

INTERNATIONAL TRUCK AND ENGINE CORPORATION		
TMS (TRUCK MATERIAL SPECIFICATION)		NUMBER: TMS-3102
TITLE: Cast Aluminum Wheels		REVISION: A
WRITTEN/EDITED BY: Materials Engineering	APPROVED BY: Materials Engineering	DATE ISSUED: APRIL 2006
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<i>This specification may involve hazardous materials, equipment, and procedures. This specification does not purport to address all of the safety issues associated with its use. The user is responsible to consult appropriate safety and health practices and to determine the applicability of regulatory limits prior to use.</i>		
Change Notice: Added Section 2.1; changes to Sections 4.5 and 6.0; changed leak testing parameters in Section 4.5.3.		
Reference: File 17; 30-2B	Keywords: Wheels, aluminum casting, cast wheels, A356 aluminum	

1.0 APPLICATION

This specification covers cast aluminum alloy wheels used for commercial trucks.

2.0 SCOPE

This specification covers the requirements for material, mechanical properties, fatigue performance, cosmetic appearance, quality, and qualification.

2.1 Restricted Chemical Substances

Effective January 1, 2007, all product supplied to the requirements of this specification must comply with the requirements of the CEMS B-50 specification.

3.0 REFERENCE DOCUMENTS

Unless otherwise specified, the latest issue of all referenced standards shall apply. The following standards, specifications and regulations are referenced in this specification.

Quality System Standard QS-9000 (ISO 9000 or TS-16949) ASTM E155
INTERNATIONAL IQR Quality Standard
INTERNATIONAL Manufacturing Standard D-13
CFR Title 29, Part 1910
INTERNATIONAL CEMS B-50

4.0 REQUIREMENTS

4.1 Material

4.1.1 Chemical Composition

The alloy used to produce cast wheels will be A356 aluminum and meet the following chemical composition requirements:

Silicon	6.5-7.5%
Magnesium	0.25-0.4%
Copper	0.05% max
Manganese	0.05% max
Iron	0.18% max
Zinc	0.10% max
Titanium	0.2% max

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Sodium*	None
Strontium*	0.008-0.030%
Other elements	0.05% max
Others total	0.15% max
Aluminum	Remainder

*May be used to achieve silicon modification.

4.1.2 Heat Treatment

The wheel casting shall be solution heat treated and artificially aged to provide the specified microstructure and mechanical properties.

4.1.3 Microstructure

The microstructure will exhibit a modified, finely dispersed, aluminum-silicon eutectic. Figure 1 shows the minimum acceptable microstructure for the hub [Fig. 1(b)], and the minimum acceptable for the rim [Fig. 1(d)].

4.2 Mechanical Properties

The properties shall be measured by standard tensile specimens taken from the flange region of the wheel. The testing must be performed after heat treatment to ensure properties are representative of the finished part.

Yield strength	189 MPa (27 ksi) min
Ultimate tensile strength	259 MPa (37 ksi) min
Elongation (in./in.)	7.0% min in outboard flange
Hardness*	60-90 HBW

*Brinell HBW 500 kg 10 mm ball; measured in hub area only

4.3 Fatigue Performance

The wheels will meet the following fatigue life requirements. For the new wheel designs, six samples for both radial and cornering fatigue shall be tested for initial qualification. For periodic quality audit or if any material or process changes are made, the following tests will be performed:

4.3.1. Radial Fatigue: run at 2.8 load factor – minimum is 700,000 cycles

4.3.2. Radial Fatigue: run at 2.0 load factor – minimum is 3,500,000 cycles

4.3.3. Cornering Fatigue: run at 1.35 load factor – minimum is 500,000 cycles

The supplier can select the accelerated load factor as required, however any load factor not specified above requires the written approval of International Truck Wheel Systems Engineering. At least one sample of each test will be run until failure, preferably two samples. If only one is run to failure, then at least two others shall be run to 120% of the minimum requirement.

4.4 Cosmetic Appearance

The surface finish and cosmetic appearance of the wheels will conform to the quality initially approved by International Industrial Design department and the receiving Plant Quality Control department. Master samples shall be retained by the supplier and the using plant for reference. Wheels reworked for cosmetic repair shall be identified for traceability.