



Rubber Sealings for Refrigerant Applications

1 Scope

This standard covers the materials and performance requirements of Ethylene Propylene Diene Monomer (EPDM) and Hydrogenated Nitrile Butadiene Rubber (HNBR) O-rings and slim line seal washers used for sealing in Air Conditioning (A/C) systems with liquid and gaseous refrigerant. Rubber material is for use with refrigerants R134a and or R1234yf in combination with the compressor oil used in respective application.

- R134a (GM Drawing/Part Number 9985751 or equivalent)
- R1234yf (GM Drawing/Part Number 9986319 or equivalent)
- Polyalkylene Glycol (PAG) compressor oil (GM Drawing/Part Number 9986181 or equivalent)
- Polyolester (POE) compressor oil (GM Drawing/Part Number US 88862657 or equivalent and Canada Drawing/Part Number 88862658 or equivalent)

1.1 Material Description. Materials covered by this standard are divided into three types;

1.1.1 Type A: EPDM, only for use with PAG oils, color code violet.

1.1.2 Type B: Drawing defined (e.g., using SAE J200 or ASTM D2000 line callout).

1.1.3 Type C: HNBR.

1.2 Symbols. Not applicable.

1.3 Applicability. O-rings and slim line seal washers used in refrigerant systems.

1.4 Remarks. PAG and POE compressor oil formulations are unique to each A/C compressor manufacturer. In order to evaluate the entire spectrum of compressor oil formulations and refrigerants (R134a and R1234yf) used in GM vehicles, the A/C sealing washer supplier shall perform the material compatibility tests with the compressor oil formulations and refrigerant type confirmed by the responsible Global Thermal Bill of Materials Family Owner (BFO).

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ASTM D2000	ISO 188	ISO 2781	ISO 23529
ISO 37	ISO 815	ISO 7111	SAE J200
ISO 48	ISO 1817	ISO 11357	

2.2 GM Standards/Specifications.

9985751	9986181	GMW3059
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2.3 Additional References.

TMC003 Material Safety Data Sheet guidance documents (available at www.gmsupplypower.com).

2.3.1 GM Part Numbers.

9986319	88862657	88862658
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3 Requirements

3.1 Resources.

3.1.1 Test Samples. Unless otherwise specified, the shape, size and number of test pieces shall be in accordance with the relevant Test Procedure(s).

Unless otherwise specified, samples are finished parts or to be taken from finished parts. If not otherwise stated, mechanical properties in delivery state and after heat or fluid immersion are to be tested at $23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ and with the same test methods.

3.1.2 Conditioning. Conditioning shall be as specified in the relevant Test Procedure(s).

3.1.3 Equipment. Conforming to the relevant Test Procedure(s).

3.1.4 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.5 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to its physical definition.

3.1.6 Facilities. Conforming to the relevant Test Procedure(s).

3.1.7 Deviations. Deviations from the requirements of this standard shall have been agreed upon. Such deviations shall be specified on component drawings, test certificates, reports, etc.

3.2 Material and Performance Requirements. Material and performance requirements are summarized in Tables 1, 2A and 2B. Tests for compound release must be performed on O-rings. Table 1 uses International Rubber Hardness Degrees (IRHD) as a unit of measure.

3.2.1 Design Validation Testing. Material properties (material/compound approval) are summarized in Table 1.

3.2.2 Product Validation and Audit/Inspection Testing. If not defined otherwise, all tests per Tables 2A and 2B should be done for product validation and production audit testing.

Table 1: Material Properties for Rubber Compound Release

Property	Test Procedure	Unit	Value
Hardness			
Types A, C	ISO 48 Method M (measured on cross section)	IRHD	75 ± 5
Type B	As specified on drawing/math data file	Shore A	As specified on drawing
Density			
All Types	ISO 2781	g/cm ³	To be reported
Elongation at Break			
Types A, C	ISO 37, on complete O-ring 500 mm/minute $\pm$ 50 mm/minute	%	150% minimum
Type B	As specified on drawing/math data file	%	As specified on drawing
Tensile Strength			
Types A, C	ISO 37, on complete O-ring 500 mm/minute $\pm$ 50 mm/minute	MPa	10 minimum
Type B	As specified on drawing/math data file	MPa	As specified on drawing
Stress at a given Strain (100% Modulus)			
Types A, C	ISO 37, on complete O-ring 500 mm/minute $\pm$ 50 mm/minute	MPa	2.8 minimum
Type B	As specified on drawing/math data file	MPa	As specified on drawing

Property	Test Procedure	Unit	Value
Age Resistance (Heat Aging)			
Types A, C	ISO 188 Method B, 72 h - 2 h at 150 °C ± 3 °C Change in Hardness Change in Elongation at Break Change in Tensile Strength Tensile Strength Change in Stress at a Given Strain	IRHD % % MPa %	±5 maximum -30 maximum -20 maximum 8 minimum +30 maximum
Types A, C	ISO 188 Method B, 504 h - 2 h at 135 °C ± 3 °C Change in Hardness Change in Elongation at Break Change in Tensile Strength	IRHD % %	±15 maximum -50 maximum ±30 maximum
Type B	As specified on drawing/math data file	N/mm	As specified on drawing
Fluid Resistance Note 1			
Types A, C	ISO 1817, 168 h - 2 h at 135 °C ± 3 °C to Refrigerant: Compressor Oil (PAG or POE oil) = 90:10, Change in Hardness Change of Volume Change of Elongation at Break Change of Tensile Strength Change in Stress at a Given Strain	IRHD % % % %	±10 maximum +10 maximum -20 maximum -30 maximum -20 maximum
Type B	As specified on drawing/math data file	-	As specified on drawing
Fluid Resistance Note 1			
Types A, C	ISO 1817, 168 h - 2 h at 135 °C ± 3 °C to Refrigerant: Compressor PAG Oil: Compressor POE Oil = 89:10:1, Change in Hardness Change of Volume Change of Elongation at Break Change of Tensile Strength Change in Stress at a Given Strain	IRHD % % % %	±10 maximum +10 maximum -20 maximum -30 maximum -20 maximum
Type B	As specified on drawing/math data file	-	As specified on drawing
Fluid Resistance Note 1			
Type C	ISO 1817, 168 h - 2 h at 135 °C ± 3 °C to Refrigerant: Compressor POE Oil: Compressor PAG Oil = 89:10:1, Change in Hardness Change of Volume Change of Elongation at Break Change of Tensile Strength Change in Stress at a Given Strain	IRHD % % % %	±10 maximum +10 maximum -20 maximum -30 maximum -20 maximum
Type B	As specified on drawing/math data file	-	As specified on drawing
Cold Resistance			
Types A, C	ISO 23529, 5 h + 1 h at -40 °C ± 3 °C, bend test until two opposite points m	-	No cracks
Type B	As specified on drawing/math data file	-	As specified on drawing
Compression Set			
Types A, C	ISO 815 on complete O-ring 125 °C ± 3 °C, 72 h - 2 h, 25% compressed	%	30 maximum
Type B	As specified on drawing/math data file	%	As specified on drawing