

ENGINEERING MATERIAL SPECIFICATION

Material Name

Specification Number

GREY IRON - PISTON RINGS (PEARLITIC)

WSD-M1A301-A1

GREY IRON - PISTON RINGS (ACICULAR)

WSD-M1A301-A2

GREY IRON - PISTON RINGS (ACICULAR)

WSD-M1A301-A3

1. SCOPE

The materials defined by this specification are flake graphite irons, with an acicular or pearlitic matrix; cast statically as single/twins, or centrifugally.

2. APPLICATION

This specification was released originally for materials used in the production of piston rings.

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 (weight %, ladle analysis)

	A1	A2	A3
Carbon (total)*	3.4 - 4.0	3.4 - 4.0	2.5 - 3.5
Silicon*	1.5 - 3.1	1.5 - 3.1	1.5 - 3.1
Phosphorus	0.3 - 0.8	0.3 - 0.8	0.5 max
Sulphur	0.15 max	0.15 max	0.15 max
Chromium	0.6 max	0.5 max	0.2 - 1.0
Copper	1.5 max	0.5 - 2.5	1.5 max

Note: The Silicon content shall be adjusted to suit the casting method.

Manganese, Nickel and Molybdenum can be added to a maximum of 1.0% each, vanadium 0.6% maximum.

Note: Manganese must be present in sufficient quantity to balance the sulphur i.e. (1.7 x S%) + 0.2 min.

Date	Action	Revisions
2002 09 30	Revised	Updated and renumbered
1988 02 08	SM/ER 2286 TC	Released. N.P. Riley. EAO.

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Carbon equivalent (*) and alloying elements shall be controlled within the above range to accommodate the ring section, size and method of casting (static/centrifugal are acceptable). The anticipated working range for each component shall be restricted to a limited band within the above.

3.3 HARDNESS (ISO 6506 ; ISO 80)

	A1	A2	A3
HB	190 – 300	255 – 350	245 - 360
HRB	94 – 107	102 – 114	100 - 117

An average of three results taken (1) adjacent to the gap (2) 90 degrees to the gap and (3) opposite the gap. Any other position will be within 10 HB or 2 Rockwell B points. In the case of dispute the umpire test method will be HB.

3.4 MICROSTRUCTURE

Graphite - uniformly distributed flakes ASTM A 247 form VII type A size 5-8 and type B (rosette) types D and E to be avoided or kept below 5% (area).

Matrix - A1 - fine lamellar pearlite with phosphide constituent present as small isolated particles or a discontinuous network. Ferrite shall not exceed 10% when averaged over a field of 2mm diameter minimum.

Matrix - A2 and A3 - Acicular ie tempered martensites and bainites with complex alloy carbides where appropriate present as small isolated particles below 10% of matrix volume.

3.5 BENDING STRENGTH (unless otherwise stated on drawing) (BS 5341 or equivalent ISO)

A1	340 MPa min
A2 and A3	450 MPa min

4. GENERAL INFORMATION

The information given below is provided for clarification and assistance in meeting the requirements of this specification.

4.1 MODULUS OF ELASTICITY (ISO 6621/2)

A1	95 GPa nominal
A2	100 GPa "
A3	115 GPa "

Note: The actual values of modulus are adjusted to match the individual requirements of each ring design.