

PURPOSE

To define the characteristics that the rubber smooth or bellow-type sleeves, with or without fabric stiffening, must meet when used for low pressure air conduction if oil vapors are present in boosting circuits. To define procedures and equipment for the execution of checks of these characteristics.

Note: *as the silicon compound (Type B) can cause oil sweating on the external surface, should a perfect permeability is required, a fluoroelastometer or fluorosilicon layer, fastened by adhesive to the inner duct, is necessary; in this case, the Class to be used is "B-0".*

This Proc. Spec. consists of 14 pages and 2 annexes

Ch.	Date	Description
-	June '93	Issue 2 – In the "Vacuum resistance" test, specified the temperature of 100 °C and changed the value of vacuum (former was 0.05 bar). Cancelled Annex 51 and carried out text changes. (FD)
-	Jan. 00	Issue 3 – Completely revised (FD)
A	01/30/02	Issue 3 – Added note on the first page and changed the table in § 1.3.1. Annex 1: changed some limits. (FD)
B	08/26/04	Issue 3 - Changed § 1.3. Added Type E and <i>Note</i> in §§ 2.4 and 2.5.9.7. (FD)
C	05/12/08	Issue 3 - Changed <i>Note</i> on page 1. Added "Expulsion test". Changed §§ 2.5.5 and 2.5.9.3. Annex 1: changed. (FD)
-	08/29/08	Issue 4 – Complete text revision; corrected the formula in para. 2.5.13.8 and detailed the limits of rubber/stiffener adhesion in Annex 2. (AN)
A	06/01/11	Issue 4 – Changed § 1.2 and 2.5.9 Added limits in Annex 1 and 2. (DC)
B	10/25/11	Issue 4 – Changed § 2.5.1, updates limits in Annex 1 and 2. (DC)
C	08-OCT-2014	Issue 4 – Editorial changes. (DC)

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§ "A": TEST EQUIPMENT

- A-1) Dump heat test permanent chamber: it shall guarantee, in all its points, a temperature of $40 \pm 2^{\circ}\text{C}$ with a relative humidity of 90 to 95%; the chamber must be at low speed air circulation and manufactured so that the parts are not directly reached by steam, nor condensing water.
- A-2) Environmental chamber (oven) able to reach and maintain in all its points the temperature corresponding to the required severity class, within the prescribed tolerance, with 20% max relative humidity, and built so that nowhere the parts undergo heating by direct radiation from the heating elements.
- A-3) Gear pump.
- A-4) Pressure gauge.
- A-5) Low temperature test chamber: it must be able to reach and keep in all its points the temperature corresponding to the required severity class, within the tolerance range of $\pm 2^{\circ}\text{C}$.
- A-6) Dynamometer of adequate capacity, with a tensile speed of 10 to 100 mm/min.
- A-7) Metal "plug" for the "Expulsion test" (ref. to § D-D/1).

§ "B": REFERENCED DOCUMENTS

- 02288 Coupling of pipe unions with pipes/couplings for engine air aspiration equipment and turbocharged engines air booster – Design directive. TFO
- 07416 Recycling markings for plastic and elastomer components. TFO
- 50184 Requirements for nonmetals – Environmental tests (for paints, enamels, etc.) TMD
- 50405 Rubber tensile test. TMD
- 50408 Rubber tests - Hardness in international degrees IRH . TMD
- 50412 Rubber tearing test. TMD
- 50413 Definitions of the variations of rubbers vulcanized after aging. TMD
- 50417 Check of the aging resistance in atmosphere enriched with ozone of the rubber subject to forced elongation. TMD
- 0.00013 Date of manufacture marking. NPR
- 7.G2183 Definition of impurities inside fluid-circulation plant components. Washing methods. PGE
- 9.01102 Quality of supplies of Fiat Group Automobiles. CFO
- 9.01103 Product Quality and Conformity Certificate. CFO
- 9.55367 Adhesive tapes with single-side coating. CMD
- ISO 48 Rubber, vulcanized or thermoplastic – Determination of hardness (hardness between 10 IRHD and 100 IRHD)

§ "C": LIST OF ANNEXES

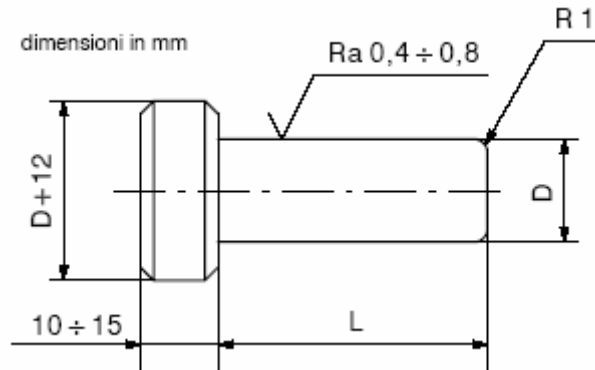
- Annex 1 Specifications Data Sheet – Sleeves of Type **A – B – B-0**
- Annex 2 Specifications Data Sheet – Sleeves of Type **C – D – E - F**

§ "D" – TEST EQUIPMENT

D/1

"Expulsion test" equipment

Essentially, the "plug" (ref. § A-7) is so sketched:



Note: value of "D" is equal to nominal diameter of the sleeve on which the same sleeve shall be mounted, while

1

GENERAL

1.1

Test environment (unless otherwise specified)

- temperature: 23 ± 5 °C
- atmospheric pressure: 860 to 1060 mbar
- relative humidity: 45 to 70%.

1.2

Classification

1.2.1

In function of use, pressures, temperatures of both driven fluid and environmental radiance, sleeves are subdivided and classified by type according to what shown in the following tables:

TABLE 1 Type	Use	Max working temperature (inside/outside) (°C)		Min. working temperature (°C)	Material[♦] (as indication)	Stiffening material (as indication)
		Continuative	Peak			
A	Section from compressor to intercooler	150	160	- 35	EAM	Para Aramide
B	Section from compressor to intercooler	200	220	- 35	VMQ	Meta Aramide
B-0	Section from compressor to intercooler	200	220	- 35	VMQ/FVMQ VMQ/FPM	Meta Aramide
C	Section between intercooler and engine	100	110	- 35	CR ; CM	Para Aramide/ polyester
D	Section between intercooler and engine	120	130	- 35	NBR/CSM (CM)	Para Aramide/ polyester
E	Section from compressor to intercooler	180	190	- 25 * - 35	* HT-ACM HT-AEM	Meta/Para Aramide
F	Section from compressor to intercooler	170	180	- 35	HT-AEM	Meta Aramide

[♦] The materials indicated in the table are referred to the inner conduit in contact with the fluid; for the intermediate part and the cover can be used alternative materials.

Class	Continuative working pressure (bar)	Peak pressure (bar)
1	1.5	1.8
	1.8	2.1
3	2.2	2.5

Classification is given by combination between working temperature and pressure, for instance: Type **A/2**

Where: **A** = pipelines with continuative temperature of 150 °C and possible peak at 160 °C

2 = pipelines with continuative pressure of 1.8 bar and possible peak of 2.1 bar

Shouldn't the Class be indicated, it has to be intended as **Class 1**.

1.3

Drawing callout

- The number of this Proc. Spec. is indication of the Type (e.g.: 9.02132/01 B-0/2). Shouldn't Class be indicated on the drawing, it has to be intended as Class 1;
- Indication of pressures/temperatures, if different from the ones required in the Proc. Spec. . In case of pressures, the peak pressure is to be intended as always equal to continuative working pressure increased of 0.3 bar;
- Vacuum resistance value if different from 0.03 bar.

2

PRODUCT QUALIFICATION REQUIREMENTS

Submit the component to tests and checks specified in the following paragraphs, verifying the compliance of the test result with values/limits indicated on drawing and/or on the annexed "Specifications Data Sheet" relevant to the specified type.

2.1

Dimensions and tolerances: according to relevant drawing

2.2

Marking: in the zone possibly indicated on the drawing, every component must bear the clear and indelible indications aimed at identifying the Supplier, manufacturing date (Standard 0.00013), indication concerning material recycling (Standard 07416) and any other indication as required on drawing and any circumferential reference mark for the positioning of fastening collars.

2.2.1

Check of indelibility of any reference circumferential marks for positioning of closing collars (realized with paints or inks)

2.2.1.1

Submit test piece taken for the pipe to be tested to 50 h exposure in thermo-humid-static chamber (ref. § A-1) according to procedures set in Standard 50184 Method B

2.2.1.2

After 2 h from the extraction from the chamber make the vinyl plastic adhesive tape (Type F) adhere on test piece circumferential marks according to Procurement Specification 9.55367 and then tear it off.

2.2.1.3

At the end, carry out visual check of surfaces involved in adhesion:

- test piece: no detachment of circumferential mark is allowed. A variation of color is allowed if it does not compromise individuation of the strip;
- adhesive tape: no signs of paint or ink are allowed on adhesive tape.

2.3

Visual check: every component must be free of roughness, pitting, holes, tears, cracks, initial detachment between sublayer and coating, between sublayer and intermediate layer and any other defect that can compromise its working.

2.4

Characteristics of materials

Check the following characteristics of materials, getting test pieces directly from the pipe, and compare with what required in the Specifications Data Sheet. In case of materials alternative to the ones shown in the classification table (§ 1.2) at the moment of qualification the Supplier must produce the complete report of the characteristics detected on the material. Moreover, characteristics of the fabric stiffening must be indicated too: chemical composition, structure type, yarn title (dtex), number of needles/number of fabric revolutions, etc .

2.4.1

Inner duct/rubber coating in the state of supply

2.4.1.1

Material type

2.4.1.1.1

For every type of elastomer utilized for manufacturing of component, detect the type of material taking some test pieces directly from the pipe by thermogravimetric analysis. The TGA curve must be attached to qualification certificate with the relevant used methodology.

2.4.1.2

Hardness

2.4.1.2.1

Carry out measurement using the equipment and following procedures described in Standard 50408-ISO 48.

2.4.1.3

Resistance to tensile stress and elongation to break

2.4.1.3.1

Carry out measurement using the equipment and following procedures described in Standard 50405.

2.4.1.4

Tearing

2.4.1.4.1

Carry out measurement using the equipment and following procedures described in Standard 50412.

2.4.1.5

Inner duct/rubber coating after aging

2.4.1.5.1

Repeat measurements as per paragraphs 2.4.1.2 to 2.4.1.4 after aging in environmental chamber(ref. § A-2) at continuative working temperature, indicated in the table in paragraph 1.2.1, according to procedures indicated in Standard 50413 for a period of 70 h and 504 h.

Repeat measurement of hardness and variation of volume after aging in oil of the used type for a period of 70 h at the temperature of $100 \pm 2^\circ\text{C}$ for type C, $120 \pm 2^\circ\text{C}$ for type D and $150 \pm 2^\circ\text{C}$ for types A, B, B-0, E and F according to procedures indicated by Standard 50413.

2.5Component characteristics**2.5.1****Resistance to pressure****2.5.1.1**

Mount the assy on a special equipment simulating the mounting on vehicle (with clamps and tightening torque as per design).

2.5.1.2

Put assy into the environmental chamber (ref. § A-2) at foreseen continuative working temperature (see para. 1.2.1) and keep it there for a period of 70 h .

2.5.1.3

After aging at same temperature, send an internal automatic pressure of 3 bar keeping it for 5 min.

2.5.1.4

Visually check conditions of the sleeve, comparing it with what required.

2.5.1.5

Loosen clamp and visually check conditions of the sleeve, comparing it with what required.

2.5.2**Diametral expansion****2.5.2.1**

Mount sleeve on a special equipment simulating mounting on vehicle (with clamps and tightening torque as per design).

2.5.2.2

Measure external diameter with decimal precision, then mark the zone involved in measurement.

2.5.2.3

Submit sleeve to peak pressure indicated in Table 2 .

2.5.2.4

Measure external diameter value again, in marked zone.

2.5.2.5

Calculate percentage variation by comparing it with prescriptions.

2.5.2.6

Repeat test at required continuative working temperature (see para. 1.2.1) on a sleeve conditioned in environmental chamber (ref. § A-2) for a period of 4 h .

2.5.3**Length variation (only on rectilinear sleeves)****2.5.3.1**

Repeat measurement only in hot conditions, with same procedures described in § 2.5.2 measuring distance between clamps at the ends of the tested sleeve, free to expand.

2.5.4**Resistance to vacuum in temperature****2.5.4.1**

Mount sleeve on a special equipment simulating the mounting on vehicle (with clamps and tightening torque as per design).

2.5.4.2

Measure external diameter with decimal precision, then mark zone involved in the measurement.

2.5.4.3

Put the sleeve into the environmental chamber (ref. § A-2) at a temperature of $100 \pm 2^\circ\text{C}$ for type C, $120 \pm 2^\circ\text{C}$ for type D and $150 \pm 2^\circ\text{C}$ for types A, B, B-0, E and F for a period of 4 h and send a vacuum of 0.03 bar (if not otherwise required by design) into the sleeve.

2.5.4.4

Measure external diameter value again in marked zone.

2.5.4.5

Calculate percentage variation by comparing it with prescriptions.

2.5.5**Joint bursting/withdrawing pressure****2.5.5.1**

Mount sleeves in following conditions:

- interface pipe unions required by design;
- clamps required by design; in case use is made of clamps with cutting-head screw, close at maximum speed required by design, while in case of clamps with normal screw (without preliminary cutting of the head) close at the minimum torque required by design.

In case of components consisting of several elements (plastic, metal or rubber pipes, fast couplings, etc.), test must be carried out on the supply assy.

2.5.5.2

Connect sleeve to a bench(ref. § A-3) that can send to the tested pipe a pneumatic (or hydraulic) pressure with increase of 2 bar/min.

2.5.5.3

On the bench pressure gauge (ref. § A-4) measure the bursting or withdrawing pressure of the rubber pipe from the interface pipe unions.

2.5.5.4

Repeat the test on a sleeve after aging for 70 h at the foreseen continuative working temperature (see para. 1.2.1).

2.5.6**Adhesion between rubber an stiffener and between rubber and rubber (where existing)****2.5.6.1**

From the tested parts, in the longitudinal direction of the sleeve and in rectilinear zone, obtain a strip with minimum width of 20 mm and minimum length of 80 mm.

2.5.6.2

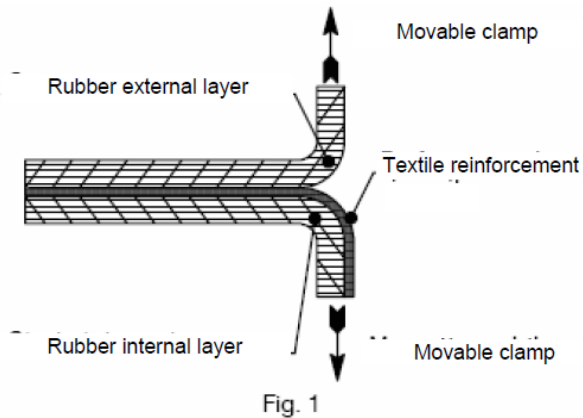
Start detaching the coating from the stiffener or between rubber and rubber (in case of sublayer obtained by a co-extrusion of 2 different mixes), from one end, making use, in case of need, of appropriate tools, for a length sufficient for allowing the grasping on dynamometer.

2.5.6.3

With the fixed clip of the dynamometer(ref. § A-6), grasp the edge of the coating, previously detached from the coating and grasp the other edge, with the movable clip, then pull at the speed of 50 mm/min (see Fig. 1 on next page).

2.5.6.4

Measure the minimum unitary load required to obtain the detachment, then compare with the required limit.



2.5.6.5

Repeat measurement on a sleeve, after aging for 70 h at the foreseen continuative working temperature (see para. 1.2.1).

2.5.7

Resistance to ozone

2.5.7.1

From rubber coating of the sleeve, get a linear test piece taken along the generatrix.

2.5.7.2

Submit test piece to an elongation of 50% and keep it blocked in such position.

2.5.7.3

Put the test piece into the ozonemeter cell working according to the procedures indicated in Standard 50417 and keep it there for a period of 70 h.

2.5.7.4

Visually check the test piece conditions, with 2 X magnifying and compare them with what required.

2.5.8

Resistance to cold

2.5.8.1

Put the sleeve into the chamber for low-temperature tests (ref. § A-5) at $-35 \pm 2^\circ\text{C}$ for a period of 48 h then at the same temperature, squeeze its walls between 2 flat surfaces until getting the complete collapse. For type E, the test must be carried out at $-25 \pm 2^\circ\text{C}$.

2.5.8.2

Visually check the conditions of the part, comparing it with what required.

2.5.9

Resistance to pulsing pressure

2.5.9.1

At the ends of the sleeves mount the pipe unions and clamps as indicated in § 2.5.5.1 .

In the case of total supply system is present a rigid pipe made of plastic material, formed by two or more 'elements welded together (excluding mounting brackets) must be performed on the total supply system the execution of 5 cycles thermal each of which so' consists of:

8 hours continuous operating temperature of the relevant class (TABLE 1)

16 hours at -30°C . Switching from one environment to another must be made within 60 seconds.

2.5.9.2

Fill with used engine oil up to 50% of internal volume and plug both ends.

2.5.9.3

Put the parts into the environmental chamber (ref. § A-2) at the continuative working temperature relevant to the Type (see Table 1; excluding Types B and B-0 for which the temperature must be $180 \pm 2^\circ\text{C}$) for 24 h .

2.5.9.4

Empty oil from the parts without dismantling pipe unions and clamps, then put them into the environmental chamber again (ref. § A-2), positioning them as in service, at the working temperature (Table 1) for 1 h .

2.5.9.5

Submit the sleeves to a pulsing pneumatic pressure with the cycle required in Diagram 1.

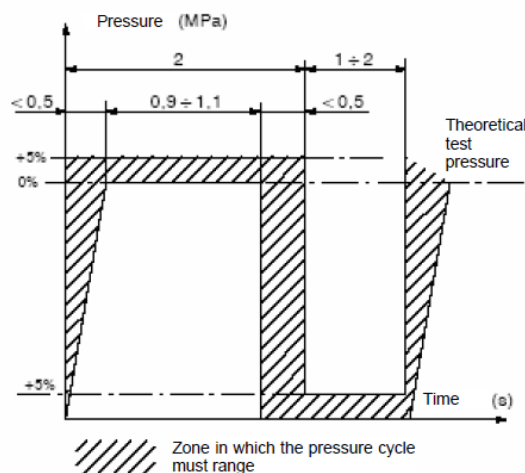


Diagram 1

2.5.9.6

Carry out a total of 150,000 cycles in four different steps with pressures and temperatures indicated in Diagram 2

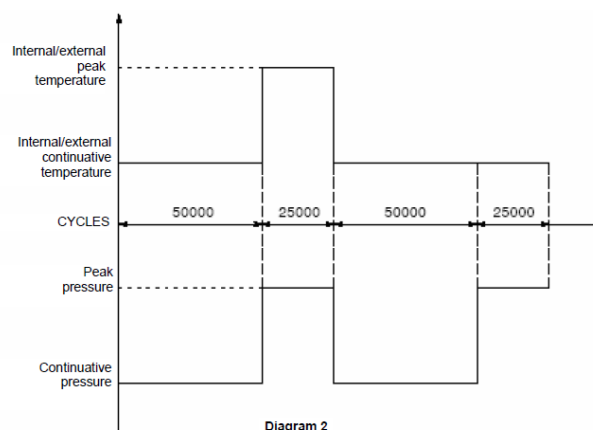


Diagram 2

2.5.9.7

Check that the behavior of the sleeve complies with the required limits. During the qualification, carry on the test until breaking the sleeve in the int/ext continuative temperature conditions + peak pressure). In case the break does not occur, after 225,000 cycles the test can be stopped.

Note: In case of components consisting of several elements (plastic, metal or rubber pipes, fast couplings, etc.), the test must be carried out on the supply assy.

2.5.10

Expulsion test

2.5.10.1

Put 2 metal plugs on both ends of rubber pipe(ref. § A-7) and tighten the sleeve making use of the clamps required by design.

Note: *in case use is made of clamps with cutting-head screw, close at the maximum speed required by design, while in case of clamps with normal screw (without preliminary cutting of the head) close at the minimum torque required by design.*

2.5.10.2

Connect one of the 2 pipe unions to a bench that can pressurize the inside of the tested sleeve with air.

2.5.10.3

Send a pneumatic pressure with increase of 2 bar/min until measuring the expulsion pressure; verify that the measured value meets what required.

2.5.11

Oil permeability test

2.5.11.1

Fill the sleeve with used engine oil up to 50% of internal volume and plug both ends.

2.5.11.2

Put the sleeve into the environmental chamber (ref. § A-2) at the continuative working temperature relevant to the Type (see Table 1; excluding Types B and B-0 for which the temperature must be 180 ± 2 °C) for 48 h .

2.5.11.3

Take the sleeve out of the chamber and put it on white absorbent paper sheet. The position must be the same as in the environmental chamber.

2.5.11.4

Let rest for 48 h at environmental temperature, then check the conditions of sleeve and absorbent paper visually and compare with the required limits.

2.5.11.5

Empty the sleeve and check that the inner duct complies with the required limits.

Note: *this test cannot apply to Type B due to the specific characteristics of silicon.*

2.5.12

Measurement of impurities

2.5.12.1

Carry out the measurement with the equipment and procedures set by Standard 7.G2183 and check that the measured values are within the set limit.

Note: *In case of components consisting of several elements (plastic, metal or rubber pipes, fast couplings, etc.), the test must be carried out on the supply assy.*

2.5.13**Permanent deformation****2.5.13.1**

Get some circular samples with Ø 15 mm, by cutting them directly from the component wall, in a straight zone, preferably on the terminals.

2.5.13.2

Measure the thickness at the center of the test piece (S0), making use of centesimal feeler gauge with Ø 2.5 mm feeler pin and preload of 45 to 50 g.

2.5.13.3

Slightly lubricate the test piece than lay it on a ground metallic plane, so that the external layer of the test piece wall is upwards.

2.5.13.4

Compress the test piece with a 4.5 mm , metallic punch with a ground base parallel to the supporting plane, until the starting thickness (S0) is 25% reduced and record the above mentioned value (S1).

2.5.13.5

Keep the test piece compressed for 30 min at environmental temperature, then put them into the environmental chamber (ref. § A-2) at the continuative working pressure relative to the Type (see Table 1) for 72 h .

2.5.13.6

Let cool at environmental temperature until the equipment reach the temperature of 23 ± 2 °C

2.5.13.7

Release the test pieces from the deformation, after 30 min measure the new thickness (S2) with the procedures described in para. 2.5.13.2.

2.5.13.8

Calculate the permanent deformation values with the formula shown below, than check that the measured value ranges within the required limit.

$$Deformation = \frac{(S0 - S2)}{(S0 - S1)} \times 100$$

3

PRESCRIPTIONS FOR SUPPLY CONTROL

Supplies are to be tested in compliance with instructions contained in P.S. 9.01102.

4

REQUIREMENTS FOR THE SUPPLIER

The Supplier shall comply with general requirements of the Specification 9.01102 "QUALITY OF SUPPLIES".

4.1

Supplies for product qualification

The Supplier shall submit the amount of product specified in the purchase order and attach the Quality and Conformity Certificate (see PS. 9.01103); all characteristics specified on the attached "Specifications Data Sheet" shall be checked. "Non conforming" supplies are not accepted.

4.2

Supplies for production

The delivered product must comply with requirements of drawing and this Procurement Specification. When defining the production process to be followed and the test severity, the Supplier must consider the classes of importance that Fiat gave to each characteristic which the requirements refer to (see § 5).

Note: during both product qualification and supply control, checks can be carried out on components that underwent non-destructive tests (indicated by NM in § 5); if the component underwent destructive tests (M) it can be utilized no more for other tests or checks if not otherwise specified every time.

5

CHARACTERISTIC CLASSIFICATION TABLE

Sleeve Types: **A - B - B-0**

CHARACTERISTICS		TEST CONDITIONS		LIMITS			
				A	B	B-0*	
Dimensions and tolerances		-		According to drawing			
Marking		-		§ 2.2			
Visual inspection		-		§ 2.3			
MATERIAL OF INNER DUCT/COATING	Hardness (IRHD - μ IRHD)	new supplied		Std. 50408 ISO 48	To be stated during qualification step ± 3		
		After aging in air (max. variation)	70 h	§ 2.4.1.5.1 and Std. 50408 ISO 48	+15	+10	+10
			504 h		+15	+15	+15
		After aging in oil (max. variation)				- 15	- 20
	Resistance to tensile stress (N/mm ²)	new supplied		Standard 50405	≥ 10	≥ 7	≥ 8
		After aging in air (max. variation)	70 h	§ 2.4.1.5.1 and Std. 50405	- 20%	- 20%	- 20%
			504 h		- 35	- 50	- 40
	Ultimate elongation (%)	new supplied		Std. 50405	≥ 250	≥ 250	≥ 300
		After aging in air (max. variation)	70 h	§ 2.4.1.5.1 and Std. 50405	- 50%	- 25%	- 20%
			504 h		- 50	- 60	- 40
	Tearing (N/mm thickness)	new supplied		Std. 50412	≥ 35	≥ 15	≥ 25
		After aging in air (max. variation)	70 h	§ 2.4.1.5.1 and Std. 50412	- 25%	- 10%●	- 10%●
504 h			- 50		- 50	- 40	
Volume (%)	After aging in oil (max. variation)		§ 2.4.1.5.1	+15	+25	± 8	
COMPONENT	Resistance to pressure		§ 2.5.1	No leakage, loss, burst or beginning of tearing allowed on the external surface.			
	Diametral expansion (%)	at 23 °C	§ 2.5.2	≤ 10			
		At working T°		≤ 15			
	Length variation (only on rectilinear sleeves) (%)	At working T°	§ 2.5.3	0 ÷ 5			
	Resistance to vacuum in temperature (%)		§ 2.5.4	≤ 10			
	Joint bursting/withdrawing pressure (bar)	In natural state After aging	§ 2.5.5	Bursting/withdrawing ≥ 7			
	Adhesion between rubber and stiffener (N/cm width)	In natural state After aging	§ 2.5.6	≥ 20	≥ 15	≥ 20	

CHARACTERISTICS		TEST CONDITIONS	LIMITS		
			A	B	B-0*
COMPONENT	Adhesion between rubber and rubber (if applicable) (N/cm width)	§ 2.5.6	≥ 8		
	Resistance to ozone	§ 2.5.7	No splits		
	Resistance to cold	§ 2.5.8	No break, cracking or splits		
	Resistance to pulsing pressure (cycles)	§ 2.5.9	≥ 150,000 (1) (unless otherwise indicated on drawing)		
	Expulsion test (bar)	§ 2.5.10	≥ 3		
	Oil permeability test ▼	§ 2.5.11	No leak, sweating of oil on the paper, no tearing or detachment of the inner liner		
	Measurement of impurities	§ 2.5.12 and Std. 7.G2183	Weight ≤ 8 mg/dm ² Dimensions ≤ 1000 μm u.m		
	Permanent deformation (%)	§ 2.5.13	≤ 65	≤ 75	≤ 75

(1) In absence of bursting, leaks, spalling or tearing of the coating, break of stiffener or diametral deformations (even localized) of extension higher than 20%. During the test no sliding of the connection toward the ogive is allowed. Any nonconformity detected during the test on the connections out of the supply purpose must be signaled to the relevant Technical Bodies. At the end of the tests, check the absence of detachment, tearing on inner liners for oil protection.

- * The shown values refer to the inner liner material for the oil protection (FVMQ/FPM), for the intermediate Layer and coating, the values are the ones of Type B.
- Values under study to be stated during the qualification step.
- Or > 15 N/mm of thickness.
- ▼ Measurement not applicable to Type B for the specific characteristic of the silicon.

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Sleeve Types: **C - D - E - F**

CHARACTERISTICS			TEST CONDI- TIONS	LIMITS				
				C	D	E	F	
Dimensions and tolerances			-	According to drawing				
Marking			-	§ 2.2				
Visual inspection			-	§ 2.3				
MATERIAL OF INNER DUCT/COATING	Hardness (IRHD - μ IRHD)	new supplied		Std. 50408 ISO 48	To be stated during qualification step ± 3			
		After aging in air (max. variation)	70 h	§ 2.4.1.5.1 and Std. 50408 ISO 48	+ 10	●	+ 10	+ 8
			504 h		+ 15	●	+ 25	+ 15
		After aging in oil (max. variation)			- 10	●	- 15	- 15
	Resistance to tensile stress (N/mm ²)	new supplied		Std. 50405	≥ 13	●	≥ 8	≥ 14
		After aging in air (max. variation)	70 h	§ 2.4.1.5.1 and Std. 50405	- 10%	●	- 20 %	- 10%
			504 h		- 40	●	- 50	- 50
	Ultimate elon- gation (%)	new supplied		Std. 50405	≥ 200	●	≥ 250	≥ 300
		After aging in air (max. variation)	70 h	§ 2.4.1.5.1 and Std. 50405	- 50 %	●	- 25 %	- 25 %
			504 h		- 50	●	≥ 100 %	- 50
	Tearing (N/mm thickness)	new supplied		Std. 50412	≥ 35	●	≥ 35	≥ 35
		After aging in air (max. variation)	70 h	§ 2.4.1.5.1 and Std. 50412	- 15 %	●	- 35%	- 25 %
			504 h		- 30	●	- 50	- 50
Volume (%)	After aging in oil (max. variation)		§ 2.4.1.5.1	+ 10	●	+ 20	+ 25	
COMPONENT	Resistance to pressure		§ 2.5.1	No leakage, loss, burst or beginning of tearing allowed on the external surface.				
	Diametral expansion (%)	at 23 °C	§ 2.5.2	≤ 10				
		At working T°		≤ 15				
	Length variation (only on rectilinear sleeves) (%)	At working T°	§ 2.5.3	0 to 5				
	Resistance to vacuum in temperature (%)		§ 2.5.4	≤ 10				
	Joint burst- ing/withdrawing pres- sure (bar)	In natural state After aging	§ 2.5.5	Bursting/withdrawing ≥ 7				
Adhesion between rubber and stiffener (N/cm width)	In natural state After aging	§ 2.5.6	≥ 20	≥ 15	≥ 15	≥ 20		

(cont'd)

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	CHARACTERISTICS	TEST CONDITIONS	LIMITS			
			C	D	E	F
COMPONENT	Adhesion between rubber and rubber (if applicable) (N/cm width)	§ 2.5.6	≥ 8			
	Resistance to ozone	§ 2.5.7	No splits			
	Resistance to cold	§ 2.5.8	No break, cracking or splits			
	Resistance to pulsing pressure (cycles)	§ 2.5.9	≥ 150,000 (1) (unless otherwise indicated on drawing)			
	Expulsion test (bar)	§ 2.5.10	≥ 3			
	Oil permeability test	§ 2.5.11	No leak, sweating of oil on the paper, no tearing or detachment of the inner liner			
	Measurement of impurities	§ 2.5.12 and Std. 7.G2183	Weight ≤ 8 mg/dm ² Dimensions ≤ 1000 μm u.m			
	Permanent deformation (%)	§ 2.5.13	≤ 65	●	≤ 85	≤ 85

(2) In absence of bursting, leaks, spalling or tearing of the coating, break of stiffener or diametral deformations (even localized) of extension higher than 20%. During the test no sliding of the connection toward the ogive is allowed. Any nonconformity detected during the test on the connections out of the supply purpose must be signaled to the relevant Technical Bodies. At the end of the tests, check the absence of detachment, tearing on inner liners for oil protection.

- Values under study to be stated during the qualification step

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