

# SOUTHWEST RESEARCH INSTITUTE®

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**FIRE PERFORMANCE EVALUATION TESTED IN  
ACCORDANCE WITH ASTM E 136-11, *STANDARD  
TEST METHOD FOR BEHAVIOR OF MATERIALS  
IN A VERTICAL TUBE FURNACE AT 750 °C***

**MATERIAL ID AND TRADE NAME: 3003**

**FINAL REPORT  
Consisting of 5 Pages**


**SwRI® Project No. 01.16052.01.620a  
Test Dates: March 18 and 24, 2011  
Report Date: April 14, 2011**

**Prepared for:**


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## 1.0 INTRODUCTION

This report describes a small-scale fire test conducted on a material identified as 3003 in accordance with ASTM E 136-11, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 °C*, for The Aluminum Association, Inc., located in Arlington, Virginia. Testing was conducted March 18 and 24, 2011, at the Fire Technology Department of Southwest Research Institute (SwRI), located in San Antonio, Texas.

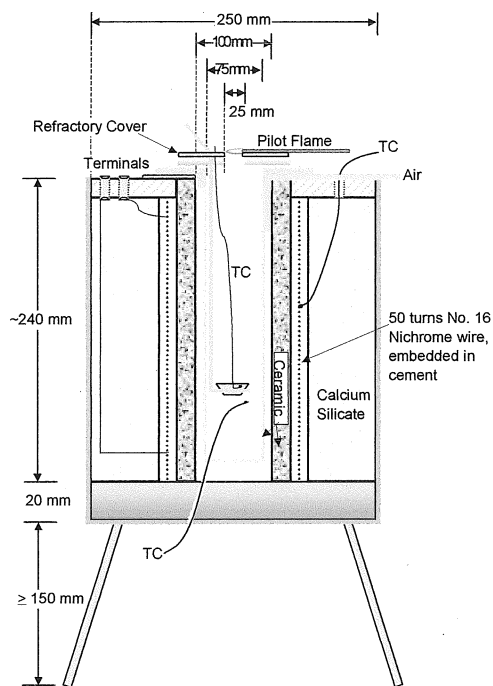
This standard should be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end use.

The results presented in this report apply specifically to the specimens tested, in the manner tested, and not to the entire production of these or similar materials, nor to the performance when used in combination with other materials.

## 2.0 DESCRIPTION OF TEST APPARATUS AND PROCEDURE

The ASTM E 136-11 hot-air ignition furnace consists primarily of an electrical heating unit and specimen holder. The furnace tube is a vertical tube, with an inside diameter of  $100 \pm 5$  mm and a length of  $230 \pm 20$  mm, made of ceramic that will withstand at least 750 °C. The inner ceramic tube, with an inside diameter of  $75 \pm 5$  mm, a length of  $230 \pm 20$  mm, and a thickness of approximately 3 mm, is placed inside the furnace tube and positioned  $20 \pm 2$  mm above the furnace floor on spacer blocks. The test apparatus is shown in Figure 1.

The air temperature inside the furnace is stabilized to 750 °C prior to testing. Sheathed thermocouples are used to measure the temperature of the furnace air ( $T_f$ ), specimen surface ( $T_s$ ), and specimen interior ( $T_c$ ). The duration of flaming is recorded during the test, and specimen mass loss is determined based on weight measurements before and after testing. ASTM E 136-11 requires that a series of four tests be conducted for each sample.



**Figure 1. Schematic of SwRI's Hot-Air Furnace.**

A material passes if at least three of the four specimens tested meet the following criteria (The three specimens do not need to meet the same condition.):

1. When the weight loss is 50% or less:
  - a. The surface and interior thermocouples cannot have a temperature rise of more than 30 °C from the stabilized temperature measured by the interior thermocouple before testing.
  - b. No sustained flaming after the first 30 s of the test.
2. When the weight loss is 50% or more:
  - a. The surface and interior thermocouples cannot exhibit any temperature rise from the stabilized temperature measured by the interior thermocouple before testing.
  - b. No flaming at any time during the test.

### 3.0 DESCRIPTION OF TEST SPECIMENS

The Aluminum Association, Inc., provided six specimens of the material, identified as 3003. The samples measured approximately 38 × 38 × 51 mm and were received by SwRI on February 28, 2011. A description of the material provided by the client can be found in Table 1. The samples were placed in a controlled environment maintained at 23 °C ± 2 °C (73 °F ± 5 °F) and 50% ± 5% relative humidity on March 5, 2011. Prior to testing, the specimens were placed in an oven at 60 °C for 24 hr, then placed in a desiccator to cool at room temperature. Due to the nature of the material, at the 750° C heat exposure from this test, the solid block changed phase to a liquid pool. To

avoid furnace damage from molten material, the specimens were slightly trimmed and placed in an open-top vessel as described in section 6.2.1 of the ASTM E136-11 standard.

**Table 1. Test Sample Description Provided by the Client.**

<b>Material ID</b>	<b>Description of Material</b>	<b>Composition</b>	<b>Nominal Thickness</b>	<b>Nominal Density</b>	<b>Color</b>
3003	3003 Test Block	Nominal w/o – 1.25 Mn – 0.12 Cu – Al Balance	2.0 in. (50.9 mm*)	0.099 lbs/in. <sup>3</sup> (2730 kg/m <sup>3</sup> *)	Aluminum (silver like) (Silver*)

\* Measured by SwRI personnel.

#### **4.0 TEST RESULTS**

Testing was conducted on March 18 and 24, 2011. During testing, flaming was not observed in any of the four test runs. Tabular test data and graphs of the measured temperatures plotted with respect to time are presented on page 5.

#### **5.0 CONCLUSIONS**

The material identified as *3003* **meets** the performance criteria presented in ASTM E 136-11.

**SOUTHWEST RESEARCH INSTITUTE**  
**ASTM E 136 TEST DATA SHEET**

*Client:* The Aluminum Association, Inc.  
*Operator:* Z. Holt  
*Test Date(s):* March 18 and 24, 2011  
*Material ID\*:* 3003  
*Trade Name\*:* 3003  
*Description\*:* 3003 Test Block

*Receipt Date:* February 28, 2011  
*Date Prepared by SwRI:* Prepared on test date  
*Color:* Silver  
*Original Thickness:* 50 mm  
*Test Sample Thickness:* 50 mm  
*Average Sample Mass:* 195.43 g

\* Information/instructions provided by the Client

**RESULTS**

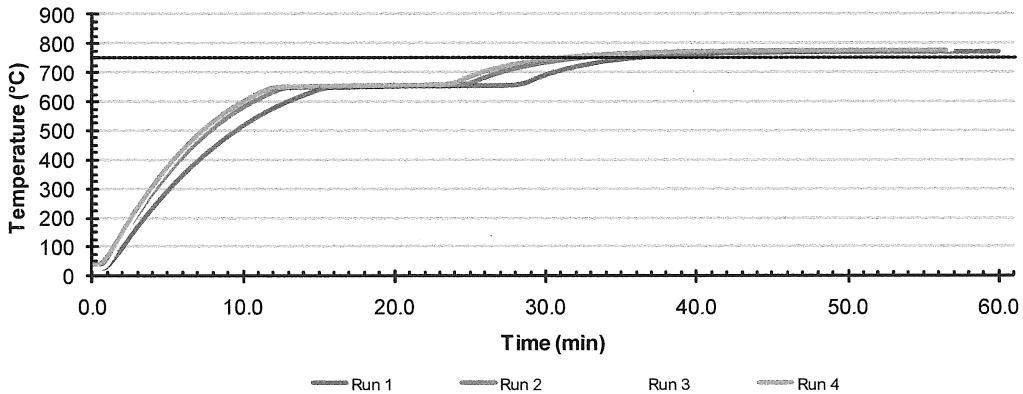
Run	Initial Mass (g)	Final Mass (g)	Percent Mass Loss	Specimen Center				Specimen Surface			
				Stabilized (°C)	Maximum (°C)	Δ T (°C)	Criteria* ΔT< 30 °C	Stabilized (°C)	Maximum (°C)	Δ T (°C)	Criteria* ΔT< 30 °C
1	184.61	184.55	0%	751	770	19	Pass	751	774	23	Pass
2	198.93	198.79	0%	752	777	26	Pass	752	777	25	Pass
3	199.45	199.35	0%	750	775	25	Pass	750	773	23	Pass
4	198.73	198.70	0%	752	776	24	Pass	752	774	22	Pass

\*Criteria for when percent mass loss < 50%

**TEST OBSERVATIONS**

Run	Insertion Time (s)	Ignition Time (min:s)	Flameout (min:s)	Duration of flaming (min:s)	Criteria: No flaming after first 30 s	Observed Smoke (min:s)	Observed Soot (min:s)	Total Test Time (s)
1	46	N/A	N/A	0:00	Pass	None	None	3554
2	40	N/A	N/A	0:00	Pass	None	None	3314
3	39	N/A	N/A	0:00	Pass	None	None	3373
4	32	N/A	N/A	0:00	Pass	None	None	3358

**Center Temperature Graph**



**Surface Temperature Graph**

