



Pre-applied, High-Temperature, Anti-Seize Coating for Threaded Fasteners

1 Scope

1.1 Material Description. Material conforming to the requirements of this specification can be used in the application up to 700 °C. The pre-applied anti-seize material is dry to the touch.

1.2 Symbols. There are three (3) material codes, depending on the maximum operating temperature:

- **Code A:** Maximum temperature 350 °C.
- **Code B:** Maximum temperature 550 °C.
- **Code C:** Maximum temperature 700 °C.

1.3 Applicability. This material is suitable for threaded fasteners that require a pre-applied anti-seize coating to prevent galling:

- During assembly due to similar metals and/or mechanical locking.
- During disassembly due to thermal effects and oxidation.

The material is suitable for applications such as diesel particle exhaust sensors and oxygen sensors. The material is also suitable for fasteners applied to exhaust manifolds, catalytic converters, and turbo chargers.

1.4 Remarks. This specification describes the performance requirements for a pre-applied anti-seize coating on threaded fasteners.

2 References

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

2.1 External Standards/Specifications.

ISO 10964 ISO 16047 ISO 17025

2.2 GM Standards/Specifications.

GMW3059 GMW14872

2.3 Additional References.

- Approved Finishers List (available at www.gmsupplypower.com)

3 Requirements

The parts coated to this specification shall meet the following technical requirements and demonstrated by the test methods described. The appropriate tests for different situations: New chemical approval, new applicator approval, Production Part Approval Process (PPAP), and regular process control testing, are described in Appendix A, Table A1.

3.1 Coefficient of Friction.

3.1.1 After coating, the total friction (μ_{tot}) shall be 0.13 ± 0.03 when tested according to ISO 16047, with the following additional requirements:

- For studs and bolts with non-rotating heads or bolts with effective length ((from head to first full thread) $\leq 3 d$), or fasteners with special locking threads, a surrogate bolt (3.1.2) can be used for friction testing. The surrogate bolt must be coated together with the production parts under the same process.

- Uncoated test nut (or bolt, if testing against coated nut) and washer must be cleaned and degreased ultrasonically within 2 hours of testing.
- After tightening, there shall be a minimum of two (2) full threads outside the nut and a minimum of one (1) full thread from the maximum grip gauging length.
- Tightening speed shall be (30 ± 3) rpm.

For referee purposes, a Coefficient of Friction Test shall be performed after a minimum of 24 hours after coating.

3.1.2 For new material approval, process thirty (30) test bolts using production equipment with regular production-loading weights and process parameters. This includes pre-treatment (cleaning), coating, post-treatments, and handling. The test parts are as follows:

- Stainless steel test washer: 11612106.
- Stainless steel test nut: 11612105.
- Stainless steel test bolt: 11612104.

The Coefficient of Friction ± 3 sigma values based on thirty (30) samples are required to be within specification.

The Coefficient of Friction Test shall be performed by an ISO 17025 accredited laboratory.

3.2 Prevailing-on Torque. Assemble the fasteners and spacer sleeve per ISO 10964 Section 8.3. Assembly torque shall be $0.13 \times \text{thread diameter} \times 0.9 \times \text{bolt-proof load}$.

The maximum prevailing-on torque of any one sample shall not exceed $0.0035 \times (\text{Thread Diameter})^3$ in Nm.

Example for M10x1.5 Thread:

$$0.0035 \times 10^3 = 3.5 \text{ Nm maximum allowable prevailing-on torque.}$$

3.3 High-temperature Cycle. After the prevailing-on torque test (3.2), place the test assemblies in a pre-heated air-circulating oven for 48 hours at the following temperatures:

- **Code A:** 350 °C.
- **Code B:** 550 °C.
- **Code C:** 700 °C.

The assemblies shall be at the specified temperature: $(0 + 10)$ °C for 48 hours (tolerance: ± 10 minutes).

After 48 hours, remove the assemblies from the oven and air-cool at room temperature (23 ± 5) °C for at least 1 hour.

After the assemblies are at room temperature, repeat the heating and cooling cycle one more time and test per Breakaway and Prevailing-off Torque Test (3.5).

Note: Do not combine this test with the Cyclic Corrosion Test (3.4).

3.4 Cyclic Corrosion. After the Prevailing-on Torque Test (3.2), expose the test assemblies per GMW14872, UB, All, 4s, Method 1/2, Exposure D with a thermal soak addition (Option 4) for 4 hours at:

- **Code A:** 350 °C (tolerance: $(0^\circ + 10)$ °C).
- **Code B:** 550 °C (tolerance: $(0^\circ + 10)$ °C).
- **Code C:** 700 °C (tolerance: $(0^\circ + 10)$ °C).

Test the assemblies per Breakaway and Prevailing-off Torque Test (3.5).

Note: Do not combine this test with the High-temperature Cycle Test (3.3).

3.5 Breakaway and Prevailing-off Torque. Disassemble the fasteners and spacer sleeve and record the breakaway and prevailing-off torque per ISO 10964 Section 9.

The maximum breakaway torque of any one sample shall not exceed the input torque from the Prevailing-on Torque Test.

The maximum prevailing-off torque of any one sample shall not exceed $0.035 \times (\text{Thread Diameter})^2$ in Nm.

Example for M10x1.5 Thread:

$$0.035 \times 10^2 = 3.5 \text{ Nm}$$

During disassembly, fasteners shall show no galling or cold-welding (seizing).