



Desiccant for Use in Refrigerant Systems Using HFC-134a and HFO-1234yf

1 Scope

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 Material Description. This standard describes the requirements of dehydrated, Zeolite or crystalline sodium or potassium-sodium alumino-silicate molecular sieves desiccants in bead form, suitable for use in Hydrofluoroolefin (HFO-1234yf), Haloalkane (HFC-134a) mobile air conditioning systems.

1.2 Symbols. Not applicable.

1.3 Typical Applications. Desiccants are used in automotive air conditioning systems to keep the refrigerant, lubricant, and components dry. Dryness is necessary to minimize hydrate formation, corrosion, and chemical reactions that may degrade system materials.

1.4 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

ASHRAE 35-2010 ASTM D4179

2.2 GM Standards/Specifications.

GMW3059

2.3 Additional References.

- TMC003 Material Safety Data Sheet guidance documents (available at www.gmsupplypower.com).
- B 68800-63 – Part Number for liners.
- National Institute of Standards and Technology.
- Scientific Specialties Service, Inc., Randallstown, MD.
- United States Standards Sieves.

3 Requirements

3.1 Bead Size. The size of the material as determined by analysis with United States Standard Sieves shall conform to the following:

- Through 6 mesh screen 100% weight minimum
- Through 8 mesh screen 90% weight minimum
- Retained on 12 mesh screen 90% weight minimum
- Retained on 20 mesh screen 99% weight minimum
- Retained on 30 mesh screen 99.9% weight minimum
- Through 100 mesh screen 0.02% weight maximum

3.1.1 Test Procedure for determination of compliance to 3.1 is in Appendix A.

3.2 Chemical Composition: The desiccant shall be anhydrous potassium sodium alumina silicate or zeolite.

- 80% K₂O, Na₂O, Al₂O₃, SiO₂, Zeolite, (Alumino – silicate containing alkali oxides).
- 20% clay binder.
- Negligible active chemicals harmful in mobile air conditioning systems.

3.3 Density: The apparent bulk density shall not be less than 0.85 g/cc (53 lb/ft³).

3.3.1 Test Procedure. The Test Procedure for determination of compliance to 3.3 is in Appendix B.

3.4 Bead Shape: The desiccant bead shape does not need to be perfect spheres, however, all surfaces on the beads shall be smooth and rounded. There shall be no significant amount of sharp edges. No more than 3% by weight of the beads shall be fractured.

3.5 Attrition.

3.5.1 Attrition – Dry: The amount of 100 mesh or finer material will typically not exceed 1.0% by weight of the “as received” beads.

3.5.1.1 Test Procedure: Paint Shaker Test, Appendix C.

3.5.2 Attrition – Fully Hydrated. The amount of 100 mesh or finer material will typically not exceed 2.0% by weight of the hydrated beads.

3.5.2.1 Test Procedure – Paint Shaker Test, Appendix D.

3.6 Water Test. Complete immersions of the “as received” desiccant beads in water shall not show any fracturing or exfoliation of the beads. There shall be no mushing or softening or dissolving of the beads.

3.7 Bead Crush Test. The average force to fracture individual beads of an “as received” 25 bead sample shall be no less than 53 N (12 lb).

3.7.1 Test Procedure for determining compliance is ASTM D4179.

3.8 Water Content. The Loss on Ignition (LOI) of the “as received” desiccant material shall be a maximum of 1.5% by weight. LOI includes absorbed water plus chemically bound water and hydrocarbon residues present in the clay binder.

3.8.1 Test Procedure for determining compliance is found in Appendix E.

3.9 Water Absorption Capacity.

3.9.1 Water Capacity in Air. When tested in air at 25 °C (77 °F) and 4.6 mm mercury (Hg) water vapor pressure, the dry desiccant shall absorb a minimum of 16.0 g of water per 100 g of dry desiccant.

3.9.1.1 Test Procedure for determining compliance is found in Appendix F.

3.9.2 Water Capacity in Liquid Refrigerant. In liquid HFO-1234yf and HFC-134a at 60 °C (140 °F), the desiccant will have approximate water absorption equilibrium capacities at the listed water contents of the refrigerant, when tested according to ASHRAE 35-2010 (see Table 1).

Table 1: Water Absorption Equilibrium Capacities

50 PPM (by weight) H ₂ O in Liquid	Desiccant H ₂ O Capacity, H ₂ O/100 g Desiccant
HFO-1234yf	16
HFC-134a	15

Note: This water capacity is the absolute water capacity of the desiccant in liquid refrigerant. To determine the useful water capacity in liquid refrigerant, subtract the “as received” water content of the desiccant, determined in 3.8 of this standard, and Appendix E.

3.10 Desiccant Chemical Compatibility. Chemical compatibility of the desiccant with the refrigerant and lubricant oil is an intrinsic property of the desiccant. Typically, the “as received” desiccant will contain < 0.01% by weight of fluoride. Typically, desiccant exposed to HFO-1234yf or HFC-134a refrigerant and lubricant oil will contain < 0.10% by weight fluoride.

3.10.1 Test Procedure for Determining Compliance, Appendix G. The desiccant chemical compatibility test, as described in 3.10, shall be performed at one (1) year intervals, or at any time, the manufacturing process is changed in any way.

4 Manufacturing Process

4.1 Packaging

4.2 The desiccant shall be supplied in an airtight and moisture vapor proof container to prevent moisture pick-up during shipping and storage.

5 Rules and Regulations

5.1 Legal Regulations. All materials must satisfy applicable laws, rules, regulations and recommendations valid in the country of usage.

5.2 Language. In the event of conflict between the English and domestic language, the English language shall take precedence.

5.3 Inspection and Rejection. All shipments of material or parts under contract or purchase order manufactured to this specification shall be equivalent in every respect to the initial samples approved by Engineering. There shall be no changes in either formulation or manufacturing processes permitted without prior notification and approval by Engineering. Lack of notification by the supplier constitutes grounds for rejection of any shipment. While samples may be taken from incoming shipments and checked for conformance to this specification, the supplier shall accept the responsibility for incoming shipments meeting this specification without dependence upon purchaser's inspection.

The series of tests used to approve each batch of product along with acceptance limits will be agreed upon by the purchaser and seller. The laboratory providing the certificate of analysis must also participate in a proficiency testing program (round robin) that is approved by the Fuels, Fluids, and Lubricants Global Subsystem Leadership Team (GSSLT) or designate. The Fuels, Fluids, and Lubricants GSSLT or designate must receive copies of the proficiency testing reports directly from the test program administrator.

5.4 Initial Source Approval. No shipment shall be made by any supplier until representative initial production samples have been approved by the Fuels, Fluids, and Lubricants Global Subsystem Leadership Team or designees meeting the requirements of this specification.

5.5 Material Safety Data Sheets/Safety Data Sheets (MSDS/SDS). For new product submissions, or when a change in chemical composition of an existing product has occurred, a complete copy of the Material Safety Data Sheet/Safety Data Sheet must be submitted in compliance with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS) requirements or other country-specific MSDS/SDS requirements. In addition, product MSDS/SDS submissions must be in compliance with specific country General Motors TMC003 Material Safety Data Sheet/Safety Data Sheet guidance documents where available.

5.6 All materials supplied to this standard must comply with the requirements of GMW3059, **Restricted and Reportable Substances for Parts.**

6 Approved Sources

Engineering qualifications of an approved source are required for this standard. Only sources listed in the GM Materials File (GM Supply Power) under this standard number have been qualified by Engineering as meeting the requirements of this standard.

For other GM locations, the responsible Engineering group should be contacted to obtain the approved source in that individual country.

7 Notes

7.1 Glossary. Not applicable.

7.2 Acronyms, Abbreviations, and Symbols.

ASHRAE American Society of Heating Refrigerating and Air Conditioning Engineers

ASTM ASTM International

GHS Globally Harmonized System of Classification and Labeling of Chemicals

GSSLT	Global Subsystem Leadership Team
HFC	Haloalkane Refrigerant
HFO	Hydrofluoroolefin Refrigerant
Hg	Mercury
ID	Inner Diameter
LOI	Loss of Ignition
MSDS	Material Safety Data Sheet
NIST	National Institute of Standards and Technology
OD	Outer Diameter
PPM	Parts per Million
PTFE	Polytetrafluoroethylene
SDS	Safety Data Sheet
SRM	Standard Reference Material
Wt	Weight

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Material per GMW16846

9 Release and Revisions

This standard was originated in August 2012. It was first approved by the Fuels, Fluids, and Lubricants Global Subsystem Leadership Team in January 2013. It was first published in January 2013.

Issue	Publication Date	Description (Organization)
1	JAN 2013	Initial publication.

Appendix A

A1 Bead Size Test Method

This procedure describes the method for determining the particle size distribution of molecular sieve bead products. A sample is placed on the top sieve of a nest, and the nest is shaken in a sieve-shaking apparatus for a specified time interval. The percentage of sample retained on each sieve is then calculated.

A1.1 Apparatus.

1. Sieve-shaking apparatus, Ro-Tap or equivalent.
2. Automatic electric timer switch, 1 h by seconds.
3. Balance capable of ± 0.01 g.
4. Sieve, 203 mm (8 in) diameter, full height, U.S. Sieve Series.

A1.2 Procedure.

1. The sieves to be used shall be nested in order of decreasing sizes with the largest sieve on top and a receiving pan at the bottom. The sieves must be clean and dry. It is recommended that brass sieves be blown free of loose particles and dust, washed with a gentle stream of water, dried in an oven at approximately 100 °C and cooled to room temperature before using.
2. Weigh approximately 150 g of the sample, to ± 0.1 g and transfer to the top sieve of the nest.
3. Cover the nest, place in the Ro-Tap sieve shaking apparatus and shake for 5 minutes ± 5 seconds with the tapper in operation.
4. Weigh the sample on each sieve individually to ± 0.05 g.
5. Calculate the percentage of sample retained on each pan using the sum of all individually retained weights as the total weight of the sample.