Ford Motor Company

ENGINEERING MATERIAL SPECIFICATION

Material Name	Specification Number
CAST IRON - LOW ALLOY, CHILLED CAMSHAFT	**WSD-M1A304-A1**
CAST IRON - LOW ALLOY, CHILLED CAMSHAFT	**WSD-M1A304-A2**

1. SCOPE

The material defined by this specification is a low alloy cast iron suitable for mechanically chilled components.

2. APPLICATION

This specification was released originally for material used for camshafts produced by mechanically chilling cams in a shell mold or green sand casting process. Camshafts to this specification approach optimum grey iron machinability in non-mechanically chilled areas.

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 Percent)

	A1	A2
Carbon	3.1 - 3.9	3.1 - 3.9
Silicon	1.5 - 2.5	1.5 - 2.5
Manganese	0.6 - 0.9	0.6 - 0.9
Phosphorus	0.2 max	0.2 max
Sulphur	0.15 max	0.15 max
Chromium	0.35 max	0.35 max
Molybdenum	0.15 max	0.8 max
Copper	0.2 max	1.0 max

Date	Action	Revisions
2002 10 09	Revised	Updated and renumbered
1990 06 29	C01031537	Revised paras 3.3/3.4 G. Lane EAO/R. Graham NAAO
1989 02 01	SM/ER3160TC	Released N. Riley

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Composition shall be selected generally from within the above range in order to meet microstructural, chill depth, chill distribution, machinability and strength requirements. Molybdenum and/or copper may be added to increase matrix hardness without significant increase in carbide content, which would be more detrimental to machining.

Specific composition limits and foundry practice to meet performance and manufacturing requirements will form part of an agreed Control Plan for each component.

3.3 MECHANICAL PROPERTIES

3.3.1 Ultimate Tensile Strength (UTS)
(ASTM E 8M/ISO 6892)

	A1	A2
Standard Test Bar, min, MPa	220	230
or		
Diabolo Test Bar, min, MPa (DIN 50109)	230	245

Ultimate Tensile Strength should be determined on separately cast test bar. Where practical, test bars machined from components should also exceed the minimum limits.

If component UTS is considered a requirement, tensile bar location and ultimate strength requirement shall be specified on the Engineering drawing.

3.3.2 Hardness (unless otherwise stated on the Engineering drawing)
(ASTM E 10/ISO 6506; ASTM E 18/ISO R 80)

Finished Camshaft Only (Surface)

	A1	A2
Cams and Eccentrics	HRC 45 min*	45 min*
Bearing Journals	HB 190-241	235-285

Note: Correction factors for surface curvature are applicable on the above HRC values.

*Applicable to all chill areas designated on the Engineering drawing.

For large volume survey on castings, agreement may be reached between foundry and manufacturing on the position of checking bearing hardness, providing the finished component hardness is met. This agreement is to be part of the control plan.

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