GRAY IRON, BRAKE COMPONENTS, DRUMS AND ROTORS **WSS-M1A176-E1**

GRAY IRON, BRAKE COMPONENTS, DRUMS AND ROTORS, IMPROVED DAMPING PROPERTIES **WSS-M1A176-E2**

GRAY IRON, BRAKE COMPONENTS, DRUMS AND ROTORS, IMPROVED TEMPERATURE PROPERTIES **WSS-M1A176-E3**

GRAY IRON, BRAKE COMPONENTS, DRUMS AND ROTORS, HIGH PERFORMANCE APPLICATIONS **WSS-M1A176-E4**

1. SCOPE

The materials defined in these specifications are low to medium strength structural gray cast iron.

2. APPLICATION

This specification was released originally for gray iron used for all brake rotor and brake drum applications. Specification E2, E3 and E4 are a lower strength, high carbon equivalent grade and shall not be used for unicast rotor applications. E3 and E4 materials are low silicon cast irons which in combination with performance friction materials may result in increased wear and cracking resistance, where the B5 material should be used in high performance applications for HP1 and HP2 vehicles. E1 is low carbon material with higher tensile strength. Any deviation to the material specification should be included on the print adjacent to the specification number. The material selection is done by Foundation Brake Core Engineering in agreement with Brake System Lay Out Team.

Table – Material specification application guide

Material specification	Material application guide
E1	For brake discs with threaded holes for connection to hub; brakes for value vehicles; brakes for nonperformance vehicles
E2	Front brakes; brakes facing issues with thermal cracking and NVH (material with better damping than E1)
E3	Alternative to E2 for better heat conductivity, wear performance and cracking resistance
E4	Alternative to E2 and E3 for better heat conductivity, wear performance and cracking resistance in high temperatures

3. REQUIREMENTS

3.1 APPROVED SOURCES

This specification does not use approved sources. Any reliable supplier meeting these requirements may be used.

Date	Action	Revisions	Rev. 00
2017 03 17	Released		R. Tillenbureg EU

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3.2 PART SAMPLING LOCATIONS

Cast or finished components must be used to determine conformance to this specification unless otherwise indicated on Engineering Drawing.

Table – Part Sampling Locations * Fig. 1

	Tensile Test Bar	Hardness	Microstructure
Full-cast (or loose) Brake Rotor **	Center of brake plate	Hardness measured on center of brake plate (2 sides) every 90° (8 measurements).	Center of brake plate; swan neck (connection of friction ring to hat)
Unicast Brake Rotor***	Wheel mounting flange	Hardness measured on center of brake plate (2 sides) every 90° (8 measurements).	Cross-section of cup seat & hub; swan neck (connection of friction ring to hat)
Brake Drum	Side wall	Inboard rim edge every 90° (4 measurements).	On braking surface

* Where callouts of this table are not suitable due to part geometry or section size, the sampling locations will be as specified in supplier control plan.

** Full-cast (or loose) Brake Rotor – A rotor that is cast separately from the hub. It consists of the brake plate (or plates) and a "hat" used to mount onto the hub.

*** Unicast Brake Rotor – A casting that includes the brake rotor, hub and wheel bearing.

3.3 TENSILE STRENGTH

(ASTM A48/ASTM E8M/ISO 6892)

E1: 207 MPa, min
E2, E3, E4: 150 MPa, min

Mechanical properties of finished components may differ from separately cast test bars due to section size and foundry practice. Preferred sampling method is from component casting. Component castings or separately cast tensile test bars may be used in accordance with the above standard. Separately cast test bars shall be processed and cooled from the same mold shakeout temperature and cooling rate as the castings they represent. If tensile strength is determined from separately cast bars or other Materials Engineering-approved method, a correlation study must be conducted to determine relationship with component castings. Frequency of test bar sampling shall be as specified in the supplier control plan.

3.4 HARDNESS (As Cast or Finished Components)

(ISO 6506/ASTM E10)

E1: 187 – 241 HBW
E2, E3, E4: 149 – 229 HBW

Hardness measured on one part can vary maximum 20 HB. Hardness to be measured on both machined friction surfaces, 4 times every 90° in the middle between inner and outer friction ring diameter

3.5 MICROSTRUCTURE

(ASTM A247)

The microstructure shall consist of types “A” graphite of size 3 – 5 predominantly (shares of 2 and 6 are allowed, to be quantified on drawing), in a pearlitic matrix, with a maximum of 5% free ferrite. A region next to cast surfaces and outer diameter containing type “D” graphite is permissible. This region to extend no further than 2 mm into the part from the casting surface.

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