

Message

**From:** Hugh Mahoney [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=21C7864F51FE42559A1E4F436EF1D73C-HUGH.MAHONE]  
**Sent:** 31/03/2015 10:39:00  
**To:** David Bradbury [DavidBradbury@jswright.co.uk]  
**CC:** Bob Hill [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c6cfce0c569e4c24a7f62cb8959f4013-Bob.Hill]  
**Subject:** RE: Grenfell Tower - Fire door strips  
**Attachments:** BLE24.pdf; Gilberts Fire Test for Series 54.pdf; Gilberts705L\_EstRespCustl014\_LIVE\_2198569.pdf

Hi David,

I see no problem with the proposed ductwork locations indicated upon your marked up drawings attached to your e-mail.

In response to the BC query regarding the testing of the damper/motor arrangement I can confirm that the proposed dampers were tested with the motors attached and their test certificate for the product is attached. I have also attached a copy of the motor manufacturers data sheet.

The attached quotation for the dampers also has the price for the matching K15 grilles. If you are still using the existing grilles then only line 10 of the quotation is applicable i.e. 80 number dampers. Ignore all other lines until we have finalised the fan/ductwork arrangement as the other dampers were for the plant room bypass arrangement. If this is not clear please give me a call and I will take you through it

Please see below for my comments/updates to the points raised.

As soon as I have the final outstanding information I will get the revised TS to you within one working day.

Best regards

Regards

**Hugh Mahoney**  
**Commercial Manager- PSB UK Ltd**

Witt UK Group  
Witt House  
Shelf Mills  
Wade House Road  
Shelf  
Halifax  
HX3 7BJ  
Tel: [REDACTED]  
Mobile: [REDACTED]  
Email: [hm@psbuk.com](mailto:hm@psbuk.com)  
Website: [www.wittukgroup.co.uk](http://www.wittukgroup.co.uk)



If you are an unauthorised recipient of this email, you are requested to preserve the identity of it and advise the sender immediately of any error in transmission. Any disclosure, copying, distribution or action taken, or omitted to be taken, by an unauthorised recipient in reliance upon the contents of this e-mail is prohibited and may be unlawful. You should carry out your own virus checks before opening any attachment. The contents of any attachment may contain software viruses which could damage your own computer system. While PSB has taken every reasonable precaution to minimise this risk, we cannot accept liability for any damage which you may sustain as a result of software viruses. Please note that in replying to this e-mail you are granting the right for that reply to be forwarded to any other individual within the business and externally and to be read by others, for instance in the event that the intended recipient is out of the office or is no longer employed by us.

*Please consider the environment before printing this email*

PSB UK Ltd is a division of the **Witt UK Group**, which includes the following companies:

**Fan Systems Group Limited**

Alldays Peacock  
**WITT&SON UK Limited**

**From:** David Bradbury [mailto:DavidBradbury@jswright.co.uk]

**Sent:** 23 March 2015 09:58

**To:** Hugh Mahoney; Simon Lawrence; David Peacock

**Subject:** Grenfell Tower - Fire door strips

Morning All,

Couple of items I need to sort out on the AOV system asap:

**Hugh,**

- Thanks for your time at the BC meeting, can you let me know when you are able to issue the revised TS to include building controls comments.  
**TS awaiting comments on primary and secondary power supplies and type of switch**
- I have a DTM at Grenfell tomorrow so will need to confirm if the new proposed AOV shaft route is acceptable from your point of view, not sure if you have reviewed the drawings yet but I've attached a copy for ease.  
**Reviewed and ductwork locations are OK.**
- Can you send over the quotes for the dampers as we need to assess the risk of us ordering these asap before we gain formal approval.  
**Attached**
- I have been informed by Rydon that the client has instructed someone to install fire door strips on the doors to the staircase on every floor at Grenfell. Will this cause any issues to the operation of our proposed system?  
**No this will be OK**

**Simon,**

- Are you able to confirm if the client wants the key operation / control as discussed in the BC meeting.  
**One comment here from me is that if they require a rocker switch as discussed with BC I will recommend that a standard rocker is used and not spring return. The reason for this is that this switch is made operational when the HMI override switch is used. i.e. these switches are normally de-activated and only become active if the Fire and Rescue Service use the HMI override facility. These switches therefore cannot be used by the public and are only operationally available to the Fire and Rescue Service.**

**Dave,**

- As far as the client is aware we have already started works on the AOV system, therefore we will need to organise the start of the strip out works of the existing dampers etc. can you organise please, bear in mind we intend of retaining the existing grilles so if the dampers / actuators are removed, the grilles can then be fixed back in place to prevent anything being thrown down the shaft. The client should be aware that most if not all the existing dampers simply do not work and therefore we are not creating any additional risk to the tenants by removing the existing dampers before the new are in place.

Any questions please do not hesitate to contact me.

Kind regards,

Dave Bradbury  
Design Manager  
Head Office

Tel: [REDACTED] | Fax: [REDACTED] | Mob: [REDACTED] | Email: [davidbradbury@iswright.co.uk](mailto:davidbradbury@iswright.co.uk) | Web: [www.iswright.co.uk](http://www.iswright.co.uk)

## J S WRIGHT & CO LTD, CELEBRATING 125 YEARS, 1890 - 2015

RESIDENTIAL

CARE HOMES

### One of the Leading Mechanical & Plumbing Design & Installation Companies in the UK

Head Office - J S Wright & Co Ltd, The Atlas Building, 16 Portland Street, Aston, Birmingham, B6 5RX  
London Office - J S Wright & Co Ltd, 1 Northumberland Avenue, London, WC2N 5BW Tel: [REDACTED]  
Bristol Office - J S Wright & Co. Ltd, Trym Lodge, 1 Henbury Road, Westbury-on-Trym, Bristol, BS9 3HQ Tel: [REDACTED]

The contents of this email and any attachments are the property of J S Wright & Co Limited and are for the confidential use of the named recipient(s) only. They may be legally privileged and should not be communicated to or relied upon by any person without our express written consent. If you are not an addressee please notify us immediately at [mailto:iswright@iswright.co.uk](mailto:mailto:iswright@iswright.co.uk) Any files attached to this email will have been checked with virus detection software before transmission. However, you should carry out your own virus check before opening any attachment. J S Wright & Co Limited accepts no liability for any loss or damage which may be caused by software viruses

Please Consider the Environment before Printing this E-mail

Actuator for  
smoke control dampers 90°↺.

- Torque 15 Nm
- Nominal voltage AC/DC 24 V
- Control: Open/close
- Damper rotation: 12 mm form-fit



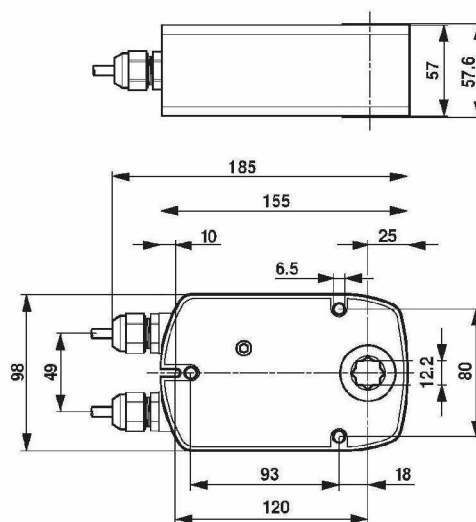
### Technical Data

Electrical data	Nominal voltage	AC 24 V, 50/60 Hz / DC 24 V
	Nominal voltage range	AC 19.2 ... 28.8 V / DC 21.6 ... 28.8 V
	Switching thresholds	min. ON voltage max. OFF voltage
		AC 19.2 V / DC 21.6 V AC 6.5 V / DC 6.5 V
	Power consumption	motoring holding locking for wire sizing
		7.5 W @ nominal torque <0.5 W 9 VA / I <sub>max</sub> 2.7 A @ 5 ms
	Auxiliary switch	2 x SPDT
	Contact rating (contacts gold plate on silver)	1 mA... 3 A, DC 5 V ... AC 250 V
	Switching points	3°↺ / 87°↺ (referred to 0 ... 90°↺)
	Tolerance	±2°↺
Functional data	Connecting cable	motor auxiliary switch
		1 m, 3 x 0.75 mm <sup>2</sup> (halogen-free) 1 m, 6 x 0.75 mm <sup>2</sup> (halogen-free)
	Torque (nominal torque)	Min. 15 Nm @ nominal voltage
	Blocking torque	dynamic steady-state
		Min. 15 Nm Min. 20 Nm
	Direction of rotation	Selected by mounting L/R
	Angle of rotation	Max. 105°↺ (incl. mechanical overrun on each side)
	Running time	<30 s for 90°↺
	Sound power level	Max. 62 dB (A)
	Damper rotation	Form-fit 12 mm
Safety	Position indication	Mechanical with pointer
	Service life	At least 10'000 cycles
	Protection class	III Safety extra-low voltage
	Degree of protection	IP54 in all mounting positions
	EMC	CE according to 89/336/EEC, 92/31/EEC, 93/68/EEC
	Low voltage directive	CE according to 2006/95/EC
	Mode of operation	Type 1.B (according to EN60730-1)
	Rated impulse voltage	0.8 kV (according to EN60730-1)
	Control pollution degree	3 (according to EN60730-1)
	Ambient temperature range	normal duty safety duty
Dimensions / weight		-30 ... +50 °C See «Safety function» on page 2
	Non-operating temperature	-40 ... +80 °C
	Ambient humidity range	95% r.H., non-condensating (EN 60730-1)
	Maintenance	Maintenance-free
Dimensions / weight	Dimensions	See «Dimensions» on page 3
	Weight	Approx. 1680 g



## Dimensions [mm]

Dimensional diagrams



Exova Warringtonfire  
Holmesfield Road  
Warrington  
WA1 2DS  
United Kingdom

T : [REDACTED]  
F : [REDACTED]  
E : warrington@exova.com  
W: www.exova.com

Testing. Advising. Assuring.



**Title:**

A fire resistance test conducted generally in accordance with BS EN 1366-2:1999 on a multi blade damper assembly.

**WF Report No:**

309850



**Prepared for:**

**Gilberts (Blackpool)  
Ltd**

Clifton Road,  
Blackpool,  
Lancashire,  
FY4 4QT.

**Date: 6<sup>th</sup> October 2011**

**Notified Body No:**

0833



0249

## Summary

<b>Objective</b>	To determine the fire resistance performance of a multi bladed fire damper mounted within a standard flexible wall construction, when tested generally in accordance with BS EN 1366-2: 1999.
<b>Test Sponsor</b>	<b>Gilberts (Blackpool) Ltd</b>
<b>Address</b>	Clifton Road, Blackpool, Lancashire, FY4 4QT.
<b>Summary of Tested Specimen</b>	<p>The damper had an internal opening of 910 mm wide by 1910 mm high. The damper was formed from 1.5 mm thick galvanised mild steel casing incorporating seven; twin skinned galvanised mild steel damper blades, formed from 1 mm thick galvanised mild steel. The blades were nominally 909 mm in length by 308 mm high, with the exception of the small top blade which was nominally 108 mm high. The damper assembly incorporated a single electric actuator, referenced BLE 24, supplied by Belimo Ltd.</p> <p>The damper was fitted into a 2000 mm high by 1000 mm wide aperture within a standard flexible wall construction and secured with self tapping screws at 500 mm centres along each damper face</p> <p>The damper assembly was connected via a plenum and various piping sections to an extractor fan capable of maintaining an under pressure of 300 Pa between the furnace chamber and the duct plenum. At the request of the sponsor the test was started with the damper in the closed position.</p>



**Test Results:**

The specimen damper assembly satisfied the performance requirements of the Standard for the periods in the following table:

PERFORMANCE CRITERIA	TEST RESULTS
<b>Integrity</b> (Leakage)	74 minutes
<b>Smoke Leakage</b>	0 minutes
<b>Integrity</b> (Cotton Pad)	*92 minutes
<b>Integrity</b> (Gap Gauge)	*92 minutes
<b>Integrity</b> (Sustained Flaming)	*92 minutes
<b>Insulation</b>	3 minutes
Leakage During Ambient Temperature Test (Clause 10.3)	256.8 m <sup>3</sup> /hr

\*The test duration. The test was discontinued after a period of 92 minutes.

**Date of Test**

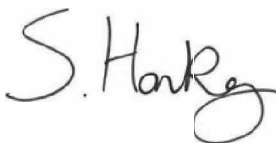
23<sup>rd</sup> August 2011

**This report may only be reproduced in full. Extracts or abridgements of reports shall not be published without permission of Exova Warringtonfire**

## Signatories

Responsible Officer  
**S. Gilfedder\***  
Testing Officer

Approved <b>A. Kearns*</b> Technical Manager	


Head of Department <b>S. Hankey *</b> Operations Manager

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

Report Issued

Date : 6<sup>th</sup> October 2011

This version of the report has been produced from a .pdf format electronic file that has been provided by **Exova Warringtonfire** to the sponsor of the report and must only be reproduced in full. Extracts or abridgements of reports must not be published without permission of **Exova Warringtonfire**. The original signed paper version of this report, which includes signatures in blue ink, is the sole authentic version. Only original paper versions of this report bear authentic signatures of the responsible **Exova Warringtonfire** staff.

<b>CONTENTS</b>	<b>PAGE NO.</b>
<b>SUMMARY.....</b>	<b>2</b>
<b>SIGNATORIES.....</b>	<b>4</b>
<b>TEST PROCEDURE.....</b>	<b>6</b>
<b>TEST SPECIMENS.....</b>	<b>8</b>
<b>SCHEDULE OF COMPONENTS.....</b>	<b>22</b>
<b>INSTRUMENTATION.....</b>	<b>24</b>
<b>TEST OBSERVATIONS.....</b>	<b>25</b>
<b>TEST PHOTOGRAPHS.....</b>	<b>26</b>
<b>TEMPERATURE AND LEAKAGE DATA.....</b>	<b>29</b>
<b>PERFORMANCE CRITERIA AND TEST RESULTS.....</b>	<b>40</b>
<b>SMOKE LEAKAGE.....</b>	<b>40</b>
<b>ONGOING IMPLICATIONS.....</b>	<b>41</b>
<b>CONCLUSIONS.....</b>	<b>41</b>

# Test Procedure

## Introduction

Fire dampers are required to maintain compartmentation at fire boundaries and protect means of escape in case of fire. It was therefore tested generally in accordance with BS EN 1366-2: 1999 'Fire resistance tests for service installations - Part 2: Fire dampers'. This test report should be read in conjunction with that Standard and with BS EN 1363-1: 1999, 'Fire resistance tests - Part 1: General requirements' and BS EN 1363-2: 1999, 'Fire resistance tests - Part 2: Alternative and additional procedures'.

The specimen was judged on its ability to comply with the performance criteria for integrity, insulation and smoke leakage, as required by BS EN 1366-2: 1999. At request of the test sponsor the damper was in closed position at the commencement of fire test (Clause 10.4), and therefore the test was not conducted fully in accordance with the standard.

Prior to the ambient leakage test (Clause 10.3) and the fire test (Clause 10.4) being conducted, the system leakage (comprising leakage associated with the connecting duct and measuring station) was evaluated. A series of system leakage measurements were recorded (with the inlet of the damper sealed) over a range of specified underpressures measured within the connecting duct. A maximum system leakage limit of 12 m<sup>3</sup>/hr is specified by the Standard. The system leakage was found to be within the limit specified by the Standard.

Prior to the fire test (Clause 10.4) being conducted, and after establishing that the system leakage was lower than 12 m<sup>3</sup>/hr, the ambient temperature leakage of the damper was determined. In addition, the damper was subjected to 50 opening and closing cycles, after which the damper showed no signs of mechanical damage, which could affect its operation.

The test rig exhaust fan was adjusted to maintain an under pressure of 300 (+/- 15) Pa in the connecting duct, relative to the pressure in the laboratory, and the ambient temperature leakage after 20 minutes was recorded. The value for the system leakage was deducted to give the actual ambient temperature leakage.

## 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

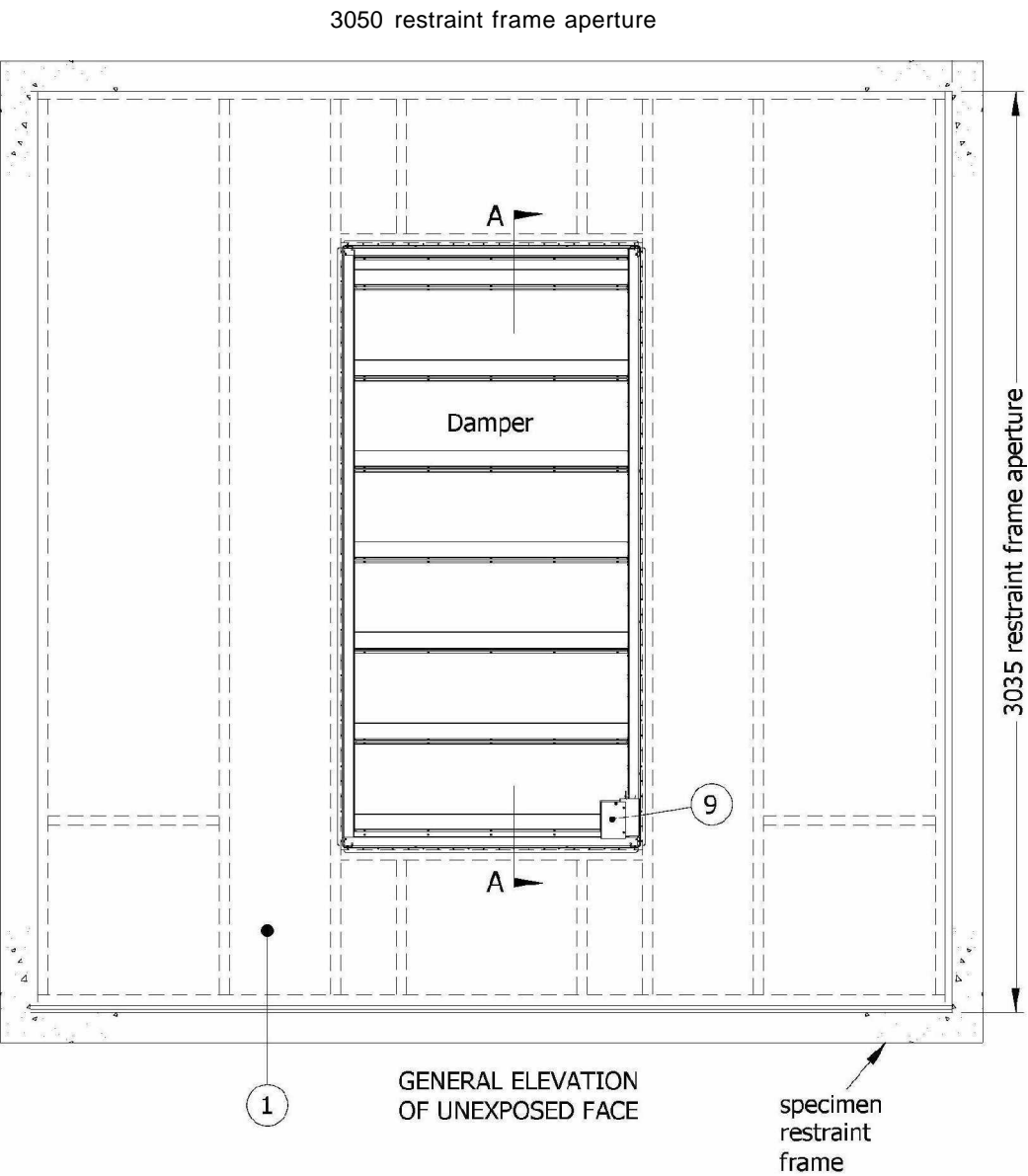
The test was conducted on the 23<sup>rd</sup> August 2011 at the request of Gilberts (Blackpool) Ltd the test sponsor.

Mr. R. Jones, Mr. C. Pendleton and MR. I. Brown representatives of the sponsor witnessed the test.

<b>Test Specimen Construction</b>	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.
<b>Installation</b>	The standard flexible wall assembly was installed into a refractory concrete lined steel restraint frame. Representative of Exova Warringtonfire installed the wall assembly between the 18 and 19 <sup>th</sup> of August 2011, and the test sponsor conducted the installation of the damper assembly on the 22 <sup>nd</sup> August 2011.
<b>Sampling</b>	<b>Exova Warringtonfire</b> was not involved in any selection or sampling procedures of the specimen or any of the components.
<b>Conditioning</b>	The specimen's storage, construction, and test preparation took place in the test laboratory over a total, combined time of 6 days. Throughout this period of time both the temperature and the humidity of the laboratory were measured and recorded as being within a range of from 12°C to 23°C and 40% to 78% respectively.

# Test Specimens

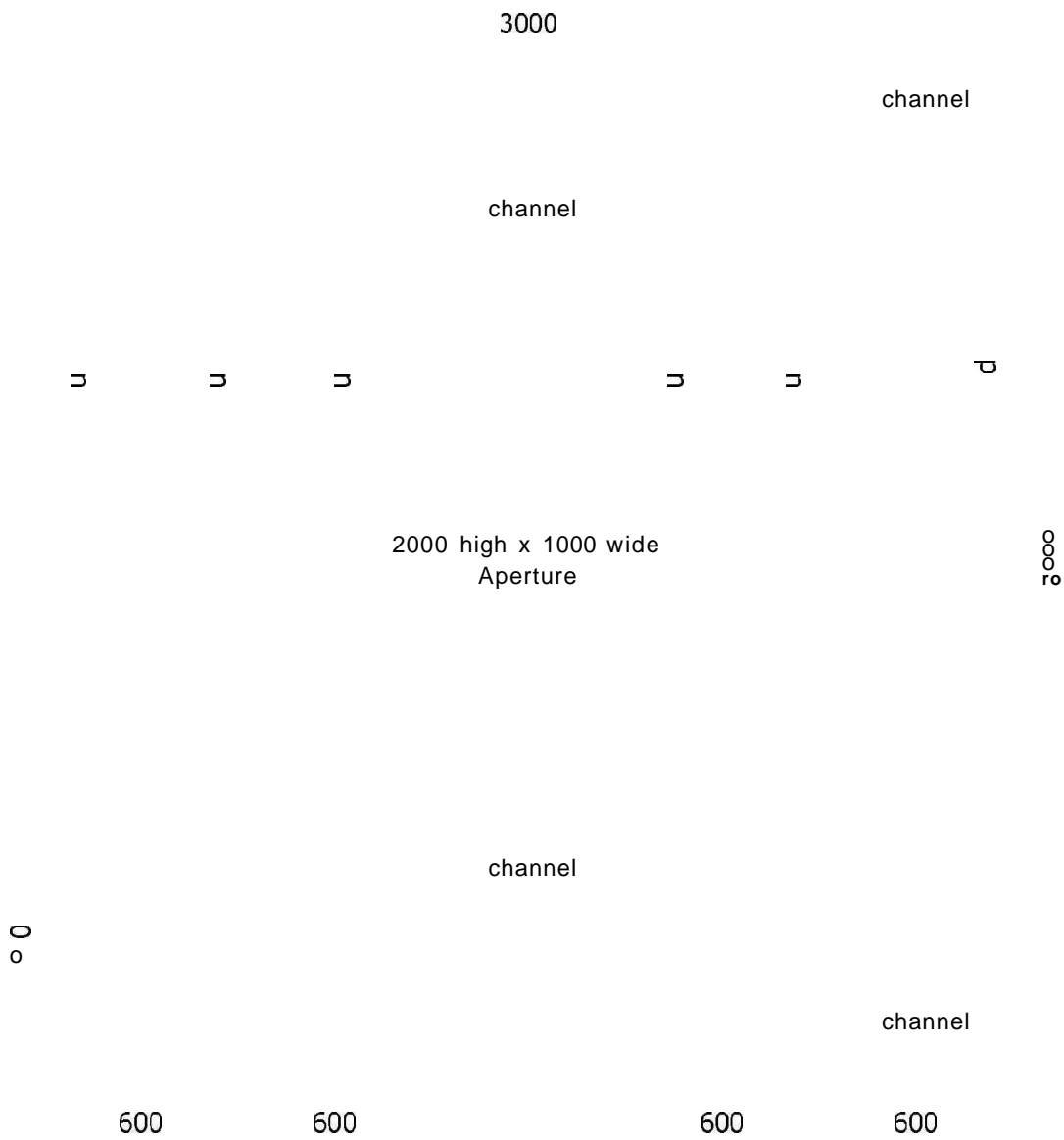
Figure 1- General Elevation of Test Specimen



Note : Enclosure not shown for clarity

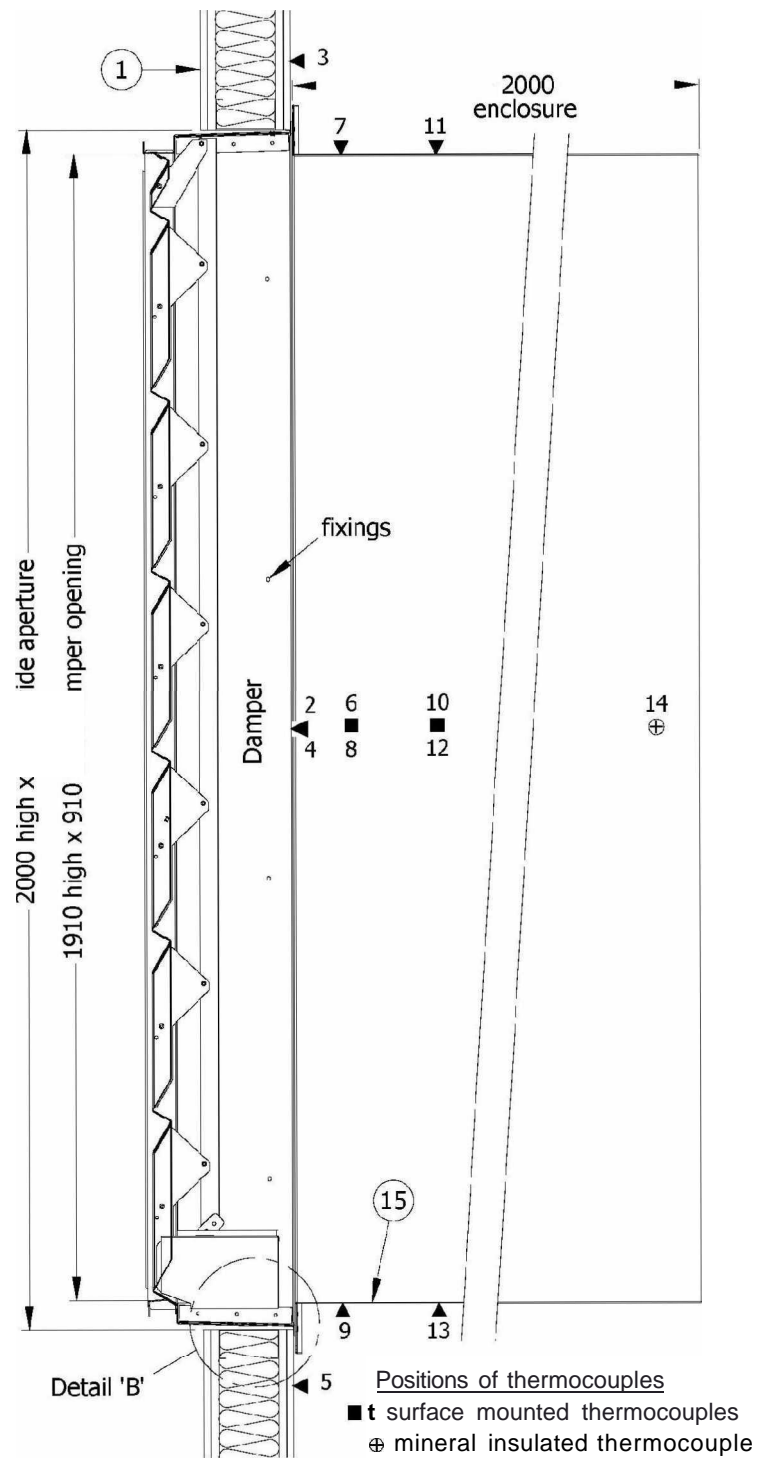
Do not scale. All dimensions are in mm

Figure 2 - Details of Partition Framework



Do not scale. All dimensions are in mm

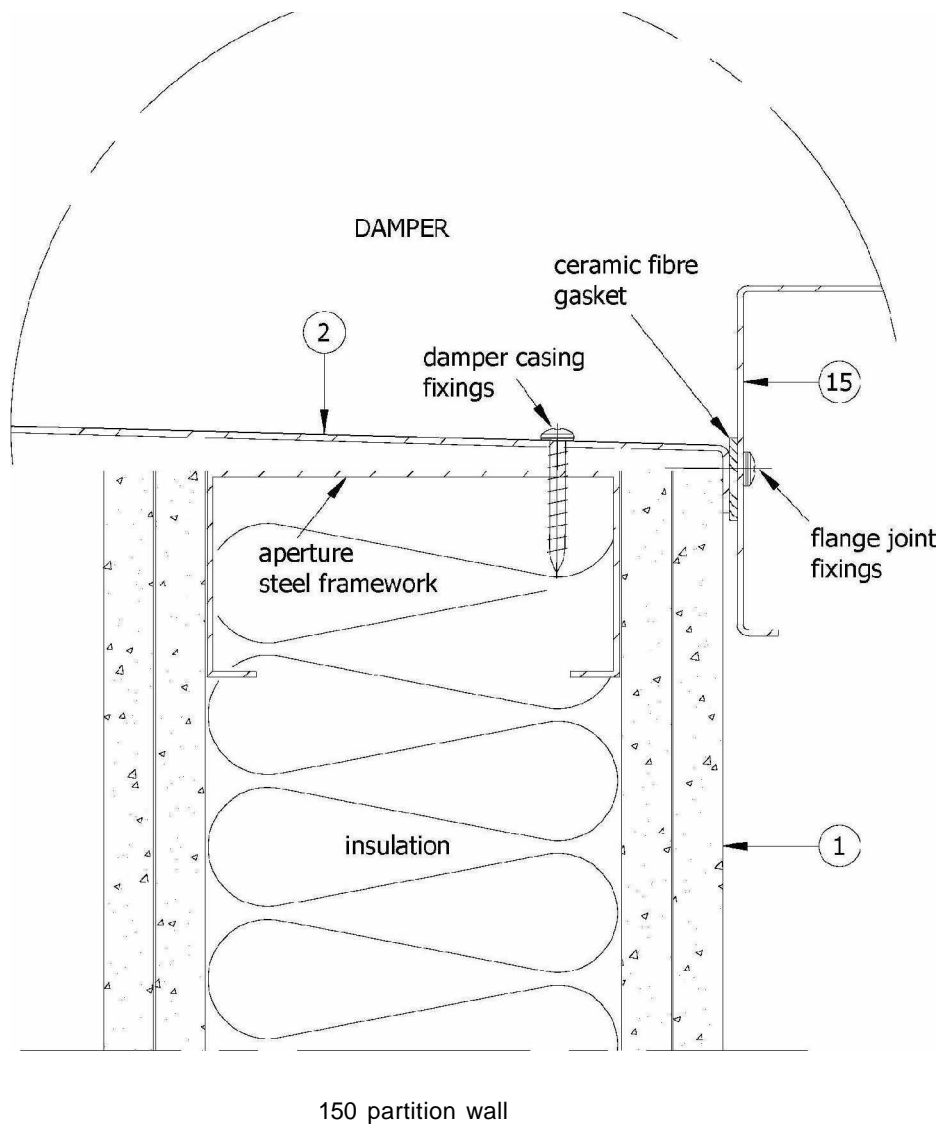
Figure 3 - Vertical Section A-A Through Test Specimen



Do not scale. All dimensions are in mm



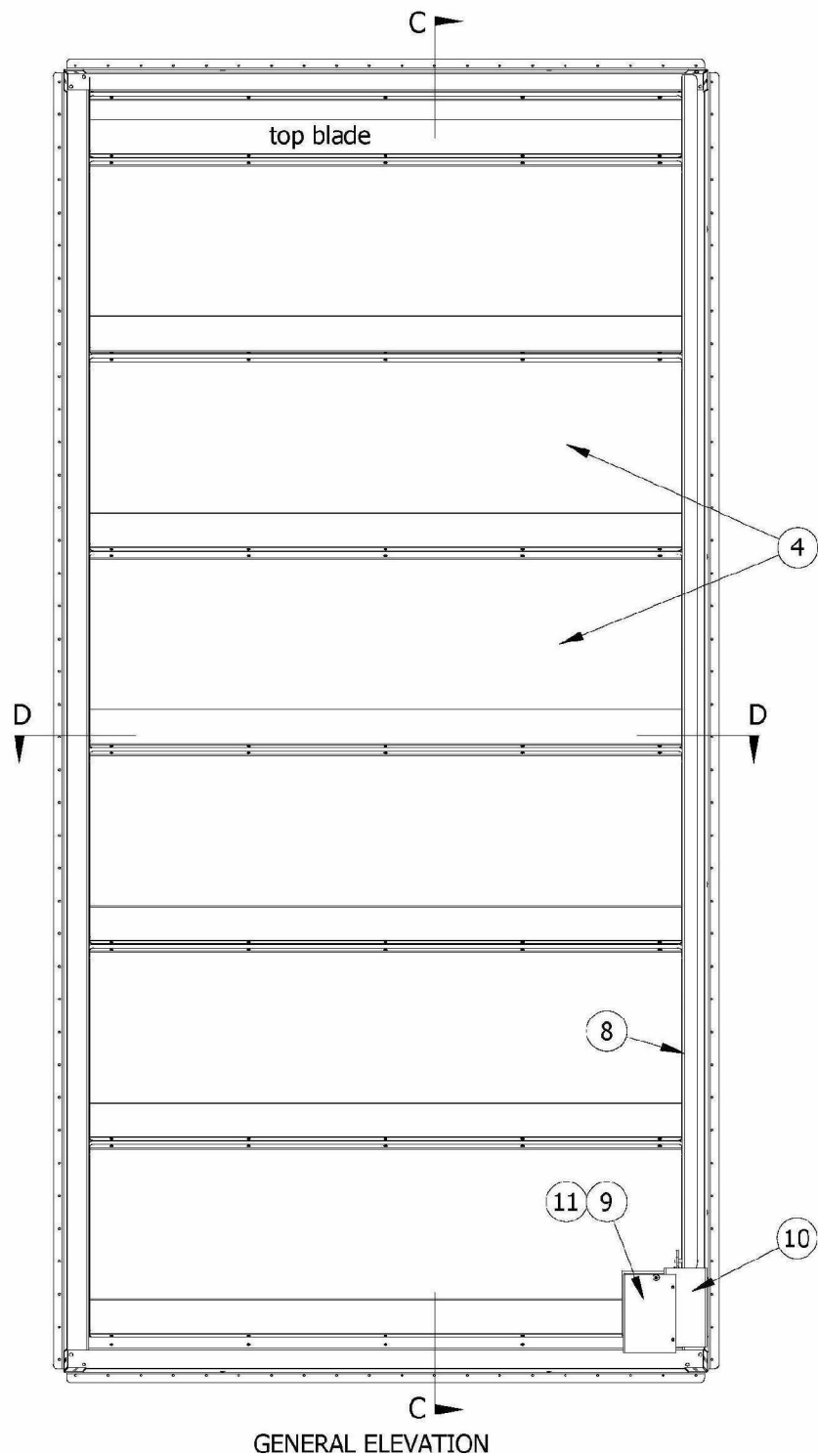
Figure 4 - Detail 'B'



Typical fixing details all around aperture

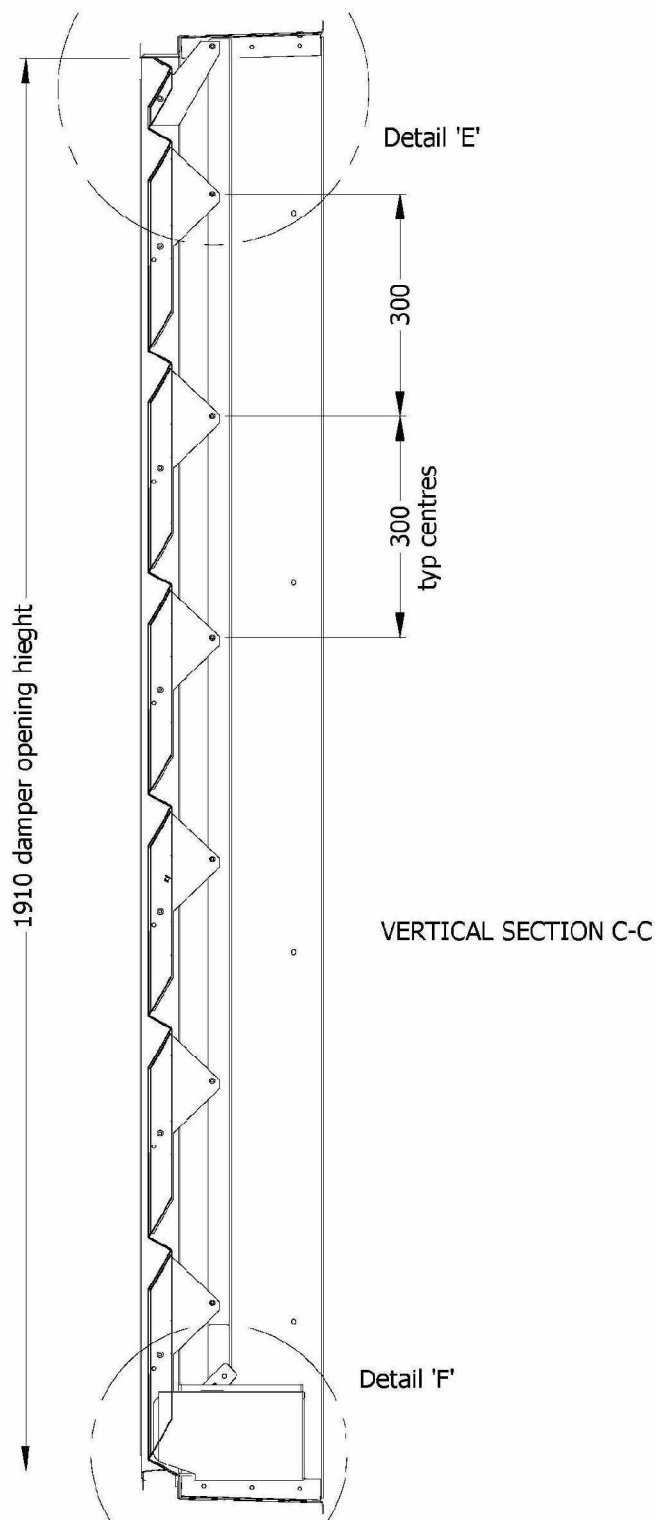
Do not scale. All dimensions are in mm

Figure 5 – Details of Damper



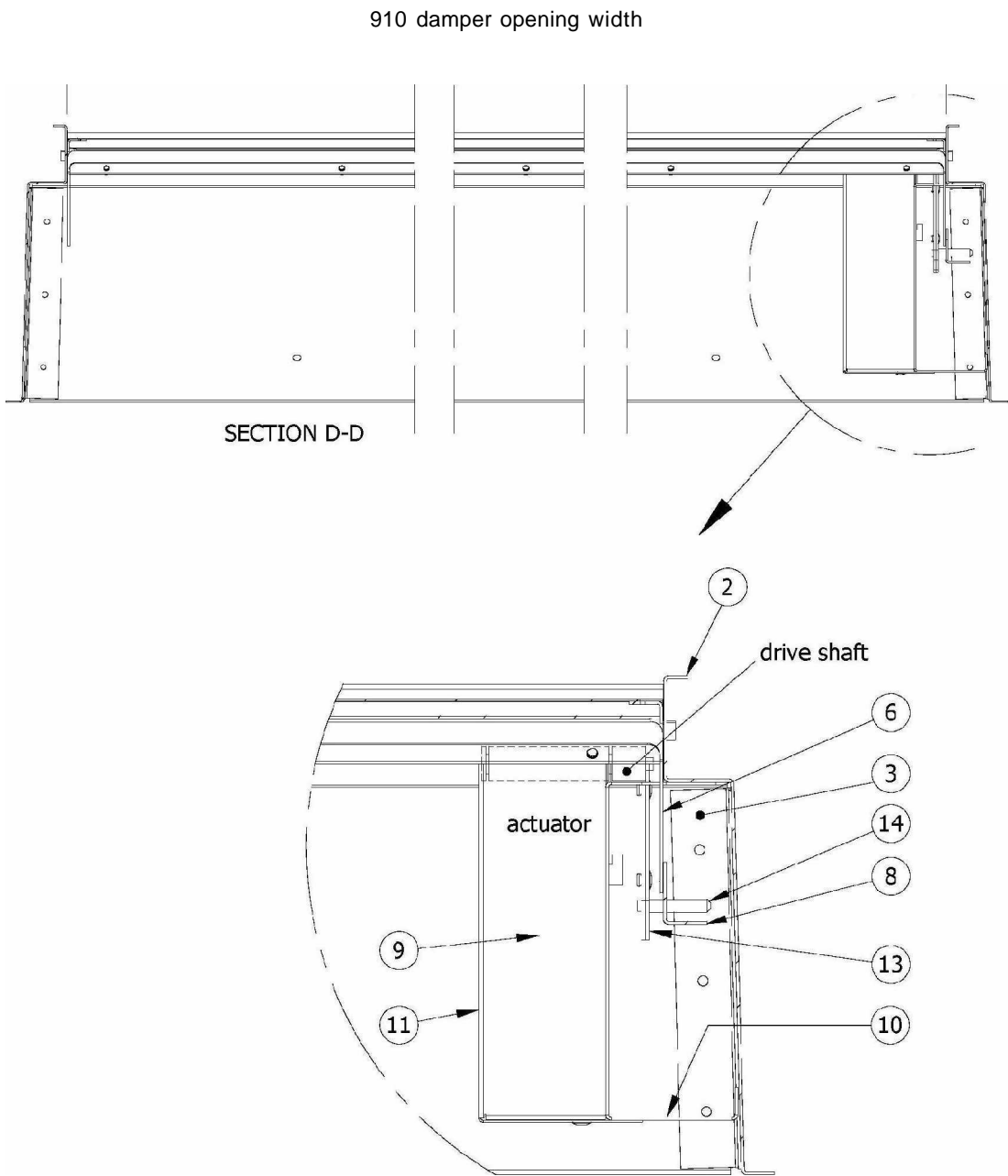
Do not scale. All dimensions are in mm

Figure 6 - Details of Damper



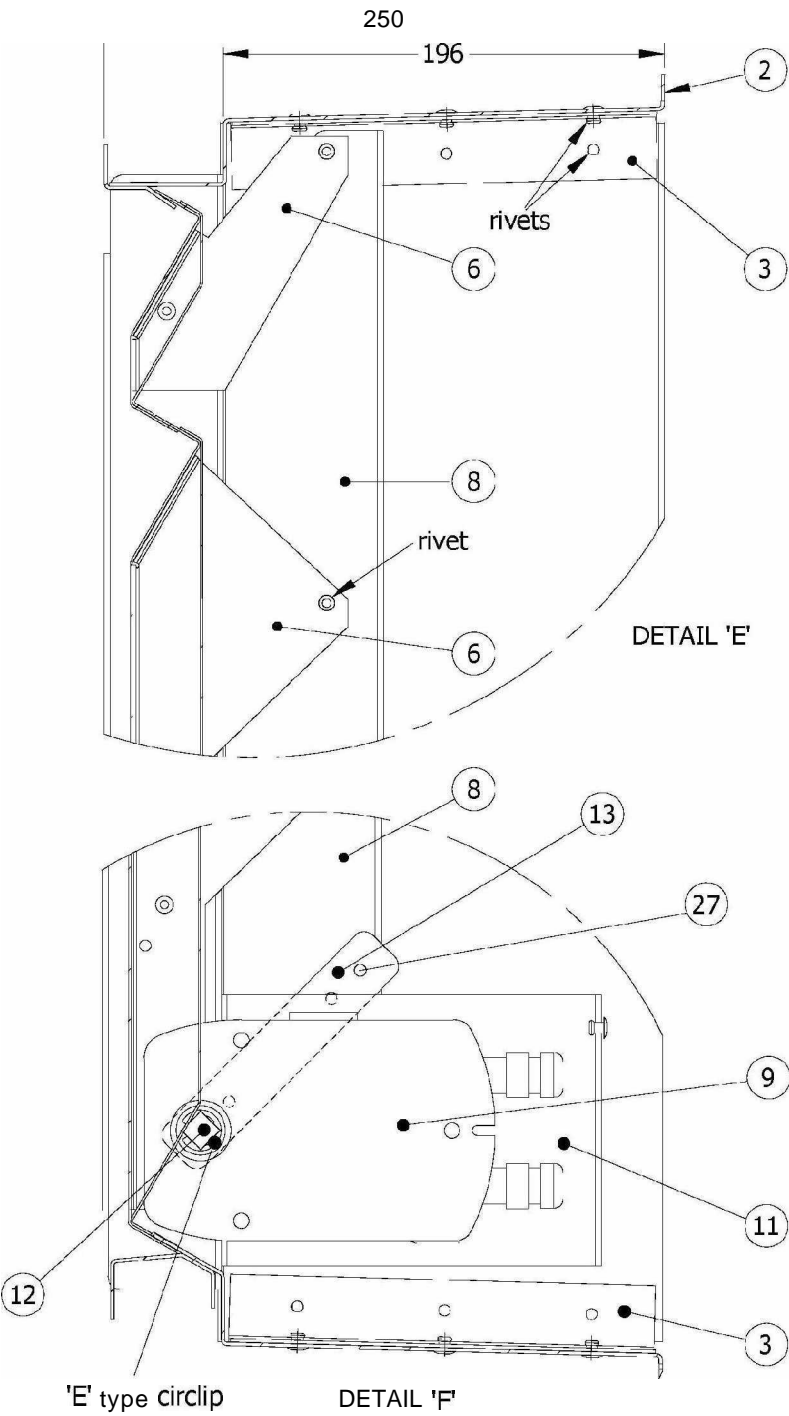
Do not scale. All dimensions are in mm

Figure 7 - Details of Damper



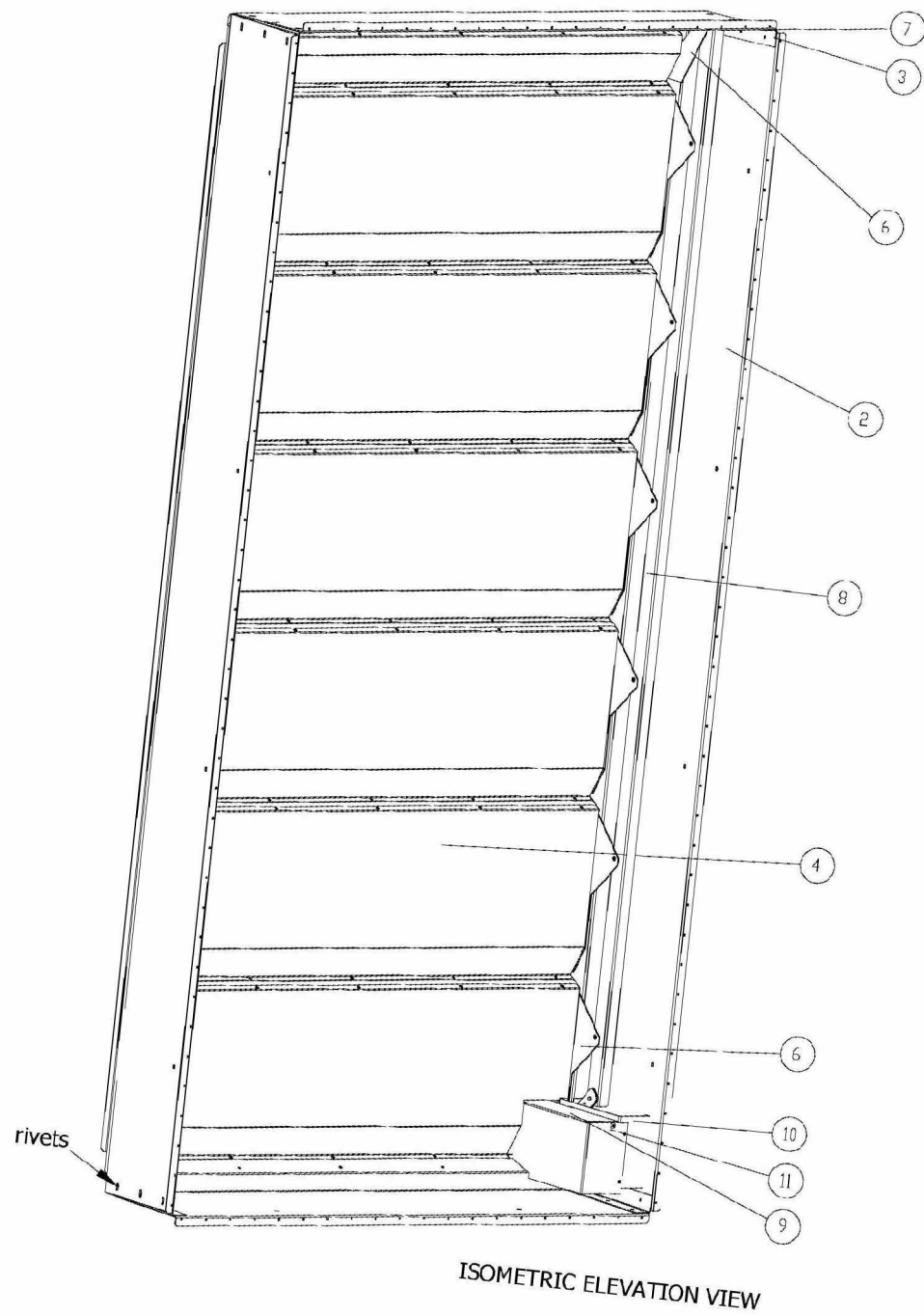
Do not scale. All dimensions are in mm

Figure 8 - Details of Damper



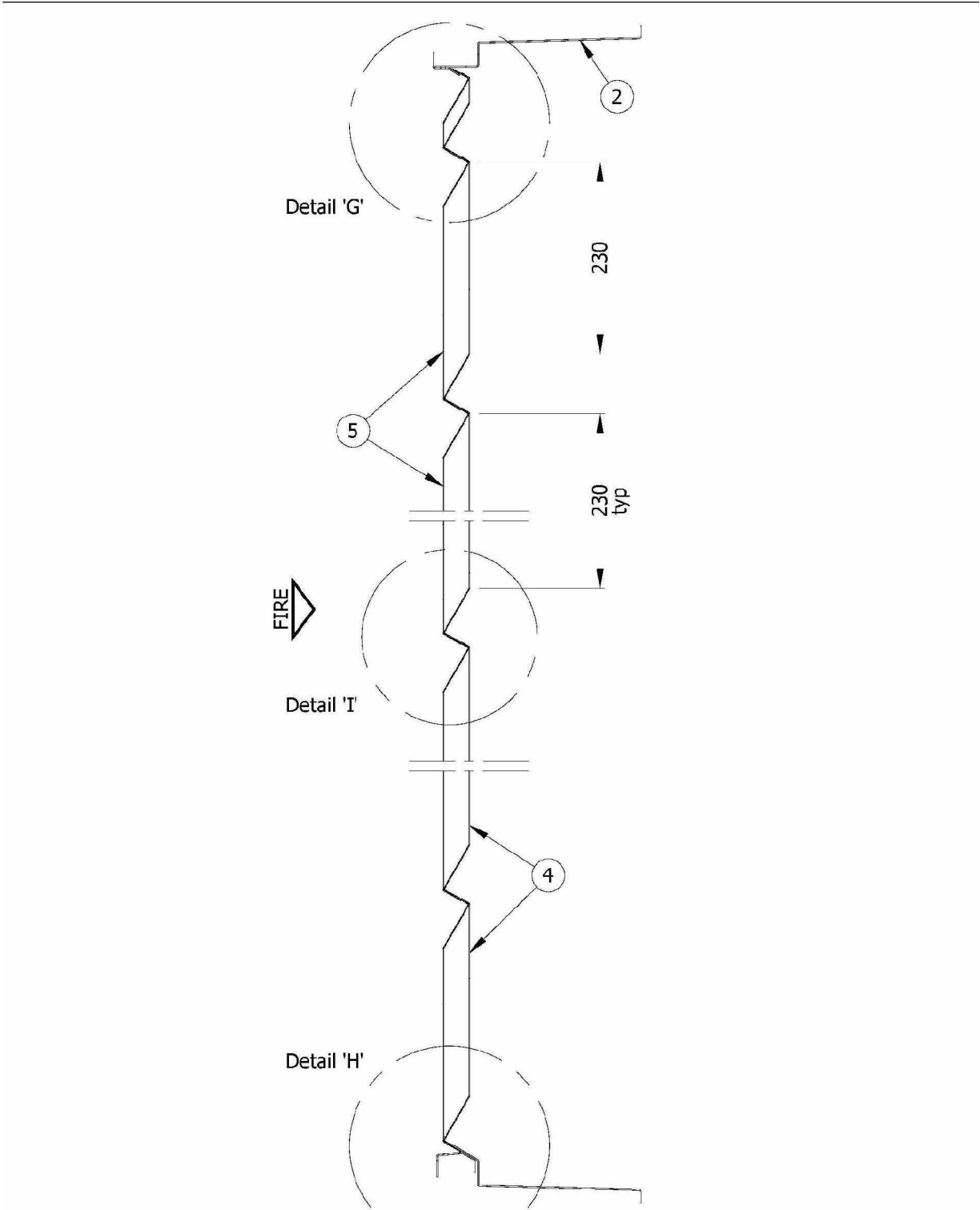
Do not scale. All dimensions are in mm

Figure 9 – Details of Damper



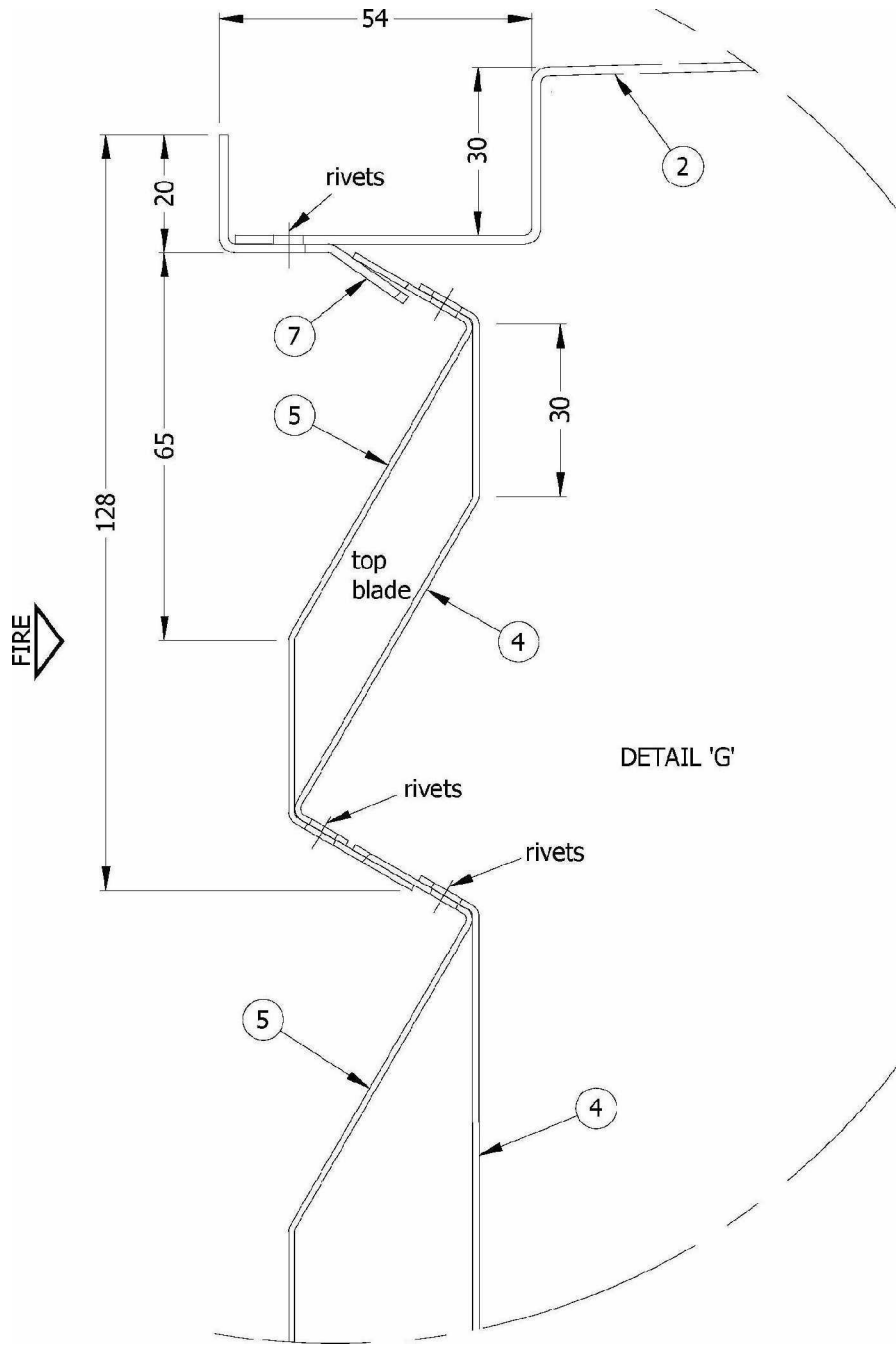
Do not scale. All dimensions are in mm

Figure 10 - Typical Blade Details



Do not scale. All dimensions are in mm

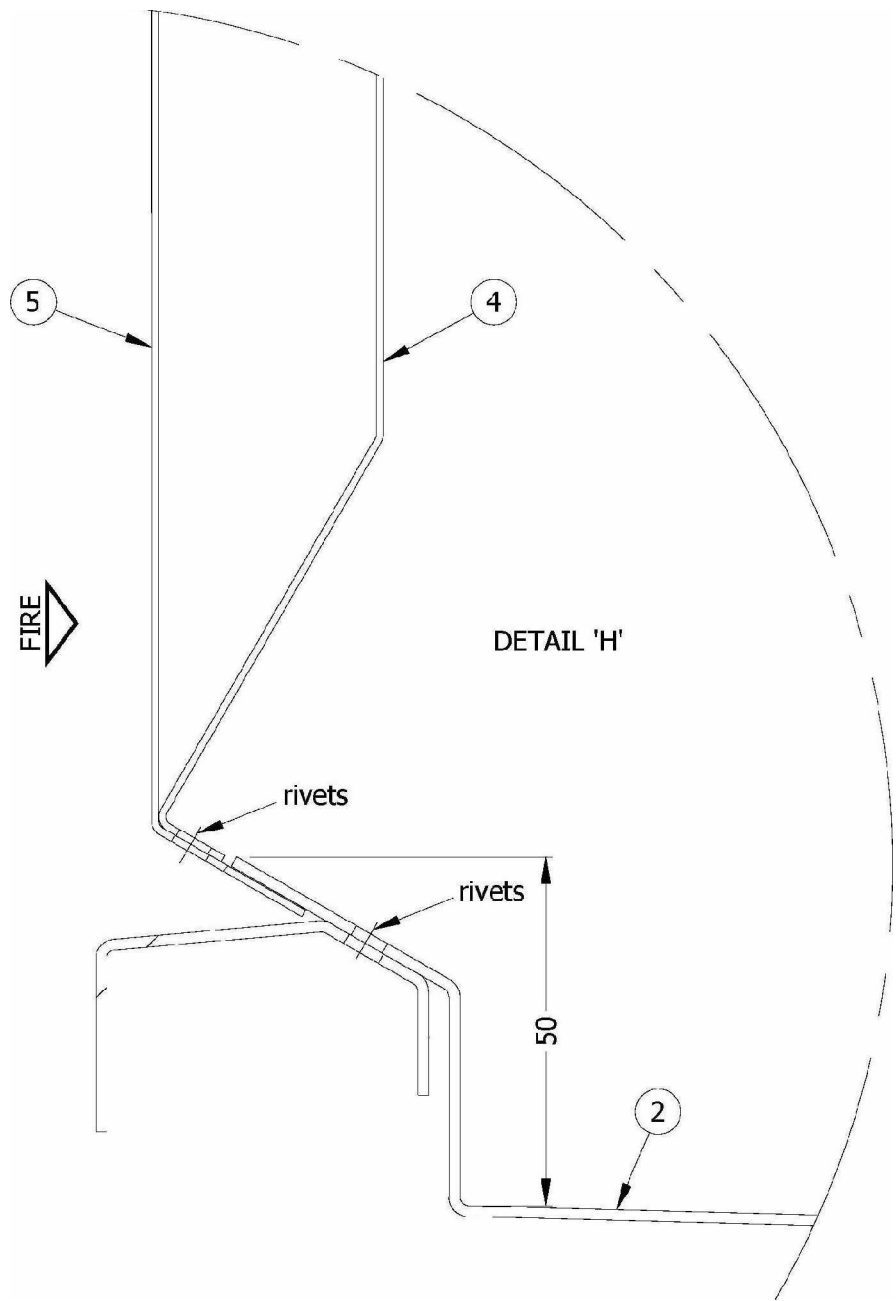
Figure 11 - Blade Details



Do not scale. All dimensions are in mm

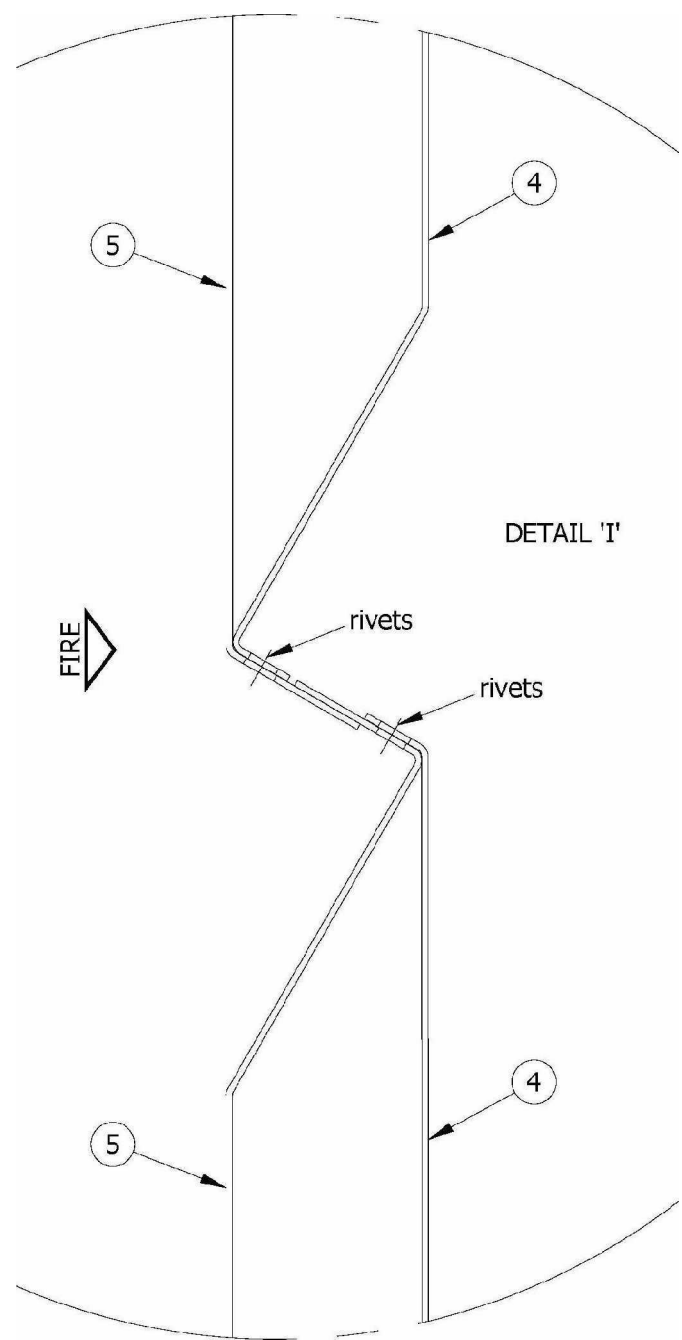


Figure 12 - Blade Details



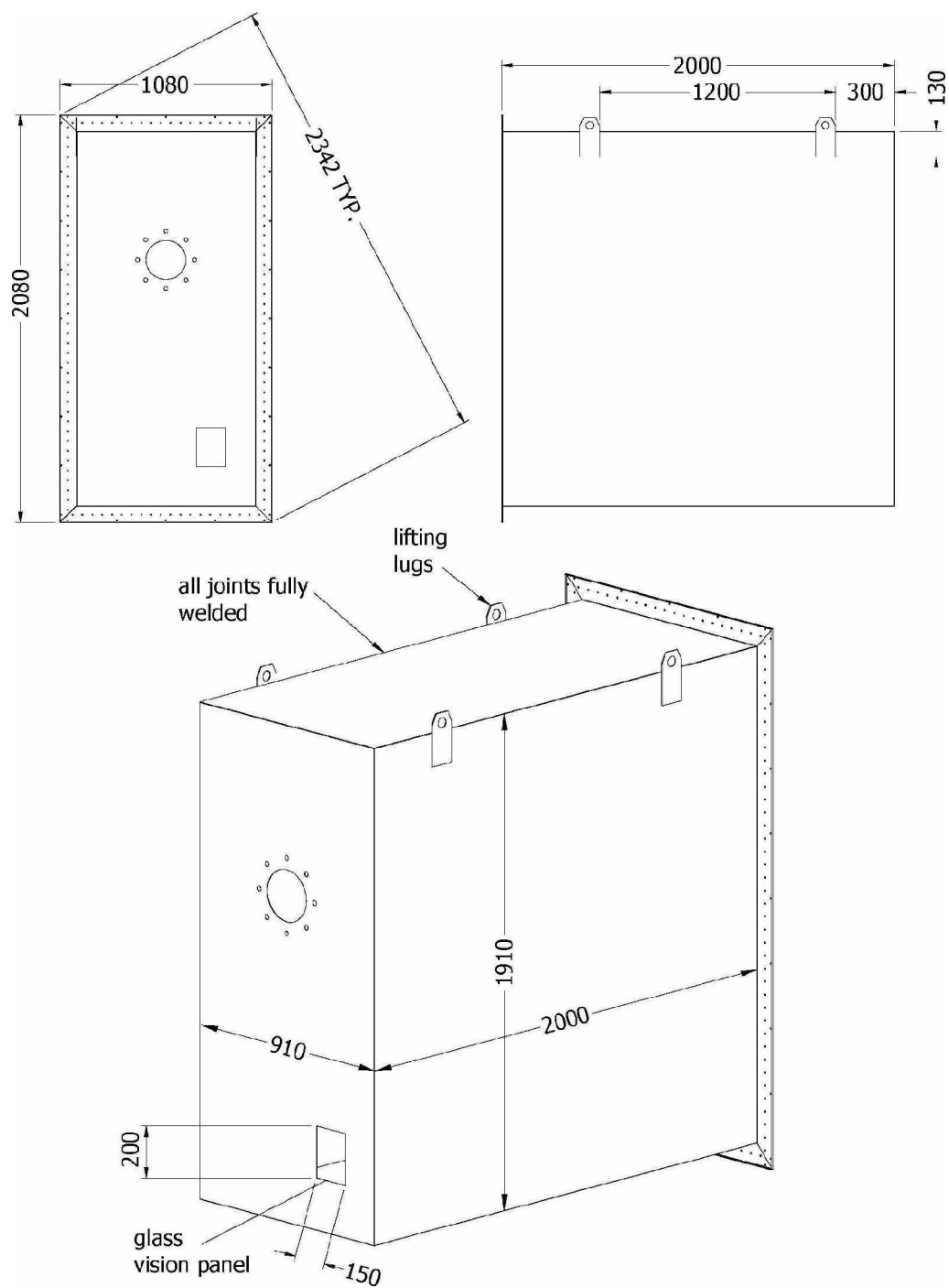
Do not scale. All dimensions are in mm

Figure 13 - Blade Details



Do not scale. All dimensions are in mm

Figure 14- Details of Enclosure (item 15)



Do not scale. All dimensions are in mm

# Schedule of Components

(Refer to Figures 1 to 14)

(All values are nominal unless stated otherwise)

(All other details are as stated by the sponsor)

Item	Description
<b>1. Partition (supplied by Exova Warringtonfire)</b>	
Details of Framework	
Reference	
i. vertical studs	92 mm standard 'C' studs
ii. top and bottom channel	94 mm standard 'U' channels
Material	Galvanised mild steel
Details of Plasterboard Panels	
Manufacturer	British Gypsum
Reference	Fireline
No. off Layers	2 no. layers, each layer 12.5 mm thick, at both faces of framework.
Fixing method	Fixed to all framework members with drywall screws at 300 mm centres. All board joints were staggered with respect to the adjacent board layer and the boards on the opposite face of the partition.
Panel Joint Finish	Standard paper tape, finished with gypsum based joint filler compound.
Details of Insulation	
Manufacturer	Rockwool
Reference	RW3
Material	Rock fibre
Thickness	100 mm
<b>2. Damper Casing</b>	
Material	Galvanised mild steel
Thickness	1.5 mm
Corner joints	Rivet fixed to corner brackets (item 3) using 6 no. steel pop rivets, 4.8 mm diameter.
Fixing method to partition surround	Fixed through pre-drilled holes at 500 mm centres along each damper face using 30 mm long x 4 mm diameter self tapping steel screws with steel washers.
<b>3. Corner Bracket</b>	
Material	Galvanised mild steel
Thickness	1.5 mm
Overall section size	30 mm x 30 mm
<b>4. Blade Front Skin</b>	
Material	Galvanised mild steel
Thickness	1 mm
Overall length	909 mm approx.
<b>5. Blade Rear Skin</b>	
Material	Galvanised mild steel
Thickness	1 mm
Overall length	909 mm approx.
Fixing method	Fixed to blade front skin (item 4) using 2 no. rows of steel pop rivets, each row of 5 no. pop rivets 4.8 mm

**Item****6. Blade Hinge**

Material  
Thickness  
Quantity  
Fixing method

diameter at 210 mm centres along length of blade.

**Description**

Galvanised mild steel  
1.5 mm  
2 no. hinges per blade (1 no. at each end of blade)  
Fixed to blade and to link bar (item 8) using 4.8 mm diameter steel pop rivets.

**7. Top Blade Stop**

Material  
Thickness  
Fixing method

Galvanised mild steel  
1.5 mm  
Fixed to damper casing with 5 no. steel pop rivets,  
4.8 mm diameter, at 210 mm centres.

**8. Link Bar**

Material  
Thickness  
Overall section size  
Quantity

Galvanised mild steel formed angle  
1.5 mm  
31 mm x 21 mm  
1 no. link bar

**9. Actuator**

Manufacturer  
Reference  
Quantity

Belimo  
BLE24  
1 no. actuator

**10. Actuator Mounting Bracket**

Material  
Thickness  
Fixing method

Galvanised mild steel  
1.5 mm  
Fixed to damper casing with steel pop rivets

**11. Actuator Cover Plate**

Material  
Thickness  
Fixing method

Galvanised mild steel  
1 mm  
Fixed to mounting bracket with steel pop rivets

**12. Drive Shaft**

Material

Mild steel BZP

**13. Actuator Lever Arm**

Material  
Thickness  
Fixing method  
i. to drive shaft  
ii. to link bar

Galvanised mild steel plate  
2 no. plates, each 2 mm thick  
  
'E' Type circlip  
Drive pin (item 14)

**14. Drive Pin**

Material  
Overall size

Mild steel BZP  
6.3 mm diameter

**15. Enclosure**

Material  
Thickness  
Fixing method

Galvanised mild steel  
1.5 mm casing  
Flange jointed to the damper casing using 4 mm diameter self tapping steel screws through the mating flanges at 50 mm centres along each side.

# Instrumentation

<b>General</b>	The instrumentation was provided in accordance with the Standard BS EN 1366 - Fire Resistance Tests for Service Installations - Part 2 Fire Dampers.
<b>Furnace</b>	Plate thermometers were provided in the furnace chamber as specified by the Standard, to measure the furnace temperature.
<b>Flow Measurement</b>	Pressure sensing devices provided within the furnace chamber, the duct plenum and the measuring station were utilised to monitor furnace pressure, static pressure in the duct plenum and differential pressure across the orifice plates within the measuring station during the test. The measurements recorded were used to measure the impermeability of the damper system whilst maintaining a constant pressure differential across the closed fire damper of 300 Pa.
<b>Temperature Measurement</b>	Thermocouples were provided to monitor the unexposed surface of the test construction and the specimen. The output of all instrumentation was recorded at one minute intervals. Figures 1 and 2 show the positions which were as follows:
<b>Thermocouples 10 to 13</b>	At four positions on the unexposed surface of the plenum duct, one approximately at the centre of each face of the plenum duct nominally 325 mm away from the surface of the test construction (referenced $T_2$ ).
<b>Thermocouples 6 to 9</b>	At four positions on the unexposed surface of the plenum duct one approximately at the centre of each face and nominally 25mm away from its interface with the damper. (Referenced $T_1$ ).
<b>Thermocouples 2 to 5</b>	At four positions on the unexposed face of the flexible wall construction nominally 25 mm away from the damper (Referenced $T_s$ ).
<b>Thermocouple 14</b>	At one position at the exit of the damper plenum to measure the gas temperatures.
<b>Integrity measurement</b>	Gap gauges and cotton pads were available to evaluate the integrity of the test construction.
<b>Furnace pressure</b>	The furnace atmospheric pressure was controlled so that it complied with the requirements of BS EN 1366-2: 1999. Clause 5. The calculated pressure differential relative to the laboratory atmosphere at mid-height of the damper was 15 ( $\pm 3$ ) Pa.

## 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 19°C at the start of the test with a maximum variation of 8°C during the test.
00	00	<b>The test commences.</b>
		<b>The damper was in the closed position at the start of the test.</b>
02	40	Smoke / steam release is visible across the top of the wall assembly.
03	36	Smoke release is visible across the top face of the plenum.
05	00	Viewed from the exposed side, the paper face of the plasterboard starts to burn away and the edges of the damper blades start to glow a dull red.
08	55	The wall assembly starts to bow in along its horizontal axis at mid-height.
09	35	The top two corners of the plenum start to discolour blue / black.
12	52	Viewed through the plenum window the edges of the damper blades glow orange.
20	00	The exposed face of the damper glows orange.
26	02	Viewed from the exposed side a small kinks are visible at mid-span along the bottom edge of each blade.
32	50	The joints in the exposed face of the plasterboard start to open up.
44	57	Slight smoke release is visible along the plenum flange, along the left hand vertical edge.
60	49	The damper assembly continues to satisfy the integrity criteria of the test.
66	27	Viewed from the exposed side, both layers of plasterboard are still attached. The exposed damper glows orange.
71	01	The corner of the plenum / damper flange bow away from the wall, most noticeable in the top left hand corner, no gaps visible.
74	09	Viewed through the plenum window the top blades appear to be bowing into the plenum, down their central vertical axis at mid-width.
74	20	<b>The leakage rate through the fire damper exceeds 360m<sup>3</sup>/h.m<sup>2</sup>.</b>
78	08	Viewed from the exposed side, the top small appears to have bowed differentially from the blades below.
92	00	<b>The test is discontinued.</b>

## Test Photographs

The unexposed face of the assembly prior to testing



The exposed face of the assembly after a test duration of 20 minutes

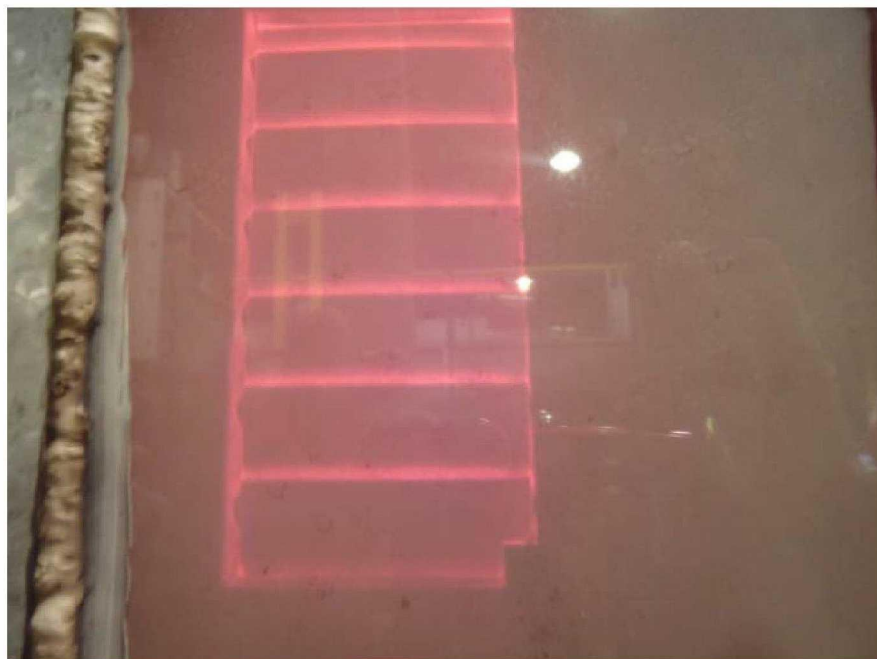




The exposed face  
of the assembly  
after a test  
duration of 60  
minutes



The damper  
viewed through  
the plenum  
window after a test  
duration of  
approximately 60  
minutes



The exposed face  
of the assembly  
after a test  
duration of 90  
minutes



## Temperature and Leakage Data

Mean furnace temperature, together with the temperature/time relationship specified in the Standard

Time Mins	Specified Furnace Temperature Deg. C	Actual Furnace Temperature Deg. C
0	20	24
3	502	493
6	603	604
9	663	671
12	706	705
15	739	732
18	766	762
21	789	789
24	809	807
27	826	826
30	842	842
33	856	858
36	869	865
39	881	884
42	892	890
45	902	901
48	912	916
51	921	921
54	930	927
57	938	938
60	945	947
63	953	954
66	960	959
69	966	965
72	973	973
75	979	977
78	985	979
81	990	987
84	996	997
87	1001	999
90	1006	1019
92	1009	1024

**Individual and mean temperatures recorded on the surface of the plenum duct by the thermocouples referenced T<sub>2</sub>**

Time Mins	T/C Number 10 Deg. C	T/C Number 11 Deg. C	T/C Number 12 Deg. C	T/C Number 13 Deg. C	Mean Temp. Deg. C
0	22	22	22	21	21
3	68	155	73	49	85
6	115	256	115	101	149
9	185	326	180	168	214
12	235	360	226	235	263
15	270	382	259	287	299
18	296	394	283	326	324
21	313	402	304	354	343
24	328	410	323	369	357
27	345	424	348	383	375
30	360	435	373	397	391
33	373	442	386	408	402
36	380	445	386	415	406
39	386	447	385	418	409
42	392	451	388	419	412
45	397	453	392	421	415
48	404	460	400	424	422
51	409	454	406	425	426
54	413	471	413	426	430
57	421	479	423	430	438
60	427	488	431	436	445
63	431	494	432	439	449
66	434	501	438	441	453
69	433	504	438	440	453
72	441	514	445	444	461
75	456	537	462	458	478
78	470	555	474	471	492
81	481	570	487	478	503
84	498	588	503	489	519
87	481	571	489	480	505
90	495	589	501	487	517
92	504	591	509	495	525

**Individual temperatures recorded on the surface of the plenum duct 25 mm away from  
the damper / sleeve flange (position T<sub>1</sub>)**

Time Mins	T/C Number 6 Deg. C	T/C Number 7 Deg. C	T/C Number 8 Deg. C	T/C Number 9 Deg. C
0	20	20	21	21
3	72	251	72	49
6	126	370	120	89
9	200	424	200	132
12	253	449	254	189
15	289	471	292	236
18	316	484	319	272
21	339	495	344	296
24	357	504	367	321
27	376	520	388	348
30	393	535	405	375
33	411	544	424	397
36	425	550	434	417
39	435	558	440	426
42	444	564	446	435
45	450	569	451	440
48	459	577	461	447
51	466	583	469	451
54	473	594	479	459
57	482	605	491	466
60	493	615	504	474
63	500	624	512	481
65	509	634	523	487
69	516	640	528	492
72	525	654	539	499
75	540	680	557	509
78	553	698	568	520
81	564	714	580	529
84	580	732	595	538
87	571	709	583	535
90	582	733	595	547
92	590	732	599	551

**Individual temperatures recorded on the dry wall construction nominally 25 mm away from damper (Position Ts).**

Time Mins	T/C Number 2 Deg. C	T/C Number 3 Deg. C	T/C Number 4 Deg. C	T/C Number 5 Deg. C
0	18	19	19	19
3	19	22	19	19
6	20	33	21	19
9	24	47	26	21
12	32	60	32	23
15	41	77	41	28
18	58	92	53	77
21	65	101	64	87
24	74	108	72	88
27	79	118	78	87
30	85	126	82	86
33	90	128	86	85
36	93	132	91	85
39	99	135	95	86
42	104	139	101	86
45	108	143	106	88
48	112	147	111	90
51	113	153	116	93
54	116	161	122	98
57	120	169	125	104
60	123	174	129	110
63	125	187	131	115
65	124	193	136	117
69	125	196	141	118
72	127	200	149	120
75	132	215	159	122
78	139	233	169	128
81	147	241	179	130
84	156	251	188	134
87	162	271	196	139
90	167	282	203	143
92	173	292	211	148

**Calculated volume flow (Corrected to 20° C)**

Time Minutes	Volume Flow Rate m3/h
0	-1.372
3	247.212
6	216.397
9	201.712
12	185.694
15	176.111
18	161.219
21	154.255
24	158.567
27	162.959
30	170.22
33	168.78
36	173.258
39	170.888
42	178.256
45	186.13
48	186.127
51	190.629
54	210.629
57	220.994
60	235.88
63	254.979
66	284.143
69	306.046
72	365.124
75	420.515
78	458.018
81	546.08
84	534.277
90	

At 84 minutes the pressure was reduced as the measuring temperature had exceeded 500° C  
the pressure was reinstated to give an indication of the volume flow at 90 minutes

**Connecting Plenum/Duct Pressure Differential During Fire Test**

Time	Plenum Pressure
Minutes	Pa
0	51.82
3	299.89
6	299.16
9	316.46
12	301.57
15	302.6
18	315.57
21	305.36
24	295.97
27	296.7
30	297.73
33	rt rt rt rt
36	298.08
39	rt rt rt rt rt
42	302.68
45	297.15
48	rt rt rt rt rt
51	290.99
54	rt rt rt rt rt
57	304.15
60	300.61
63	288.16
66	295.75
69	313.44
72	300.2
75	290.22
78	305.14
81	296.17
84	325.02
90	289.12

At 84 minutes the pressure was reduced as the measuring temperature had exceeded 500°C  
the pressure was reinstated to give an indication of the volume flow at 90 minutes



**Measuring Station Pressure Differential During Fire Test**

Time	Measuring Station Differential Pressure
Minutes	Pa
0	-6.08
3	220.51
6	184.77
9	174.17
12	153.22
15	141.13
18	120.44
21	111.17
24	118.32
27	127.33
30	140.13
33	139.84
36	147.85
39	145
42	154.6
45	158.9
48	175.07
51	176.49
54	rt rt rt rtrt
57	238.86
60	283.58
63	296.67
66	352.83
69	445.08
72	528.06
75	778.64
78	1062.53
81	1290.8
84	1914.84
90	1831.76

At 84 minutes the pressure was reduced as the measuring temperature had exceeded 500°C  
the pressure was reinstated to give an indication of the volume flow at 90 minutes

**Measuring station gas temperature during fire test**

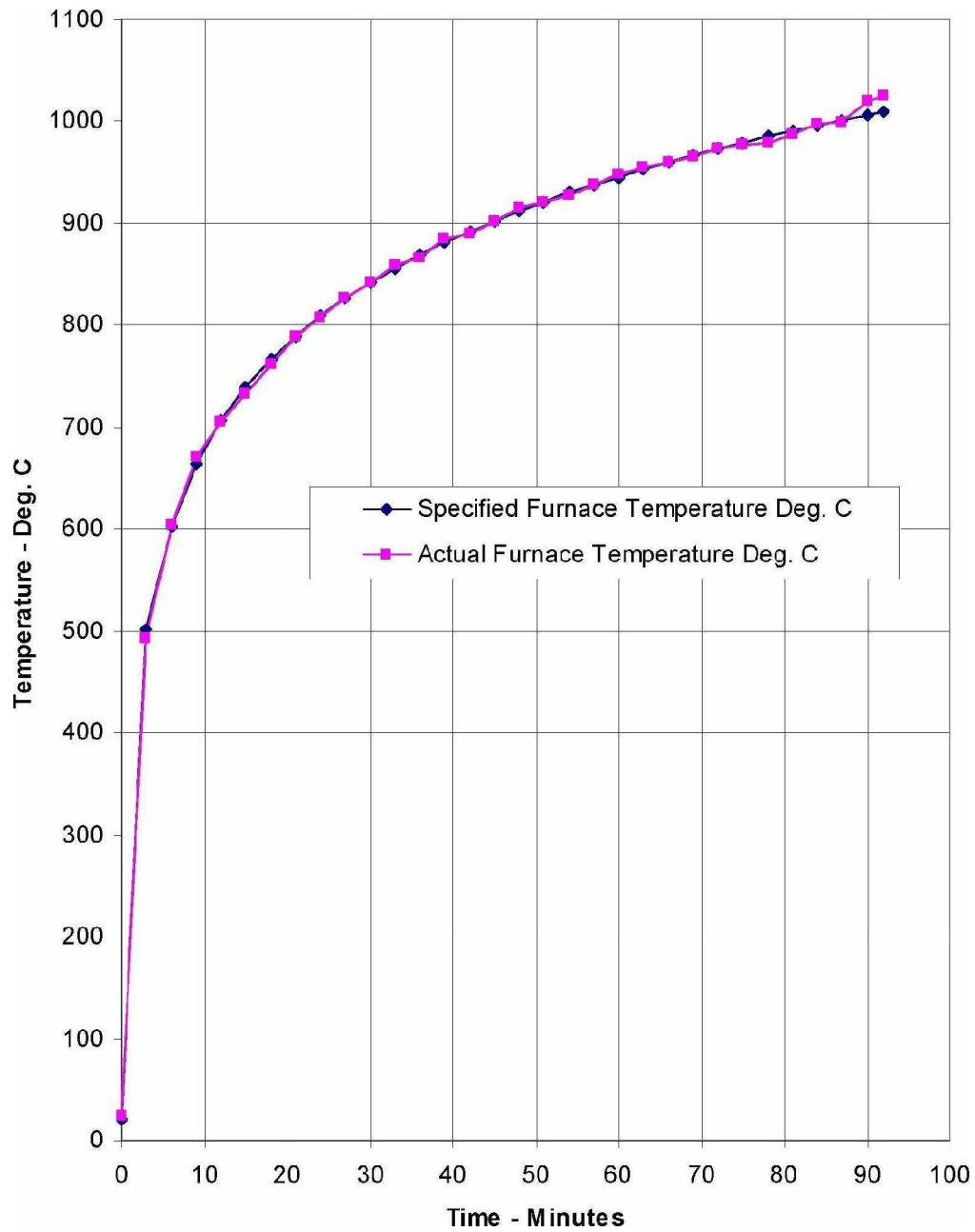
Time Minutes	Measuring Station Temperature Deg C
0	15.17
3	130.05
6	188.49
12	243.99
15	251.00
18	234.00
21	201.20
24	203.91
27	209.23
30	201.12
33	287.92
36	298.97
39	299.335
42	303.48
45	300.39
48	309.0
51	317.76
54	322.19
57	335.38
60	340.03
63	356.9
66	359.67
69	373.46
72	386.5
75	403.53
78	431.27
81	453.16
84	471.21
87	502.74
90	502.85

At 84 minutes the pressure was reduced as the measuring temperature had exceeded 500°C  
the pressure was reinstated to give an indication of the volume flow at 90 minutes

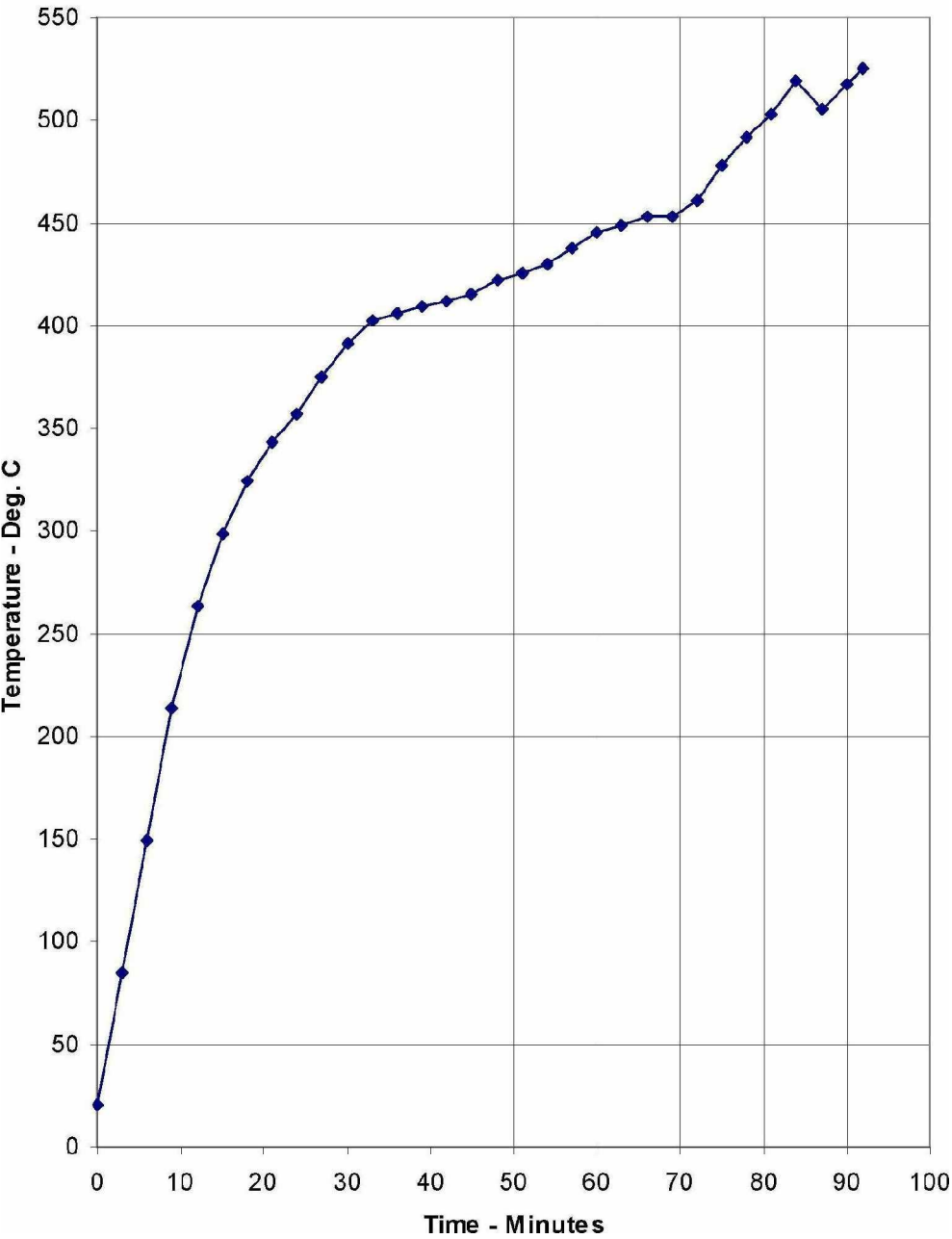
**Plenum/Connecting Duct Exit Gas Temperature During Fire Test**

Time Mins	T/C Number 14 Deg. C
0	22
3	293
6	392
9	438
12	470
15	484
18	503
21	514
24	525
27	536
30	545
33	554
36	556
39	562
42	564
45	565
48	573
51	575
54	583
57	592
60	598
63	602
66	609
69	616
72	627
75	648
78	662
81	678
84	702
87	675
90	707
92	686

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



Graph showing mean temperature recorded on the surface of the duct by the thermocouples referenced T<sub>2</sub>



## Performance Criteria and Test Results

### Integrity (Leakage)

Integrity (Leakage) - failure in accordance with the performance criterion of integrity is deemed to occur when leakage through the fire damper exceeds  $360\text{m}^3/\text{h.m}^2$  measured after the first 5 minutes of the test duration. The integrity around the perimeter of the fire damper is also judged in accordance with the criteria given in BS EN 1363-1. The test specified that an under pressure of  $300 \pm 15$  Pa be utilised. The specimen satisfied this criterion for duration of 74 minutes.

### Integrity

It is required that the evaluation of the integrity of the junction between the supporting construction and connecting duct/specimen is determined, without either causing ignition of a cotton pad when applied, or permitting the penetration of a gap gauge as specified in BS EN 1363-1: 1999, or resulting in sustained flaming on the unexposed surface.

Sustained flaming 92 minutes\*

Gap gauge 92 minutes\*

Cotton pad 92 minutes\*

\*The test duration. The test was discontinued after a period of 92 minutes.

### Insulation

The mean temperature rise of the unexposed surface shall not be greater than  $140^\circ\text{C}$  (determined by the mean value of the thermocouples referenced  $T_2$ ) and the maximum temperature rise shall not be greater than  $180^\circ\text{C}$ . Insulation failure also occurs simultaneously with integrity failure as specified in BS EN 1363-1: 1999. A maximum temperature rise greater than  $180^\circ\text{C}$  was recorded after a test duration of 3 minutes

### Smoke leakage

Smoke leakage - failure in accordance with the performance criterion of leakage is deemed to occur when leakage through the fire damper exceeds  $200\text{m}^3/\text{h.m}^2$  measured after the first 5 minutes of the test duration. The test specified that an under pressure of  $300 \pm 15$  Pa be utilised. The specimen did not satisfy this criterion after the first five minutes of the test.

## Ongoing Implications

### Limitations

Because of the nature of fire resistance testing and the consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.

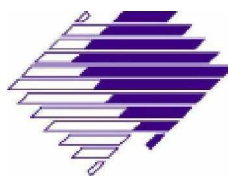
## Conclusions

### Evaluation against objective

To determine the fire resistance performance of an insulated single bladed fire damper mounted within a standard flexible wall construction, when tested generally in accordance with BS EN 1366-2: 1999. The performance of the specimen was evaluated against the requirements of the Standard and achieved the following results:

PERFORMANCE CRITERIA	TEST RESULTS
<b>Integrity</b> (Leakage)	74 minutes
<b>Smoke Leakage</b>	0 minutes
<b>Integrity</b> (Cotton Pad)	*92 minutes
<b>Integrity</b> (Gap Gauge)	*92 minutes
<b>Integrity</b> (Sustained Flaming)	*92 minutes
<b>Insulation</b>	3 minutes
Leakage During Ambient Temperature Test (Clause 10.3)	256.8 m <sup>3</sup> /hr

\*The test duration. The test was discontinued after a period of 92 minutes.



# GILBERTS

AIR DISTRIBUTION AND NATURAL VENTILATION SOLUTIONS

GILBERTS (BLACKPOOL) LTD  
Head Office and Works, Clifton Road  
Blackpool Lancashire FY4 4QT  
Tel: [REDACTED]  
Fax: [REDACTED]  
E-Mail: [Estimating@gilbertsblackpool.com](mailto:Estimating@gilbertsblackpool.com)

## CUSTOMER QUOTATION

P S B UK Ltd  
Witt House  
Brooklands Industrial Estate  
Burrwood Way, Holywell Green  
Halifax  
West Yorkshire HX4 9BH  
UNITED KINGDOM  
Contact: Hugh Mahoney  
Fax Number:

Date of Issue: 22 January 2015

Your Quotation is valid for 30 days

Telephone Number:

### Product Group    Quotation No

**Quotation Reference: J / P000069649**

**Project : Grenfell Tower London**

**Dear Sir/Madam,**

Thank you for your valued enquiry. We are now pleased to submit our Quotation as follows, which we hope will meet with your approval. Your Quotation is provided strictly on the basis of the written information provided. Please check all details, since we cannot be held responsible for any omissions or any misinterpretations of your requirements.

Costs shown are for Supply and Delivery only. VAT will be extra at the applicable rate.

All prices are based on the complete package of supply as presented in our quotation and therefore prices may have to be revised if quantities are reduced or items are deleted. Please also be aware that the performance data for all Gilberts products is derived using a Gilberts plenum design and specification. Performance cannot be guaranteed where alternative plenum designs are used.

When placing your order please ensure that you confirm the Quotation Reference as above.

Delivery Time: Our current standard delivery time for the products on this Quotation is in the region of 15 working days from receipt of order. We do however operate a flexible delivery system with fast track capability designed to help us meet your precise delivery needs. Please contact our Sales Office who will be happy to provide details, advice and guidance on delivery times. Please be aware however that if the order does not contain full and final information allowing us to proceed delivery times may be extended. The delivery period quoted can also vary subject to factory loading at the time of placing the order.

For prompt attention with any design, technical or product query, please do not hesitate to contact your support team:

#### Support Co-ordinator:

**Mark Griffiths Tel:** [REDACTED] **Fax:** [REDACTED] **E-Mail:** [markgriffiths@gilbertsblackpool.com](mailto:markgriffiths@gilbertsblackpool.com)

External Contact:

**Steve Cooper Tel:** [REDACTED] **Fax:** [REDACTED] **E-Mail:** [stevecooper@gilbertsblackpool.com](mailto:stevecooper@gilbertsblackpool.com)

Yours Faithfully

**Gilberts (Blackpool) Ltd**

The acceptance of all orders received and contracts entered into will be subject to our standard Terms & Conditions of Sale, a copy of which is available upon request, or can be viewed at our website - [www.gilbertsblackpool.com](http://www.gilbertsblackpool.com)

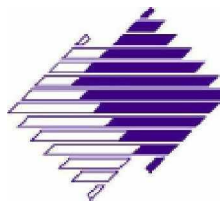
Please note that this Quotation will not be further confirmed unless specifically requested.

Registered in England No. 673483

Gilberts Document Reference: SL-EST-001







# GILBERTS

AIR DISTRIBUTION AND NATURAL VENTILATION SOLUTIONS

**Product Group    Quotation No**

**Quotation Reference: J / P000069649**

**Project : Grenfell Tower London**

LINE NO	ITEM DESCRIPTION AND SIZE (W x H)	QTY	NETT PRICE (EA)	LINE TOTAL
10	Special Instructions: Supplied with a BLE 24 volt motor. Finish: Mill Finish	80	36.87	2,949.60
11	K15/300x600/CB to suit a Series54 Special Instructions: Concealed Bracket Fixing as DRG.P0100/09 Finish: PPC RAL 9010 20% Gloss	6	256.66	1,539.96
20	Series54/600x1200/OC/24/CON/CB Special Instructions: Supplied With a BLE 24 volt motor. Finish: Mill Finish	6	86.12	516.72
21	K15/600x1200/CB to suit a Senes54 Special Instructions: Concealed Bracket Fixing as DRG.P0100/09 Finish: PPC RAL 9010 20% Gloss	3	317.37	952.11
30	AG/F/SC/700x600 c/w 24v BE24 OPEN/ CLOSED MOTOR	2	359.60	719.20
40	AG/C/SC/630 c/W24v BE24 OPEN/ CLOSED MOFOR			

**Additional Notes:**

1. It is essential that this quotation is read in conjunction with the following notes. Failure to do so may result in delays to delivery programmes, goods not being suitable for purpose, or extra invoice costs being applied.

2. It is essential that the Project and Quote number is clearly indicated on any order placed against this quotation. Please be advised that delivery is to a UK mainland destination/port only unless otherwise noted. Please note that in certain cases we will offer our nearest standard size where requested sizes are not available. Please check this is acceptable prior to order stage.

**3. SERIES 54**

The Series 54 damper is designed to be used for natural and mechanical smoke extract applications by means of a vertical shaft.

The damper has undergone an EN1366-2 test started from the closed position and lasted over 60 minutes for both fire integrity and smoke leakage (ES60) but has no formal certification

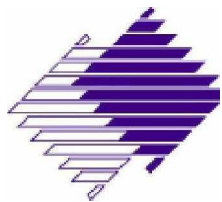
The damper is not CR marked as we believe that the application of fitting the dampers into ductwork systems as the test describes is not relevant in smoke shaft systems.

We are not aware that there is a product currently on the market for this application that is CE marked and as a result we are prepared to supply the damper in the interim.

We strongly recommend that you discuss the specific technical requirements of the damper with the relevant authority to ensure that it is acceptable

We have successfully and independently tested the Series 54 damper to EN 12101 - 2 : 2003 Annex G to achieve a B300 rating on the damper

4. K15 - linear bar grille comprising 3mm fineline blades on 19mm pitches with a 15 degree downturn and 32mm flanged border.



# GILBERTS

AIR DISTRIBUTION AND NATURAL VENTILATION SOLUTIONS

**Product Group      Quotation No**

**Quotation Reference: J / P000069649**

**Project : Grenfell Tower London**

PLEASE NOTE THAT ALL PRICES ARE QUOTED IN POUNDS STERLING	<b>NETT EX WORKS:</b>	<b>22,109.59</b>
	<b>PACKING &amp; CARRIAGE: (5.00%)</b>	<b>1,105.48</b>
	<b>DELIVERED (EX VAT):</b>	<b>23,215.07</b>