



ALUMINUM CASTING ALLOY, ENGINE CYLINDER HEAD, AS-CAST CONDITION

WSS-M2A169-A

1. SCOPE

The material defined by this specification is a special aluminum "as-cast" alloy with titanium and high copper content.

2. APPLICATION

The alloy was originally developed to be used for South American engine cylinder heads produced by die cast and precision sand casting process without heat treatment. For use in other regions, consult your local Materials Engineering Activity.

2.1 LIMITATIONS

- 2.1.1 This specification is intended for use only in South America.
- 2.1.2 The materials described in this specification are intended to be used in the "as-cast" (un-heat treated or F Temper) condition.
- 2.1.3 The materials described in the specification may not be stable when subjected to engine running temperatures. Dimensional growth/distortion accompanied by increase in yield strength and a decrease in % elongation could occur.
- 2.1.4 Slowly solidifying regions of this cylinder head may exhibit copper segregation associated with macro/micro shrinkage due to the presence of strontium, which may adversely affect material properties
- 2.1.5 Design and Manufacturing Engineers should measure/evaluate microstructure in critical areas and understand the potential dimensional changes, which may occur at engine operating temperature prior to releasing a new design.

3. REQUIREMENTS

Material specification requirements are to be used for initial qualification of materials.

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).

Date	Action	Revisions
2006 10 23	Activated	



Documents

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3.2 CHEMICAL COMPOSITION

(Weight Percent) (ASTM E 1479/ASTM E 1251 Suggested):

Si:	8.00 - 9.50
Cu:	4.30 - 5.00
Mn *:	0.30 - 0.50
Mg:	0.50 - 0.70
Ti:	0.10 - 0.20
Sr:	0.012 - 0.02
Fe:	0.75 max
Ni:	0.30 max
Zn:	0.70 max
Ca:	0.003 max
Each Other Elements	0.05 max
Total Other Elements:	0.50 max
Al:	Remainder

*: The Mn minimum composition have to equal or more than the proportion $\text{wt\%Mn} = 0.5 \times \text{wt\%Fe}$, see General Information.

3.3 MECHANICAL PROPERTIES AND HARDNESS

The following mechanical properties are minimum values. Properties measured on samples cut from castings. The position where samples must be cut from parts must be stated on Engineering Drawing, Engineering Specification, SDS or other Engineering document. Mechanical properties of castings depend on process parameters - cooling rates, wall thickness, temperatures, etc. If part geometry requires deviations from the mechanical property requirements below, the deviations must be stated on the Engineering Drawing. Tensile properties according to ASTM B 557, compressive properties according to ASTM E 9, shear properties according to ASTM B 769, fatigue limit according ASTM E 466 and hardness according to ASTM E 10. During the production the control items are: tensile strength, yield strength, elongation and hardness.

3.3.1	Tensile strength (ASTM B 557), min	190 MPa
3.3.2	Yield strength, 0.2% Proof Stress (ASTM B 557), min	150 MPa
3.3.3	Shear Strength (ASTM B 769), min	130 MPa
3.3.4	Compressive Yield (ASTM E 9), min	130 MPa
3.3.5	Elongation (ASTM B 557), min	0.7%
3.3.6	Fatigue limit at 5×10^8 (ASTM E 466), min	55 MPa
3.3.7	Hardness (ASTM E 10), min	75 HB

