



ENGINEERING MATERIAL SPECIFICATION

Material Name

Specification Number

SINTERED IRON-CARBON-COPPER-TIN-PHOSPHORUS-STEEL

WSE-M10A94-A1

1. SCOPE

The material defined by this specification is a sintered iron-carbon-copper-tin-phosphorus steel.

2. APPLICATION

This specification was released originally for valve guides for internal combustion engines.

3. REQUIREMENTS

3.1 STATISTICAL PROCESS

Suppliers must conform to the requirements of Ford Quality System Standard Q-101. A mutually acceptable Control Plan as described therein is required for material/source approval. Appropriate statistical tools must be used to analyze process/product data so that variation in the final product is continuously reduced.

3.2 CHEMICAL COMPOSITION, Weight, %
(ASTM A 751/ASTM E 1019/ASTM A 484)

Total carbon	1.50 - 2.50
Combined carbon	0.70 - 2.00
Manganese	0.03 - 0.49
Sulfur	0.02 - 0.11
Copper	2.00 - 6.00
Tin	0.10 - 1.00
Phosphorus	0.10 - 1.00
Magnesium	0.02 - 0.20
Silicon	0.05 - 0.30
Others	1.0 max
Iron	Balance

3.3 DENSITY, g/cm³
(ISO 2738/ASTM B 328)

6.3 min (average)
6.4 min (top third)
6.1 min (middle third)
6.4 min (bottom third)

3.4 APPARENT HARDNESS
(ASTM E 18/ISO 4498)

65 - 90 HRB

Average of a minimum of five readings along a longitudinal section of the wall on the outside surface a minimum of 5 mm from either end. All individual hardness readings shall conform to the hardness range.

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1991 07 23	NE01E10127076020	Released C. Webster

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3.5 MICROSTRUCTURE (ASTM E 3/ASTM E 562)

The microstructure shall consist of a mixture of pearlite, ferrite, iron-phosphorus-carbon eutectic and solid lubricant. When observed in a radial cross section the iron-phosphorus-carbon eutectic shall not be less than 5 %.

Internal voids shall not exceed 0.38 mm in any dimension when cross sections are examined in the unetched condition.

3.6 SURFACE CONDITION

Surfaces shall be free of scale and rust. Nicks, cracks, burrs and depressions shall not exceed 0.25 mm in any direction. Visual inspection is to be performed under white light without the aid of magnification.

3.7 SUPPLIER'S RESPONSIBILITY

All materials supplied to this specification must be equivalent in all characteristics to the material upon which approval was originally granted.

Prior to making any change in the properties, composition, construction, color, processing or labeling of the material originally approved under this specification, whether or not such changes affect the material's ability to meet the specification requirements, the Supplier shall notify Purchasing, Toxicology and the affected Materials Engineering activity of the proposed changes and obtain the written approval of the Materials Engineering activity. Test data, test samples and a new code identification are to be submitted with the request.

Substance restrictions imposed by law, regulations or Ford, apply to the materials addressed by this document. The restrictions are defined in Engineering Material Specification WSS-M99P9999-A1, unless a different suffix (e.g., A2 or A3) is specified on the engineering document for the application.