

ADHESIVE, RETAINING RUBBER PARTS

9986134

1 SCOPE. This standard describes the material and performance requirements of a 1 component, pressure sensitive adhesive used as a shipping and assembly aid to hold molded thermoset rubber parts to their mating surfaces.

1.1 SIGNIFICANCE AND USE. This standard is intended to describe key material properties related to plant assembly and functional needs for adhering thermoset rubber parts. It does not imply functional success, since it is dependent on design and process factors not addressed by this standard.

1.2 APPLICATION REQUIREMENTS (TYPE I)

1.2.1 Application Technique. Apply the approved materials using the method that best provides the most uniform coating and sufficient dry thickness in the shortest time that satisfies part performance needs. (See 1.3).

1.2.2 Cleanliness. Application surfaces should be cleaned with technical grade isopropyl alcohol, VM&P naphtha or other product approved by the applicator, the adhesive manufacturer, GM Materials Engineering and the parts responsible product engineer. For maximum holding power, apply the retaining adhesive to the intended surface within the time limits agreed by the adhesive manufacturer and the applicator after cleaning. Storage banks of clean parts must be properly protected from contaminants. The applicator and adhesive manufacturer must establish acceptable storage conditions and surface conditions, based on a random statistical sampling of parts meeting all requirements. The process plan document must contain provisions for inspection to the satisfaction of the applicator and GM supplier quality.

1.2.3 Application Temperature and Assembly Sequence. Unless otherwise specified by the adhesive manufacturer, apply the adhesive on the intended surface whose temperature is from 10 to 40°C. Cool temperatures slow the adhesive cure rate. Some adhesives may contain solvents that temporarily swell and/or distort the rubber part (see 1.3). Assembly sequence and time must counteract any distortion to permit assembly of the rubber part without damage.

1.2.4 Other Surface Treatments. The adhesive(s) approved to this standard must be applied after paint or coated part treatments. It is the responsibility of the applicator and the adhesive manufacturer to evaluate the optimum conditions, e.g. time, temperature and cure to provide acceptable adhesion.

1.3 APPLICATIONS. Typical applications include the following: (Type I: All 1996 4.3L V6 O-ring to Oil Filter Adapter; '97 2.2L OHV Cam Cvr. Gskt. to Cover; '97 3.1L OHV Oil Pan Gskt. to Pan.)

1.4 LIMITATIONS. Type I: The functional temperature environment for the product(s) approved to this type is -20 to 75°C. The approved material(s) require no catalyst or heat to cure. When applied, it will adhere to most clean surfaces without need of a primer. Cleaning solvent residues will effect the drying time of the adhesive. Consult the adhesive manufacturer regarding the solvent best suited to your operations. Type I material is not miscible with water which can prevent the

adhesive from covering intended locations. We do not recommend immersing rubber parts in this adhesive prior to assembly. Parts will swell significantly within an hour of immersion. After removal, most rubber compounds will return to their original shape given a sufficient time in air at room temperature.

1.5 DETAIL DRAWING PROTOCOL. When specifying this 998 series material, the following information must be placed on the engineering drawing:

Example - Material: Adhesive, per 9986134, Type I. (We also recommend placing cleanliness, bead location and width dimensions on the part detail drawing or PAD sheet.)

2 REFERENCED STANDARDS.

GM502M	ASTM D1298
GM1000M	ASTM D1545
GM1003M	ASTM D3182
GM9763P	ASTM E659
MTL 1197	IEEE/ASTM S1
ASTM D93	ISO Guide 25
ASTM D445	SAE J1351
ASTM D892	QS9000

3 GENERAL REQUIREMENTS. NOTE: Until such time as the A/D/V Test Procedure Library is operational, MTL procedures are obtained from the appropriate release engineer.

3.1 All materials submitted to this specification must meet all requirements of GM1000M Restricted and Reportable Chemicals as well as GM1003M Standard Adhesive Requirements.

3.2 HANDLING AND REPORTING OF DATA.

3.2.1 Material minimum and maximum specification limits for table(s) are based on a 6 sigma limit spread in (normal distribution) data from a minimum of 6 production lots. Tentative approval, signified by the letter (T), will be given based on data from 1 production and 3 lab lots. Tier 1 sources will be responsible for continuing to submit data until the total number of samples is met for full qualification as stated in the first line of this paragraph. Appropriate industry statistical standards, methods or practices should be used when generating data.

3.2.2 New material approvals shall be based on the median of 5 samples per test unless otherwise specified. Tests designated as once for initial approval (not for further statistical analysis) shall be run on a minimum of 3 samples, with each test meeting the stated requirements.

3.2.3 Accredited Data. All data must be generated by a GM approved lab (GP-10), or a lab accredited by one of the following:

- (a) The American Association of Laboratory Accreditation (A2LA), 656 Quince Orchard Road, Gaithersburg, MD 20878.

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- (b) Standards Council of Canada, 350 Sparks, Suite 1200, Ottawa, Ontario, Canada K1P 6N7.
- (c) National Voluntary Laboratory Accreditation Program (NVLAP), Gaithersburg, MD 20896.
- (d) Departamento Del SINALP, Naucalpan De Juarez, Edo. de Mexico.
- (e) Other approved organizations for ISO Guide 25 accreditation.

NOTE: Registration to QS9000 is not a substitute for lab accreditation to ISO/IEC Guide 25.

3.2.4 Test Frequency. The following tests should be performed at the frequency indicated once the requirements of 3.2 are complete:

- a. Color, dirt, homogeneity, inclusions, relative density, percent solids, viscosity, tack and peel strength. Every batch lot by the adhesive manufacturer.
- b. Odor once per year unless regulations require more frequent testing by adhesive manufacturer.
- c. Test at a suitable frequency by assembly plant personnel until the process conditions, amount and location of adhesive variables are known to insure compliance. Testing may be ended once documented testing data and evidence of process controls are in place.
- d. All other tests are once for initial approval. Those tests not so designated are subject to testing per 3.2.1 and 3.2.2.

3.2.5 Test Units. Report data in the appropriate SI units using IEEE/ASTM S1 document.

3.2.6 Test Methods. See GM1003M.

3.3 TEST CONDITIONS. Unless otherwise specified, room temperature and humidity testing shall be conducted @ 50% RH and 23°C. If temperature and humidity are known not to significantly effect test results, use a relative humidity range of 20 to 90% and temperature range of 20 to 32°C. All test conditions must be within ± 2 h, $\pm 2^\circ\text{C}$ and $\pm 5\%$ RH of the specified numbers unless otherwise indicated.

3.3.1 Safety. This standard may involve hazardous materials, operations, and equipment. This standard does not address all of the safety problems associated with its use. It is the responsibility of the user of this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

4 REQUIREMENTS.

4.1 CHEMICAL.

4.1.1 Appearance Criteria. Sample a sufficient quantity so that it is considered truly representative of the total amount of adhesive shipped. No numerical ratings are given. Report the material as acceptable for the given characteristic or unacceptable

with an explanation and photos of the abnormal item. A visual examination of the material is made under adequate transmitted and/or reflected light. Spread the adhesive thinly on clean glass plates.

4.1.2 Color. As specified wet and dry in Table A1.

4.1.3 Dirt. No localized or gross contamination should be visible to the human eye.

4.1.4 Homogeneity. The adhesive should be a clear liquid, creamy emulsion, or opaque, consistent with its initially approved condition.

4.1.5 Inclusions. The adhesive should be free of lumps, gels, agglomerates, or crystals.

4.1.6 Odor (SAE J1351). See Table A1 for odor rating.

4.1.7 Oil Gel Test. No gel must be formed after the following procedure A.1 run @ $23 \pm 2^\circ\text{C}$ and $50 \pm 5\%$ RH.

4.2 PHYSICAL.

4.2.1 Flash Point (ASTM D93). Use Pensky-Martin Closed Cup.

4.2.2 Autoignition Temperature (ASTM E659). Table value is based on the AIT (hot-flame autoignition temperature).

4.2.3 Relative Density (ASTM D1298). See Table A1.

4.2.4 Peel Strength. See A2 for procedure.

4.2.5 Solids Content. See A3 for procedure.

4.2.6 Tact. See A2 for procedure.

4.2.7 Viscosity (ASTM D1545). Place test sample in a clean, empty Gardner tube. Cap tube and place in a 25°C water bath with known viscosity tubes. Bracket the test sample between adjacent known Gardner tube standards having the nearest viscosity response (after sample rack is inverted). Record the letter of the known tube having the closest viscosity. Report the viscosity in centistokes @ 25°C , using the Table 1 chart found in ASTM D1545 that correlates the letter to a known viscosity. Note 6 in ASTM D1545 advises this method must not be used for silicone fluids. The approved silicone adhesive contains a significant percentage of solvent and is not considered a silicone fluid in the context used by ASTM D1545.

4.3 ADDITIONAL.

4.3.1 Fluid Compatibility. See Table A1. Test procedure is found in A4.

4.3.1.1 Fluid Resistance. Select the test fluids, times and temperatures best suited to your usage needs. Test all the likely combinations including blends (if appropriate) to represent customer conditions.

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4.3.1.2 Foam Break Test (ASTM D892, Sequence 1-4).

4.3.1.3 Changes in Fluid Viscosity (ASTM D445). Measure kinematic viscosity @ 38°C in mm²/s using a Cannon-Fenske tube. Change in viscosity (percent increase or decrease) is determined on fresh oil without adhesive and sample from same oil that completed the ASTM D892, Sequence III test.

4.3.1.4 Phase Separation. None.

4.3.2 Non-Corrosive to Metals. See A5 for procedure. Evaluate the compatibility of cure reaction by-product with metals. C1 = copper, C2 = 1008/1010 steel, C3 = AA319 or AA356T6 aluminum, C4 = other. If metals are coated, test on production approved coating.

4.3.3 Stability (GM9763P). Material conditioned using potential storage conditions must be capable of passing all the requirements of this specification.

4.3.3.1 Elevated Temperature Stability. As shipped, the adhesive/sealant must be capable of withstanding a temperature of 55°C for 72 h, without separation or caking.

4.3.3.2 Low Temperature Stability. As shipped, the adhesive/sealant must be capable of withstanding 3 cycles of the applicable cycle schedule outlined in A2 of GM9763P.

4.3.3.3 Storage Stability. The shelf life of the adhesive/sealant in closed containers shall be 6 months at a temperature not to exceed 35°C. Shelf life of the material commences upon the receipt of the material from the manufacturer. Material must be capable of withstanding pumping pressure without adversely affecting viscosity or result in curing.

4.3.4 Electrical Equipment Classification. Dispensing or adjacent equipment must have Class 1, Division 1, Group C capability in the immediate area of the Type I adhesive.

4.4 PART.

4.4.1 Rubber Contact Reactions. At initial contact no smoking must occur. No shrinkage beyond part drawing dimensional requirements or permanent curling of the part may occur.

4.4.1.1 Affect on Rubber Conformability to Mating Surfaces. Measure the adhesive affect on storage modulus of the rubber using dynamic mechanical analysis (DMA). No significant change should be observed. See A6.

4.4.2 Suspension Test. The part applied to the appropriate production released mating part or surface must not sag (no visible gap) or fall out when suspended horizontally with the part down for a period of 30 minutes immediately after the following separate tests:

- (a) 1 h @ 49°C, uncontrolled humidity
- (b) 1 h @ -17°C, uncontrolled humidity

4.4.3 Adhesive Compatibility in Engine Oil Joint. For applications involving current production engine oil, the production joint hardware and materials will be tested for a minimum of 120 h on the MTL 1197 Rig. The component must not visually leak, nor shall the retained part show any evidence of adhesive induced attack. The appropriate parts responsible engineer must supply the GM Powertrain Seal Lab (Warren, MI) the required production joint hardware and materials for test on the rig. The load or assembly conditions will be based on nominal print requirements unless otherwise specified. The number of test samples depends on the size of the assembly and shall be agreed upon between the release engineer and the lab technician. Unless otherwise specified, the test cycle is 8 h @ 135°C followed by 16 h at RT each day for 5 days. Other oils may be substituted to fit the needs of the application under study at the discretion of the lab technician and parts responsible engineer.

4.4.4 Adhesive Compatibility in Engine Coolant Joint. For applications involving current production engine coolant, the production joint hardware and materials will be tested for a minimum of 120 h on the GM Coolant Test Rig. The component must not visually leak, nor shall the retained part show any evidence of adhesive induced attack. The appropriate parts responsible engineer must supply the GM Powertrain Seal Lab (Warren, MI) the required production joint hardware and materials for test on the GM Coolant Test Rig. The load or assembly conditions will be based on nominal print requirements unless otherwise specified. The number of test samples depends on the size of the assembly and shall be agreed upon between the release engineer and the lab technician. Unless otherwise specified, the test cycle is 8 h @ 125°C followed by 16 h at RT each day for 5 days.

4.4.5 Shipping and Handling Durability. As shipped and received, all adhesively retained parts must be on the part, and require no repositioning to facilitate proper assembly. Prior to approval, the part responsible release engineer shall schedule a trial. The trial shall involve not less than 100 parts to be shipped by the appropriate/normal method of delivery in the production packaging approved by the receiving plant. It is recommended that the applicator, shipper and receiver of the parts agree on the times (between adhesive application and shipment), temperature/humidity (high and low) and distances that represent the greatest stress to the adhesive bond between the expected geographical environments. Due to timing of approvals, more than 1 trial may be needed to capture the desired range of conditions. The parts responsible engineer is advised to consider seasonal factors before granting full approval.

4.5 RECYCLING GUIDELINES (GM502M). Materials developed to this specification shall be optimized to provide maximum end-of-life cycle value utilizing the Recyclability Checklist and GM Recycling Design Guidelines. Recycled content shall be reported to the approving and procuring Materials Engineering Department utilizing the Recycled Content Report Form. Reference the GM Recycling Design Guide, GM502M.