

Exova Warringtonfire
Holmesfield Road
Warrington
WA1 2DS
United Kingdom

T : +44 (0) 1925 655 116
F : +44 (0) 1925 655 419
E : warrington@exova.com
W: www.exova.com



Testing. Advising. Assuring.

Title:

Fire resistance test utilising the general principles of BS 476: Part 20: 1987 on a specimen of an insulated flexible duct.

Report No:

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Prepared for:

ISIL Muhendislik
Mak.San.TIC.AS
Yayahar mah. Akinsok No.
18
Pendik
Turkey

Date: 23rd January 2018

Summary

Objective To determine the fire resistance performance of a specimen of an insulated flexible duct, when exposed on its internal surface to the heating conditions specified in BS 476: Part 20: 1987.

Sponsor **ISIL Muhendislik**, Mak.San.TIC.AS, Yayahar mah. Akinsok No. 18, Pendik, Turkey

Summary of the Tested Specimen The tested duct was of 160 mm nominal internal diameter and had an exposed length of 2000 mm.

The duct, referenced 'Flexiva SKY Insulated', was of an insulated construction, and briefly comprised an internal single layer of aluminium foil, spirally wound over a wire helix, and outer jacket of polyester. Between the outer layer of the spirally wound material and the inner face of the outer jacket was a layer of glass wool insulation, nominally 25mm thick by 16kg/m³.

If the ability of the flexible duct to contain flames and hot gases, is assessed against the integrity criteria of BS 476: Part 20: 1987, the results could be expressed as follows:

Test Result:

Integrity 26 minutes

The test was discontinued after a period of 28 minutes.

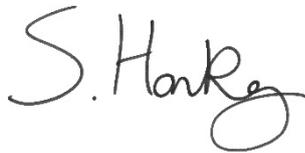
Date of Test 13th December 2017

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Signatories



Responsible Officer
G. Edmonds*
Deputy Operations Manager



Approved
S. Hankey*
Business Unit Head

* For and on behalf of **Exova Warringtonfire**

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Test Procedure

Introduction

Flames and hot gases from a fire may be transferred from one part of a building to another via ducts employed for air conditioning and ventilation systems. Dampers are normally provided within such ducts to preserve the fire compartmentation within a building, to guard against spread of fire and to limit the extent of structural damage.

Ducting systems frequently incorporate flexible joints and/or flexible ducting used as connections between the main rigid ventilation ductwork and items such as ventilation units, extract units or ventilation grilles. There may be a need for these flexible joints or ducts to have the ability to contain any fire that may enter them.

There is not, at present, any recognised method for testing the fire integrity of such flexible ducts and performance criteria is therefore not available. In the test described in this report, a flow of hot gases from a gas fired furnace, controlled to comply with the heating conditions of British Standard 476: Part 20: 1987, was channelled through a length of horizontal ducting supported in a manner stated to be typical of that used in practice. The performance of the duct was assessed against the criteria for integrity (given in British Standard 476: Part 20: 1987).

Fire Test Study Group/EGOLF

Certain aspects of some fire test specifications are open to different interpretations. The Fire Test Study Group and EGOLF have identified a number of such areas and have agreed Resolutions which define common agreement of interpretations between fire test laboratories which are members of the Groups. Where such Resolutions are applicable to this test they have been followed.

Instruction to test

The test was conducted on the 27th May 2010 at the request of **ISIL Muhendislik**, the test sponsor.

Test Specimen Construction

A comprehensive description of the test construction is given in the Schedule of Components. The description is based on a detailed survey of the specimen and information supplied by the sponsor of the test.

Installation

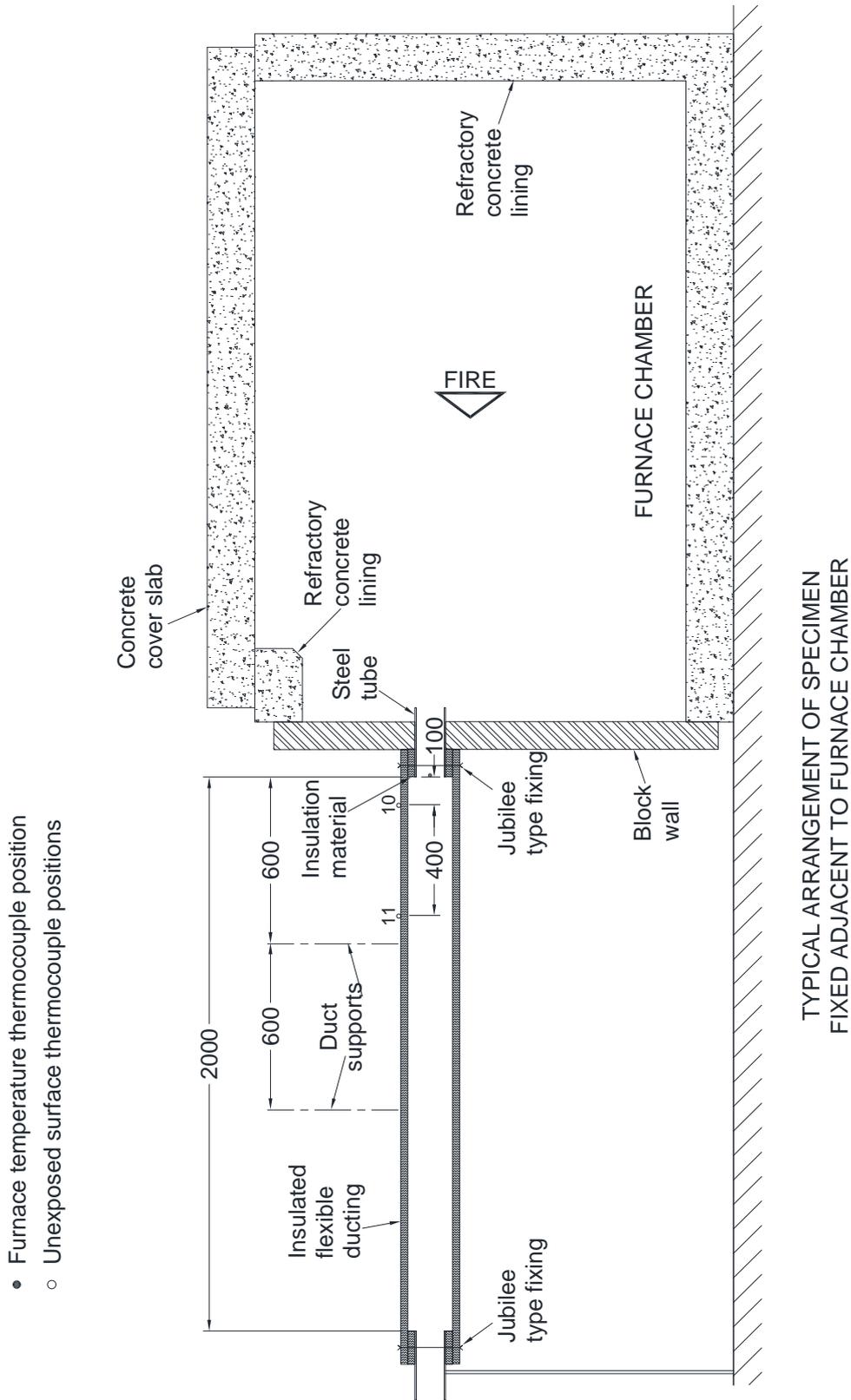
The duct was fitted over a steel tube projecting from the front vertical masonry wall of a gas fired furnace for a distance of approximately 100 mm. A compressible insulation material was fitted between the duct and the steel tube to prevent heat transfer. Representatives of **Exova Warringtonfire** conducted the installation work on the 27th May 2010.

Sampling

Exova Warringtonfire was not involved in any selection or sampling procedures for the tested specimen.

Test Procedure

Figure 1- Typical Arrangement of Specimen Fixed Adjacent to Furnace Chamber



- Furnace temperature thermocouple position
- Unexposed surface thermocouple positions

Do not scale. All dimensions are in mm

Schedule of Components

(All values are nominal unless stated otherwise)
(All other details are as stated by the sponsor)

<u>Item</u>	<u>Description</u>
Specimen	
Manufacturer	: Isil Muhendislik Mak. Ve Ins. San. Tic. A. S.
Reference	: Flexiva SKY Insulated
Type	: Insulated
Construction	: Double ply
Material	
i. inner & outer jacket	: Aluminium foil & Polyester to DIN EN 573-3
ii. helix	: Steel wire
iii. insulation	: A1 class glass wool, 25 mm thick with 16kg/m ³ stated density
Diameter	
i. internal	: 160 mm
ii. external	: 210 mm
Wire helix gauge	: 1.1 mm diameter
Wire helix pitch	: 50 mm

Instrumentation

General	The instrumentation was provided in accordance with the requirements of the Standard.
Furnace	The furnace was controlled so that the temperature within the duct complied with the requirements of BS 476: Part 20: 1987, Clause 3.1. Using a single mineral insulated thermocouple, positioned at mid-diameter of the inside of the duct, at a position approximately 100 mm from the unexposed surface of the wall, coincident with the end of the steel tube.
Integrity Criteria	Cotton pads and gap gauges were available to evaluate the integrity of the specimen.
Furnace Pressure	After the first five minutes of testing and for the remainder of the test, the pressure within the furnace chamber measured at the mouth of the flexible duct was controlled to be at a positive pressure of 10 (± 2) Pa relative to the pressure within the laboratory.

Test Observations

Time		All observations are from the unexposed face unless noted otherwise.
mins	secs	The ambient air temperature in the vicinity of the test construction was 12°C at the start of the test with a maximum variation of 1°C during the test.
00	00	The test commences.
03	00	Smoke is beginning to release from the end of the test specimen duct.
05	00	Small amount of smoke is being released from the outer ducting.
10	00	Smoke release increases
12	00	No visible significant changes to the test specimen duct.
18	00	The outer layer of duct foil material is coming apart lightly where it emerges from the wall of the furnace.
21	00	No visible significant changes to the test specimen duct.
26	00	A large hole develops in the wall of the duct in excess of the maximum allowable. Integrity failure of the specimen duct occurs.
27	00	The hole in the side of the duct increases.
28	00	The test is discontinued.

Test Photographs

The specimen
prior to testing



The specimen
during testing



The specimen
prior to testing



The specimen
during testing



The specimen during testing



The specimen during testing



The specimen during testing



The specimen after 26 minute showing the large hole that had formed to cause integrity failure



The specimen
shortly after the
end of the test

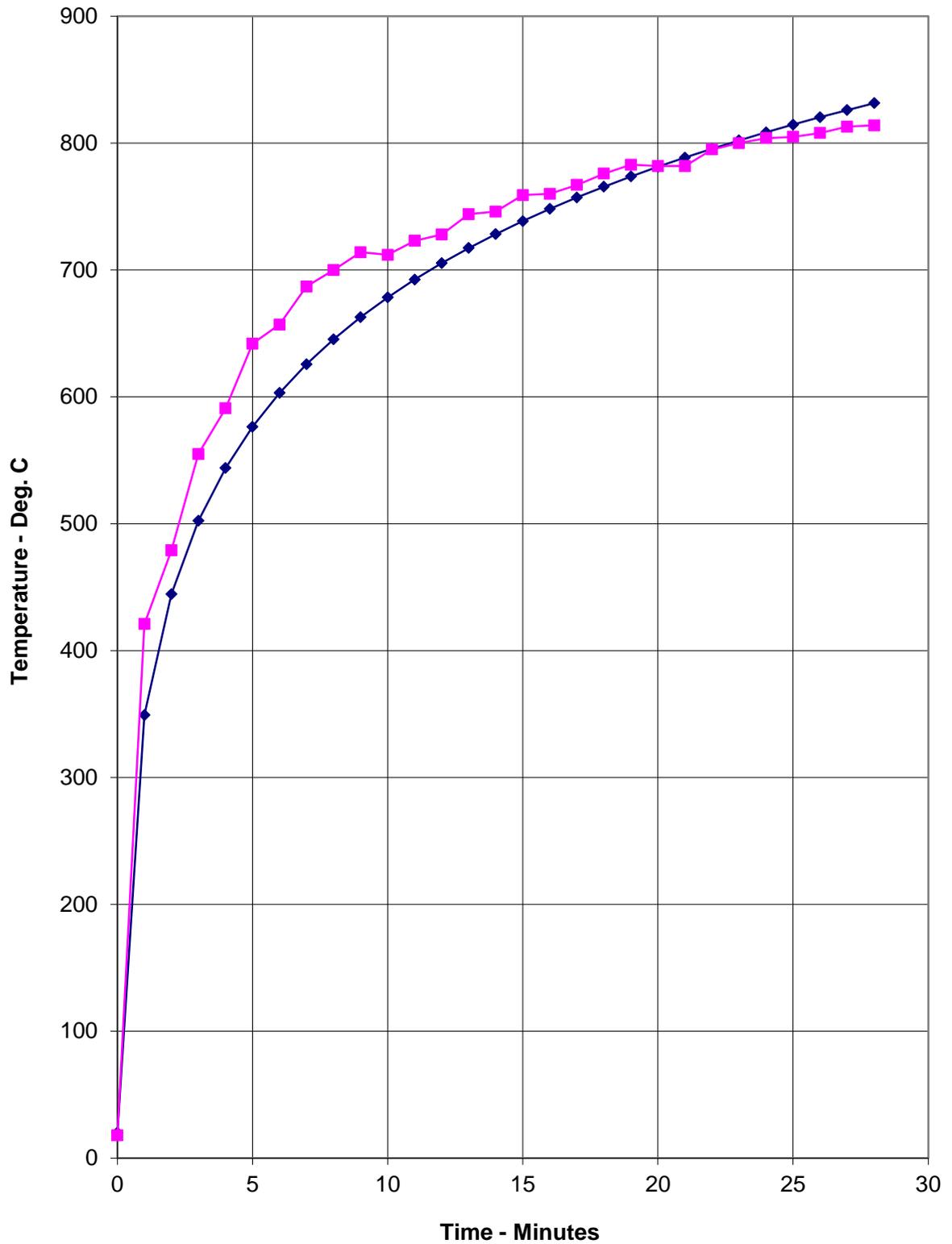


Temperature Data

Actual air temperature, together with the temperature/time relationship specified in the Standard

Time min	Specified Furnace Temperature Deg. C	Actual Furnace Temperature Deg. C
0	20	18
1	349	421
2	445	479
3	502	555
4	544	591
5	576	642
6	603	657
7	626	687
8	645	700
9	663	714
10	678	712
11	693	723
12	705	728
13	717	744
14	728	746
15	739	759
16	748	760
17	757	767
18	766	776
19	774	783
20	781	782
21	789	782
22	796	795
23	802	800
24	809	804
25	815	805
26	820	808
27	826	813
28	832	814

Graph showing mean air temperature, together with the temperature/time relationship specified in the Standard



Performance Criteria and Test Results

Integrity It is required that there is no collapse of the specimen, no sustained flaming on the unexposed surface and no loss of impermeability. These requirements were satisfied for the test duration of 26 minutes.

Ongoing Implications

Limitations The result relates only to the behaviour of the flexible duct assembly under the particular conditions of test. They are not intended to be the sole criterion for assessing the potential fire performance of the elements in use, nor do they reflect the actual behaviour in fires.

The test result relates only to the specimen tested. Appendix A of BS 476: Part 20: 1987 provides guidance information on the application of fire resistance tests and the interpretation of test data. Application of the result to ducts of different dimensions or supported in any other manner or incorporating different components should be the subject of a design appraisal.

Review This report covers a test which was conducted to a procedure which is not the subject of any British Standard specification, but the test utilised the general principles of fire resistance testing given in BS 476: Part 20: 1987. Since fire tests are the subject of a continuing Standardisation process, and because existing standards are the subject of review and possible amendment and new interpretations, it is recommended that the report be referred back to the test laboratory after a period of two years to ensure that the methodology adopted and the results obtained remain valid in the light of the situation prevailing at that time.

Conclusions

Evaluation against objective A fire test has been performed on a specimen of an insulated flexible duct. The specimen was supported in a horizontal orientation and was subjected internally to the heating conditions specified in BS 476: Part 20: 1987 by passing hot gases from a gas fired furnace through it.

If the ability of the duct, 'Flexiva SKY Insulated', to contain flames and hot gases, is assessed against the integrity criteria of BS 476: Part 20: 1987, the results could be expressed as follows:

Test Result:

Integrity 26 minutes

The test was discontinued after a period of 28 minutes.