GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW14727

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 specification GMW5038 or equivalent).
- R1234yf (GM specification GMW16283 or equivalent).
- Polyalkylene Glycol (PAG) compressor oil (GM specification GMW16638 or equivalent).
- Polyolester (POE) compressor oil (GM Drawing/Part Number 9986277 or equivalent).

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose/Material Description. Materials covered by this standard are divided into three (3) types:

1.1.1 Type A: EPDM, color code violet.

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

9986277	GMW5038	GMW16283	GMW16638
GMW3059	GMW14270		

2.3 Additional References. Not applicable.

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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 ± 3) °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 Table 1, Table 2, and Table 3. 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 (DV) Testing. Material properties (material/compound approval) are summarized in Table 1.

3.2.2 Product Validation (PV) and Audit/Inspection Testing. If not defined otherwise, all tests per Table 2 and Table 3 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/cm³	To be reported
Elongation at Break			
Types A, C	ISO 37, on complete O-ring 500 mm/minute ± 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 ± 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 ± 50 mm/minute	MPa	2.8 minimum
Type B	As specified on drawing/math data file	MPa	As specified on drawing

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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			
Types A, 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
Thermogravimetric Analysis (TGA)			
All Types	ISO 7111, 50 °C to 950 °C; first derivative	-	To be reported

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