

Chapter 9 Radiant Heat Testing of Evacuation Slides, Ramps, and Rafts

9.1 Scope

9.1.1 This method is used to show compliance to Technical Standard Order (TSO) C69A.

9.2 Definition

9.2.1 Time to Failure

The time to failure is the time between first application of heat to the specimen and the first decrease in pressure below the maximum pressure attained in the test cylinder during the test.

9.3 Test Apparatus

9.3.1 Pressure Cylinder and Specimen Holder

The pressure cylinder will consist of a 12 3/8-inch (314-mm) -long aluminum cylinder with a 7 inch (178 mm) outside diameter and a 6 1/2 inch (165 mm) inside diameter, as shown in figures 9-1, 9-2, and 9-3.

9.3.1.1 An aluminum plate 1/2 inch (13 mm) thick will be welded to one end of the cylinder and will be drilled and tapped near its upper edge for a 1/4-inch (6.4-mm) American Standard taper pipe thread to facilitate the hook up of air pressure and pressure recording equipment.

9.3.1.2 An aluminum ring 7 inches (178 mm) in outer diameter, 5 1/2 inches (140 mm) in inner diameter, and 1/2 inch (13 mm) thick will be welded to the other end of the cylinder. The ring will have eight evenly spaced 10-32 bolt holes on the circle 5/16 inch (8 mm) from the ring's inner edge. (The diameter of this circle is 6 1/8 inches [156 mm] and adjacent bolt holes are 2 5/16 inches [60 mm] apart.) A 10-32 steel bolt 7/8 inch (22 mm) long will be placed into each of the holes.

9.3.1.3 An aluminum ring, 6 3/4 inches (171 mm) in outer diameter, 5 1/2 inches (140 mm) in inner diameter, 1/2 inch (13 mm) thick, and two neoprene rubber gaskets with similar clearance holes to fit over the bolts will provide a means for clamping and sealing the test specimen in place. Hinges and adjustable stops will be welded to the sides of the cylinder, as shown in figures 9-1, 9-2, and 9-3.

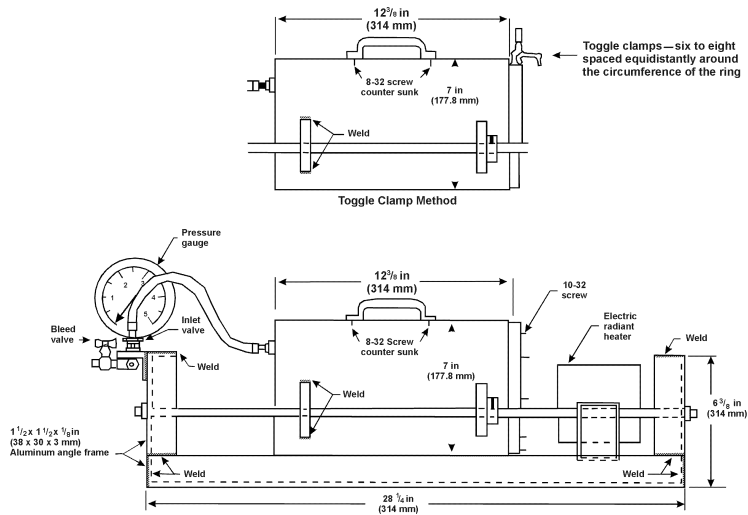


Figure 9-1. Evacuation Slide Material Test Apparatus – Front View

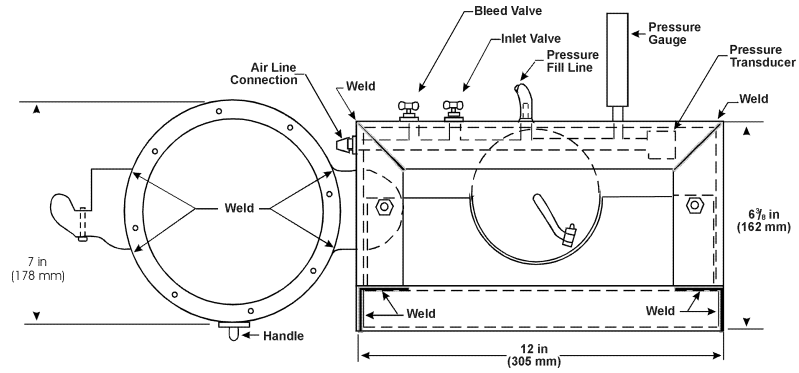


Figure 9-2. Evacuation Slide Material Test Apparatus – Side View

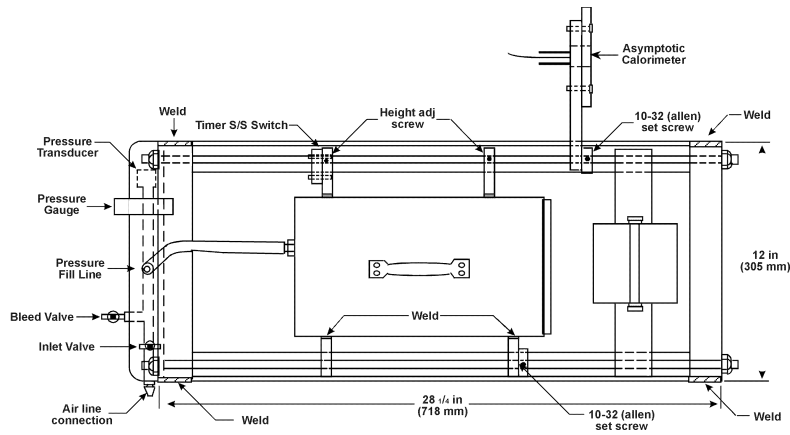


Figure 9-3. Evacuation Slide Material Test Apparatus – Top View

9.3.2 Electric Furnace

An electric furnace with a 3-inch (76-mm) -diameter opening, as shown in figure 9-4, will be provided to supply a constant irradiance on the specimen surface. The Smoke Density Chamber radiant heat furnace, or equivalent, has been found suitable.

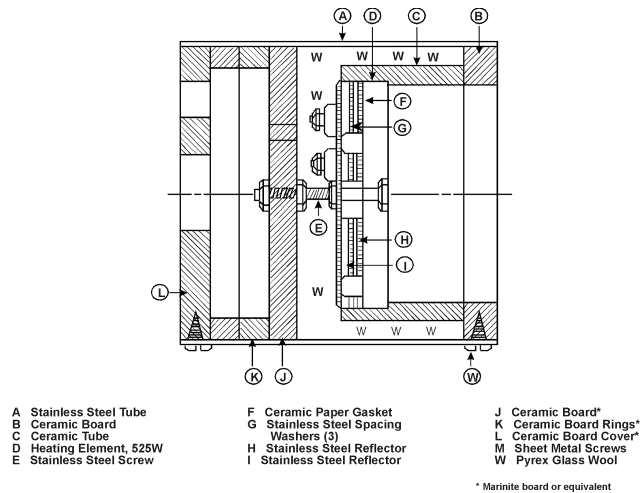


Figure 9-4. Furnace Details

9.3.3 Furnace Voltage Control

A variable voltage control, 115V, 600W minimum, will be provided to connect to the electric furnace power supply to adequately control the heat flux from the furnace. The furnace control system will be capable of maintaining the irradiance level under steady-state conditions for a minimum of 20 minutes.

9.3.4 Calorimeter

A 0 to 5 Btu/ft²-sec calorimeter will be provided to monitor the heat flux from the furnace. The calorimeter will be mounted in a 4 1/2-inch (114-mm) -diameter by 3/4-inch (19-mm) -thick insulating block, such as calcium-silicate millboard, with the surface of the calorimeter flush with the surface of the insulating block. The calorimeter will be hinged to one of the sliding bars of the framework and centered with the furnace (see figure 9-3).

9.3.5 Apparatus Framework

The pressure cylinder, calorimeter, and furnace are mounted on a framework, as detailed in figure 9-3. Adjustable sliding stops are located on each of the bars for setting the cylinder and calorimeter at any distance from the opening of the furnace.

9.3.6 Pressure Supply and Equipment

Compressed air is connected to the cylinder through a needle valve attached to the end of the framework. A tee-manifold on the outlet side of the valve provides for a 0 to 5 psig pressure gauge, a transducer, a flexible tube to supply air to the rear plate of the pressure cylinder, and a bleed valve, as shown in figure 9-1.

9.3.7 Instrumentation

The outputs of the calorimeter and pressure transducer are measured and recorded using a recording potentiometer or other suitable instrument capable of measurement over the range required.

9.4 Test Specimens

9.4.1 For each test, at least three specimens, 7 inches (178 mm) in diameter with eight 1/4-inch (6-mm) holes punched in the material to match the studs in the pressure cylinder, will be cut from the material to be tested.

9.4.2 If the pressure holding material has any exposed surfaces that are marked, overlay material, seams, or are altered in any other manner that affects radiant heat resistance, each different surface will be tested as a specimen set.

9.5 Conditioning

9.5.1 Condition test specimens at 70° ± 5°F (21° ± 3°C) relative humidity for a minimum of 24 hours prior to testing.

9.6 Calibration

9.6.1 Turn on the radiant heat furnace and other required instrumentation and allow 1/2 to 3/4 hours to stabilize heat output and for instrumentation warmup.

9.6.2 Adjust the transformer to produce a radiant heat flux density of 2 Btu/ft²-sec (2.3 W/cm²) when the calorimeter is positioned at approximately 1 1/2 inches (38 mm) in front of the radiant heat furnace.

9.6.3 Find the precise location in front of the furnace where the test heat flux density of 1.5 Btu/ft²-sec (1.7 W/cm²) is achieved by sliding the calorimeter on the horizontal bar and fixing the position with the sliding stop. Swing the calorimeter out of position.

9.7 Procedure

- 9.7.1 Conduct the tests in a draft free room or enclosed space. It is recommended that tests be conducted under a hood or other means to remove potentially hazardous gases from the test area.
- 9.7.2 Turn on the radiant heat furnace and other required instrumentation and allow 1/2 to 3/4 hours to stabilize heat output and for instrumentation warmup.
- 9.7.3 Rotate the cylinder away from the furnace. Mount the specimen with the reflective surface of the material facing the furnace on the open end of the cylinder and with a neoprene gasket on each side of the specimen. Place the aluminum ring on the studs and tighten the nuts so that an airtight seal is achieved.
- 9.7.4 Pressurize the cylinder to the slide material nominal operating pressure and check for leakage.
- 9.7.5 Locate the pressure cylinder so that the distance from the test specimen to the surface of the radiant heat furnace is the distance established in section 9.6.3.
- 9.7.6 Place the calorimeter in front of the radiant heat furnace at the distance established in section 9.6.3 and record the heat flux density. Verify that the heat flux is $1.5 \text{ Btu/ft}^2\text{-sec}$ (1.7 W/cm^2). Remove the calorimeter.
- 9.7.7 Rotate the pressure cylinder with the test specimen in front of the radiant heat furnace. Start the timer.
- 9.7.8 Monitor the pressure cylinder from the time the specimen is placed in front of the furnace until the first observed pressure loss.
- 9.7.9 Record time to failure in seconds.

9.8 Report

- 9.8.1 Report material description and full identification that may include type of fabric and coating, manufacturer, manufacturer style number, weight, thickness, color, and any alterations, if applicable.
- 9.8.2 Report the test conditions, including the heat flux density and starting pressure for each of the three specimens.
- 9.8.3 Report any observations of the material behavior during the test and times of occurrence.
- 9.8.4 Report the time to failure for each of the three specimens and the overall average.

9.9 Requirement

- 9.9.1 The average time to failure for the three specimens tested will not be less than 90 seconds.

Chapter 9 Supplement

This supplement contains advisory material pertinent to referenced paragraphs.

9.3.1 Figure 9-1 represents an alternative method of securing the specimen in place on the holder by using toggle clamps instead of welded hinges and adjustable stops.

9.3.2 The electric furnace is available from Superpressure, Inc., 8030 Georgia Avenue, Silver Springs, Maryland 20910 (Catalog Number #D-257-68086).

9.6.1 To prolong the life of the furnace, increase the voltage to cold furnace slowly.