Ford Motor Company

ENGINEERING MATERIAL SPECIFICATION

Material Name	Specification Number
STEEL, FERRITIC STAINLESS, CAST	**WSE-M1A329-A1**
STEEL, AUSTENITIC STAINLESS, CAST	**WSE-M1A329-A2**

1. SCOPE

The materials defined by these specifications are cast stainless steels. The A1 grade is a ferritic stainless steel, while the A2 grade is an austenitic stainless steel.

2. APPLICATION

These specifications were released originally for exhaust manifold applications. The A1 grade is suitable for service temperatures up to 870 °C, and the A2 grade for service temperatures up to 980 °C. Manifolds made to the A1 grade may be heat treated, if required, to attain thermalstability and required microstructural and mechanical properties.

3. REQUIREMENTS

3.0 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	0.20 max	0.40 - 0.50
Silicon	0.50 - 2.25	0.80 - 1.25
Manganese	2.00 max	0.75 - 1.10
Molybdenum	1.00 - 2.25	0.50 max
Phosphorus	0.05 max	0.04 max
Sulfur	0.02 max	0.11 - 0.15
Chromium	17.0 - 21.0	24.0 - 27.0
Nickel	1.00 max	12.0 - 15.0
Titanium	0.50 max	---
Niobium	0.5 - 1.50	1.70 - 2.10
Vanadium	0.75 max	---
Nitrogen	0.10 - 0.20	0.08 - 0.40
Others	---	0.50 max
Iron	Balance	Balance

Specific composition limits and foundry practices to meet performance and manufacturing requirements will form part of an agreed Control Plan for individual component geometries and process routes.

Date	Action	Revisions
2003 03 13	Revised	Para 3.0 Inserted; Paras 3.1, 3.6, 3.7, 4 Deleted
1994 04 19	Revised	Added A2; Completely revised; Updated G. Weber
1994 09 16	NE01E10127076140	Released P. Lee G. Lane

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Composition shall be selected generally from within the above range in order to provide a material which will respond well to heat treatment and will meet microstructural, machinability, hardenability and strength requirements.

3.3 MECHANICAL PROPERTIES

Tensile, compressive, and shear properties are to be measured on separately cast test bars. Test bar diameters and solidification rates should be such that the microstructure and properties are commensurate with the manifold as supplied to the manufacturer.

		A1	A2
3.3.1	Tensile Properties (ASTM E 8M/ISO 6892)		
	Ultimate Tensile Strength, min	410 Mpa	550 MPa
	Yield Strength (0.2 % Offset), min	370 Mpa	310 MPa
	Elongation, min	2 %	7 %
3.3.2	Compressive Yield Strength (0.2 % Offset), min (ASTM E 9)	370 Mpa	310 MPa
3.3.3	Shear Strength, min (ASTM B 769)	460 Mpa	400 MPa
3.3.4	Hardness (Unless otherwise stated on Engineering drawing) ASTM E 10/ISO 6506, ASTM E 18/ISO 6508)		
	Bolt Boss Hardness, HB (As supplied to manufacturer)	140 – 190	187 - 248

For large volume surveys on heat treated manifolds, agreement may be reached between foundry and manufacturing on the manner of checking bolt boss hardness after heat treatment and before machining, providing the finished component hardness is met. This agreement is to be part of the control plan.

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