PREIS GROUP

# Rubber Cords, Sheets and Strips

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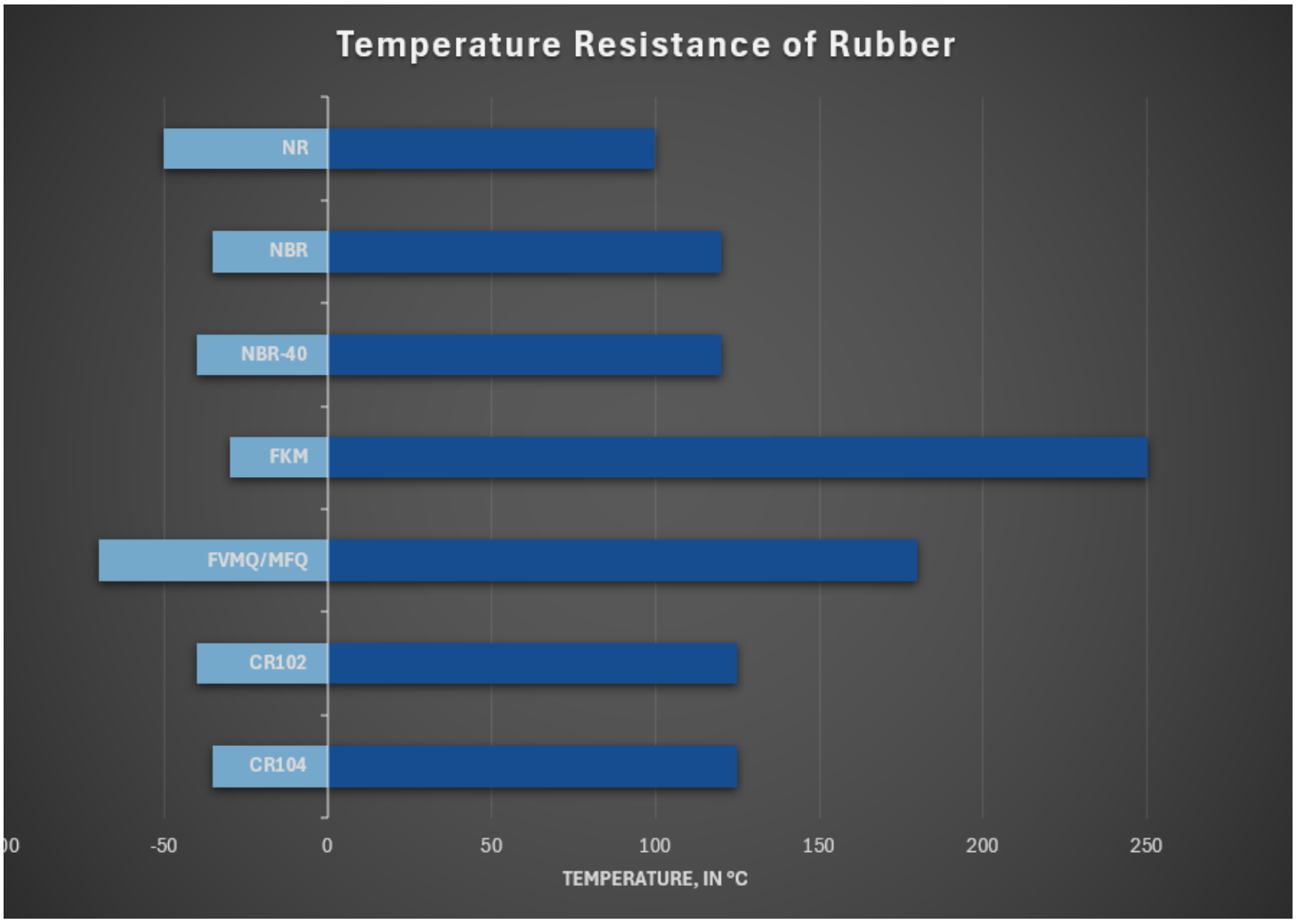
# General Properties of Rubber

| General Name | Natural Rubber | Nitrile (standard) | Nitrile (-40 °C) | Fluorocarbon | Fluorosilicone | Cork Rubber 102 | Cork Rubber 104 |
|---|---|---|---|---|---|---|---|
| Chemical | Polyisoprene | Acrylonitrile Butadien Rubber | Acrylonitrile Butadien Rubber | Fluorocarbon Rubber | Fluorosilicone Rubber | NBR Rubber binded with Cork Granules | NBR Rubber binded with Cork Granules |
| Abbreviation | NR | NBR | NBR-40 | FKM | FVMQ/MFQ | CR102 | CR104 |
| Hardness | 30-95 | 70 | 60-70 | 60-70 | 70 | 65-75 | 75 |
| Cross Reference: Comparable to | | | | Viton®* | | Amorim® TD1120* | Amorim® TD1049* |
| Service Temperature Range | | | | | | | |
| Max. | 75 °C | 120 °C | 120 °C | 250 °C | 180 °C | 125 °C | 125 °C |
| Min. | -60 °C | -35 °C | -40 °C | -30 °C | -70 °C | -40 °C | -35 °C |

Natural Rubber (NR) is used as a reference to compare itself to the products offered by PREIS




* Viton® is a registered trademark of The Chemours Company FC, LLC. This reference is for informational and comparison purposes only and does not imply any affiliation with or endorsement by the trademark holder. TD1120 and TD1049 are product designations of Amorim Cork Composites. This reference is for informational and comparison purposes only and does not imply any affiliation with or endorsement by the trademark holder.

# Environmental Resistance Properties of Rubber

| Polymer | NR | NBR | NBR-40 | FKM | FVMQ/ MFQ | CR102 | CR104 |
|---|---|---|---|---|---|---|---|
| Oxidation Resistance | 2-3 | 2-3 | 2-3 | 1 | 1 | - | - |
| Ozone Resistance | 4 | 4 | 4 | 1 | 1 | - | - |
| Weathering Resistance | 4 | 2-3 | 2-3 | 1 | 1 | - | - |
| Sunlight Resistance | 3-4 | 3-4 | 3-4 | 1 | 1 | - | - |
| Water Resistance | 1 | 1-2 | 1-2 | 1-2 | 1 | - | - |
| Flame Resistance | 4 | 4 | 4 | 1-2 | 1 | - | - |
| Heat Resistance | 4 | 2 | 2 | 1 | 1 | - | - |
| Low Temperature Flexibility | 1-2 | 2-3 | 2-3 | 2-3 | 1 | - | - |

1 = Excellent 2 = Good 3 = Fair 4 = Poor Natural Rubber (NR) is used as a reference to compare itself to the products offered by PREIS

# Chemical Resistance Properties of Rubber

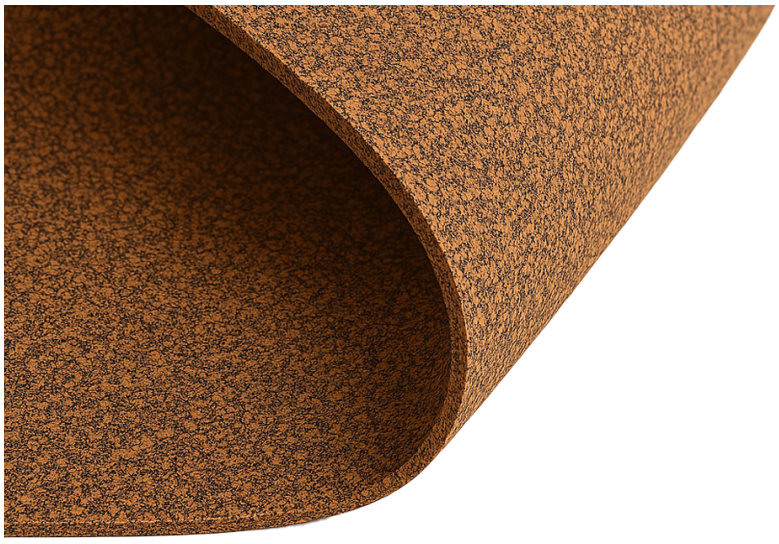
| Polymer | NR | NBR | NBR-40 | FKM | FVMQ/ MFQ | CR102 | CR104 |
|---|---|---|---|---|---|---|---|
| Oil and Gasoline | 4 | 1-2 | 1-2 | 1 | 2 | - | - |
| Animal and Vegetable Oils | 3 | 1-2 | 1-2 | 1 | 1 | - | - |
| Alcohols | 2 | 2-3 | 2-3 | 2-3 | 1-2 | - | - |
| Alkalies | 3 | 1-2 | 1-2 | 2-3 | 1 | - | - |
| Acids | 2-3 | 2 | 2-3 | 2 | 1 | - | - |
| Aliphatic Hydro- carbon Solvents | 4 | 1 | 1 | 1 | 1 | - | - |
| Aromatic Hydro- carbon Solvents | 4 | 2-3 | 2-3 | 1 | 1-2 | - | - |
| Oxygenated Solvents | 2 | 4 | 4 | 4 | 2 | - | - |

1 = Excellent 2 = Good 3 = Fair 4 = Poor Natural Rubber (NR) is used as a reference to compare itself to the products offered by PREIS

# Rubber and Cork Rubber Sheets

Meet your specific performance requirements with our rubber sheets, which can be crafted from a range of elastomers. Our NBR, FKM, FVMQ/MFQ and cork rubber sheets are specially formulated to ensure high performance for transformer applications.

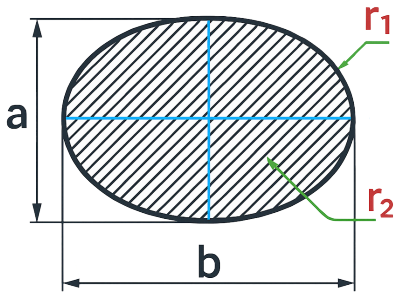
| STANDARD SHEET SIZES | |
|---|---|
| Width x Length (mm) | Thickness (mm) |
| 540 x 540 | 2 - 3 - 4 - 5 - 6 - 8 - 10 - 12 |
| 700 x 1000 | 2 - 3 - 4 - 5 - 6 - 8 - 10 - 12 |
| 1000 x 1000 | 2 - 3 - 4 - 5 - 6 - 8 - 10 - 12 |
| 1000 x 2000 | 2 - 3 - 4 - 5 - 6 - 8 - 10 - 12 |
| 1000 x 10000* | 2 - 3 - 4 - 5 - 6 - 8 - 10 - 12 |
| * only for rubber sheets | |



# Metric Rubber Cords, Rubber and Cork Rubber Strips

Transformer lid rubbers can be manufactured from a range of elastomers to fulfill your specific performance requirements. Available options include NBR, FKM, FVMQ/MFQ and cork rubber. Custom dimensions can also be produced upon request to perfectly fit your application.

| METRIC CORDS | |
|---|---|
| Diameter (mm) | Roll Length (m) |
| 6 | 50 |
| 8 | 50 |
| 10 | 50 |
| 12 | 50 |
| 14 | 50 |
| 16 | 50 |
| 20 | 25 |
| 22 | 25 |
| 24 | 25 |
| 30 | 25 |




| ELLIPTICAL CORDS | |
|---|---|
| Dimensions a x b (mm) | Roll Length (m) |
| 11 x 14 | 50 |
| 14 x 18 | 50 |

| RECTANGULAR SHAPED STRIPS | |
|---|---|
| Dimensions a x b (mm) | Roll Length (m) |
| 8 x 12 | 50 |
| 10 x 20 | 25 |
| 12 x 20 | 25 |
| 10 x 25 | 25 |
| 10 x 30 | 25 |
| 20 x 30 | 25 |
| 12 x 40 | 25 |
| 10 x 100 | 10 |

| CORK RUBBER STRIPS | | |
|---|---|---|
| Width (mm) | Thickness (mm) | Roll Length (m) |
| 30 | 4 - 6 | 10 |
| 40 | 4 - 6 | 10 |
| 50 | 4 - 6 | 10 |
| 60 | 4 - 6 | 10 |
| 65 | 4 | 10 |
| 70 | 6 | 10 |
| 80 | 6 - 8 - 10 | 10 |
| 100 | 6 - 8 - 10 | 10 |

# NBR Rubber (standard) Technical Report

**Rubber Type:** **Acrylonitrile Butadien Rubber (NBR)**
**Working Temperature:** **-35 °C - +120 °C**

| Test | Test Method | Unit | Test Result |
|---|---|---|---|
| Hardness | TS ISO 7619-1 | Shore A | 70 |
| Density | TS 2827-ISO281 | $gr/cm^3$ | 1.3 |
| | (Method A) | | |
| Tensile Strength | DIN 53504 | $N/mm^2$ | 15.7 |
| | (Mold S1) | | |
| Elongation at break | DIN 53504 | % | 398 |
| | (Mold S1) | | |
| Compression Set | DIN ISO 815 | % | 16 |
| (70 °C, 24 hours) | (sample type A) | | |
| Compression Set | DIN ISO 815 | % | 32 |
| (100 °C, 24 hours) | (sample type A) | | |
| Tear Resistance | ASTM D 624-00 | $N/mm^2$ | 46 |
| | (Mold C) | | |
| Elasticity | DIN 53512 | % | 20 |
| Aging in Oven | DIN 53508 | | |
| (70 °C, 168 hours) | | | |
| Change in Hardness | TS ISO 7619-1 | Shore A | +4 |
| Change in Tensile Strength | DIN 53504 | % | -1 |
| | (Mold S1) | | |
| Change in Elongation | DIN 53504 | % | -24 |
| | (Mold S1) | | |
| Low Temperature Resistance | TS 4709 | ----- | resistant |
| (-35 °C, 5 hours) | | | |
| | | | |
| **After aging in SHELL DIALA AX oil according to TS ISO 1817** | | | |
| (120 °C, 72 hours) | | | |
| Change in Hardness | TS ISO 7619-1 | Shore A | -5 |
| Change in Tensile Strength | DIN 53504 | % | -8 |
| | (Mold S1) | | |
| Change in Elongation | DIN 53504 | % | -27 |
| | (Mold S1) | | |
| Change in Volume | DIN ISO 1817 | % | +7.9 |
| Change in Weight | DIN ISO 1817 | % | +4.7 |
| Low Temperature Resistance (-35 °C, 5 hours) | TS 4709 NO. 2.3.9. | ----- | after bending the test pieces no cracks and fractures were observed. |
| **Fluid Compatibility** | | | |
| Mineral Oil | suitable | | |
| Natural and Synthetic Oil | suitable | | |
| Silicone Oil | suitable | | |

# NBR-40 Shore A 60 Rubber Technical Report

**Rubber Type:** **Acrylonitrile Butadien Rubber (NBR)**
**Working Temperature:** **-40 °C - +120 °C**

| Test | Test Method | Unit | Test Result |
|---|---|---|---|
| Hardness | TS ISO 7619-1 | Shore A | 60 |
| Density | TS 2827-ISO281 | $gr/cm^3$ | 1.31 |
| | (Method A) | | |
| Tensile Strength | DIN 53504 | $N/mm^2$ | 15.7 |
| | (Mold S1) | | |
| Elongation at break | DIN 53504 | % | 398 |
| | (Mold S1) | | |
| Compression Set | DIN ISO 815 | % | 16 |
| (70 °C, 24 hours) | (sample type A) | | |
| Compression Set | DIN ISO 815 | % | 32 |
| (100 °C, 24 hours) | (sample type A) | | |
| Tear Resistance | ASTM D 624-00 | $N/mm^2$ | 46 |
| | (Mold C) | | |
| Elasticity | DIN 53512 | % | 20 |
| Aging in Oven | DIN 53508 | | |
| (70 °C, 168 hours) | | | |
| Change in Hardness | TS ISO 7619-1 | Shore A | +4 |
| Change in Tensile Strength | DIN 53504 | % | -1 |
| | (Mold S1) | | |
| Change in Elongation | DIN 53504 | % | -24 |
| | (Mold S1) | | |
| Low Temperature Resistance | TS 4709 | ----- | resistant |
| (-40 °C, 5 hours) | | | |
| | | | |
| **After aging in SHELL DIALA AX oil according to TS ISO 1817** | | | |
| (120 °C, 72 hours) | | | |
| Change in Hardness | TS ISO 7619-1 | Shore A | -5 |
| Change in Tensile Strength | DIN 53504 | % | -8 |
| | (Mold S1) | | |
| Change in Elongation | DIN 53504 | % | -27 |
| | (Mold S1) | | |
| Change in Volume | DIN ISO 1817 | % | +7.9 |
| Change in Weight | DIN ISO 1817 | % | +4.7 |
| Low Temperature Resistance (-40 °C, 5 hours) | TS 4709 NO. 2.3.9. | ----- | after bending the test pieces no cracks and fractures were observed. |
| **Fluid Compatibility** | | | |
| Mineral Oil | suitable | | |
| Natural and Synthetic Oil | suitable | | |
| Silicone Oil | suitable | | |

# NBR-40 Shore A 70 Rubber Technical Report

**Rubber Type:** **Acrylonitrile Butadien Rubber (NBR)**
**Working Temperature:** **-40 °C - +120 °C**

| Test | Test Method | Unit | Test Result |
|---|---|---|---|
| Hardness | TS ISO 7619-1 | Shore A | 70 |
| Density | TS 2827-ISO281 | $gr/cm^3$ | 1.31 |
| | (Method A) | | |
| Tensile Strength | DIN 53504 | $N/mm^2$ | 15.7 |
| | (Mold S1) | | |
| Elongation at break | DIN 53504 | % | 398 |
| | (Mold S1) | | |
| Compression Set | DIN ISO 815 | % | 16 |
| (70 °C, 24 hours) | (sample type A) | | |
| Compression Set | DIN ISO 815 | % | 32 |
| (100 °C, 24 hours) | (sample type A) | | |
| Tear Resistance | ASTM D 624-00 | $N/mm^2$ | 46 |
| | (Mold C) | | |
| Elasticity | DIN 53512 | % | 20 |
| Aging in Oven | DIN 53508 | | |
| (70 °C, 168 hours) | | | |
| Change in Hardness | TS ISO 7619-1 | Shore A | +4 |
| Change in Tensile Strength | DIN 53504 | % | -1 |
| | (Mold S1) | | |
| Change in Elongation | DIN 53504 | % | -24 |
| | (Mold S1) | | |
| Low Temperature Resistance | TS 4709 | ----- | resistant |
| (-40 °C, 5 hours) | | | |
| | | | |
| **After aging in SHELL DIALA AX oil according to TS ISO 1817** | | | |
| (120 °C, 72 hours) | | | |
| Change in Hardness | TS ISO 7619-1 | Shore A | -5 |
| Change in Tensile Strength | DIN 53504 | % | -8 |
| | (Mold S1) | | |
| Change in Elongation | DIN 53504 | % | -27 |
| | (Mold S1) | | |
| Change in Volume | DIN ISO 1817 | % | +7.9 |
| Change in Weight | DIN ISO 1817 | % | +4.7 |
| Low Temperature Resistance (-40 °C, 5 hours) | TS 4709 NO. 2.3.9. | ----- | after bending the test pieces no cracks and fractures were observed. |
| **Fluid Compatibility** | | | |
| Mineral Oil | suitable | | |
| Natural and Synthetic Oil | suitable | | |
| Silicone Oil | suitable | | |

# FKM Shore A 60 Technical Report

**Rubber Type:** **Fluorocarbon Rubber (FKM)**

| Test | Test Method | Unit | Test Result |
|---|---|---|---|
| Hardness | TS ISO 7619-1 | Shore A | 61 |
| Density | TS 2827-ISO281 | $gr/cm^3$ | 2 |
| | (Method A) | | |
| Tensile Strength | DIN 53504 | $N/mm^2$ | 21 |
| | (Mold S1) | | |
| Elongation at break | DIN 53504 | % | 230 |
| | (Mold S1) | | |
| Compression Set | DIN 53517 | % | 19 |
| (100 °C, 22 hours) | | | |
| Tear Resistance | ASTM D 624 B | $N/mm^2$ | 24 |
| | | | |
| Ozone Resistance | DIN 53509 | | ok |
| (23 °C, 2 ppm, 4 hours) | | | |
| Aging in Oven | ASTM D573 | | |
| (70 °C, 250 hours) | | | |
| Change in Hardness | | Shore A | +2 |
| Change in Tensile Strength | | % | 15 |
| **Fluid Compatibility** | | | |
| Mineral Oil | suitable | | |
| Natural and Synthetic Oil | suitable | | |
| Silicone Oil | suitable | | |
| **Working Temperature** | | | |
| Min. Temperature | | min. dynamic | -20 °C |
| | | min. static | -30 °C |
| Max. Temperature | | long time | +250 °C |
| | | short time | +275 °C |

**Cross Reference: Comparable to Viton®***

* Viton® is a registered trademark of The Chemours Company FC, LLC. This reference is for informational and comparison purposes only and does not imply any affiliation with or endorsement by the trademark holder.

# FKM Shore A 70 Rubber Technical Report

**Rubber Type:** **Fluorocarbon Rubber (FKM)**

| Test | Test Method | Unit | Test Result |
|---|---|---|---|
| Hardness | TS ISO 7619-1 | Shore A | 73 |
| Density | TS 2827-ISO281 | $gr/cm^3$ | 2.14 |
| | (Method A) | | |
| Tensile Strength | DIN 53504 | $N/mm^2$ | 21 |
| | (Mold S1) | | |
| Elongation at break | DIN 53504 | % | 230 |
| | (Mold S1) | | |
| Compression Set | DIN 53517 | % | 19 |
| (100 °C, 22 hours) | | | |
| Tear Resistance | ASTM D 624 B | $N/mm^2$ | 24 |
| | | | |
| Ozone Resistance | DIN 53509 | | ok |
| (23 °C, 2 ppm, 4 hours) | | | |
| Aging in Oven | ASTM D573 | | |
| (70 °C, 250 hours) | | | |
| Change in Hardness | | Shore A | +2 |
| Change in Tensile Strength | | % | 15 |
| **Fluid Compatibility** | | | |
| Mineral Oil | suitable | | |
| Natural and Synthetic Oil | suitable | | |
| Silicone Oil | suitable | | |
| **Working Temperature** | | | |
| Min. Temperature | | min. dynamic | -20 °C |
| | | min. static | -30 °C |
| Max. Temperature | | long time | +250 °C |
| | | short time | +275 °C |

**Cross Reference: Comparable to Viton®***

* Viton® is a registered trademark of The Chemours Company FC, LLC. This reference is for informational and comparison purposes only and does not imply any affiliation with or endorsement by the trademark holder.

# FVMQ/MFQ Rubber Technical Report

**Rubber Type:** **Fluorosilicone Rubber (FVMQ/MFQ)**
**Working Temperature:** **-70 °C - +180 °C**

| Test | Test Method | Unit | Test Result |
|---|---|---|---|
| Colour | | | grey |
| Density | DIN 53479 | $gr/cm^3$ | 1.48 |
| Hardness | DIN 53505 A | Shore A | 70 |
| Tensile | DIN 53504 S1 | $N/mm^2$ | 9 |
| Elongation | DIN 53504 S1 | % | 256 |
| Modulus %100 | DIN 53504 S1 | $N/mm^2$ | - |
| Modulus %200 | DIN 53504 S1 | $N/mm^2$ | - |
| Tear Strength | ASTM D 624 C | $N/mm^2$ | - |
| Abrasion Resistance | ISO 4649 | $mm^3$ | - |
| Rebound Resilience | DIN 53512 | % | 35 |
| Compression Set | DIN 53517 | % | 8 |
| (70 °C, 24 hours) | | | |
| Compression Set | DIN 53517 | % | 9 |
| (100 °C, 24 hours) | | | |
| Low Temperature Resistance | DIN 53509 | % | no cracks observed after bending |
| (-60 °C, 5 hours) | | | |
| **Aging in Oven** | | | |
| (70 °C, 168 hours) | | | |
| Change in Hardness | DIN 53505 A | Shore A | +1 |
| Change in Tensile | DIN 53504 S1 | % | -15 |
| Change in Elongation | DIN 53504 S1 | % | -14 |
| **Aging in IRM 902** | | | |
| (100 °C, 168 hours) | | | |
| Change in Hardness | DIN 53505 A | Shore A | -2 |
| Change in Tensile | DIN 53504 S1 | % | -3 |
| Change in Elongation | DIN 53504 S1 | % | -10 |
| Change in Volume | DIN ISO 1817 | % | +6.8 |
| Change in Weight | DIN ISO 1817 | % | +2.4 |
| **Aging in IRM 903** | | | |
| (100 °C, 168 hours) | | | |
| Change in Hardness | DIN 53505 A | Shore A | -16 |
| Change in Tensile | DIN 53504 S1 | % | -10 |
| Change in Elongation | DIN 53504 S1 | % | -10 |
| Change in Volume | DIN ISO 1817 | % | +23.6 |
| Change in Weight | DIN ISO 1817 | % | +14.2 |

# Cork Rubber 102 (CR102) Technical Report

**Rubber Type:** **Acrylonitrile Butadien Rubber (NBR) binded with Cork Granules**
**Working Temperature:** **-40 °C - +125 °C**

| Test | Unit | Range | Test Result |
|---|---|---|---|
| Colour | | | black/natural |
| Hardness | Shore A | 65 - 75 | 70 |
| Density | $kg/m^3$ | 850 - 900 | 860 |
| Tensile Strength | Mpa | | 2.2 |
| Elongation | % | | 90 |
| Compressive Strength | Mpa | | 71 |
| Flexibility | | | |
| Original | | | no cracks |
| ASTM No: 1 Oil | | | no cracks |
| (125 °C, 70 hours) | | | |
| Oven | | | no cracks |
| (100 °C, 70 hours) | | | |
| Volume Change after Aging | | | |
| ASTM No: 1 Oil | | -10 to +10 | -1 |
| (100 °C, 70 hours) | | | |
| **Fluid Compatibility** | | | |
| Mineral Oil | suitable | | |
| SF6 Gas | acceptable | | |
| Natural Ester Oil | suitable | | |
| Silicone Oil | suitable | | |

Asbestos-free
Heavy metal (Pb, Cd, Hg, Cr) free
Polycyclic aromatic hydrocarbon (PAH) free

**Cross Reference: Comparable to Amorim® TD1120***

* TD1120 is a product designation of Amorim Cork Composites. This reference is for informational and comparison purposes only and does not imply any affiliation with or endorsement by the trademark holder.

# Cork Rubber 104 (CR104) Technical Report

**Rubber Type:** Acrylonitrile Butadien Rubber (NBR) binded with Cork Granules
**Cork Granules:** 0.5 - 1 mm
**Working Temperature:** -35 °C - +125 °C

| Test | Test Method | Unit | Range | Test Result |
|---|---|---|---|---|
| **Density** | ASTM D297 | kg/m³ | 850 - 1100 | 900 |
| **Hardness** | ASTM D2240 | Shore A | | 73 |
| after immersion (100 °C, 70 hours), IRM 903 oil | | | | 73 |
| after immersion (100 °C, 70 hours), IRM 901 oil | | | | 73 |
| **Tensile Strength (Mpa) Min.** | ASTM D412 | | | 2.43 |
| after immersion (100 °C, 70 hours), IRM 903 oil | | | | 2.75 |
| after immersion (100 °C, 70 hours), IRM 901 oil | | | | 2.62 |
| **Compressibility at 2.76 Mpa (%)** | ASTM F146 | | | 2.1 |
| after immersion (100 °C, 70 hours), IRM 903 oil | | | | 2.1 |
| after immersion (100 °C, 70 hours), IRM 901 oil | | | | 2.2 |
| **Recovery after 2.76 Mpa (%)** | ASTM F146 | | | |
| after immersion (100 °C, 70 hours), IRM 903 oil | | | > 80 | 99.2 |
| after immersion (100 °C, 70 hours), IRM 901 oil | | | > 80 | 99.6 |
| **Volume Change after Aging** | ASTM F146 | | | |
| after immersion (100 °C, 70 hours), IRM 903 oil | | | | |
| Thickness increase | | % | Max. 25 % | 0.3 |
| Weight increase | | % | | 2.7 |
| Volume increase | | % | | 2.2 |
| after immersion (100 °C, 70 hours), IRM 901 oil | | | | |
| Thickness increase | | % | Max. 15 % | 0.7 |
| Weight increase | | % | | 2.3 |
| Volume increase | | % | | 0.5 |
| **Flexibility** | ASTM F147 | | | |
| At room temperature | | after < 0 mm radius | | no cracks |
| After immersion in IRM 903 and IRM 901 for 70 hours at 100 °C | | after < 0 mm radius | | no cracks |
| After 70 hours heating at 100 °C | | after < 0 mm radius | | no cracks |
| Flexibility at -40 °C | | | | cracks after 50 - 60 mm radius |

**Cross Reference: Comparable to Amorim® TD1049***

* TD1049 is a product designation of Amorim Cork Composites. This reference is for informational and comparison purposes only and does not imply any affiliation with or endorsement by the trademark holder.

For more technical information

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