NODULAR IRON, MEDIUM TO HIGH STRENGTH **WSE-M1A172-B1/B2/B3/B4**

1. SCOPE

The material defined by this specification is a nodular iron.

2. APPLICATION

This specification was released originally for material used for crankshafts.

3. REQUIREMENTS

3.1 STANDARD REQUIREMENTS FOR PRODUCTION MATERIALS

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

3.2 CHEMICAL COMPOSITION (LADLE)

Specific chemistry will vary based on section size and foundry practice to achieve the required mechanical properties. The ladle analysis will form part of the control plan.

3.3 HARDNESS

3.3.1 As cast hardness - Determined between foundry and machinist.

3.3.2 Bearing and 'seal running'

Surface Hardness, HB (ISO 6506/ASTM E10)	B1	B2	B3	B4
	217-286	235-302	255-311	302-359

Unless otherwise specified, castings may be normalized or annealed to meet the desired hardness range.

Grade B4 shall be oil hardened and tempered.

Date	Action	Revisions	Rev. 3
2013 03 07	Revised	Revised 3.4	G. Weber, FNA
2002 07 30	Revised	Updated and renumbered	
1987 10 28	SM/ER1249TC	Released - H. Nikkel NAAO, N P Riley, EAO	

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3.4 MECHANICAL PROPERTIES
(ISO 6892/ASTM E8M)

		B1	B2	B3	B4
3.4.1	Tensile Strength, MPa, min	560	630	700	900
3.4.2	Yield Strength, MPa, min (0.2 % offset)	350	400	450	600
3.4.3	Elongation, %, min	2	2	2	2

Mechanical properties shall be measured on test specimens taken from parts produced according to the approved Control Plan. The test specimen and Brinell hardness location shall be indicated on the appropriate Engineering Drawing and/or Engineering Specification, and reflected in the Supplier Control Plan. Tests may be carried out on substandard test specimens if standard specimens cannot be obtained.

3.5 MICROSTRUCTURE - Finished Component
Before Fillet Rolling

When viewed at 100x critical areas shall consist of:

	B1	B2	B3	B4
Tempered Martensite, %, min	--	--	--	Complete transformation
Pearlite, %, min	50	80	90	--
Ferrite, %, max	50	20	10	< 1
Retained Austenite, %, max	--	--	--	15
Free Carbide, %, max	1	1	1	1
Graphite Form, %, min (ASTM A 247 Type I & II)	75	90	90	90

Graphite Size:
(ASTM A 247)

The graphite shall be predominantly size 5, 6 & 7, size 4 nodules shall not exceed 5 %, the nodule distribution shall be uniform, random and free from agglomeration and flotation.

Note: Critical areas (eg bearing surfaces, fillet radii,etc.) to be specified by Engineering. Other control locations may be employed provided the finished part microstructure is maintained.

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