabrication date

On semi-finished products the information is imprinted every 5 meters, in such a way that it does not provoke malfunctions.

On products with small dimensions, the marking must be adapted or abandoned.

The marking of the flexible hoses has to be made according to appendix 9 B.

8. Legal grounds

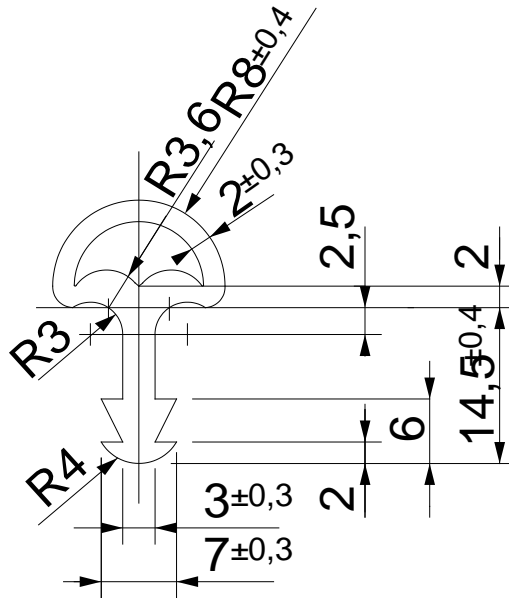
These technical requirements become effective on January 1st, 1997 and replace the article 5 and appendix B2 of the directives of the Swiss Office of Civil Defence for the technical requirements for small ventilating equipment, dated April 15th, 1965.

After July 1st, 1997 only moulded and semi-finished elements in thermoplastic, thermoset material and elastomers (synthetic material and rubber), embedding compounds and adhesives will be approved, that are in accordance with the technical requirements in hand.

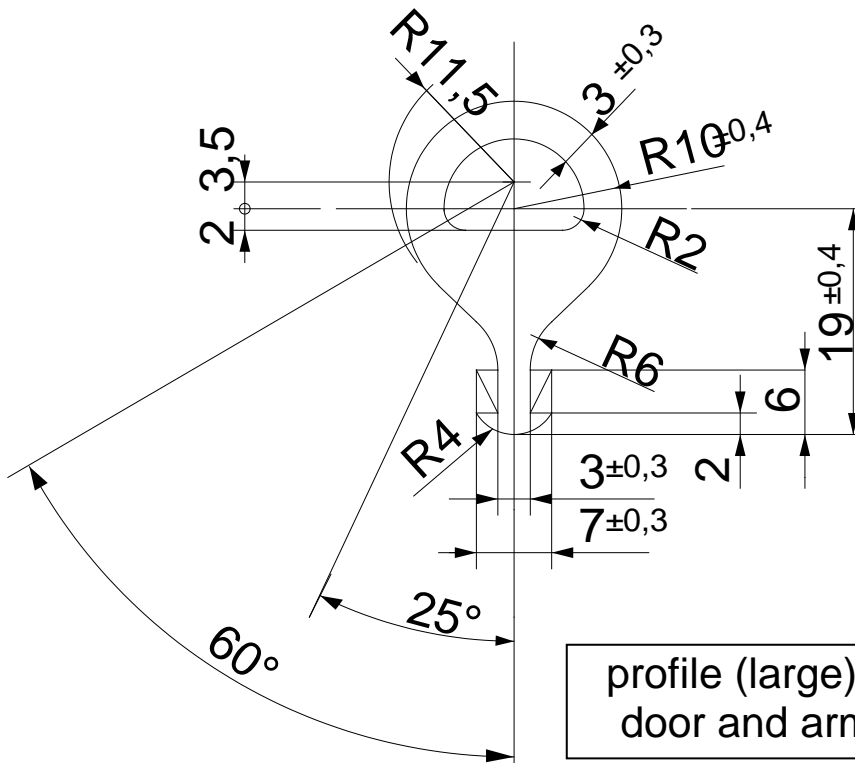
If there are discrepancies compared to the directives TWP, TWO and TWS, the technical requirements in hand have priority.

9. Appendices

A) door seal profile



profile (small) for pressure door

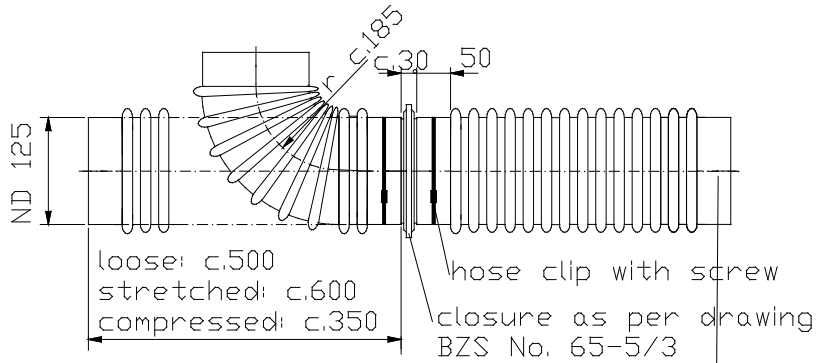


profile (large) for armoured door and armoured cover

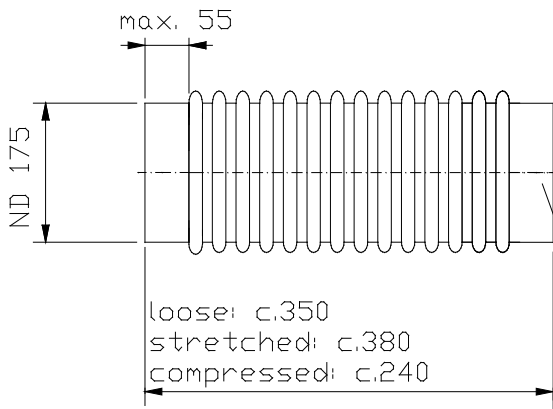
B) flexible hoses and/or bellows

B.1 MAIN DIMENSIONS

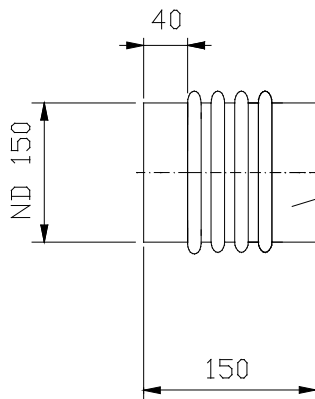
flexible hoses ND 125 mm



flexible hoses ND 175 mm



bellow ND 150 mm



spot for a well visible and lasting marking on the flexible hoses and bellow:

- BZS number
- Manufacturer's code
- fabrication date

B.2 MAXIMUM FLOW RESISTANCE

Air volume	ND 125		ND 175	
	A	B	A	C
m ³ /h	in Pa	in Pa	in Pa	in Pa
150	12	36	--	--
300	55	165	4	8
600	--	--	10	25

A = two flexible hoses with coupling, straight, connected to the measuring tube (pressure drop of the measuring tube is subtracted)

B = two flexible hoses with coupling, bent 180° degrees connected to the measuring tube (pressure drop of the measuring tube is subtracted)

C = two flexible hoses with coupling, bent 90° degrees connected to the measuring tube (pressure drop of the measuring tube is subtracted)

B.3 FLEXIBILITY TEST

The flexible hoses ND 125 must be able to be formed into the configurations 1-4 shown below.

