Fire Resistance Test Generally In Accordance With BS 476: Part 22: 1987, Clause 5, on an Insulated Fabric Barrier

Test Sponsor

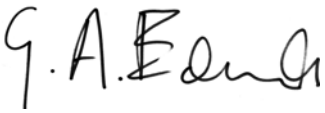
Saveguard (UK) Limited

Warrington Fire Research Centre Ltd., Holmesfield Road, Warrington, UK WA1 2DS
Tel: int + (0) 1925 655116 • Fax: int + (0) 1925 244638 • Reg. No. 1247124

Fire Resistance Test Generally In Accordance With BS 476: Part 22: 1987, Clause 5, on an Uninsulated Fabric Barrier

Test Sponsor

Saveguard (UK) Limited
Tame Valley Mill
Wainwright Street
Dukinfield
Cheshire
SK16 5NB

Report	Name	Signature*
Responsible Officer	S. Hankey	
Approved	G. Edmonds	

* For and on behalf of Warrington Fire Research Centre

Report Issued : 9th March 1999

Fire Resistance Test Generally In Accordance With BS 476: Part 22: 1987, Clause 5, on an Uninsulated Fabric Barrier

Summary

A single specimen of an uninsulated fabric barrier has been subjected to a test conducted generally in accordance with BS 476: Part 22: 1987, Clause 5 to determine its fire resistance performance.

The specimen had overall dimensions of 3035 mm high by 3050 mm wide and incorporated a nominally 0.4 mm thick fabric referenced 'FireHalt'. The specimen was retained by steel angles at the perimeter and included three vertical joints .

The specimen satisfied the performance requirements specified in Clause 5 of BS 476: Part 22: 1987 for the following period:

Integrity : 132 minutes
Insulation : 2 minutes

The test was discontinued after a period of 132 minutes.

Date of Test : 25th January 1999

Contents

1 Purpose of the Test

1.1 To determine the fire resistance of a single specimen of an uninsulated fabric barrier referenced 'FireHalt' when tested generally in accordance with BS 476: Part 22: 1987.

2 Introduction

2.1 The specimen was of an uninsulated construction and the test was therefore conducted generally in accordance with Clause 5 of BS 476: Part 22: 1987 'Methods for determination of the fire resistance of non-loadbearing elements of construction'. This test report should be read in conjunction with that Standard and with BS 476: Part 20: 1987, 'Methods for determination of the fire resistance of elements of construction (general principles)'.

2.2 As the specimen was fully restrained on all four sides its construction was not fully in accordance with the requirements of Clause 5 of BS 476: Part 22: 1987. The test was therefore not fully in accordance with the Standard.

2.3 The specimen was judged on its ability to comply with the performance criteria for integrity and insulation as required by BS 476: Part 22: 1987, Clause 5.

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

2.5 The test was conducted on the 25 January 1999, at the request of Saveguard (UK) Limited, the sponsor of the test.

2.6 The test was witnessed by Mr. B. Kennedy and Mr. Alan Schofield, representatives of the test sponsor.

3 Test Specimen Construction

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

3.2 The specimen was supplied by the sponsor on the 22nd January 1999. Warrington Fire Research Centre was not involved in any selection or sampling procedures of the specimens or any of the components.

3.3 The specimen was installed into a refractory concrete lined support frame to form the test construction. Installation was conducted by representatives of the test sponsor on the 22nd January 1999.

4 Instrumentation and Measuring Equipment

4.1 The instrumentation was provided in accordance with the requirements of the Standard.

4.2 Nine thermocouples distributed over a plane 100 mm from the surface of the test construction were provided to monitor the temperature of the furnace atmosphere.

4.3 Pressure sensors were provided within the furnace to monitor the furnace atmospheric pressure.

4.4 Thermocouples were provided to monitor the temperature of the unexposed face of the specimen as follows:

4.4.1 At five positions, one approximately at the centre of the specimen and one at approximately the centre of each quarter section. (Thermocouples 11 to 15)

4.4.2 At one position on the unexposed surface of the upper steel retaining angle at approximately mid-width (Thermocouple 16)

4.4.3 The locations and reference numbers of the various unexposed surface thermocouples are shown in Figure 1 of Annex A.

4.5 A roving thermocouple was available to measure temperatures on the unexposed surface of the specimen at any position which might appear to be hotter than the temperatures indicated by the fixed thermocouples.

4.6 Gap gauges were available to evaluate the impermeability of the specimen to hot gases where applicable.

4.7 A water-cooled foil heat-flux meter was used to record the heat radiation from the specimen. The heat-flux meter was positioned at a distance of 3704 mm from the unexposed surface of the specimen so that its angle of view of 60° circumscribed the diagonal of the blanket.

5 Test Procedure

5.1 The test was conducted generally in accordance with the procedure specified in BS 476: Part 22: 1987, Clause 5.

5.2 The furnace was controlled so that its mean temperature complied with the requirements of BS 476: Part 20: 1987, Clause 3.1.

5.3 After the first five minutes of testing and for the remainder of the test, the furnace atmospheric pressure was controlled so that it complied with the requirements of BS 476: Part 20: 1987, Clause 3.2.2. The calculated pressure differential relative to the laboratory atmosphere at the top of the specimen was 17 ($\pm$2) Pa.

5.4 Throughout the test the temperatures indicated by the thermocouples provided to monitor the furnace and the specimen were continuously monitored and were recorded at one minute intervals.

5.5 The thermocouples referred to in 4.2 were used to determine the mean furnace temperature.

5.6 The thermocouples referred to in 4.4.1 and 4.4.2 were used for information purposes only.

5.7 The occurrence of any sustained flaming on the unexposed surface was monitored to determine compliance with the integrity criterion of the Standard.

6 Test Data and Information

6.1 The following data, which was recorded during the test, is given in Annex B:

6.1.1 Mean furnace temperature, together with a comparison with the temperature/time relationship specified in the Standard.

6.1.2 The mean and individual temperatures recorded by the thermocouples fixed to the unexposed surface of the specimen.

6.1.3 Recorded radiation intensities.

6.2 A summary of the observations made on the general behaviour of the specimen is given in Annex C.

6.3 Photographs of the specimen before, during and after the test are included within Annex D.

6.4 The ambient air temperature in the vicinity of the test construction was 11^0C at the start of the test with a variation during the test of +9ºC.

6.5 Deflections of the specimen where applicable, were estimated during the test and are given in Annex C.

6.6 The test was discontinued after a period of 132 minutes.

7 Evaluation Against the Performance Criteria

7.1 The performance of the specimen was judged against the following criteria of BS 476: Part 20: 1987:

7.1.1 **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 132 minute test duration.

7.1.2 **Insulation** - It is required that the mean temperature rise of the unexposed surface shall not be greater than 140°C and that the maximum temperature rise shall not be greater than 180°C. Insulation failure also occurs simultaneously with integrity failure. This criterion was satisfied for a period of 2 minutes after which time the mean unexposed face temperature was exceeded.

8 Conclusions

8.1 A single specimen of an uninsulated fabric barrier has been subjected to a fire resistance test generally in accordance with BS 476: Part 22: 1987, Clause 5.

8.2 The specimen satisfied the performance requirements specified in the Standard for the period stated below:

Integrity : 132 minutes
Insulation : 2 minutes

The test was discontinued after a period of 132 minutes.

9 Limitations

9.1 The results relate only to the behaviour of the specimen of the element of construction under the particular conditions of test. They are not intended to be the sole criteria for assessing the potential fire performance of the element in use, nor do they reflect the actual behaviour in fires.

9.2 The test results relate 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 results to specimens of different dimensions or supported other than by a concrete wall or incorporating different components should be the subject of a design appraisal.

10 Review

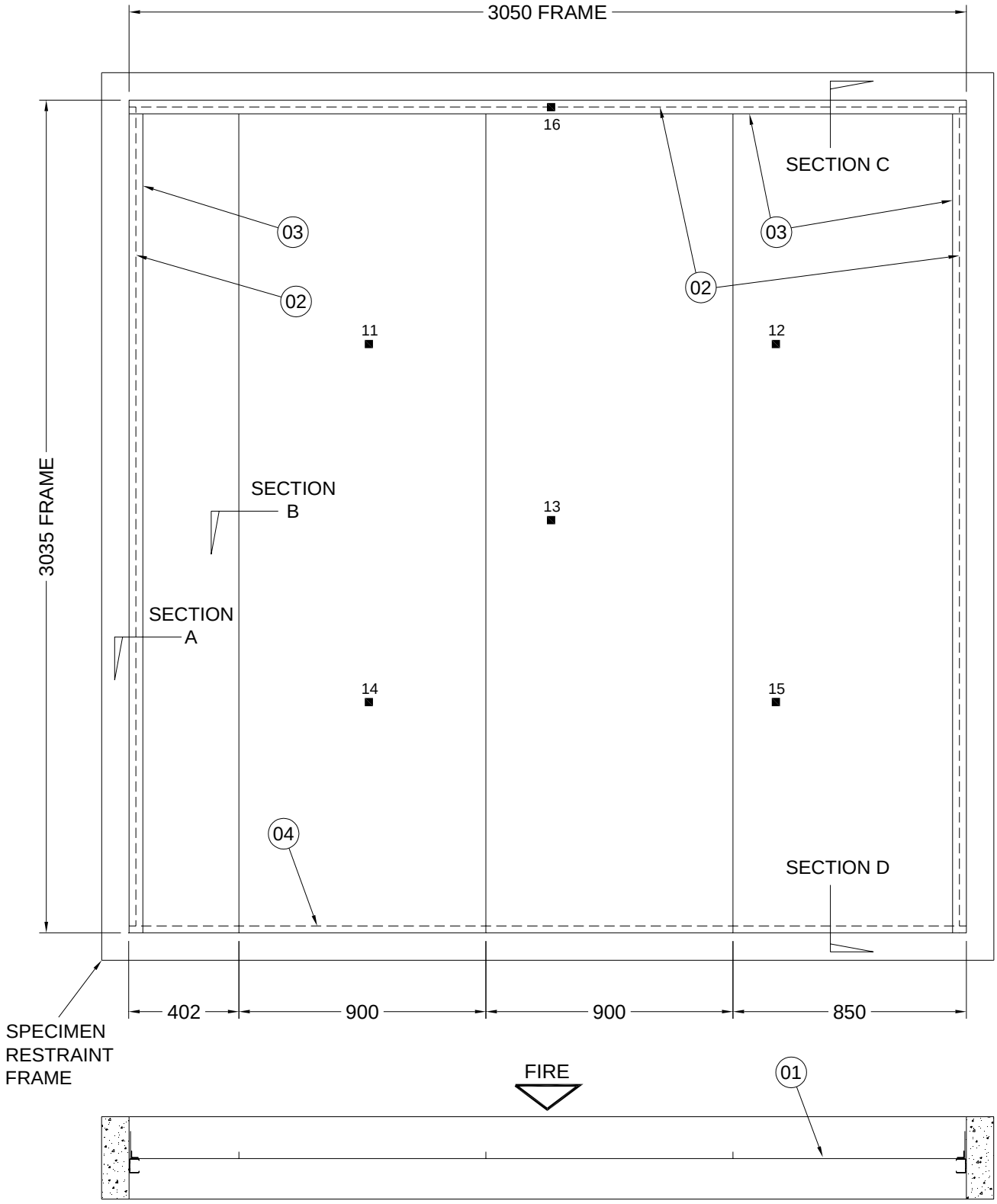
10.1 The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

9th March 1999

Annex A

Schedule of Components
(Refer to Figures 1 and 2)
(All values are nominal unless stated otherwise)
(All other details are as stated by the sponsor)

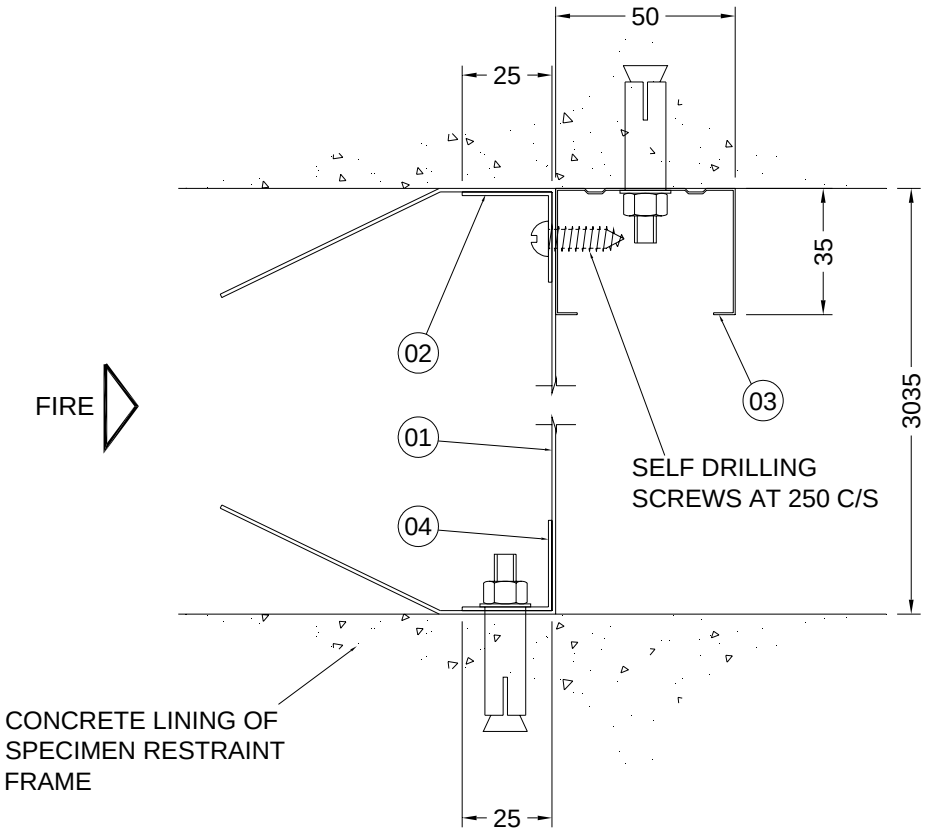
Item		Description	
1	**Fire Barrier**		
	Manufacturer	:	Saveguard (UK) Limited.
	Reference	:	FireHalt.
	Materials	:	A proprietary chemically treated woven glass fabric, 0.47 kg/m^2.
	Nominal thickness	:	0.4 mm.
	Fixing		
	i. perimeter to concrete	:	100 mm folds and clamped as shown in Figure 2.
	ii. vertical joints	:	50 mm folds as shown in Figure 2. First fold fixed with 1 row of size 10 galvanised staples at 500 mm vertical centres. Second fold with size 10 staples at 100 mm centres.
	.		
2	**Angle Section to Stud**		
	Materials	:	Galvanised mild steel.
	Overall size	:	25 mm x 25 mm x 0.5 mm thick.
	Fixing to stud section		
	i. type	:	Steel self drilling screws.
	ii. size	:	38 mm x 4 mm diameter.
	iii. centres	:	250 mm centres.
3	**Stud Section**		
	Materials	:	Galvanised mild steel.
	Overall size	:	50 mm x 35 mm x 0.5 mm thick.
	Fixing		
	i. type	:	Steel Rawlbolts.
	ii. size	:	M6 10P.
	iii. centres	:	250 mm centres.
4	**Angle Section to Concrete**		
	Materials	:	Galvanised mild steel.
	Overall size	:	25 mm x 25 mm x 0.5 mm thick.
	Fixing to concrete		
	i. type	:	Steel Rawlbolts
	ii. size	:	M6 10P.
	iii. centres	:	250 mm centres.
	Angle length	:	Continuous.

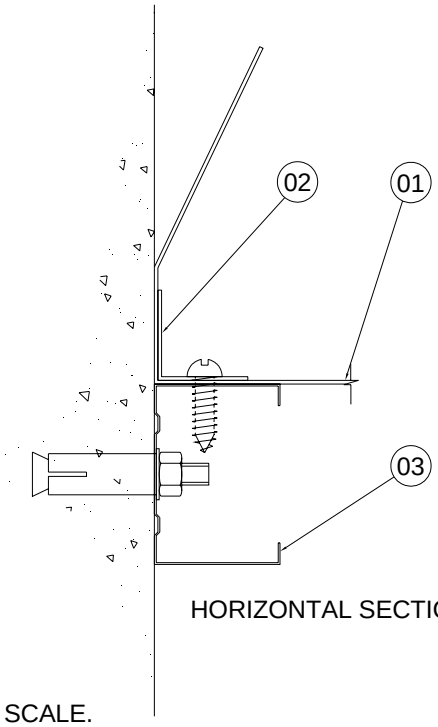


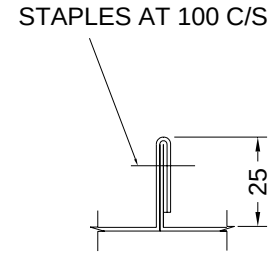
■ POSITIONS OF UNEXPOSED FACE THERMOCOUPLES.
DO NOT SCALE.
SEE ANNEX A FOR SCHEDULE.
ALL DIMENSIONS ARE IN MM.

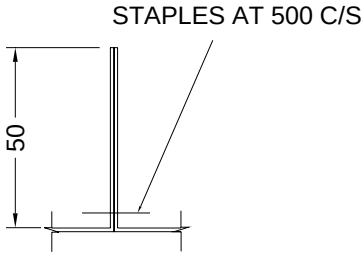
ELEVATION OF UNEXPOSED FACE WITH A HORIZONTAL SECTION

FIGURE 1









DO NOT SCALE.
SEE ANNEX A FOR SCHEDULE.
ALL DIMENSIONS ARE IN MM.

DETAILS OF SPECIMEN

FIGURE 2

Annex B

Data Recorded During the Test

Table 1

Actual and Specified Furnace Temperatures with Percentage Tolerances

Time Minutes	Specified Furnace Temperature Deg. C.	Actual Furnace Temperature Deg. C.
0	20	13
4	544	547
8	645	639
12	705	698
16	748	756
20	781	771
24	809	805
28	832	817
32	851	843
36	869	871
40	885	879
44	899	900
48	912	917
52	924	930
56	935	934
60	945	949
64	955	958
68	964	963
72	973	967
76	981	970
80	988	970
84	996	972
88	1003	980
92	1009	980
96	1016	982
100	1022	983
104	1028	988
108	1033	988
112	1039	990
116	1044	993
120	1049	994
124	1054	996
128	1059	996
132	1063	997

Annex B (Continued)

Table 2

Individual and Mean Temperatures Recorded on the Unexposed Surface of the Specimen.

Time Minutes	T/C Number 11 Deg. C.	T/C Number 12 Deg. C.	T/C Number 13 Deg. C.	T/C Number 14 Deg. C.	T/C Number 15 Deg. C.	Mean Temperature Deg. C.
0	13	15	14	15	14	14
4	272	335	280	255	306	290
8	444	460	456	410	451	444
12	490	502	517	469	491	494
16	560	557	591	549	525	556
20	571	576	603	558	550	572
24	603	607	637	589	587	605
28	621	621	650	609	599	620
32	653	647	682	642	625	650
36	677	670	708	667	651	675
40	689	684	718	679	662	686
44	719	705	747	708	685	713
48	735	719	761	724	697	727
52	742	735	768	727	722	739
56	753	743	781	744	721	748
60	767	758	796	757	743	764
64	780	766	806	771	746	774
68	789	771	813	780	753	781
72	794	779	818	786	759	787
76	797	784	822	790	763	791
80	803	788	823	795	764	795
84	804	790	823	795	771	796
88	809	794	828	799	775	801
92	812	796	830	805	773	803
96	816	802	832	808	778	807
100	819	802	830	810	781	808
104	820	806	832	812	785	811
108	823	811	834	814	786	813
112	825	811	833	816	787	814
116	825	815	835	817	791	817
120	827	815	837	818	793	818
124	827	820	837	822	793	820
128	828	818	839	822	796	820
132	829	822	840	823	797	822

Annex B (Continued)

Table 3

Individual Temperature Recorded on the Unexposed Surface of the Specimen

Time Minutes	T/C Number 16 Deg. C.
0	16
4	77
8	114
12	142
16	166
20	178
24	190
28	199
32	216
36	229
40	240
44	254
48	264
52	276
56	293
60	311
64	345
68	370
72	391
76	410
80	433
84	463
88	496
92	509
96	519
100	524
104	526
108	534
112	544
116	555
120	562
124	572
128	579
132	611

Annex B (Continued)

Table 4

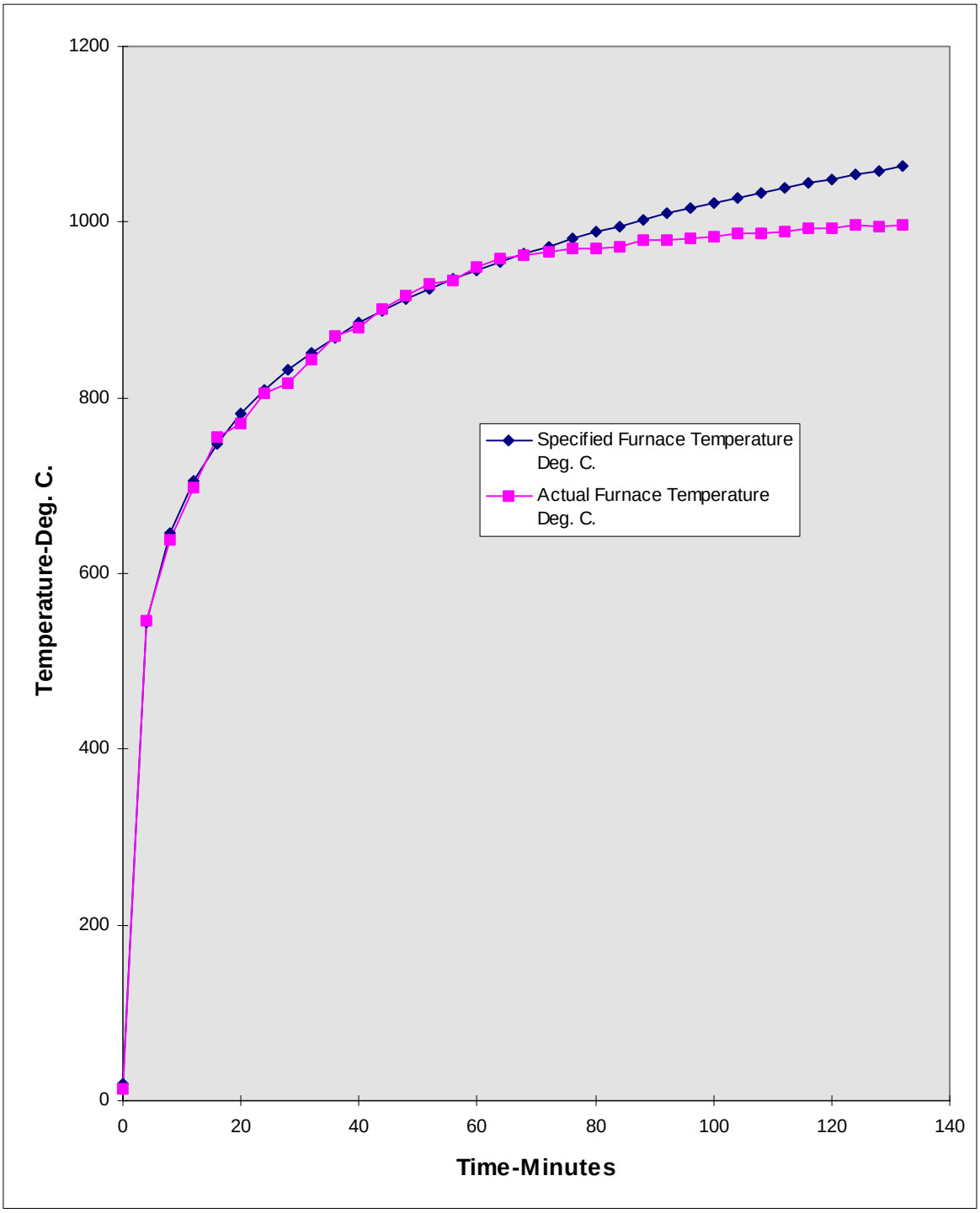
Radiation Intensity Measured at 3704mm from the Unexposed Surface of the Specimen.

Time Minutes	Radiation Intensity At 3704mm W/sqcm
0	0.000
4	0.000
8	0.024
12	0.056
16	0.095
20	0.113
24	0.141
28	0.153
32	0.181
36	0.208
40	0.222
44	0.248
48	0.275
52	0.290
56	0.300
60	0.322
64	0.332
68	0.344
72	0.355
76	0.354
80	0.362
84	0.363
88	0.371
92	0.376
96	0.380
100	0.386
104	0.388
108	0.391
112	0.395
116	0.400
120	0.402
124	0.408
128	0.408
132	0.407

Annex B (Continued)

Graph 1

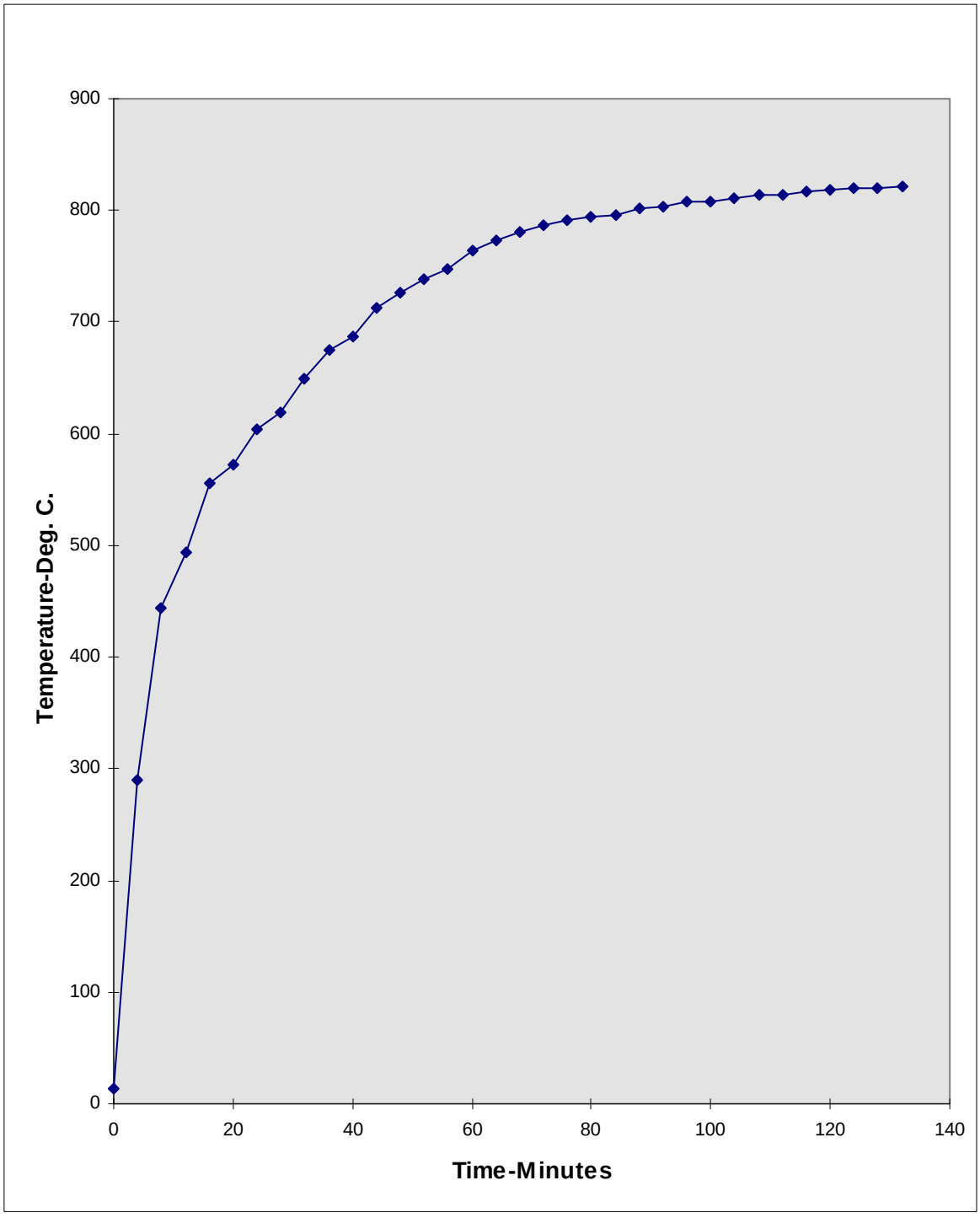
Specified and Actual Furnace Temperatures.



Annex B (Continued)

Graph 2

Mean Unexposed Surface Temperature.



Annex C

Observations Made During the Test

U - Observations made on unexposed side
E - Observations made on exposed side

Time			
mins	**secs**		
00	00		**The test commences.**
02	30	U	There is a large smoke release from the head of the specimen.
02	45	U	The upper half of the curtain/barrier has discoloured a light brown colour.
03	10	U	All of the surface has discoloured a mid brown.
04	00	U	The upper 2 m height of the barrier has deflected away from the furnace and the lower 1 m has deflected towards the furnace, due to the furnace pressure conditions.
05	00	U	The smoke release has decreased from the head of the specimen.
12	00	U	The perimeter channel has buckled slightly.
18	55	U	The entire area of the barrier has now discoloured a mid dark brown colour.
25	00	U	There are no further significant visible changes.
30	00	U	Integrity remains intact.
45	00	U	The entire unexposed surface of the specimen is radiating a dull orange colour. Integrity remains intact.
47	40	U	The three vertical joints are glowing a bright orange colour.
56	40	U	The channel to the perimeter of the specimen has buckled to the top and vertical edges.
60	00	U	Integrity remains intact.
60	30	U	The entire surface area continues to glow at mid orange colour.
75	00	U	No further significant visible change.
90	00	U	No further significant visible change.
120	00	U	No further significant visible change. Integrity remains intact.
132	00		**The test is discontinued.**

Annex D

Photographs Taken During the Test

Plate 1	-	Unexposed surface of the specimen prior to testing.
Plate 2	-	Unexposed surface of the specimen during the test.
Plate 3	-	Unexposed surface of the specimen during the test.
Plate 4	-	Unexposed surface of the specimen during the test.
Plate 5	-	Unexposed surface of the specimen during the test.
Plate 6	-	Unexposed surface of the specimen during the test.
Plate 7	-	Unexposed surface of the specimen during the test.
Plate 8	-	Unexposed surface of the specimen during the test.
Plate 9	-	Unexposed surface of the specimen during the test.
Plate 10	-	Unexposed surface of the specimen during the test.
Plate 11	-	Unexposed surface of the specimen during the test.
Plate 12	-	Unexposed surface of the specimen during the test.
Plate 13	-	Unexposed surface of the specimen during the test.
Plate 14	-	Unexposed surface of the specimen during the test.
Plate 15	-	Unexposed surface of the specimen during the test.
Plate 16	-	Exposed surface of the specimen after the test.

Plate 1

Plate 2

Plate 3

Plate 4

Plate 5

Plate 6

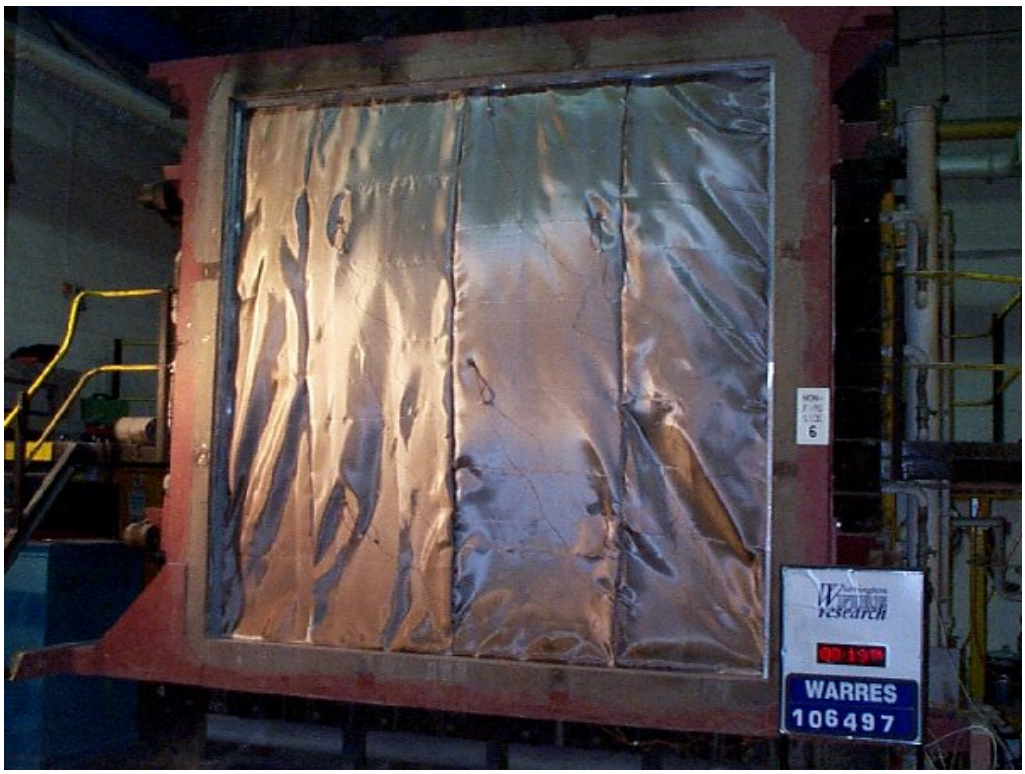


Plate 7

Plate 8

Plate 9

Plate 10

Plate 11

Plate 12

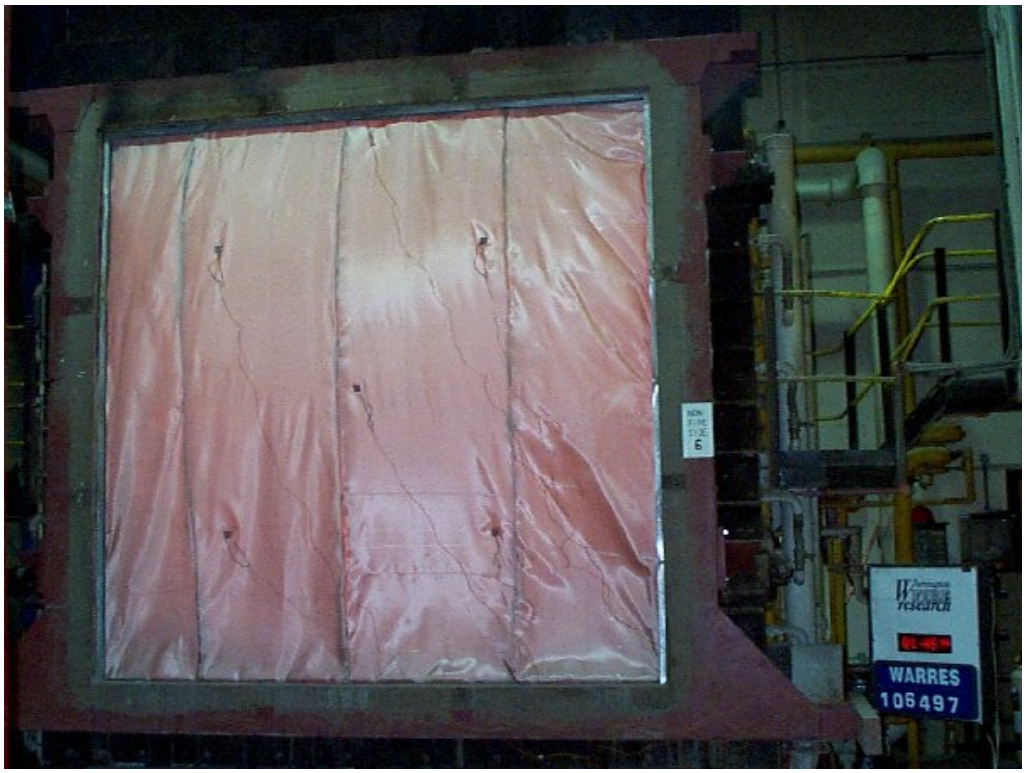


Plate 13

Plate 14

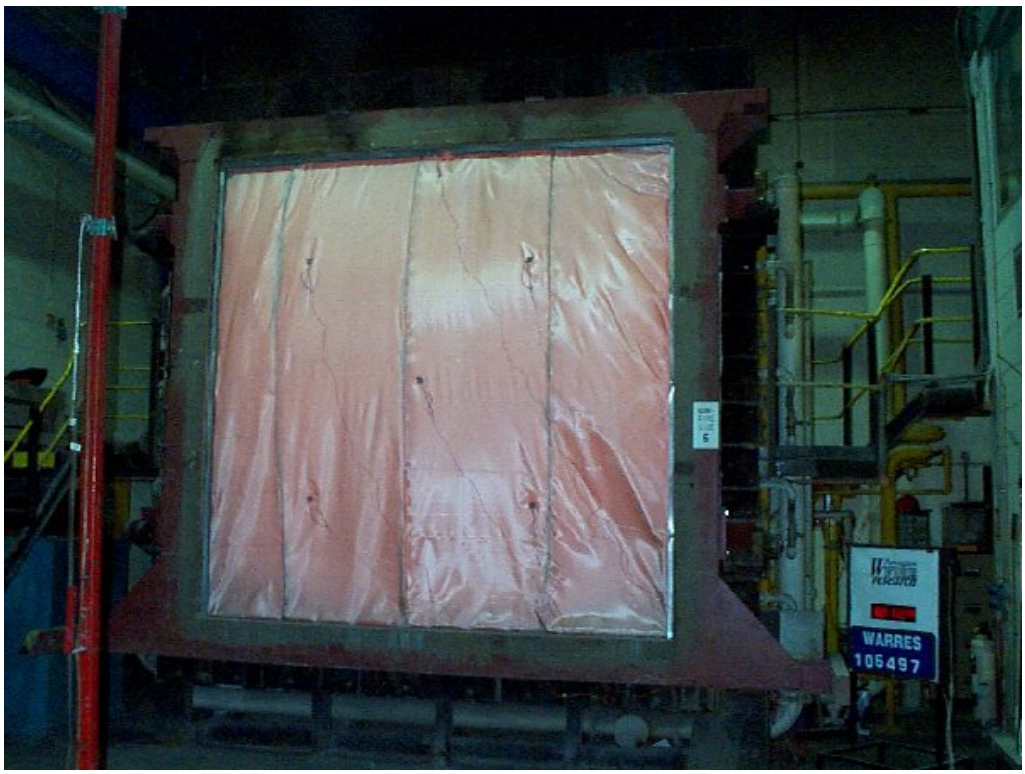


Plate 15

Plate 16