

## **Chapter 15**

### **Two Gallon per Hour Oil Burner Certification Testing for Repaired Cargo Compartment Liners**

#### **15.1 Scope**

- 15.1.1 This test method gives certification test procedures for repair of damaged cargo liners which would include, but not be limited to, ceiling and sidewall liners, pressurized cylinder cover liners, fabric liners, and compartment separation liners. Repairs should not be made to areas of the cargo liner that are designed for blowout in case of decompression.
- 15.1.2 Repairs generally consist of patches of fiberglass reinforced materials bonded to the cargo liners to cover rips, tears, and punctures that result from wear, abuse, and accidents. The patches are usually coated with an intumescent-type material to prevent separation during heat exposure.
- 15.1.3 Because of the large array of damage types that can occur to cargo liners, the following test procedures are aimed at ensuring that all types of repairs can safely contain a cargo compartment fire.
- 15.1.4 Soft or neoprene-coated fabric liners, typically used as partition separators, must also be included in this category and should follow the identical testing procedures as the conventional liners when repairs are made.

#### **15.2 Test Specimens**

The sample cargo liner used in the test specimens must be identical to the in-service liner in both material type and thickness, since certain thicknesses of liner may react quite differently than others. Thicker liners release significantly more amounts of heat than do thinner liners. Thinner (conventional type) liners contain less reinforcement, thereby providing less structural support to which the repair unit can adhere. If a patch is intended for use on a variety of liner thicknesses, tests should be run for each thickness. As an alternative, tests may be run on the minimum and maximum thicknesses of liners that the repair patch will be used on in service to alleviate the testing of all thicknesses within this range. Similarly, if there are several variants of a particular liner resin structure (i.e., fiberglass reinforcement with several slightly different phenolic resins), it is only necessary to test the generic construction (fiberglass/phenolic) and not every single resin type.

##### **15.2.1 Liner Repair Burnthrough Resistance Specimen**

###### **15.2.1.1 Specimen Configuration**

A flat sheet of material, identical to that used in the construction of the repair unit (patch), must be tested for resistance to burnthrough in the ceiling position of the cargo liner test apparatus.

###### **15.2.1.2 Specimen Size**

The burnthrough resistance sample shall measure 16 by 24 inches and contain the necessary mounting holes, as shown in figure 15-1.

###### **15.2.1.3 Specimen Number**

A minimum of three samples for each type of repair unit material shall be prepared.

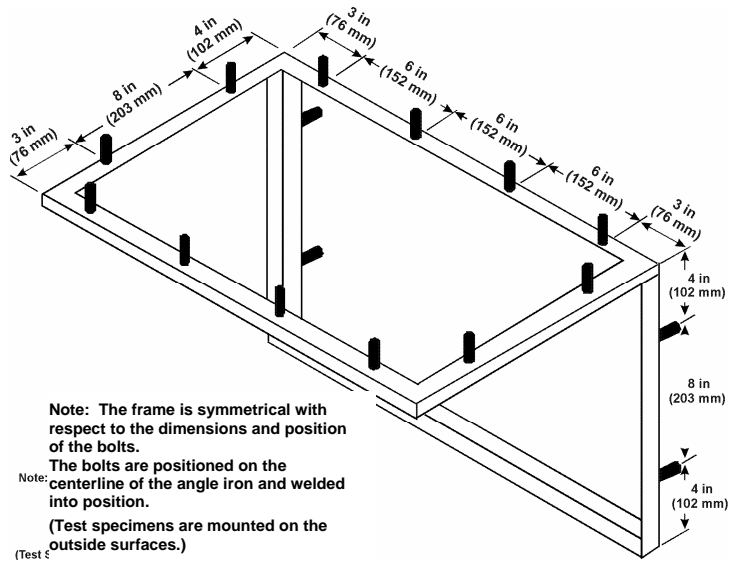


Figure 15-1. Cargo Liner Test Specimen Frame

## 15.2.2 Liner Repair Adhesion Specimen

### 15.2.2.1 Specimen Configuration

The repair patch must be placed over the standard damage area in the sample liner. The damage area must measure 5 by 5 inches with a width of 1 inch, in the form of an L-shape, and positioned according to figure 15-2. The placement of the repair patch in this location has been shown to be the most severe.

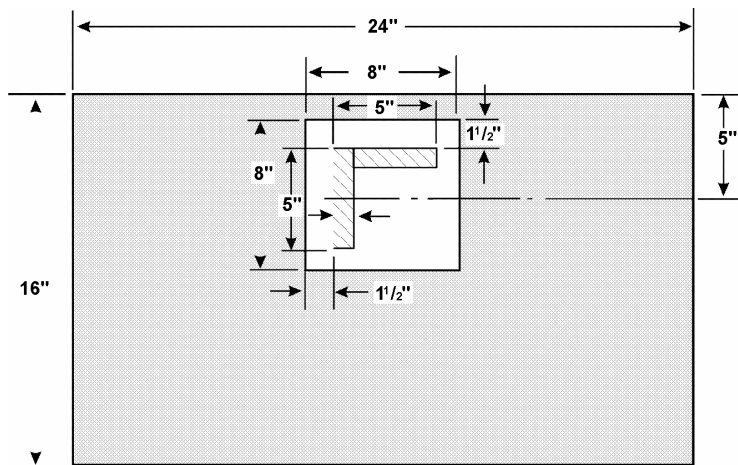


Figure 15-2. Eight-by-Eight-Inch Patch Over Standard Damage

### 15.2.2.2 Specimen Size

The repair patch must measure 8 by 8 inches and be positioned over top of the damage area, according to figure 15-2. The liner sample must measure the standard 16 by 24 inches including the necessary mounting holes (see figure 15-1).

### 15.2.2.3 Specimen Number

A minimum of three samples must be prepared for each type of repair unit material.

### 15.2.3 Liner Repair Shingling Specimen

#### 15.2.3.1 Specimen Configuration

Two 4- by 4-inch patches must be overlapped by 1 inch and placed over the standard damage area in the sample liner. The damage area must measure 1 by 5 inches and be positioned as shown in figure 15.3.

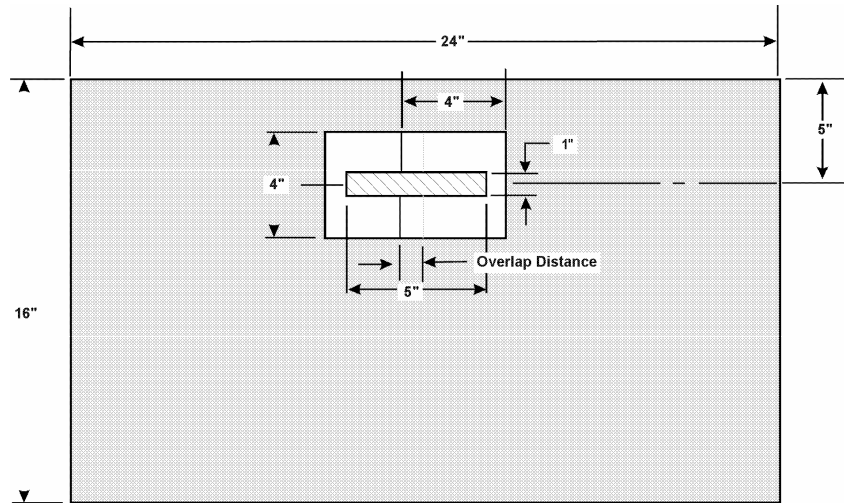


Figure 15-3. Overlapped Patches for Shingling Test

#### 15.2.3.2 Specimen Size

Patches must measure 4 by 4 inches, and the sample liner must measure the standard 16 by 24 inches including mounting holes (see figure 15-1).

#### 15.2.3.3 Specimen Number

A minimum of three samples must be prepared for each type of repair patch.

## 15.3 Specimen Conditioning

15.3.1 The specimens shall be conditioned at  $70^{\circ} \pm 5^{\circ}\text{F}$  ( $21^{\circ} \pm 2^{\circ}\text{C}$ ) and  $55\% \pm 5\%$  relative humidity for a minimum of 24 hours prior to testing.

## 15.4 Procedure

Reference FAA technical documents DOT/FAA/CT-TN88/33, DOT/FAA/CT-TN89/17, and DOT/FAA/AR-TN95/83 for a description of related test results and the development of this test procedure.

### 15.4.1 Burnthrough Resistance Test

The material that comprises the primary fire barrier of the repair patch must be tested in a flat sheet, 16 by 24 inches, in the ceiling position of the cargo liner test apparatus. The sidewall area of the apparatus should be blocked off with either Kaowool ceramic fiber board or Marinite block. Follow procedures in chapter 8, section 8.8 to conduct the burnthrough test.

### 15.4.2 Adhesion Test

In addition to the burnthrough resistance test, the repair patch must also display the ability to remain adhered to the liner specimen under the same conditions. The patched liner will be tested in the ceiling position of the test apparatus with the sidewall area blocked off with Kaowool board or Marinite. Follow the procedures outlined in chapter 8, section 8.8 paying close attention to the positioning of the repair patch over the standard damage area.

#### 15.4.3 Shingling Test

The repair patch must also display its ability to shingle, since most repairs are long tears, and a single patch is not sufficient to cover the entire damage area. The overlapped patches, when placed on the liner specimen material, must be tested in the ceiling position of the cargo liner apparatus with the sidewall area blocked off with either Kaowool board or Marinite block. Follow the procedures in chapter 8, section 8.8 to conduct the test.

### 15.5 Report

A record of burner test apparatus calibration should be provided for each of the above repair patch tests.

#### 15.5.1 Burnthrough Resistance Test of Repair Patch

- 15.5.1.1 Report a complete description of the material(s) being tested including manufacturer, type of liner, thickness of liner, etc.
- 15.5.1.2 Record any observations regarding the behavior of the test specimen during flame exposure such as delamination, resin ignition, smoke, etc., and the time of occurrence of each event.
- 15.5.1.3 Report the time of occurrence of flame penetration, if applicable, for each of the specimens tested.
- 15.5.1.4 If flame penetration does not occur, report the maximum backside temperature and the time of occurrence.

#### 15.5.2 Adhesion Test of Repair Patch

- 15.5.2.1 Report a complete description of the material(s) being tested including manufacturer; type of repair patch; type of intumescent coating, if used; type and thickness of liner specimen; type of attachment (rivets); etc.
- 15.5.2.2 Record any observations regarding the behavior of the test specimen during flame exposure such as delamination, separation of repair patch from sample liner, lifting or curling of repair patch edges, resin ignition, smoke, etc., and the time of occurrence of each event.
- 15.5.2.3 Report the time of occurrence of either flame penetration or repair patch separation, if applicable, for each of the specimens tested.

#### 15.5.3 Shingling Test of Repair Patch

- 15.5.3.1 Report a complete description of the material(s) being tested including manufacturer; type of repair patch; type of intumescent coating, if used; type and thickness of liner; type of attachment (rivets); etc.
- 15.5.3.2 Record any observations regarding the behavior of the test specimen during flame exposure such as delamination; separation of the two patches, allowing passage of flames; lifting or curling of repair patch edges; resin ignition; smoke; etc., and the time of occurrence of each event.
- 15.5.3.3 Report the time of occurrence of either flame passage or patch separation, if applicable, for each of the specimens tested.

### 15.6 Requirements

#### 15.6.1 Liner Repair Burnthrough Resistance

- 15.6.1.1 None of the three specimens tested shall burn through at any time during the 5-minute test.

15.6.1.2 The backface temperature must not exceed 400°F at any time for any of the test specimens when measured at 4 inches above the **front side of the** liner sample, over the center point of the burner cone.

15.6.2 Liner Repair Adhesion

15.6.2.1 The repair unit must remain totally adhered to the liner specimen during the entire 5-minute test. Minor curling or lifting of the repair patch that occurs near the edges is acceptable, provided no flames penetrate the standard damage area.

15.6.3 Liner Repair Shingling

15.6.3.1 Repair units (4- by 4-inch patches) must remain totally adhered to the liner specimen during the entire 5-minute test. Minor curling or lifting of the repair patch that occurs near the edges is acceptable, provided the shingled area remains attached along the entire seam and no flames penetrate the standard damage area.