GM	WORLDWIDE ENGINEERING STANDARDS	Material Specification	GMW16218

Ferritic Nitrocarburized Brake Rotors

1 Scope

This standard describes the requirements for ferritic nitrocarburized (FNC) gray iron brake rotors. Additional requirements or agreements shall be specified by the local business units.

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. Ferritic nitrocarburization.

1.2 Symbols. Not applicable.

1.3 Applicability. Ferritic nitrocarburized brake rotors.

2 References

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

2.1 External Standards/Specifications.

ASTM E3 SAE AMS2753C SAE AMS2757B SAE AMS2759/12A

2.2 GM Standards/Specifications.

GMW3059

2.3 Additional References. Not applicable.

3 Requirements

3.1 Pre-Treatment Rotors may be pre-treated prior to machining by stress relief processing or may be supplied in the as-cast condition.

3.1.1 Stress Relief Code (SR). Stress relieved castings shall be oriented or racked vertically, as shown in Figure 1. Castings shall be stress relieved prior to machining at 607 °C ± 15 °C part temperature for 3 h minimum in an atmosphere which minimizes scaling/oxidation. Surface scale/oxidation shall not affect the machinability of the castings. Furnace cool the parts to 426 °C maximum then air cool to ambient. Stress relief processors shall be approved by GM Engineering.

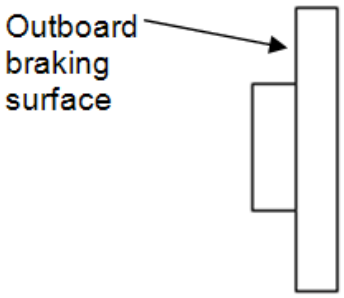

Figure 1: Rotor Orientation during Stress Relief and FNC Processing

3.1.2 As-cast Code (AC). The rotor is supplied in the as-cast condition without stress relief.

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3.1.3 Stress Relief Modified Code (SRM). Modified stress relief treatments may be specified. The modified time, temperature and surface protection will be detailed on the part drawing. Modified stress relief processors shall be approved by GM Engineering.

3.2 Ferritic Nitrocarburization. Finish machined rotors shall be free of processing fluids, rust preventatives and machining debris prior to FNC. The finish machined rotors may be FNC processed by the salt bath or gas methods. Salt bath and gaseous FNC processed rotors shall be oriented or racked vertically as shown in Figure 1. Salt bath FNC processors, gas FNC processors and rack design shall be approved by GM Engineering.

3.2.1 Salt Bath FNC. Salt Bath FNC per SAE AMS2753C at a process temperature of 580 °C. The oxidized or porous layer shall be > 10% but ≤ 50% of the white layer. The processing schedule must be capable of maintaining dimensional requirements as defined by GM Engineering.

3.2.2 Gaseous FNC. Gas FNC per SAE AMS2759/12A Group 3, Class 2 optional SAE AMS2757B at a process temperature of 580 °C maximum. The oxidized or porous layer shall be > 10% but ≤ 50% of the white layer. The processing schedule must be capable of maintaining dimensional requirements as defined by GM Engineering.

3.2.2.1 Furnace Cooling. After oxidation treatment, rotors shall be furnace cooled in a protective atmosphere to 149 °C, and then air cooled to ambient, unless otherwise specified as described in 3.2.2.2.

3.2.2.2 Optional Furnace Cooling Code (O). Rotors are furnace cooled in a protective atmosphere to 370 °C to 426 °C after oxidation treatment, then air cooled to ambient. The surface will show a light blue to light gray oxide.

3.3 Sample Preparation. Metallographic preparation shall be done in accordance with ASTM E3, Standard Guide for Preparation of Metallographic Specimens. All samples will be derived from outboard braking surface, see Figure 1. Acceptable methods for optimum edge retention will be nickel plating or tightly wrapped tin foil, see Figure 2. Compound layer depth will be determined from the average of three places when viewed horizontally at 400x to 500x magnification; see Figure 2. Surface graphite, flake or spheroidal will not be included in the compound layer average.

The minimum compound layer depth, excluding surface graphite will be 10 µm. A second photomicrograph at taken at 200x, horizontally will be used to demonstrate a continuous compound layer, excluding surface graphite; see Figure 3.

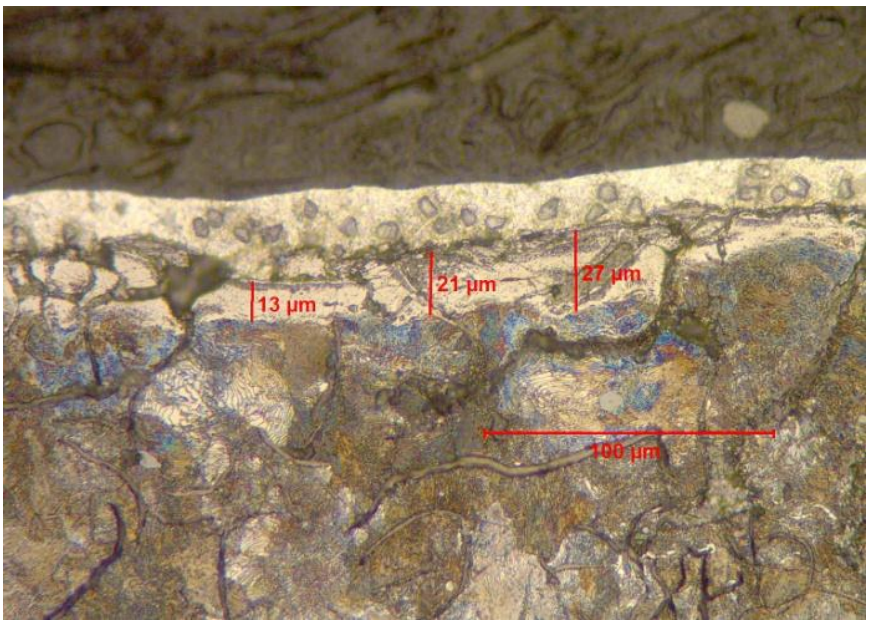

Figure 2: Photomicrograph at 500x Depicting Case Depth Measurement

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