

# assessment report



**Title:**

The Fire Performance of Tuffa  
Protective Covers to Domestic  
& Non-Domestic Oil Storage  
Tanks

**WF Assessment Report No:**

180983B

**Prepared for:**

**TUFFA UK Ltd**

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**Date:**

**1<sup>st</sup> April 2009**

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## Executive Summary

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<b>Objective</b>	This report presents an appraisal of the fire performance of the Tuffa protective covers to oil storage tanks in terms of the integrity and insulation performance requirements of BS 476: Part 22: 1987 when fitted to external oil storage tanks for domestic and non-domestic applications and when fitted to internal oil storage tanks for domestic applications up to 3500 litres.
<b>Report Sponsor</b>	<b>TUFFA UK Ltd</b>
<b>Address</b>	Dovefields Industrial Estate Derby Road Uttoxeter Staffordshire ST14 8SW
<b>Summary of Conclusions</b>	Should the recommendations given in this report be followed, it can be concluded that the Tuffa protective covers, which enclose the sides, top and underside of the oil storage tank with a non-combustible construction, provide a fire resistance of 60 minutes in terms of the integrity and insulation criteria of BS 476: Part 22: 1987.
<b>Valid until</b>	1 <sup>st</sup> April 2014

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## Introduction

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This report presents an appraisal of the fire performance of the Tuffa protective covers for external oil storage tanks for domestic and non-domestic applications and when fitted to internal oil storage tanks for domestic applications up to 3500 litres.

The proposal is for the covers to be non-combustible and to provide a barrier with a fire resistance of 60 minutes, in terms of the integrity and insulation criteria of BS 476: Part 22: 1987, between the tank and an adjacent fire source.

### FTSG

The data referred to in the supporting data section has been considered for the purpose of this appraisal which has been prepared in accordance with the Fire Test Study Group Resolution No. 82: 2001.

## Assumptions

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### Tank location and size

It is assumed that the tank is situated either externally to the building in which the appliance is installed and that maximum storage capacity of the tank is 3500 litres in a domestic application and 60000 litres for non-domestic applications or situated within a building for domestic applications up to 3500 litres.

### Supporting construction

It is assumed that the tank is installed on or over a non-combustible base that extends out at least 300mm from all sides of the tank, except that if the tank is closer than 300mm to a wall or boundary wall, the base need only extend as far as the wall. Types of acceptable base are:

- Concrete at least 100mm thick;
- Paving stones at least 42mm thick positioned closely to each other on level ground;
- Stonework at least 42mm thick.

## Proposals

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### Covers

The Tuffa protective covers are constructed with Tuffa FireStop 60 barrier material. The Tuffa FireStop 60 barrier consists of three identical layers of material. Each layer of material consists of one layer of 'E' glass needelfelt blanket, nominally 5mm thick x 700g/m<sup>2</sup> weight encased within 50µm aluminium foil, enclosed within two layers of 420g/m<sup>2</sup> woven 'E' glass fabric, 0.4mm thick, rendered temperature resistant by the application of a proprietary chemical treatment. The whole is assembled together using a small amount of thermoplastic adhesive. The composite barrier is 15mm nominal thickness and 5.4kg/m<sup>2</sup> weight.

The covers are constructed to enclose the sides, top and underside of the tank. At vertical joints in the barrier material, the two materials are folded for 50mm and stapled together, either each layer separately or through all the layers simultaneously. At horizontal joints each layer of the material is jointed separately. For each layer the core blankets are overlapped by at least 50mm and the 'E' glass fabric, on each face, are folded for at least 50mm and stapled together. The staples used are 12mm stainless steel staples at 50mm nominal centres. The jointing method is shown in Figure 1. The covers are designed for tanks up to a maximum storage capacity of 60000 litres and a maximum cover height (drop) of 4m.

**Pipe penetrations** The Tuffa protective cover encloses the complete tank except for three steel pipes that penetrate through the covers. At each of these locations a Tuffa Firestop penetration seal is fitted. There are no other penetrations through the cover. However each penetration may also include a copper tube, maximum 10mm diameter, and an electrical signal cable, maximum 10mm diameter, tied to the steel pipe.

At these locations a slot or feather circle is cut through the Tuffa FireStop barrier material to allow the pipe to pass through. Tuffa collars, made of the same Tuffa FireStop 60 barrier material, are wrapped around the pipe on the inside of the cover, extending up to the tank, and on the outside of the cover for a minimum distance of 300mm. The collars are fitted tightly around the pipes by fastening the edges together using 12mm stainless steel staples at 100mm nominal centres. Beads of Tuffa high temperature adhesive, 2 x 6mm beads, are used to attach the flange of each collar to the cover. Any visible gaps are sealed with Tuffa high temperature adhesive. The flanges of the collars are stapled to the cover with one 16mm stainless steel staple on each side. The maximum steel pipe size is 88mm external diameter.

## Basic Test Evidence

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**Tuffa FireStop** The test referenced Faverdale No. FTCCR/96/0057 and described briefly in the supporting data section of this report describes a fire resistance test conducted on a vertical Tuffa FireStop 30 cavity barrier. The test shows that the barrier is able to provide an integrity performance of at least 60 minutes.

The test referenced WF No. 155327 and described briefly in the supporting data section of this report describes an indicative fire resistance test conducted on a vertical Tuffa FireStop 60 cavity barrier. The test shows that the barrier is capable of providing an integrity and insulation performance of 60 minutes.

The test referenced AFTF No. 080502 and described briefly in the supporting data section of this report describes a fire resistance test conducted on a vertical Tuffa FireStop 'E' glass coated fabric cavity barrier. The test shows that the barrier is able to provide an integrity performance of over 60 minutes.

## Penetrations

The test referenced WARRES No. 69612 and described briefly in the supporting data section of this report describes a fire resistance test conducted on a 1m x 1m Tuffa FireStop 30 cavity barrier when penetrated by two cable trays and two steel pipes. Each service was fitted with an uninsulated Tuffa collar on the fire face of the barrier. The test shows that the penetrated barrier assembly is able to provide an integrity performance of 60 minutes.

The test referenced Beele No. 17-07-07/1 and described briefly in the supporting data section of this report describes a fire resistance test conducted on a steel bulkhead clad with Tuffa FireStop 60 barrier material when penetrated by a steel pipe. The service was fitted with a Tuffa FireStop 60 penetration seal on the non-fire face of the bulkhead. The test shows that the penetrated seal assembly is able to provide an integrity performance of 60 minutes and an insulation performance of 49 minutes with a 200mm-long collar.

## Assessed Performance

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### BS 5410-1

The guidance provided in BS 5410: Part 1, Section 6, on the accommodation for oil storage tanks has been adopted for this assessment. Therefore the assessment is limited to oil storage tanks that are situated externally to a building or within a building for domestic applications up to 3500 litres.

In section 6.3, 'Methods of tank protection', the standard states that 'It is considered unlikely that a fire will originate from the stored oil and it is the purpose of these recommendations to ensure that a fire which may originate from a building or other external source is not transmitted to the tank contents or, if a fire occurred, its effects are limited'. The standard lists a number of ways by which adequate safety may be achieved. One of these ways is by enclosing the tank with a non-combustible fire resisting construction that will provide a barrier between the tank and the fire. The barrier must also prevent the passage of direct radiated heat from the fire. The standard also states that for tanks located within a building 'tanks should never be installed in a habitable area'.

### Risk assessment

It is recommended that a risk assessment be carried out to determine sources of potential fire hazard.

### Tuffa FireStop

A non-combustibility test was carried out in accordance with BS 476: Part 4: 1970 on samples of Tuffa FireStop barrier material (TE 201288). The samples did not exceed the limits imposed by the standard for flaming and temperature rise. The material was therefore deemed to be non-combustible.

The performance of the vertical Tuffa FireStop 'E' glass coated fabric (a single layer of material nominally 0.34mm thick), when subjected to the standard fire resistance test, has been demonstrated in test AFTF No. 080502 where a 3m x 3m barrier incorporating two vertical joints satisfied the integrity criteria of the standard for 113 minutes. There was no failure of the material in the test; one joint in the fabric began to open near the top of the curtain due to the incorrect fitting of the fixing staples at that location.

The Tuffa FireStop 30 fire barrier consists of two outer layers of 'E' glass coated fabric separated by two needlefelt 450g/m<sup>2</sup> core blankets. The performance of the vertical Tuffa FireStop 30 cavity barrier system, when subjected to the standard fire resistance test, has been demonstrated in test No. FTCT/96/0057 where a 3m x 3m barrier incorporating two vertical joints achieved an integrity performance of 73 minutes and an insulation performance of 17 minutes. After 14 minutes of the test the barrier was subjected to a simulated blast condition due to a malfunction of the furnace control system. The barrier remained intact, satisfying the integrity criteria of the standard, but it is thought that the abnormally high pressure to which the barrier was subjected may have damaged the material of the barrier, resulting in a lower than expected insulation performance.

The Tuffa FireStop 60 fire barrier consists of three identical layers of material. Each layer of material consists of one layer of needlefelt 700g/m<sup>2</sup> core blanket enclosed between two layers of 'E' glass coated fabric. Although the Tuffa FireStop 60 barrier material has not been subjected to a fire resistance test at a size of 3m x 3m, the 'E' glass coated fabric and the Tuffa FireStop 30 barrier material have shown that they are able to satisfy the integrity criteria of the test standard for at least 60 minutes at that size. Therefore it is expected that the Tuffa FireStop 60 barrier material would provide an integrity performance of 60 minutes if tested at a size of 3m x 3m as each layer of needlefelt 700g/m<sup>2</sup> core blanket is supported by two layers of 'E' glass coated fabric, compared to two layers of needlefelt 450g/m<sup>2</sup> core blanket supported by two layers of 'E' glass coated fabric for the Tuffa FireStop 30.

In order to further investigate the insulation performance of the Tuffa FireStop 60 barrier material, an indicative fire test was carried out (WF No. 155327) where thermocouples were attached to the non-fire face of a 1000mm high x 1000mm wide sample of the vertical barrier. The barrier satisfied the mean temperature rise requirement of the test standard for 62 minutes and the maximum temperature rise requirement for 65 minutes.

## Penetrations

Steel pipes are connected to the tank. There are typically three pipes, these being the filler and vent pipes (at the top of the tank) and the outlet pipe close to the bottom of the tank. Where each of these pipes passes through the cover a Tuffa FireStop penetration seal is fitted.

The performance of the basic Tuffa FireStop penetration seal system, when subjected to the standard fire resistance test, has been demonstrated in test referenced WARRES No. 69612. In this test, conducted on a 1m x 1m Tuffa FireStop barrier when penetrated by two cable trays and two steel pipes, each pipe service was fitted with an uninsulated Tuffa collar, 300mm-long, on the fire face of the barrier. The collars consisted of the outer glass fabric of the Tuffa FireStop barrier material without the internal insulating layers of needlefelt blanket. The test has demonstrated that the Tuffa FireStop penetration seal system, when fitted to steel pipes passing through the Tuffa FireStop barrier, is able to provide an integrity performance of 60 minutes. It has also shown that the addition of a small copper pipe and a small electrical signal tied to the metal pipe would not adversely affect the fire performance.

The test referenced Beele No. 17-07-07/1 describes the fire resistance test that was conducted on a steel bulkhead clad with Tuffa FireStop 60 barrier material when penetrated by a 160mm-diameter steel pipe. The service was fitted with a Tuffa FireStop 60 penetration seal on the non-fire face of the bulkhead. The test shows that the penetrated seal assembly is able to provide an integrity performance of 60 minutes and an insulation performance of 49 minutes with a 200mm-long collar. The maximum temperature rise limit (+180°C) was not exceeded on the barrier or on the collar during the 60-minute test. However, it was exceeded after 49 minutes on the steel pipe at the end of the collar.

The maximum temperature rise on the tested steel pipe at 60 minutes was 215°C. Therefore, in order to ensure that the maximum temperature rise on the steel pipes does not exceed 180°C for a 60-minute standard fire exposure, the length of the collar fitted to the pipe outside the cover has been extended to 300mm and a collar also fitted to the pipe inside the cover up to the tank. Also the size of pipe fitted to the tanks, maximum 88mm external diameter, is much less than the tested pipe size of 160mm-diameter. Smaller diameter protected steel pipes usually achieve a longer insulation performance than large steel pipes in the standard fire test. Also the heat conduction down a small copper pipe and a small electrical signal cable would be very small compared to the steel pipe.

## Covers

The fire tests have demonstrated that the covers are non-combustible and form a 60-minute fire resisting barrier around the sides, top and underside of the tank.

## Conclusions

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The Tuffa protective covers enclosing the sides, top and underside of external oil storage tanks for domestic and non-domestic applications or of internal oil storage tanks for domestic applications up to 3500 litres, as described in the proposals section of this report, are constructed with a non-combustible fire barrier material with a fire resistance of 60 minutes in terms of the integrity and insulation criteria of BS 476: Part 22: 1987 when tested as a vertical or horizontal cavity barrier. The covers therefore enclose the sides, top and underside of the oil storage tank with a non-combustible construction with a fire resistance of 60 minutes, given the requirements and limitations stated in this report.

## Validity

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This assessment is issued on the basis of test data and information available at the time of issue. If contradictory evidence becomes available to Bodycote **warringtonfire** the assessment will be unconditionally withdrawn and TUFFA UK Ltd will be notified in writing. Similarly the assessment is invalidated if the assessed construction is subsequently tested because actual test data is deemed to take precedence over an expressed opinion. The assessment is valid initially for a period of five years i.e. until 1<sup>st</sup> April 2014, after which time it is recommended that it be returned for re-appraisal.

The appraisal is only valid provided that no other modifications are made to the tested construction other than those described in this report.

## Summary of Primary Supporting Data

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### **Faverdale No. FTCR/96/0057**

This report describes a fire resistance test in accordance with BS 476: Part 22: 1987 that was carried out on a vertical Tuffa FireStop 30 cavity barrier assembly for a heating period of 73 minutes. The assembly, 3000mm high x 3000mm wide, comprised Tuffa FireStop 30 barrier material clamped between 0.5mm-thick steel channel and angle sections at the head and sides. Two vertical joints in the material were included in the barrier.

The cavity barrier assembly satisfied the integrity criterion for 67 minutes and the insulation criterion for 17 minutes.

Test date : 26<sup>th</sup> June 1996

Test sponsor : Another company who has given written permission to TUFFA UK Ltd to use the report.

### **AFTF No. 080502**

This report describes a fire resistance test in accordance with BS 476: Part 22: 1987 that was carried out on a vertical Tuffa FireStop 'E' glass coated fabric cavity barrier assembly for a heating period of 115 minutes. The assembly, 3000mm high x 3000mm wide, comprised a single layer of Tuffa FireStop 'E' glass coated fabric, 0.34mm nominal thickness, clamped between 0.5mm-thick steel channel and angle sections at the head and sides. Two vertical joints in the material were included in the barrier.

The cavity barrier assembly satisfied the integrity criteria of the standard for 113 minutes.

Test date : 29<sup>th</sup> May 2002

Test sponsor : Another company who has given written permission to TUFFA UK Ltd to use the report.

### **WF No. 155327**

This report describes an indicative fire resistance test adopting the appropriate procedures and performance criteria of BS 476: Part 20: 1987 on a vertical Tuffa FireStop 60 cavity barrier assembly for a heating period of 67 minutes. The assembly, 1000mm high x 1000mm wide, comprised Tuffa FireStop 60 barrier material clamped between 0.5mm-thick steel channel and angle sections on all four edges.

The cavity barrier assembly satisfied the adopted integrity criterion for 67 minutes (no failure) and the insulation criterion for 62 minutes.

Test date : 5<sup>th</sup> June 2006

Test sponsor : TUFFA UK Ltd.

**WARRES No.  
69612**

This report describes a fire resistance test in terms of the adopted integrity and insulation performance criteria of BS 476: Part 22: 1987 that was carried out on a 1m x 1m Tuffa FireStop 30 cavity barrier when penetrated by two cable trays and two steel pipes, for a heating period of 66 minutes. Each service was fitted with an uninsulated Tuffa collar on the fire face of the barrier.

The barrier assembly satisfied the adopted integrity criteria for 66 minutes and the adopted insulation criteria for 15 minutes.

Test date : 10<sup>th</sup> October 1996

Test sponsor : Another company who has given written permission to TUFFA UK Ltd to use the report.

**Beele No. 17-07-  
07/1**

This report describes a fire resistance test adopting the heating conditions and performance criteria of IMO Resolution A.754(18) that was carried out on a vertical steel bulkhead, 1600mm x 1600mm x 6mm thick, protected on the non-fire face with Tuffa FireStop 60 barrier material for a heating period of 60 minutes. The bulkhead was penetrated by a 160mm-diameter steel pipe protected with a Tuffa FireStop 60 penetration seal fitted with a 200mm-long collar on the non-fire side.

The bulkhead assembly satisfied the adopted smoke and flame (integrity) criteria for 60 minutes and the insulation criteria for 60 minutes on the bulkhead and 49 minutes on the pipe penetration.

Test date : 17<sup>th</sup> July 2007

Test sponsor : Another company who has given written permission to TUFFA UK Ltd to use the report.

**LPC/BRE No. TE  
201288**

This report describes a non-combustibility test in accordance with BS 476: Part 4: 1970 on samples of Tuffa FireStop barrier material.

The samples did not exceed the limits imposed by the standard for flaming and temperature rise. The material was therefore deemed to be non-combustible.

Test date : 18<sup>th</sup> August 2000

Test sponsor : Another company who has given written permission to TUFFA UK Ltd to use the report.

## **Summary of Secondary Supporting Data**

**BS 5410-1:1997**

British Standard 5410 – Code of practice for oil firing. Part 1: Installations up to 45kW output capacity for space heating and hot water supply purposes. British Standards Institution, 1997.

## Declaration by TUFFA UK Ltd

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We the undersigned confirm that we have read and complied with the obligations placed on us by the UK Fire Test Study Group Resolution No. 82: 2001.

We confirm that the component or element of structure, which is the subject of this assessment, has not to our knowledge been subjected to a fire test to the Standard against which the assessment is being made.

We agree to withdraw this assessment from circulation should the component or element of structure be the subject of a fire test to the Standard against which this assessment is being made.

We are not aware of any information that could adversely affect the conclusions of this assessment.

If we subsequently become aware of any such information we agree to cease using the assessment and ask Bodycote **warringtonfire** to withdraw the assessment.

Signed:



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For and on behalf of:


Tuffa UK LTD

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## Signatories

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Responsible Officer
R H Earle* - Certification Engineer


Approved
A Kearns* - Technical Manager

\* For and on behalf of Bodycote **warringtonfire**.

Report Issued: 1 <sup>st</sup> April 2009
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The assessment report is not valid unless it incorporates the declaration duly signed by the applicant.

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