The English language version is the original and the reference in case of dispute.

Rubber

Orientation

This issue differs from issue 5 in that the standards in the section Normative references have been updated to their latest revisions.

Contents

1 Scope and field of application

The standard gives guidelines for the specification of vulcanized rubber based on the properties of the individual rubber types. The standard contains specification tables for the physical properties that characterize each rubber as well as a designation system. Since a rubber’s physical properties depend on the type of rubber, all rubbers are classified into two types and sorted by hardness.

The standard includes:

- Natural rubber (NR)
- Styrene butadiene rubber (SBR)
- Nitrile rubber (NBR)
- Hydrogenated nitrile rubber (HNBR)
- Nitrile rubber mixed with PVC (NBR/PVC)
- Chloroprene rubber (CR)
- Acrylic rubber (ACM)
- Ethylene acrylic rubber (AEM)
- Fluorocarbon rubber (FKM)
- Silicone rubber (VMQ)
- Epichlorohydrin rubber (ECO)
- Ethylene propylene rubber (EPM and EPDM).

A rubber material can also be mixed with other polymers. The name of a rubber type is based on the main polymer in the rubber material

The specifications in this standard give a basic material that is satisfactory for general use. For specific product applications, materials with modified requirements may be needed. It might also be necessary to specify additional requirements, e.g. for dynamic properties.

2 Material designation

For each rubber polymer in this standard, one or several alternative materials are specified. When using this standard, start by selecting a rubber polymer in accordance with the Volvo design guidelines or ISO 7620, and then select the hardness. You can also supplement the designation with a supplementary requirement. How to designate the selected material is described in section 3 Designation system.

3 Designation system

The vulcanized rubber material number shall be designated by the number of this Volvo standard ”STD 412-0001", followed by rubber type, hardness, type number, and designation(s) for supplementary requirements.

Supplementary requirements:

C = Cold resistance

F = Fuel resistance

L = Long-term properties

O = Oil resistance

Oz = Ozone resistance

T = Tear resistance

U_1 = Shear modulus

U_2 = Compression modulus

U_3 = Damping

U_4 = Dynamic modulus

U_5 = Rebound resilience

Z1 = Min resistivity 10^6 Ωm at 23 ºC

E.g. STD 412-0001 NR 70-1-C-L-Oz

All materials have certain mandatory property requirements which they must fulfil. For certain materials, the requirements can be more stringent due to supplementary requirements. Table 1 lists the supplementary requirements that are possible for the different materials.

Table 1 – Supplementary requirements for the different materials

Material	Supplementary designation									
	C	F	L	O	Oz	T	U_1	U_2	U_3	Z1
Natural Rubber (NR) type 1, materials with high tensile properties and good compression set properties	X		X		X		X	X	X	
Natural Rubber (NR) type 2, materials with moderate tensile properties and moderate compression set properties	X		X		X		X	X	X	
Styrene Butadien Rubber (SBR) type 1, materials with high tensile properties and good compression set properties	X		X		X					
Styrene Butadien Rubber (SBR) type 2, materials with moderate tensile properties and moderate compression set properties	X		X		X					
Nitrile Rubber (NBR) type 1, acrylnitrile content approx. 33 %		X			X					
Nitrile Rubber (NBR) type 2, acrylnitrile content approx. 28 %					X					
Hydrogenated Nitrile Rubber (HNBR) type 1, materials with a high degree of hydrogenation										X
Hydrogenated Nitrile Rubber (HNBR) type 2, materials with a moderate degree of hydrogenation										X
Nitrile/PVC Rubber (NBR/PVC) type 1										X
Chloroprene Rubber (CR) type 1	X									X
Acrylic Rubber (ACM) type 1										
Ethylene Acrylic Rubber (AEM) type 1, moderate-swell type										
Ethylene Acrylic Rubber (AEM) type 2, low-swell type										
Ethylene Acrylic Rubber (AEM) type 3, designed for extruded products which are continuously vulcanized without overpressure										
Ethylene Acrylic Rubber (AEM) type 4, high-temperature type / moderate-swell type										
Fluorocarbon Rubber (FKM) type 1, copolymer										
Fluorocarbon Rubber (FKM) type 2, terpolymer										
Silicone Rubber (VMQ) type 1				X		X				
Epichlorohydrin Rubber (ECO) type 1										
Ethylene Propylene Rubber (EPDM) type 1, sulphur vulcanized	X									X
Ethylene Propylene Rubber (EPM and EPDM) type 2, peroxide vulcanized	X									X

Table 2 – Examples of material designation

Material	Material designation	Hardness	Supplementary designation
Natural Rubber (NR) type 1, with high tensile properties and good compression set properties	STD 412-0001 NR 40-1-C-L-Oz STD 412-0001 NR 50-1-C-L-Oz STD 412-0001 NR 60-1-C-L-Oz STD 412-0001 NR 70-1-C-L-Oz STD 412-0001 NR 80-1-C-L-Oz	40º IRH 50º IRH 60º IRH 70º IRH 80º IRH	Cold-resistant + Long-term properties + Ozone resistance
Natural Rubber (NR) type 2, with moderate tensile properties and moderate compression set properties	STD 412-0001 NR 40-2-C-L-Oz STD 412-0001 NR 50-2-C-L-Oz STD 412-0001 NR 60-2-C-L-Oz STD 412-0001 NR 70-2-C-L-Oz STD 412-0001 NR 80-2-C-L-Oz	40º IRH 50º IRH 60º IRH 70º IRH 80º IRH	Cold-resistant + Long-term properties + Ozone resistance
Styrene Butadiene Rubber (SBR) type 1, with high tensile properties and good compression set properties	STD 412-0001 SBR 40-1-C-L-Oz STD 412-0001 SBR 50-1-C-L-Oz STD 412-0001 SBR 60-1-C-L-Oz STD 412-0001 SBR 70-1-C-L-Oz STD 412-0001 SBR 80-1-C-L-Oz	40º IRH 50º IRH 60º IRH 70º IRH 80º IRH	Cold-resistant + Long-term properties + Ozone resistance
Styrene Butadiene Rubber (SBR) type 2, with moderate tensile properties and moderate compression set properties	STD 412-0001 SBR 40-2-C-L-Oz STD 412-0001 SBR 50-2-C-L-Oz STD 412-0001 SBR 60-2-C-L-Oz STD 412-0001 SBR 70-2-C-L-Oz STD 412-0001 SBR 80-2-C-L-Oz	40º IRHD 50º IRHD 60º IRHD 70º IRHD 80º IRHD	Cold-resistant + Long-term properties + Ozone resistance
Nitrile Rubber (NBR) type 1, acrylnitrile content approx. 33 %	STD 412-0001 NBR 40-1-F-Oz STD 412-0001 NBR 50-1-F-Oz STD 412-0001 NBR 60-1-F-Oz STD 412-0001 NBR 70-1-F-Oz STD 412-0001 NBR 80-1-F-Oz	40º IRH 50º IRH 60º IRH 70º IRH 80º IRH	Fuel resistance + Ozone resistance
Nitrile Rubber (NBR) type 2, acrylnitrile content approx. 28 %	STD 412-0001 NBR 40-2-Oz STD 412-0001 NBR 50-2-Oz STD 412-0001 NBR 60-2-Oz STD 412-0001 NBR 70-2-Oz STD 412-0001 NBR 80-2-Oz	40º IRH 50º IRH 60º IRH 70º IRH 80º IRH	Ozone resistance
Hydrogenated Nitrile Rubber (HNBR) type 1, with a high degree of hydrogenation	STD 412-0001 HNBR 50-1 STD 412-0001 HNBR 60-1 STD 412-0001 HNBR 70-1 STD 412-0001 HNBR 80-1	50º IRH 60º IRH 70º IRH 80º IRH	
Hydrogenated Nitrile Rubber (HNBR) type 2, with a moderate degree of hydrogenation	STD 412-0001 HNBR 50-2 STD 412-0001 HNBR 60-2 STD 412-0001 HNBR 70-2 STD 412-0001 HNBR 80-2	50º IRH 60º IRH 70º IRH 80º IRH	
Nitrile/PVC Rubber (NBR/PVC) type 1	STD 412-0001 NBR/PVC 50-1 STD 412-0001 NBR/PVC 60-1 STD 412-0001 NBR/PVC 70-1	50º IRH 60º IRH 70º IRH	
Chloroprene Rubber (CR) type 1	STD 412-0001 CR 40-1-C STD 412-0001 CR 50-1-C STD 412-0001 CR 60-1-C STD 412-0001 CR 70-1-C STD 412-0001 CR 80-1-C	40º IRH 50º IRH 60º IRH 70º IRH 80º IRH	
Acrylic Rubber (ACM) type 1	STD 412-0001 ACM 70-1 STD 412-0001 ACM 80-1	70º IRH 80º IRH	

Material	Material designation	Hardness	Supplementary designation
Ethylene Acrylic Rubber (AEM) type 1, moderate-swell type	STD 412-0001 AEM 40-1 STD 412-0001 AEM 50-1 STD 412-0001 AEM 60-1 STD 412-0001 AEM 70-1	40º Shore A 50º Shore A 60º Shore A 70º Shore A	
Ethylene Acrylic Rubber (AEM) type 2, low-swell type	STD 412-0001 AEM 40-2 STD 412-0001 AEM 50-2 STD 412-0001 AEM 60-2 STD 412-0001 AEM 70-2	40º Shore A 50º Shore A 60º Shore A 70º Shore A	
Ethylene Acrylic Rubber (AEM) type 3, designed for extruded products that are continously vulcanized without overpressure	STD 412-0001 AEM 65-3 STD 412-0001 AEM 75-3 STD 412-0001 AEM 85-3	65º Shore A 75º Shore A 85º Shore A	
Ethylene Acrylic Rubber (AEM) type 4, high-temperature type / moderate-swell type	STD 412-0001 AEM 60-4	60º Shore A	
Fluorocarbon Rubber (FKM) type 1, copolymer	STD 412-0001 FKM 60-1 STD 412-0001 FKM 70-1 STD 412-0001 FKM 80-1	60º IRH 70º IRH 80º IRH	
Fluorocarbon Rubber (FKM) type 2, terpolymer	STD 412-0001 FKM 70-2 STD 412-0001 FKM 80-2	70º IRH 80º IRH	
Silicone Rubber (VMQ) type 1	STD 412-0001 VMQ 20-1-O-T STD 412-0001 VMQ 30-1-O-T STD 412-0001 VMQ 40-1-O-T STD 412-0001 VMQ 50-1-O-T STD 412-0001 VMQ 60-1-O-T STD 412-0001 VMQ 70-1-O-T STD 412-0001 VMQ 80-1-O-T STD 412-0001 VMQ 70-1-O-T STD 412-0001 VMQ 80-1-O-T	20º IRH 30º IRH 40º IRH 50º IRH 60º IRH 70º IRH 80º IRH 70º IRH 80º IRH	Oil resistance + Tear resistance
Epichlorohydrin Rubber (ECO) type 1	STD 412-0001 ECO 50-1 STD 412-0001 ECO 60-1 STD 412-0001 ECO 70-1	50º IRH 60º IRH 70º IRH	
EPDM type 1, sulphur vulcanized	STD 412-0001 EPDM 30-1-C STD 412-0001 EPDM 40-1-C STD 412-0001 EPDM 50-1-C STD 412-0001 EPDM 60-1-C STD 412-0001 EPDM 70-1-C STD 412-0001 EPDM 80-1-C STD 412-0001 EPDM 90-1-C	30º IRH 40º IRH 50º IRH 60º IRH 70º IRH 80º IRH 90º IRH	Cold resistance
EPDM and EPM type 2, peroxide vulcanized	STD 412-0001 EPDM 60-2-C STD 412-0001 EPDM 70-2-C STD 412-0001 EPDM 80-2-C	60º IRH 70º IRH 80º IRH	Cold resistance

4 Indication in design-engineering documentation

The material type, material designation (including any condition) and standards document designation shall be stated in the technical documentation.

Given below is an example of indication of material according to this standard:

Example: RUBBER STD 412-0001 NR 70-1-C-L-Oz

5 Specifications

5.1 Natural Rubber (NR)

5.1.1 Natural Rubber (NR) type 1 (natural rubber with high tensile properties and good compression set properties)

Table 3 – Basic properties for NR, type 1

Property			Hardness and type number					Test method
			40-1	50-1	60-1	70-1	80-1	
Hardness	°IRH		40±5	50±5	60±5	70±5	80±5	ISO 48 Method N
Tensile strength	MPa	min	17	20	20	20	19	ISO 37 Test piece type 1
Elongation at break	%	min	550	500	450	350	250	
Tension set 70 °C / 72 h and 50 % strain	%	max	25	25	25	30	30	ISO 2285 Test method tension set constant tension.
Tear resistance	N/mm	min	40	45	50	50	50	ISO 34-1 Method C
Compression set 70 °C / 72 h	%	max	25	25	25	30	30	ISO 815-1 Method A Test pieces type A 1)
Change in hardness 70 °C / 72 h	°IRH		±5	±5	±5	±5	±5	ISO 48 Method N 1)
Change in tensile strength 70 °C / 72 h	%	max	-20	-20	-20	-20	-20	ISO 37 Test piece type 1 1)
Change in elongation at break 70 °C / 72 h	%	max	-30	-30	-30	-30	-30	

1) Ageing in accordance with ISO 188, method A

Table 4 – Supplementary properties for NR, type 1

Property					Hardness and type number					Test method
					40-1	50-1	60-1	70-1	80-1	
Long-term properties (L)	Compression set 70 °C / 42 days		%	Max	50	50	50	60	60	ISO 815-1 Method A. Test pieces type A [1)]
	Change in hardness 70 °C / 42 days		°IRH		+10 -5	+10 -5	+10 -5	+10 -5	+10 -5	ISO 48 Method N [1)]
	Change in tensile strength 70 °C / 42 days		%	Max	-40	-40	-40	-40	-40	ISO 37 Test piece type 1 [1)]
	Change in elongation at break 70 °C / 42 days		%	Max	-55	-55	-55	-55	-55	
Ozone resistance (Oz)	Ozone resistance 50 pphm / 40 °C / 96 h		%	Min	30	30	30	20	20	ISO 1431-1 Procedure C
Cold resistance Temp. retraction (C)		TR_{10}	°C	Max	-45	-45	-40	-40	-35	ISO 2921
		TR_{30}	°C	Max	-40	-40	-35	-30	-25	
Shear modulus (U_1)			KPa		150–300	200–500	300–900	400–1400	600–2200	ISO 1827 Method A
Compression modulus (U_2)			KPa		500–1000	700–1500	1000–2500	1300–4000	2000–6500	ISO 7743 Method B [1)]
Change in compression modulus at 70 °C (U_2)		70 h	%	Max	20	25	20	30	30	
		1000 h	%	Max	40	50	50	50	50	
Rebound resilience (U_3)			%	Min	40	40	35	35	-	ISO 4662 Apparatus B2 (Lüpke Pendulum)

5.1.2 Natural Rubber (NR) for type 2 (natural rubber with moderate tensile properties and moderate compression set properties)

Table 5 – Basic properties for NR, type 2

Property			Hardness and type number					Test method
			40-2	50-2	60-2	70-2	80-2	
Hardness	°IRH		40±5	50±5	60±5	70±5	80±5	ISO 48 Method N
Tensile strength	MPa	Min	12	14	14	14	12	ISO 37 Test piece type 1
Elongation at break	%	Min	400	400	400	300	200	
Tension set 70 °C / 72 h and 50 % strain	%	Max	50	50	50	50	50	ISO 2285 Test method tension set constant tension
Tear resistance	N/mm	Min	30	30	30	40	40	ISO 34-1 Method C
Compression set 70 °C / 72 h	%	Max	40	40	40	40	40	ISO 815-1 Method A Test pieces type A 1)
Change in hardness 70 °C / 72 h	°IRH		+10 -5	+10 -5	+10 -5	+10 -5	+10 -5	ISO 48 Method N 1)
Change in tensile strength 70 °C / 72 h	%	Max	-25	-25	-25	-25	-25	ISO 37 Test piece type 1 1)
Change in elongation at break 70 °C / 72 h	%	Max	-35	-35	-35	-35	-35	

1) Ageing in accordance with ISO 188, Method A

Table 6 – Supplementary properties for NR, type 2

<table>
<tr><th colspan="4" rowspan="2">Property</th><th colspan="5">Hardness and type number</th><th rowspan="2">Test method</th></tr>
<tr><th>40-2</th><th>50-2</th><th>60-2</th><th>70-2</th><th>80-2</th></tr>
<tr><td rowspan="4">Long-term properties (L)</td><td>Compression set 70 °C / 42 days</td><td>%</td><td>Max</td><td>70</td><td>70</td><td>70</td><td>80</td><td>80</td><td>ISO 815-1 Method A, Test pieces type A[1)]</td></tr>
<tr><td>Change in hardness 70 °C / 42 days</td><td colspan="2">°IRH</td><td>+15
-5</td><td>+15
-5</td><td>+15
-5</td><td>+15
-5</td><td>+15
-5</td><td>ISO 48 Method N [1)]</td></tr>
<tr><td>Change in tensile strength 70 °C / 42 days</td><td>%</td><td>Max</td><td>-45</td><td>-45</td><td>-45</td><td>-45</td><td>-45</td><td rowspan="2">ISO 37 Test piece type 1[1)]</td></tr>
<tr><td>Change in elongation at break 70 °C / 42 days</td><td>%</td><td>Max</td><td>-65</td><td>-65</td><td>-65</td><td>-65</td><td>-65</td></tr>
<tr><td>Ozone resistance (Oz)</td><td>Ozone resistance 50 pphm / 40 °C / 96 h</td><td>%</td><td>Min</td><td>30</td><td>30</td><td>30</td><td>20</td><td>20</td><td>ISO 1431-1 Procedure C</td></tr>
<tr><td colspan="2" rowspan="2">Cold resistance Temp. retraction (C) TR_{10}</td><td>°C</td><td>Max</td><td>-40</td><td>-40</td><td>-35</td><td>-35</td><td>-30</td><td rowspan="2">ISO 2921</td></tr>
<tr><td>°C</td><td>Max</td><td>-35</td><td>-35</td><td>-30</td><td>-25</td><td>-20</td></tr>
<tr><td colspan="2">Shear modulus (U_1)</td><td colspan="2">KPa</td><td>150–300</td><td>200–500</td><td>300–900</td><td>400–1400</td><td>600–2200</td><td>ISO 1827 Method A</td></tr>
<tr><td colspan="2">Compression modulus (U_2)</td><td colspan="2">KPa</td><td>500–1000</td><td>700–1500</td><td>1000–2500</td><td>1300–4000</td><td>2000–6500</td><td rowspan="3">ISO 7743 Method B[1)]</td></tr>
<tr><td colspan="2" rowspan="2">Change in compression modulus at 70 °C (U_2)   70 h / 1000 h</td><td>%</td><td>Max</td><td>20</td><td>25</td><td>20</td><td>30</td><td>30</td></tr>
<tr><td>%</td><td>Max</td><td>40</td><td>50</td><td>50</td><td>50</td><td>50</td></tr>
<tr><td colspan="2">Rebound resilience (U_3)</td><td>%</td><td>Min</td><td>40</td><td>40</td><td>35</td><td>35</td><td>-</td><td>ISO 4662 Apparatus B2 (Lüpke Pendulum)</td></tr>
</table>

1) Ageing in accordance with ISO 188, Method A

5.2 Styrene Butadiene Rubber (SBR)

5.2.1 Styrene Butadiene Rubber (SBR) type 1 (styrene butadiene rubber with high tensile properties and good compression set properties)

Table 7 – Basic properties for SBR, type 1

Property			Hardness and type number					Test method
			40-1	50-1	60-1	70-1	80-1	
Hardness	°IRH		40±5	50±5	60±5	70±5	80±5	ISO 48 Method N
Tensile strength	MPa	Min	12	14	14	14	12	ISO 37 Test piece type 1
Elongation at break	%	Min	500	450	400	350	250	
Tension set 70 °C / 72 h and 50 % strain	%	Max	25	25	25	30	30	ISO 2285 Test method tension set constant strain
Tear resistance	N/mm	Min	30	40	40	40	40	ISO 34-1 Method C
Compression set 70 °C / 72 h	%	Max	25	25	25	30	30	ISO 815-1 Method A Test pieces type A[1)]
Change in hardness 70 °C / 72 h	°IRH	Max	+5	+5	+5	+5	+5	ISO 48 Method N [1)]
Change in tensile strength 70 °C / 72 h	%	Max	-20	-20	-20	-20	-20	ISO 37 Test piece type 1 [1)]
Change in elongation at break 70 °C / 72 h	%	Max	-30	-30	-30	-30	-30	

Table 8 – Supplementary properties for SBR, type 1

Property				Hardness and type number					Test method
				40-1	50-1	60-1	70-1	80-1	
Longterm properties (L)	Compression set 70 °C / 42 days	%	Max	50	50	50	60	60	ISO 815-1 Method A Test pieces type A[1)]
	Change in hardness 70 °C / 42 days	°IRH	Max	+10	+10	+10	+10	+10	ISO 48 Method N [1)]
	Change in tensile strength 70 °C / 42 days	%	Max	-40	-40	-40	-40	-40	ISO 37 Test piece type 1 [1)]
	Change in elongation at break 70 °C / 42 days	%	Max	-55	-55	-55	-55	-55	
Ozone resistance (Oz)	Ozone resistance 50 pphm / 40 °C / 96 h	%	Min	30	30	30	20	20	ISO 1431-1 Procedure C
Cold resistance Temp. retraction (C)	TR_{10}	°C	Max	-40	-40	-35	-35	-30	ISO 2921
	TR_{30}	°C	Max	-35	-35	-30	-25	-20	

1) Ageing in accordance with ISO 188, Method A

5.2.2 Styrene Butadiene Rubber (SBR) type 2 (styrene butadiene rubber with moderate tensile properties and moderate compression set properties)

Table 9 – Basic properties for SBR, type 2

Property			Hardness and type number					Test method
			40-2	50-2	60-2	70-2	80-2	
Hardness	°IRH		40±5	50±5	60±5	70±5	80±5	ISO 48 Method N
Tensile strength	MPa	Min	7	10	10	10	7	ISO 37 Test piece type 1
Elongation at break	%	Min	400	400	400	300	200	
Tension set 70 °C / 72 h	%	Max	50	50	50	50	50	ISO 2285 Test method tension set constant load
Tear resistance	N/mm	Min	25	35	35	35	35	ISO 34-1 Method C
Compression set 70 °C / 72 h	%	Max	50	50	50	50	50	ISO 815-1 Method A Test pieces type A 1)
Change in hardness 70 °C / 72 h	°IRH	Max	+5	+5	+5	+5	+5	ISO 48 Method N 1)
Change in tensile strength 70 °C / 72 h	%	Max	-25	-25	-25	-25	-25	ISO 37 Test piece type 1 1)
Change in elongation at break 70 °C / 72 h	%	Max	-35	-35	-35	-35	-35	

Table 10 – Supplementary properties for SBR, type 2

Property				Hardness and type number					Test method
				40-2	50-2	60-2	70-2	80-2	
Long-term properties (L)	Compression set 70 °C / 42 days	%	Max	70	70	70	80	80	ISO 815-1 Method A Test pieces type A 1)
	Change in hardness 70 °C / 42 days	°IRH	Max	+15	+15	+15	+15	+15	ISO 48 Method N 1)
	Change in tensile strength 70 °C / 42 days	%	Max	-45	-45	-45	-45	-45	ISO 37 Test piece type 1 1)
	Change in elongation at break 70 °C / 42 days	%	Max	-65	-65	-65	-65	-65	
Ozone resistance (Oz)	Ozone resistance 50 pphm / 40 °C / 96 h	%	Min	30	30	30	20	20	ISO 1431-1 Procedure C
Cold resistance Temp. retraction (C)	TR_{10}	°C	Max	-40	-40	-35	-35	-30	ISO 2921
	TR_{30}	°C	Max	-35	-35	-30	-25	-20	

1) Ageing in accordance with ISO 188, Method A

5.3 Nitrile Rubber (NBR)

5.3.1 Nitrile Rubber (NBR) type 1 (acrylonitrile content approx. 33 %)

Table 11 – Basic properties for NBR type 1

Property				Hardness and type number					Test method
				40-1	50-1	60-1	70-1	80-1	
Hardness		°IRH		40±5	50±5	60±5	70±5	80±5	ISO 48 Method N
Tensile strength		MPa	Min	7	7	10	10	10	ISO 37 Test piece type 1
Elongation at break		%	Min	400	350	300	250	200	
Tension set 100 °C / 72 h and 50 % strain		%	Max	25	25	25	25	25	ISO 2285 Test method tension set constant strain
Tear resistance		N/mm	Min	15	20	20	20	20	ISO 34-1 Method C
Compression set 100 °C / 72 h		%	Max	25	25	25	25	25	ISO 815-1 Method A Test pieces type A[1)]
Compression set 100 °C / 42 days		%	Max	50	50	50	50	50	
Change in hardness 100 °C / 72 h		°IRH	Max	+10	+10	+10	+10	+5	ISO 48 Method N[1)]
Change in hardness 100 °C / 42 days		°IRH	Max	+25	+25	+15	+15	+10	
Change in tensile strength 100 °C / 72 h		%	Max	-20	-20	-20	-20	-20	ISO 37 Test piece type 1[1)]
Change in tensile strength 100 °C / 42 days		%	Max	-20	-20	-20	-20	-20	
Change in elongation at break 100 °C / 72 h		%	Max	-30	-30	-30	-30	-30	
Change in elongation at break 100 °C / 42 days		%	Max	-65	-65	-65	-65	-65	
Cold resistance Temp. retraction	TR_{10}	°C	Max	-30	-25	-25	-25	-25	ISO 2921
	TR_{30}	°C	Max	-25	-20	-20	-20	-20	
Resistance to liquids 100 °C / 72 h (Change in volume)	ASTM Oil No. 1	%		+5 -15	+5 -10	+5 -10	+5 -10	+5 -10	ISO 1817
	ASTM Oil No. 3	%		+20 -5	+10 -5	+10 -5	+10 -5	+10 -5	

Table 12 – Supplementary properties for NBR, type 1

Property				Hardness and type number					Test method
				40-1	50-1	60-1	70-1	80-1	
Ozone resistance (Oz)	Ozone resistance 50 pphm / 40 °C / 96 h	°C	Max	20	20	20	15	10	ISO 1431-1 Procedure C

1) Ageing in accordance with ISO 188, Method A

5.3.2 Nitrile Rubber (NBR) type 2 (acrylonitrile content approx. 28 %)

Table 13 – Basic properties for NBR type 2

Property				Hardness and type number					Test method
				40-2	50-2	60-2	70-2	80-2	
Hardness		°IRH		40±5	50±5	60±5	70±5	80±5	ISO 48 Method N
Tensile strength		MPa	Min	7	7	10	10	10	ISO 37 Test piece type 1
Elongation at break		%	Min	400	350	300	250	200	
Tension set 100 °C / 72 h and 50 % strain		%	Max	20	20	20	20	20	ISO 2285 Test method tension set constant strain
Tear resistance		N/mm	Min	15	20	20	20	20	ISO 34-1 Method C
Compression set 100 °C / 72 h		%	Max	20	20	20	20	20	ISO 815-1 Method A Test pieces type A[1)]
Compression set 100 °C / 42 days		%	Max	50	50	50	50	50	
Change in hardness 100 °C / 72 h		°IRH	Max	+10	+10	+10	+10	+10	ISO 48 Method N [1)]
Change in hardness 100 °C / 42 days		°IRH	Max	+25	+25	+25	+25	+25	
Change in tensile strength 100 °C / 72 h		%	Max	-20	-20	-20	-20	-20	ISO 37 Test piece type 1[1)]
Change in tensile strength 100 °C / 42 days		%	Max	-20	-20	-20	-20	-20	
Change in elongation at break 100 °C / 72 h		%	Max	-30	-30	-30	-30	-30	
Change in elongation at break 100 °C / 42 days		%	Max	-65	-65	-65	-65	-65	
Cold resistance Temp. retraction	TR_{10}	°C	Max	-40	-40	-35	-35	-35	ISO 2921
	TR_{30}	°C	Max	-35	-35	-30	-30	-30	
Resistance to liquids 100 °C / 72 h (Change in volume)	ASTM Oil No. 1	%		+5 -15	+5 -15	+5 -15	+5 -15	+5 -15	ISO 1817
	ASTM Oil No. 3	%		+25 0	+25 0	+25 0	+25 0	+25 0	

Table 14 – Supplementary properties for NBR, type 2

Property				Hardness and type number					Test method
				40-2	50-2	60-2	70-2	80-2	
Ozone resistance (Oz)	Ozone resistance 50 pphm / 40 °C / 96 h	°C	Max	20	20	20	15	10	ISO 1431-1 Procedure C

1) Ageing in accordance with ISO 188, Method A

5.4 Hydrogenated Nitrile Rubber (HNBR)

5.4.1 Hydrogenated Nitrile Rubber (HNBR) type 1 (materials with a high degree of hydrogenation)

Table 15 – Basic properties for HNBR type 1

Property				Hardness and type number				Test method
				50-1	60-1	70-1	80-1	
Hardness		°IRH		50±5	60±5	70±5	80±5	ISO 48 Method N
Tensile strength		MPa	Min	15	18	20	20	ISO 37 Test piece type 1
Elongation at break		%	Min	500	350	250	150	
Tension set 150 °C / 72 h and 50 % strain		%	Max	30	30	30	35	ISO 2285 Test method tension set constant strain
Tear resistance		N/mm	Min	15	20	25	35	ISO 34-1 Method C
Compression set 150 °C / 72 h		%	Max	30	30	30	35	ISO 815-1 Method A Test pieces type A[1]
Compression set 150 °C / 42 days		%	Max	60	60	60	70	
Change in hardness 150 °C / 72 h		°IRH	Max	+10	+5	+5	+5	ISO 48 Method N [1]
Change in hardness 150 °C / 42 days		°IRH	Max	+20	+15	+15	+15	
Change in tensile strength 150 °C / 72 h		%	Max	-15	-15	-15	-15	ISO 37 Test piece type 1[1]
Change in tensile strength 150 °C / 42 days		%	Max	-25	-25	-25	-25	
Change in elongation at break 150 °C / 72 h		%	Max	-30	-30	-30	-30	
Change in elongation at break 150 °C / 42 days		%	Max	-70	-70	-70	-70	
Cold resistance Temp. retraction	TR_{10}	°C	Max	-15	-15	-15	-15	ISO 2921
	TR_{30}	°C	Max	-10	-10	-10	-8	
Ozone resistance 50 pphm / 40 °C / 96 h		%	Min	80	80	60	60	ISO 1431-1 Procedure C
Resistance to liquids 150 °C / 72 h (Change in volume)	ASTM Oil No. 1	%		+5 -1	+5 -1	+5 -1	+5 -1	ISO 1817
	ASTM Oil No. 3	%		+30 -0	+30 -0	+30 -0	+30 -0	

Table 16 – Supplementary properties for HNBR, type 1

Property			Hardness and type number				Test method
			50-2	60-2	70-2	80-2	
Resistivity at 23 ºC (Z_1)	Ωm	Min	10^6	10^6	10^6	10^6	ISO 1853 Method 1

1) Ageing in accordance with ISO 188, method A

5.4.2 Hydrogenated Nitrile Rubber (HNBR) type 2 (materials with a moderate degree of hydrogenation)

Table 17 – Basic properties for HNBR type 2

Property			Hardness and type number				Test method
			50-1	60-1	70-1	80-1	
Hardness	°IRH		50±5	60±5	70±5	80±5	ISO 48 Method N
Tensile strength	MPa	Min	12	12	12	12	ISO 37 Test piece type 1
Elongation at break	%	Min	400	300	200	150	
Tension set 150 °C / 72 h and 50 % strain	%	Max	30	30	30	35	ISO 2285 Test method tension set constant strain
Tear resistance	N/mm	Min	10	15	20	25	ISO 34-1 Method C
Compression set 125 °C / 72 h	%	Max	25	25	25	30	ISO 815-1 Method A Test pieces type A[1)]
Compression set 125 °C / 42 days	%	Max	50	50	50	60	
Change in hardness 150 °C / 72 h	°IRH	Max	+10	+5	+5	+5	ISO 48 Method N [1)]
Change in hardness 150 °C / 42 days	°IRH	Max	+20	+15	+15	+15	
Change in tensile strength 150 °C / 72 h	%	Max	-20	-20	-20	-20	ISO 37 Test piece type 1[1)]
Change in tensile strength 150 °C / 42 days	%	Max	-35	-35	-35	-35	
Change in elongation at break 150 °C / 72 h	%	Max	-30	-30	-30	-30	
Change in elongation at break 150 °C / 42 days	%	Max	-75	-75	-75	-75	
Cold resistance Temp. retraction TR_{10}	°C	Max	-25	-25	-25	-25	ISO 2921
TR_{30}	°C	Max	-20	-20	-20	-20	
Ozone resistance 50 pphm / 40 °C / 96 h	%	Min	80	80	60	60	ISO 1431-1 Procedure C
Resistance to liquids 150 °C / 72 h (Change in volume) ASTM Oil No. 1	%		±5	±5	±5	±5	ISO 1817
ASTM Oil No. 3	%		+30 -0	+30 -0	+30 -0	+30 -0	

Table 18 – Supplementary properties for HNBR, type 2

Property			Hardness and type number				Test method
			50-2	60-2	70-2	80-2	
Resistivity at 23 ºC (Z_1)	Ωm	Min	10^6	10^6	10^6	10^6	ISO 1853 Method 1

1) Ageing in accordance with ISO 188, method A

5.5 Nitrile Rubber mixed with PVC (NBR/PVC)

5.5.1 Nitrile Rubber mixed with PVC (NBR/PVC) type 1

Table 19 – Basic properties for NBR/PVC type 1

Property				Hardness and type number			Test method
				50-1	60-1	70-1	
Hardness		°IRH		50±5	60±5	70±5	ISO 48 Method N
Tensile strength		Mpa	Min	10	10	10	ISO 37 Test piece type 1
Elongation at break		%	Min	300	250	200	
Tension set 100 °C / 72 h and 50 % strain		%	Max	40	40	40	ISO 2285 Test method tension set constant strain
Tear resistance		N/mm	Min	20	25	30	ISO 34-1 Method C
Compression set 100 °C / 72 h		%	Max	40	40	40	ISO 815-1 Method A Test pieces type A 1)
Compression set 100 °C / 42 days		%	Max	60	60	60	
Change in hardness 100 °C / 72 h		°IRH	Max	+10	+10	+10	ISO 48 Method N 1)
Change in hardness 100 °C / 42 days		°IRH	Max	+15	+15	+15	
Change in tensile strength 100 °C / 72 h		%	Max	-20	-20	-20	ISO 37 Test piece type 1 1)
Change in tensile strength 100 °C / 42 days		%	Max	-25	-25	-25	
Change in elongation at break 100 °C / 72 h		%	Max	-40	-40	-40	
Change in elongation at break 100 °C / 42 days		%	Max	-60	-60	-60	
Cold resistance Temp. retraction	TR_{10}	°C	Max	-20	-20	-20	ISO 2921
	TR_{30}	°C	Max	-15	-15	-10	
Ozone resistance 50 pphm / 40 °C / 96 h		%	Min	40	40	30	ISO 1431-1 Procedure C

Table 20 – Supplementary properties for NBR/PVC

Property			Hardness and type number			Test method
			50-2	60-2	70-2	
Resistivity at 23 °C (Z_1)	Ωm	Min	10^6	10^6	10^6	ISO 1853 Method 1

1) Ageing in accordance with ISO 188, method A

5.6 Chloroprene Rubber (CR)

5.6.1 Chloroprene Rubber (CR) type 1

Table 21 – Basic properties for CR type 1

Property				Hardness and type number					Test method
				40-1	50-1	60-1	70-1	80-1	
Hardness		°IRH		40±5	50±5	60±5	70±5	80±5	ISO 48 Method N
Tensile strength		MPa	Min	9	10,5	10,5	10,5	10,5	ISO 37 Test piece type 1
Elongation at break		%	Min	350	300	250	200	150	
Tension set 100 °C / 72 h and 50 % strain		%	Max	35	35	35	35	35	ISO 2285 Test method tension set constant strain
Tear resistance		N/mm	Min	10	15	20	20	20	ISO 34-1 Method C
Compression set 100 °C / 72 h		%	Max	35	35	35	35	35	ISO 815-1 Method A Test pieces type A 1)
Compression set 100 °C / 42 days		%	Max	60	60	60	60	60	
Change in hardness 100 °C / 72 h		°IRH	Max	+5	+5	+5	+5	+5	ISO 48 Method N 1)
Change in hardness 100 °C / 42 days		°IRH	Max	+15	+15	+15	+15	+15	
Change in tensile strength 100 °C / 72 h		%	Max	-20	-20	-20	-20	-20	ISO 37 Test piece type 1 1)
Change in tensile strength 100 °C / 42 days		%	Max	-35	-35	-35	-35	-35	
Change in elongation at break 100 °C / 72 h		%	Max	-30	-30	-30	-30	-30	
Change in elongation at break 100 °C / 42 days		%	Max	-60	-60	-60	-60	-60	
Cold resistance Temp. retraction	TR_{10}	°C	Max	-30	-30	-30	-25	-20	ISO 2921
	TR_{30}	°C	Max	-25	-25	-25	-20	-15	
Ozone resistance 50 pphm / 40 °C / 96 h		%	Min	60	60	50	50	40	ISO 1431-1 Procedure C
Resistance to liquids 100 °C / 72 h (Change in volume)	ASTM Oil No. 1	%		+10 -5	+10 -5	+10 -5	+10 -5	+10 -5	ISO 1817
	ASTM Oil No. 3	%		+80 0	+80 0	+80 0	+80 0	+80 0	

Table 22 Supplementary properties for CR

Property				Hardness and type number					Test method
				40-1	50-1	60-1	70-1	80-1	
Cold resistance (C)	Low temperature compression set -10 °C / 72 h	%	Max	30	30	30	50	90	ISO 815-2 2)
Resistivity at 23 ºC (Z_1)		Ωm	Min	10^6	10^6	10^6	10^6	10^6	ISO 1853 Method 1

1) Ageing in accordance with ISO 188, method A
2) Change in hardness max 10 °IRH at -10 °C

5.7 Acrylic Rubber (ACM)

5.7.1 Acrylic Rubber (ACM) type 1

Table 23 – Basic properties for ACM type 1

Property				Hardness and type number 70-1	80-1	Test method
Hardness		°IRH		70±5	80±5	ISO 48 Method N
Tensile strength		MPa	Min	9	9	ISO 37 Test piece type 1
Elongation at break		%	Min	175	125	
Tension set 125 °C / 72 h and 50 % strain		%	Max	40	45	ISO 2285 Test method tension set constant strain
Tear resistance		N/mm	Min	20	20	ISO 34-1 Method C
Compression set 125 °C / 72 h		%	Max	25	30	ISO 815-1 Method A Test pieces type A[1)]
Compression set 125 °C / 42 days		%	Max	55	60	
Change in hardness 125 °C / 72 h		°IRH	Max	+5	+5	ISO 48 Method N [1)]
Change in hardness 125 °C / 42 days		°IRH	Max	+10	+10	
Change in tensile strength 125 °C / 72 h		%	Max	-10	-10	ISO 37 Test piece type 1[1)]
Change in tensile strength 125 °C / 42 days		%	Max	-30	-30	
Change in elongation at break 125 °C / 72 h		%	Max	-20	-20	
Change in elongation at break 125 °C / 42 days		%	Max	-60	-60	
Cold resistance Temp. retraction	TR_{10}	°C	Max	-25	-25	ISO 2921
	TR_{30}	°C	Max	-15	-15	
Ozone resistance 50 pphm / 40 °C / 96 h		%	Min	60	60	ISO 1431-1 Procedure C
Resistance to liquids 150 °C / 72 h (Change in volume)	ASTM Oil No. 1	%		±5	±5	ISO 1817
	ASTM Oil No. 3	%		+20 0	+20 0	

1) Ageing in accordance with ISO 188, method A

5.8 Ethylene Acrylic Rubber (AEM)

5.8.1 Ethylene Acrylic Rubber (AEM) type 1 (moderate-swell type)

Table 24 – Basic properties for AEM, type 1

Property				Hardness and type number				Test method
				40-1	50-1	60-1	70-1	
Hardness		°Shore A		40±5	50±5	60±5	70±5	ISO 48 Method N
Tensile strength		MPa	Min	7	9	10	11	ISO 37 Test piece type 1
Elongation at break		%	Min	400	350	300	250	
Tension set 150 °C / 72 h and 50 % strain		%	Max	15	15	15	15	ISO 2285 Test method tension set constant strain
Tear resistance		N/mm	Min	15	20	20	20	ISO 34-1 Method C
Compression set 125 °C / 72 h		%	Max	15	15	15	15	ISO 815-1 Method A, Test pieces type A 1)
Compression set 125 °C / 42 days		%	Max	40	40	40	40	
Change in hardness 125 °C / 72 h		°Shore A	Max	+5	+5	+5	+5	ISO 48 Method N 1)
Change in hardness 125 °C / 42 days		°Shore A	Max	+10	+10	+10	+10	
Change in tensile strength 125 °C / 72 h		%	Max	-20	-20	-20	-20	ISO 37 Test piece type 1 1)
Change in tensile strength 125 °C / 42 days		%	Max	-20	-20	-20	-20	
Change in elongation at break 125 °C / 72 h		%	Max	-20	-20	-20	-20	
Change in elongation at break 125 °C / 42 days		%	Max	-40	-40	-40	-40	
Cold resistance Temp. retraction	TR_{10}	°C	Max	-28	-28	-28	-28	ISO 2921
	TR_{30}	°C	Max	-20	-20	-20	-20	
Ozone resistance 50 pphm / 40 °C / 96 h		%	Min	80	80	80	60	ISO 1431-1 Procedure C
Resistance to liquids 150 °C / 72 h (Change in volume)	ASTM Oil No. 1	%		±5	±5	±5	±5	ISO 1817
	ASTM Oil No. 3	%		+60 0	+60 0	+60 0	+60 0	

1) Ageing in accordance with ISO 188, Method A

5.8.2 Ethylene Acrylic Rubber (AEM) type 2 (low-swell type)

Table 25 – Basic properties for AEM, type 2

Property				Hardness and type number				Test method
				40-2	50-2	60-2	70-2	
Hardness		°Shore A		40±5	50±5	60±5	70±5	ISO 48 Method N
Tensile strength		MPa	Min	7	9	10	11	ISO 37 Test piece type 1
Elongation at break		%	Min	400	350	300	250	
Tension set 150 °C / 72 h and 50 % strain		%	Max	15	15	15	15	ISO 2285 Test method tension set constant strain
Tear resistance		N/mm	Min	15	20	20	20	ISO 34-1 Method C
Compression set 125 °C / 72 h		%	Max	15	15	15	15	ISO 815-1 Method A Test pieces type A[1)]
Compression set 125 °C / 42 days		%	Max	40	40	40	40	
Change in hardness 125 °C / 72 h		°Shore A	Max	+5	+5	+5	+5	ISO 48 Method N [1)]
Change in hardness 125 °C / 42 days		°Shore A	Max	+10	+10	+10	+10	
Change in tensile strength 125 °C / 72 h		%	Max	-20	-20	-20	-20	ISO 37 Test piece type 1[1)]
Change in tensile strength 125 °C / 42 days		%	Max	-20	-20	-20	-20	
Change in elongation at break 125 °C / 72 h		%	Max	-20	-20	-20	-20	
Change in elongation at break 125 °C / 42 days		%	Max	-40	-40	-40	-40	
Cold resistance Temp. retraction	TR_{30}	°C	Max	-25	-25	-25	-25	ISO 2921
	TR_{30}	°C	Max	-15	-15	-15	-15	
Ozone resistance 50 pphm / 40 °C / 96 h		%	Min	80	80	80	60	ISO 1431-1 Procedure C
Resistance to liquids 150 °C / 72 h (Change in volume)	ASTM Oil No. 1	%		+5 -10	+5 -10	+5 -10	+5 -10	ISO 1817
	ASTM Oil No. 3	%		+30 0	+30 0	+30 0	+30 0	

1) Ageing in accordance with ISO 188, method A

5.8.3 Ethylene Acrylic Rubber (AEM) type 3 (designed for extruded products that are continuously vulcanized without overpressure / moderate-swell type)

Table 26 – Basic properties for AEM, type 3

Property				Hardness and type number			Test method
				65-3	75-3	85-3	
Hardness		°Shore A		65	75	85	ISO 48 Method N
Tensile strength		MPa	Min	6	9	10	ISO 37 Test piece type 1
Elongation at break		%	Min	200	175	150	
Tension set 150 °C / 72 h and 50 % strain		%	Max	10	10	10	ISO 2285 Test method tension set constant strain
Tear resistance		N/mm	Min	20	25	25	ISO 34-1 Method C
Compression set 125 °C / 72 h		%	Max	50	50	50	ISO 815-1 Method A Test pieces type A[1)]
Compression set 125 °C / 42 days		%	Max	80	80	80	
Change in hardness 125°C / 72 h		°Shore A		± 5	± 5	± 5	ISO 48 Method N [1)]
Change in hardness 125 °C / 42 days		°Shore A		+10/-0	+10/-0	+10/-0	
Change in tensile strength 125 °C / 72 h		%		± 5	± 5	± 5	ISO 37 Test piece type 1[1)]
Change in tensile strength 125 °C / 42 days		%		+10/-5	+10/-5	+10/-5	
Change in elongation at break 125 °C / 72 h		%		+7/-10	+7/-10	+7/-10	
Change in elongation at break 125 °C / 42 days		%	Max	-15	-15	-15	
Cold resistance Temp. retraction	TR_{10}	°C	Max	-23	-23	-23	ISO 2921
	TR_{30}	°C	Max	-15	-15	-15	
Ozone resistance 50 pphm / 40 °C / 96 h		%	Min	80	60	60	ISO 1431-1 Procedure C
Resistance to liquids 150 °C / 72 h (Change in volume)	ASTM Oil No. 1	%		+10 0	+7 0	+5 0	ISO 1817
	ASTM Oil No. 3	%		+60 0	+60 0	+60 0	

1) Ageing in accordance with ISO 188, Method A

5.8.4 Ethylene Acrylic Rubber (AEM) type 4 (high-temperature type / moderate-swell type)

Table 27 – Basic properties for AEM, type 4

Property				Hardness and type number	Test method
				60-4	
Hardness		°Shore A		60	ISO 48 Method N
Tensile strength		MPa	Min	14	ISO 37 Test piece type 1
Elongation at break		%	Min	200	
Tension set 175 °C / 72 h and 50 % strain		%	Max	15	ISO 2285 Test method tension set constant strain
Tear resistance		N/mm	Min	12	ISO 34-1 Method C
Compression set 175 °C / 72 h		%	Max	25	ISO 815-1 Method A Test pieces type A[1)]
Compression set 175 °C / 42 days		%	Max	50	
Change in hardness 175°C / 72 h		°Shore A		± 5	ISO 48 Method N [1)]
Change in hardness 175 °C / 42 days		°Shore A		± 5	
Change in tensile strength 175 °C / 72 h		%	Max	-40	ISO 37 Test piece type 1[1)]
Change in tensile strength 175 °C / 42 days		%	Max	-50	
Change in elongation at break 175 °C / 72 h		%		+7/-10	
Change in elongation at break 175 °C / 42 days		%	Max	-50	
Cold resistance Temp. retraction	TR_{10}	°C	Max	-30	ISO 2921
	TR_{30}	°C	Max	-25	
Ozone resistance 50 pphm / 40 °C / 96 h		%	Min	80	ISO 1431-1 Procedure C
Resistance to liquids 150 °C / 72 h (Change in volume)	ASTM Oil No. 1	%		± 5	ISO 1817
	ASTM Oil No. 3	%		+60 -0	

1) Ageing in accordance with ISO 188, Method A

5.9 Fluorocarbon Rubber (FKM)

5.9.1 Fluorocarbon Rubber type copolymer (FKM) type 1

Table 28 – Basic properties for FKM type 1

Property				Hardness and type number 60-1	70-1	80-1	Test method
Hardness		°IRH		60±5	70±5	80±5	ISO 48 Method N
Tensile strength		MPa	Min	11	10	10	ISO 37 Test piece type 1
Elongation at break		%	Min	200	150	150	
Tension set 175 °C / 72 h and 50 % strain		%	Max	20	20	20	ISO 2285 Test method tension set constant strain
Tear resistance		N/mm	Min	15	15	15	ISO 34-1 Method C
Compression set 175 °C / 72 h		%	Max	20	20	20	ISO 815-1 Method A Test pieces type A[1)]
Compression set 175 °C / 42 days		%	Max	50	50	50	
Change in hardness 175 °C / 72 h		°IRH	Max	+5	+5	+5	ISO 48 Method N [1)]
Change in hardness 175 °C / 42 days		°IRH	Max	+10	+10	+10	
Change in tensile strength 175 °C / 72 h		%	Max	-15	-15	-15	ISO 37 Test piece type 1[1)]
Change in tensile strength 175 °C / 42 days		%	Max	-15	-15	-15	
Change in elongation at break 175 °C / 72 h		%	Max	-10	-10	-10	
Change in elongation at break 175 °C / 42 days		%	Max	-15	-15	-15	
Cold resistance Temp. retraction	TR_{10}	°C	Max	-15	-15	-15	ISO 2921
	TR_{30}	°C	Max	-10	-10	-10	
Resistance to liquids 150 °C / 72 h (Change in volume)	ASTM Oil No. 1	%		+5 0	+5 0	+5 0	ISO 1817
	ASTM Oil No. 3	%		+10 -5	+10 -5	+10 -5	

1) Ageing in accordance with ISO 188, method A

5.9.2 Fluorocarbon Rubber type terpolymer (FKM) type 2

Table 29 – Basic properties for FKM type 2

Property				Hardness and type number 70-2	80-2	Test method
Hardness		°IRH		70±5	80±5	ISO 48 Method N
Tensile strength		MPa	Min	10	10	ISO 37 Test piece type 1
Elongation at break		%	Min	200	150	
Tension set 150 °C / 72 h and 50 % strain		%	Max	20	20	ISO 2285 Test method tension set constant strain
Tear resistance		N/mm	Min	20	20	ISO 34-1 Method C
Compression set 150 °C / 72 h		%	Max	20	20	ISO 815-1 Method A Test pieces type A 1)
Compression set 150 °C / 42 days		%	Max	50	50	
Change in hardness 150 °C / 72 h		°IRH	Max	+5	+5	ISO 48 Method N 1)
Change in hardness 150 °C / 42 days		°IRH	Max	+10	+10	
Change in tensile strength 150 °C / 72 h		%	Max	-15	-15	ISO 37 Test piece type 1 1)
Change in tensile strength 150 °C / 42 days		%	Max	-15	-15	
Change in elongation at break 150 °C / 72 h		%	Max	-10	-10	
Change in elongation at break 150 °C / 42 days		%	Max	-15	-15	
Cold resistance Temp. retraction	TR_{10}	°C	Max	-12	-12	ISO 2921
	TR_{30}	°C	Max	-8	-8	
Resistance to liquids 150 °C / 72 h (Change in volume)	ASTM Oil No. 1	%		+5 0	+5 0	ISO 1817
	ASTM Oil No. 3	%		±5	±5	

1) Ageing in accordance with ISO 188, method A

5.10 Silicone Rubber (VMQ)

5.10.1 Silicone Rubber (VMQ) type 1

Table 30 – Basic properties for VMQ 1

Property			Hardness and type number							Test method
			20-1	30-1	40-1	50-1	60-1	70-1	80-1	
Hardness	°IRH		20±5	30±5	40±5	50±5	60±5	70±5	80±5	ISO 48 Method N
Tensile strength	MPa	Min	5	5	5	5	7	7	7	ISO 37 Test piece type 1
Elongation at break	%	Min	650	600	500	400	300	200	150	
Tension set 150 °C / 72 h and 50 % strain	%	Max	15	15	15	15	15	15	15	ISO 2285 Test method tension set constant strain
Tear resistance	N/mm	Min	10	10	10	10	15	15	10	ISO 34-1 Method C
Compression set 150 °C / 72 h	%	Max	15	15	15	15	15	15	15	ISO 815-1 Method A Test pieces type A 1)
Compression set 150 °C / 42 days	%	Max	50	50	50	50	50	50	50	
Change in hardness 150 °C / 42 days	°IRH	Max	5	5	5	5	5	5	5	ISO 48 Method N 1)
Change in tensile strength 150 °C / 72 h	%	Max	-20	-20	-20	-20	-20	-20	-20	ISO 37 Test piece type 1 1)
Change in tensile strength 150 °C / 42 days	%	Max	-20	-20	-20	-20	-20	-20	-20	
Change in elongation at break 150 °C / 72 h	%	Max	-30	-30	-30	-30	-30	-30	-30	
Change in elongation at break 150 °C / 42 days	%	Max	-35	-35	-35	-35	-35	-35	-35	
Cold resistance Temp. retraction TR_{10}	°C	Max	-45	-45	-45	-45	-45	-45	-45	ISO 2921
Cold resistance Temp. retraction TR_{30}	°C	Max	-35	-35	-35	-35	-35	-35	-35	

Table 31 – Supplementary properties for VMQ

Property				Hardness and type number							Test method
				20-1	30-1	40-1	50-1	60-1	70-1	80-1	
Resistance to liquids 150 °C / 72 h (Change in volume)	ASTM Oil No. 1	%		+10 0	+10 0	+10 0	+10 0	+10 0	+10 0	+10 0	ISO 1817
	ASTM Oil No. 3	%		+50 0	+50 0	+50 0	+50 0	+50 0	+50 0	+50 0	
Tear resistance (T)	Tear resistance	N/mm	Min	15	20	30	35	35	35	35	ISO 34-1 Method C

1) Ageing in accordance with ISO 188, method A

5.11 Epichlorohydrin Rubber (ECO)

5.11.1 Epichlorohydrin Rubber (ECO) type 1

Table 32 – Basic properties for ECO

Property				Hardness and type number			Test method
				50-1	60-1	70-1	
Hardness		°IRH		50±5	60±5	70±5	ISO 48 Method N
Tensile strength		MPa	Min	10	10	10	ISO 37 Test piece type 1
Elongation at break		%	Min	350	300	200	
Tension set 100 °C / 72 h and 50 % strain		%	Max	25	25	25	ISO 2285 Test method tension set constant strain
Tear resistance		N/mm	Min	15	20	25	ISO 34-1 Method C
Compression set 100 °C / 72 h		%	Max	25	25	25	ISO 815-1 Method A Test pieces type A[1)]
Compression set 100 °C / 42 days		%	Max	60	60	60	
Change in hardness 100 °C / 72 h		°IRH	Max	+5	+5	+5	ISO 48 Method N[1)]
Change in hardness 100 °C / 42 days		°IRH	Max	+10	+10	+10	
Change in tensile strength 100 °C / 72 h		%	Max	-10	-10	-10	ISO 37 Test piece type 1[1)]
Change in tensile strength 100 °C / 42 days		%	Max	-10	-10	-10	
Change in elongation at break 100 °C / 72 h		%	Max	-20	-20	-20	
Change in elongation at break 100 °C / 42 days		%	Max	-50	-50	-50	
Cold resistance Temp. retraction	TR_{10}	°C	Max	-35	-35	-30	ISO 2921
	TR_{30}	°C	Max	-35	-30	-25	
Ozone resistance 50 pphm / 40 °C / 96 h		%	Min	80	80	60	ISO 1431-1 Procedure C
Resistance to liquids 100 °C / 72 h (Change in volume)	ASTM Oil No. 1	%		+5 -10	+5 -10	+5 -10	ISO 1817
	ASTM Oil No. 3	%		+15 -0	+15 -0	+15 -0	

5.12 Ethylene-propylene Rubber (EPDM)

5.12.1 EPDM type 1 (sulphur vulcanized)

Table 33 – Basic properties for EPDM, type 1

Property			Hardness and type number							Test method
			30-1	40-1	50-1	60-1	70-1	80-1	90-1	
Hardness	°IRH		30±5	40±5	50±5	60±5	70±5	80±5	90±5	ISO 48 Method N
Tensile strength	MPa	Min	7	7	7	10	10	7	7	ISO 37 Test piece type 1
Elongation at break	%	Min	400	400	400	250	200	200	150	
Tension set 100 °C / 72 h and 50 % strain	%	Max	45	45	45	45	45	45	45	ISO 2285 Test Method tension set constant strain
Tear resistance	N/mm	Min	10	15	15	20	20	20	20	ISO 34-1 Method C
Compression set 100 °C / 72 h	%	Max	45	45	45	45	45	45	50	ISO 815-1 Method A Test pieces type A[1)]
Compression set 100 °C / 42 days	%	Max	75	75	75	75	75	75	80	
Change in hardness 100 °C / 72 h	°IRH	Max	+10	+10	+10	+5	+5	+5	+3	ISO 48 Method N [1)]
Change in hardness 100 °C / 42 days	°IRH	Max	+15	+15	+15	+10	+10	+10	+5	
Change in tensile strength 100 °C / 72 h	%	Max	-15	-15	-15	-15	-15	-15	-15	ISO 37 Test piece type 1[1))]
Change in tensile strength 100 °C / 42 days	%	Max	-30	-30	-30	-30	-30	-30	-30	
Change in elongation at break 100 °C / 72 h	%	Max	-35	-35	-35	-35	-35	-35	-35	
Change in elongation at break 100 °C / 42 days	%	Max	-60	-60	-60	-60	-60	-60	-60	
Ozone resistance 50 pphm / 40 °C / 96 h	%	Min	80	80	80	80	60	60	-60	ISO 1431-1 Procedure C

Table 34 – Supplementary properties for EPDM, type 1

Property				Hardness and type number							Test method
				30-1	40-1	50-1	60-1	70-1	80-1	90-1	
Cold resistance Temp. retraction (C)	TR_{10}	°C	Max	-35	-35	-40	-40	-40	-40	-25	ISO 2921
	TR_{30}	°C	Max	-25	-25	-30	-30	-30	-30	-15	
Resistivity at 23 ºC (Z_1)		Ωm	Min	10^6	10^6	10^6	10^6	10^6	10^6	- [2)]	ISO 1853 Method 1

1) Ageing in accordance with ISO 188, method A
2) It is not possible to make an EPDM in hardness 90 °IRH with a minimum resistivity of 10^6 Ωm at 23 ºC

5.12.2 EPDM and EPM type 2 (peroxide vulcanized)

Table 35 – Basic properties for EPDM and EPM, type 2

Property			Hardness and type number			Test method
			60-2	70-2	80-2	
Hardness	°IRH		60±5	70±5	80±5	ISO 48 Method N
Tensile strength	MPa	Min	7	8	8	ISO 37 Test piece type 1
Elongation at break	%	Min	200	175	150	
Tension set 125 °C / 24 h and 50 % strain	%	Max	30	30	30	ISO 2285 Test method tension set constant strain
Tear resistance	N/mm	Min	8	10	10	ISO 34-1 Method C
Compression set 125 °C / 72 h	%	Max	30	30	30	ISO 815-1 Method A Test pieces type A 1)
Compression set 125 °C / 42 days	%	Max	50	50	50	
Change in hardness 125 °C / 72 h	°IRH	Max	+5	+5	+5	ISO 48 Method N 1)
Change in hardness 125 °C / 42 days	°IRH	Max	+10	+10	+10	
Change in tensile strength 125 °C / 72 h	%	Max	-10	-10	-10	ISO 37 Test piece type 1 1)
Change in tensile strength 125 °C / 42 days	%	Max	-20	-20	-20	
Change in elongation at break 125 °C / 72 h	%	Max	-15	-15	-15	
Change in elongation at break 125 °C / 42 days	%	Max	-30	-30	-30	
Ozone resistance 50 pphm / 40 °C / 96 h	%	Min	80	60	60	ISO 1431-1 Procedure C

Table 36 – Supplementary properties for EPDM and EPM, type 2

Property				Hardness and type number			Test method
				60-2	70-2	80-2	
Cold resistance Temp. retraction (C)	TR_{10}	°C	Max	-35	-35	-35	ISO 2921
	TR_{30}	°C	Max	-25	-25	-25	
Resistivity at 23 ºC (Z_1)		Ωm	Min	10^6	10^6	10^6	ISO 1853 Method 1

1) Ageing in accordance with ISO 188, method A

6 Normative references

The following standards contain requirements, which through reference in this text also constitute requirements of this standard.

- ISO 34-1:2022, Rubber, vulcanized or thermoplastic – Determination of tear strength – Part 1: Trouser, angle and crescent test pieces
- ISO 37:2017 Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties
- ISO 48-2:2018, Rubber, vulcanized or thermoplastic – Determination of hardness (hardness between 10 °IRH and 100 °IRH)
- ISO 188:2023 Rubber, vulcanized or thermoplastic – Accelerated ageing and heat-resistance tests
- ISO 815-1:2019 Rubber, vulcanized or thermoplastic – Determination of compression set at ambient or elevated temperatures
- ISO 1431-1:2022, Rubber, vulcanized or thermoplastic – Resistance to ozone cracking – Part 1: Static strain test
- ISO 1629:2013, Rubber and latices – Nomenclature
- ISO 1817:2022 Rubber, vulcanized – Determination of the effect of liquids
- ISO 1827:2022 Rubber, vulcanized or thermoplastic – Determination of modulus in shear or adhesion to rigid plates – Quadruple shear method
- ISO 1853:2018 Conducting and dissipative rubbers, vulcanized or thermoplastic – Measurement of resistivity
- ISO 2285:2019 Rubber, vulcanized or thermoplastic - Determination of tension set under constant elongation, and of tension set, elongation and creep under constant tensile load
- ISO 2921:2019 Rubber, vulcanized – Determination of low temperature characteristics – Temperature-retraction procedure (TR test)
- ISO 4662:2017 Rubber – Determination of rebound resilience
- ISO 48-4:2018 Rubber, vulcanized or thermoplastic - Determination of hardness - Part 4: Indentation hardness by durometer method (Shore hardness)
- ISO 7620:2005 Rubber materials – Chemical resistance

7 Delivery specifications

See STD 430-0001