

ENGINEERING MATERIAL SPECIFICATION

Material Name

Specification Number

**AFTERMARKET ADHESIVE, WELDABLE, RIVETABLE, AIR DRY,
STRUCTURAL, ALUMINUM**

WSS-M2G410-A2

1. SCOPE

The materials defined by this specification are pumpable, two component, air dry curing, weldable, or rivetable structural adhesives for aluminum.

2. APPLICATION

This specification is released for materials used to structurally bond body components such as: top rails, quarter panels, roofs, rear sills, and cross members to floor pans and inners to outers in a wheel house. These adhesives can be used to bond E-coated service parts including pretreated aluminum sheet, castings, and extrusions during warranty and after collision damage repairs.

Aftermarket repairs may or may not require the use of a pretreatment to provide optimal characteristics. Bond line spacers are required components to maintain bond line thickness during the service repair process. These materials are to be room temperature cured or can be force cured using temperatures no higher than 140 °F/60 °C panel temperature in the field.

The Manufacturing Properties and Engineering Performance requirements defined in this specification are based on laboratory sample testing and define the minimum acceptance criteria for adhesive performance. The pass /fail test criteria for these products will be raised within three years of specification release to raise/improve the durability of currently available products. The function and design requirements for the Sub-system Design Specification (SDS) defines the application, key life test requirements, or vehicle program requirements.

Prior to use, the adhesive must be evaluated using parameters listed in this specification. The choice of substrates types, and specific design application may affect adhesive performance. Compliance with this specification does not guarantee the adhesive will function for all potential applications on a vehicle.

3. REQUIREMENTS

Material specification requirements are to be used for initial qualification of materials.

3.0 STANDARD REQUIREMENTS FOR PRODUCTION MATERIALS

Material suppliers and part producers must conform to the Company's Standard Requirements For Production Materials (WSS-M99P1111-A).

Date	Action	Revisions
2002 12 10	Revised	Para 3.0 inserted ; Para 3.1, 3.2, 3.3, 3.9, 3.10, 4 deleted
2002 05 06	Activated	T. Muller, S. Ward, J. Crist, J. Hughes

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Documents

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3.4 SYSTEM COMPATIBILITY

Initial adhesive approval is based on a specific material system, which includes the substrate, E-coat and adhesive. Substrate choice, service part processing conditions may affect adhesive performance. If any of these parameters are changed, the adhesive performance must be validated using the new parameters.

3.5 MATERIAL PROPERTIES

- 3.5.1 Cure Requirements Air Dry & Force Cure Report
(Define the process cure window for material cure, Report minimum and maximum time at temperature requirements to define performance boundaries)

Critical performance characteristics shall include, but are not limited to, the following

- Stress Durability, para 3.7.2
- Fracture Toughness, para 3.7.4
- Fatigue, para 3.7.5
- Tensile Properties, para 3.7.7

- 3.5.2 Expansion No porosity or expansion

Substrates per Para 5.1, cure per Para 5.2, one panel for each substrate and cure)

Extrude a 13 x 200 mm adhesive bead onto a 100 x 300 mm panel. Room temperature cure.

Place the test panel in an air-circulating oven and bake at 140 °F / 60 °C for 40 minutes oven time. After bake, condition test panel at 23 +/- 2 °C for 1 h min.

Cut the panel length wise through the center of the adhesive.

Examine the adhesive for any voids, porosity or expansion caused by entrapped air or internal gassing.

3.6 MANUFACTURING PROPERTIES

- 3.6.1 Rheology
(SAE J1524, Brookfield Viscosity measurement. Report production material batch/lot number and identify Brookfield model used, including spindle and speed used. Submit plot for viscosity vs. temperature.

Initial (as received)

- Test at Room temperature application
- Test over range 140 °F/60 °C to 170 °F/76 at increments of 10 °F

Aged (age then test at 23 °C and room temperature application)

- 7 days at 40 +/- 1 °C
- 90 days at 32 +/- 1 °C

The rheology variation for any one supplier shall be +/- 50%, based on the recorded rheology of the original approved production sample. The flow curves established for initial approval shall constitute the reference standard and shall be kept on file at the designated material laboratory. All samples shall produce flow curves that correspond to the reference standard when tested under the same conditions.

Final approval of material rheology for service stock production shipments shall be made by the affected activity. In all cases, the rheology shall be within the limits as identified on the material control plan.

3.6.2 Pumpability/Dispense Capability Report

Materials being considered for approval to this specification shall be evaluated for processing capability using existing aftermarket methodologies. The pumpability/dispensing capability report must be approved by the affected service activity operation. Cartridge sizes for materials will be 50 ml. and 225 ml. No extreme measures will be accepted to improve pumpability of the materials. Results shall be made available to Materials Engineering prior to material approval and release.

3.6.3 Sag Resistance (FLTM BV 118-01, lab caulking gun applied 5 mm diameter bead, substrates per para 5.1, condition for 24 h at 140 °F/60 °C, oven schedule per para 5.2, one panel each bake)

- | | |
|--------------|------------------------|
| • Horizontal | No measurable movement |
| • Vertical | No measurable movement |
| • Inverted | No loss of material |

3.6.4 Slump Resistance, max 3 mm

- Assembly aged 30 days at 50 +/- 1 °C

Test Assembly: Two 25 x 100 mm coupons, prepared per para 5.1, with two 38 x 12 x 3 mm spacers. The spacers are placed at each end of one of the coupons, and sufficient adhesive is applied between the spacers to fill the gap. The second coupon is placed on top of the adhesive and spacers (Figure 1). Clamp the assembly with spring clips at each end. Remove excess adhesive from all exterior edges with a spatula.

Test Method:

- Prepare three assemblies per substrate and subject to exposure
- After exposure, condition assemblies at 23 +/- 2 °C for 24 hours, then bake at minimum bake per para 5.2.

- Determine the slump by measuring adhesive loss from the bottom of the assembly.
- Photograph and record observations of any adhesive loss after exposure and force curing.
- Repeat the above procedures for maximum force curing per Para 5.2.

3.6.5 Bridging, max 3 mm
(SAE J243 ADS-9, Section 3.3, Method D, non-flow fixture, substrates per Para 5.1, photograph after exposure and after material cure, force curing conditions per Para 5.2)

- Assembly aged 30 days at 50 +/- 1 °C

3.6.6 Paint Material Compatibility
Use current Ford Approved Refinish paints as identified by FCSD, substrates per Para 5.1)

Shall not contaminate primer, basecoat, or cause any paint film irregularities.

3.6.7 Rivetability

The adhesive shall not cause excess quilting as defined in Figure 2, nor cause a break through of the sheet metal or buckling of the rivet.

Approval is based on laboratory and service facility trials using commercially available air powered and hand manual operated riveting equipment.

Test Method:

Perform rivet tests using methods typical of the service repair application, e.g. air powered or hand manual. Using 1.0 x 100 x 400 mm aluminum coupons construct an assembly as defined in Figure 3. A 3 mm bead of adhesive shall be applied 9.5 mm from edge of lower coupon prior to mating with the top coupon. Use rivet and type as specified by the application. After riveting, cure adhesive per Para 5.2.

Examine the assembly. Cross section the assembly through the rivet. FCSD and Design Engineering must approve a rivetability report. Results shall be made available to RPP Materials Engineering prior to material approval and release.

3.6.8 Odor

Shall be free from objectionable odors as determined by the FCSD, both as received and after curing. No lingering odor is allowed after full 8 hr cure time has evolved.

3.6.9 Material Consistency

Shall be a smooth homogenous mixture, free from entrapped air, foreign materials and any properties detrimental to normal service repair procedures.

3.6.10 Storage Stability

Report as required

Heat greatly accelerates aging. The material shall be stored in closed containers away from all sources of heat. The shelf life of the material shall be 12 months from date of manufacture when stored below 27 °C. When materials are stored at temperatures below 23 °C, they shall be conditioned at room temperature 24 hours prior to application. Application properties are optimized with adequate conditioning of the material.

Ambient repair facility conditions may fluctuate between 7 °C (or 15) and 38 °C. Materials shall be evaluated for local extreme conditions to determine facility specific requirements in excess of 27 °C.

Critical performance characteristics to evaluate for and pass for shelf life stability shall include, but are not limited to, the following:

- Rheology, Para 3.6.1
- Sag Resistance, Para 3.6.3
- Slump Resistance, Para 3.6.4
- Rivetability, Para 3.6.7
- Stress Durability, Para 3.7.2
- Fracture Toughness, Para 3.7.4
- Fatigue, Para 3.7.5
- Tensile Properties, para 3.7.7

3.6.11 Color

Each component should be distinctly different in color. The mixed adhesive should be a significantly different color than each component indicating correctly mixed and in-process curing product and shall meet manufacturing process control requirements. Final approval of material color for service stock shipments shall be made by the affected activity.

The material color for any one supplier shall not visually deviate from the originally approved production sample.

3.6.12 Creep Resistance, min

(ASTM D 1780, substrates per para 5.1

0.25 mm adhesive bondline thickness,

13 mm bond overlap, accelerated heat per para 5.1 or cure per para 5.2, condition at 23 +/- 2 °C for 72 h, before testing.

Room Temperature

No creep w/dead load
weight of 5 kg