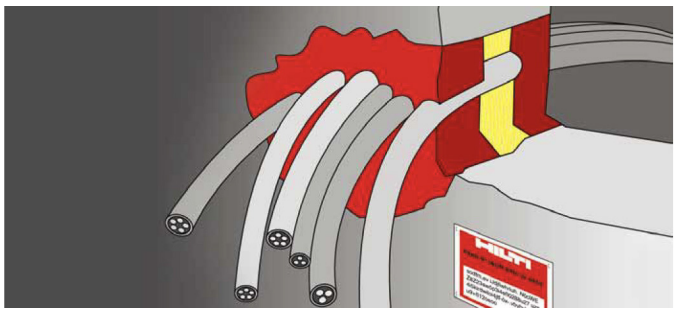
Hilti FS-ONE MAX High-Performance

Intumescent Firestop Sealant Submission Folder

Hilti (HK) | askHilti 工程師技術支援平台 ask.hilti.com.hk | 香港客戶熱線 +852 8228 8118 澳門客戶熱線(免費) 00800 8228 8118 | 香港門市：大角咀洋松街1號形品星寓地下2號舖 澳門門市：澳門布魯塞爾街70號建興龍廣場地下W座地舖 | 電郵：hksales@hilti.com 傳真：+852 2954 1751

High performance intumescent firestop sealant FS-ONE MAX



APPLICATIONS

- For effectively sealing most common through penetrations in a variety of base materials
- Copper and EMT pipes
- Insulated steel and copper pipes
- Single cables and cable bundles
- Closed or vented plastic pipes
- HVAC penetrations

ADVANTAGES

- One product for most firestop applications
- Cost-effective solution
- Easy to work with and fast cleanup

Technical data	
Chemical basis	Water-based acrylic dispersion
Base materials	Concrete, Concrete block, Metal, Wood, Gypsum
Expansion ratio (unrestricted, up to)	1:5
Approx. curing time[1)]	4 mm/3 days
Average volume shrinkage	19.4 %
Application temperature range	5 - 40 °C
Temperature resistance range	-20 - 100 °C
Storage and transportation temperature range	5 - 25 °C
Shelf life[3)]	18 Months

[1)] at 75°F/24°C, 50% relative humidity
[2)] at 77°F/25°C and 50% relative humidity; from date of manufacture

Smoke | Water Tight | Acoustic | Siesmic

Low VOC | Mould & Mildew

Consumption Guide

Cartridge size = 310 ml (FS-ONE)

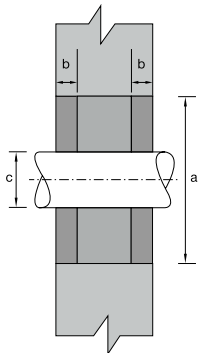
Sealing volume in wall application (installation on both sides)

$$Vs = \frac{\pi}{4} \times (a^2 - c^2) \times 2b$$

Sealing volume in floor application (installation on one side only)

$$Vs = \frac{\pi}{4} \times (a^2 - c^2) \times b$$

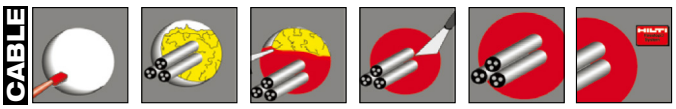
a = hole diameter in cm
b = installation depth in cm (see approvals)
c = outside diameter of pipe or bunched cable diameter in cm



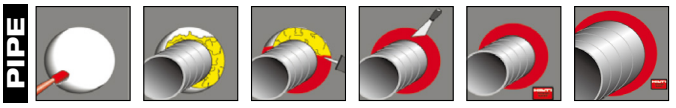
No. of cartridges needed,

$$n = \frac{Vs}{\text{cartridge volume in ml}}$$

Application Procedure



1. Clean opening
2. Pack Mineral wool. (If required)
3. Apply FS-ONE MAX.
4. Smooth FS-ONE MAX.
5. Leave completed seal undisturbed for 48 hours.
6. Fasten identification plate. (If required)



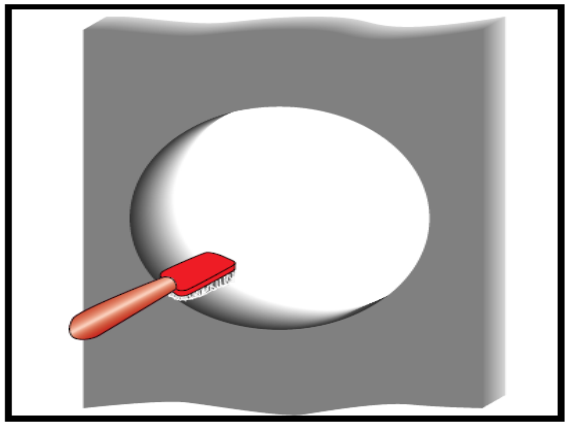
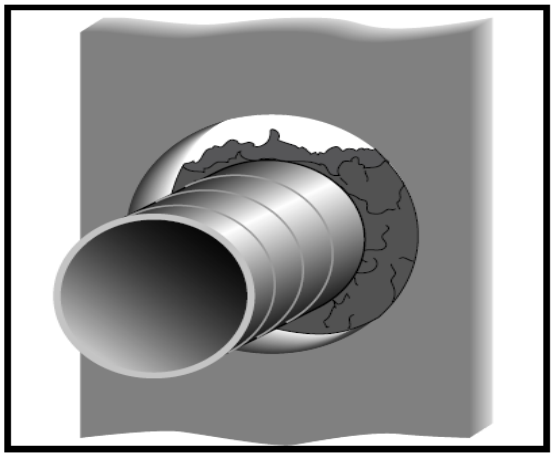
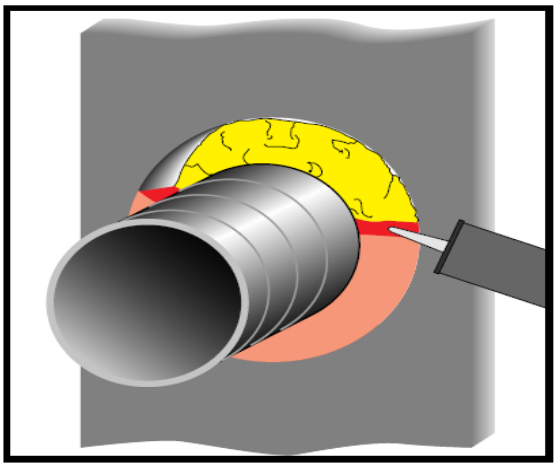
1. Clean opening
2. Pack Mineral wool. (If required)
3. Apply FS-ONE MAX.
4. Smooth FS-ONE MAX.
5. Leave completed seal undisturbed for 48 hours.
6. Fasten identification plate. (If required)

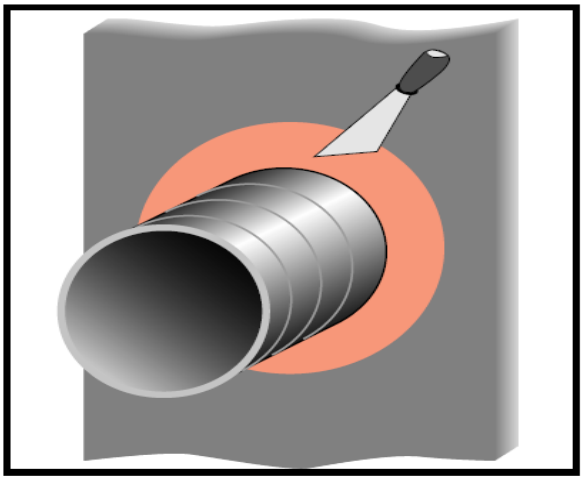
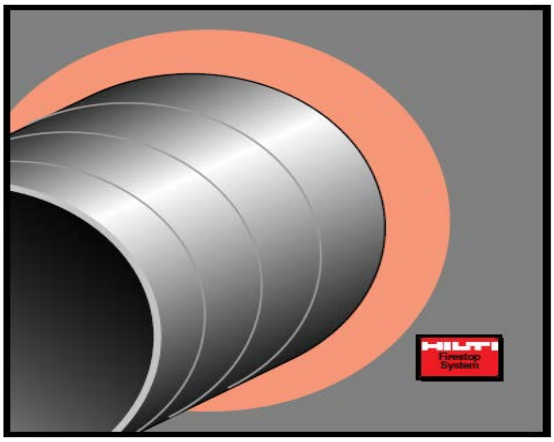
Order Now

Ordering designation	Colour	Volume per unit	Packaging	Sales pack quantity	Item number
FS-ONE MAX 10.1OZ CART	Red	300 ml	Cartridge	1 pc	**2101534**

Please visit Hilti website for the latest item numbers and related products

Subject: **Method Statement of FS-ONE MAX for Penetration Seal.**
Material: FS-ONE MAX firestop sealant
Accessory: Hilti Dispenser CFS-DISP or Hilti Dispenser CS 270-P1 or equivalent.

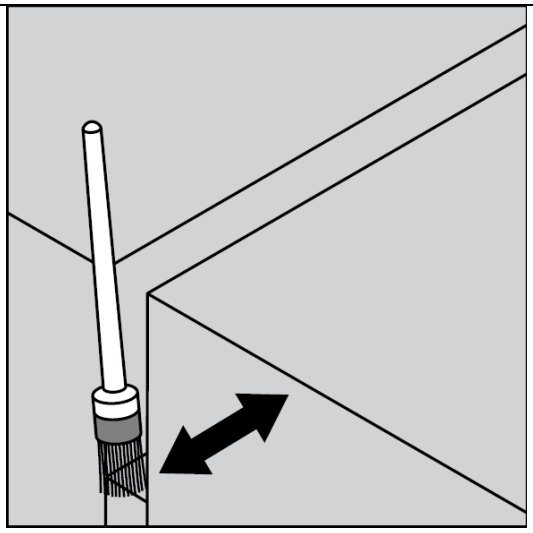
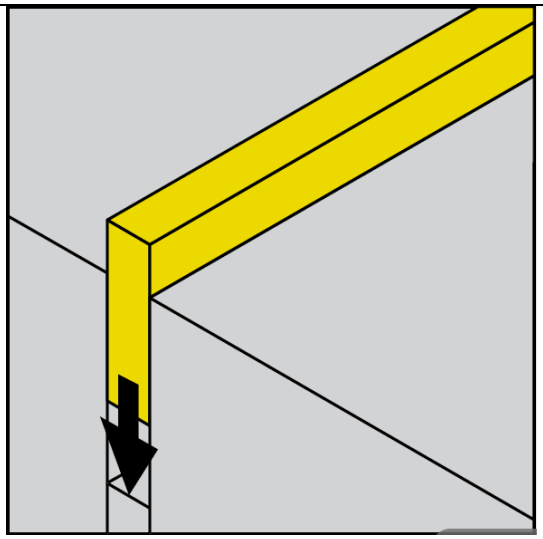
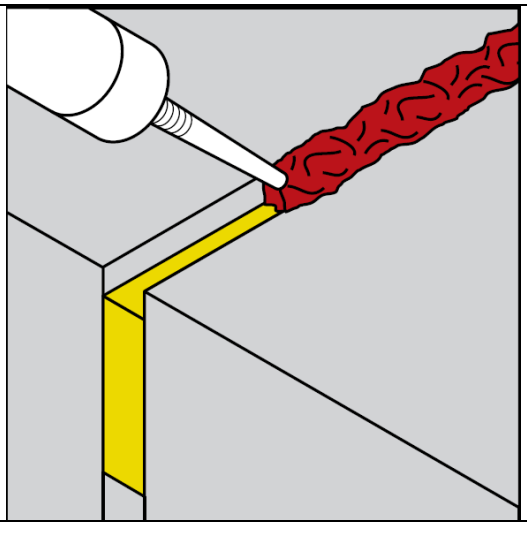
Setting Operation		
1	Clean the opening. Surfaces to which FS-ONE MAX will be applied should be cleaned of loose debris, dirt, oil, wax and grease. The surface should be moisture and frost free.	
2	Insert the required fill of mineral wool and backer.	
3	Apply firestop FS-ONE MAX over backer.	

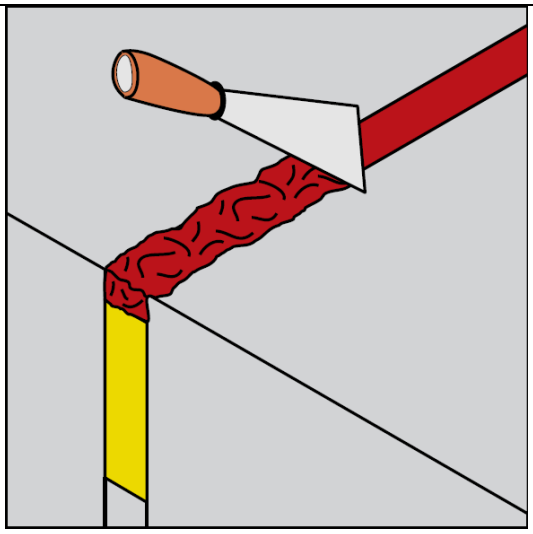
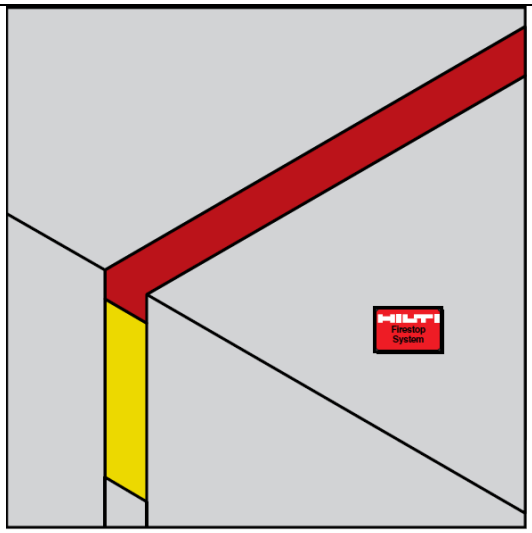
4	Smooth the firestop sealant with a trowel before the skin forms. Once cured, FS-ONE MAX can only be removed mechanically.	
5	For maintenance reasons, a penetration seal could be permanently marked with an identification plate. In such a case, mark the Identification plate and fasten it in a visible position next to the seal.	

Safety precautions:

- Never use in areas immersed in water
- Keep out of reach of children
- Read the Material Safety Data Sheet
- Eyes sand hands must be suitably protected
- Avoid contact with eyes/skin
- Only use in well ventilated areas

Subject: **Method Statement of FS-ONE MAX for Linear Joint Seal**
Material: FS-ONE MAX firestop sealant
Accessory: Hilti Dispenser CFS-DISP or Hilti Dispenser CS 270-P1 or equivalent.

Setting Operation		
1	Clean the opening. Surfaces to which FS-ONE MAX will be applied should be cleaned of loose debris, dirt, oil, wax and grease. The surface should be moisture and frost free.	
2	Insert fill of mineral wool or backing material (if required)	
3	Apply FS-ONE MAX over the backing material .	

4	Smooth FS-ONE MAX using a trowel before the skin forms. It can only be removed mechanically once it is cured.	
5	For maintenance reasons, a penetration seal would be permanently marked with an identification plate. In such a case mark the identification plate and fasten it in a visible position next to the seal	

Safety precautions:

- Never use in areas immersed in water
- Keep out of reach of children
- Read the Material Safety Data Sheet
- Eyes and hands must be suitably protected
- Avoid contact with eyes/skin
- Only use in well ventilated areas

RESEARCH ENGINEERING DEVELOPMENT FAÇADE CONSULTANTS LIMITED -
Fire and Facade Testing Laboratory
雄略幕牆顧問有限公司 - 消防及幕牆檢測實驗中心
DD134, Lung Kwu Tan, Tuen Mun, N.T., Hong Kong

HOKLAS 091 TEST

FIRE RESISTANCE TEST IN ACCORDANCE WITH BS 476: PART 20: 1987

On 7 nos. of Penetration Systems (Specimens '2a', '2b', '3', '6', '8', '9' and '10')

Test Report No.: R16L28-1B

Identification No.: Q16L45-1

Issue Date: 26 April 2017

Testing Location:

RED Hong Kong Main Laboratory
DD 134, Lung Kwu Tan, Tuen Mun,
N.T., Hong Kong

Test Sponsor

Hilti (Hong Kong) Limited
701-704, 7/F, Tower A, Manulife Financial Centre,
223 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong

APPROVED SIGNATORY: _____ **DATE:** 26 APR 2017

Ir. Dr. YUEN Sai-wing, MHKIE (FIRE)

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CONTENT

1 SUMMARY

Fire resistance test conducted in accordance with BS 476: Part 20: 1987 on 7 nos. of penetration systems (specimens '2a', '2b', '3', '6', '8', '9' and '10')

Twenty-seven specimens of penetration systems, namely specimens '1a' to '27' (refer to test sponsor's drawings in the appendix), had been subjected to a test in accordance with BS 476: Part 20: 1987, in order to determine their fire resistance performances. In this test report, only trunkings, speed sleeve and cable trays, namely specimens '2a', '2b', '3', '6', '8', '9' and '10' (refer to photo 1), were considered. As requested by the test sponsor, the specimens were mounted within concrete line specimen holder as shown in the test sponsor's drawings (see the appendix). The specimens were symmetrical and only one side of specimen was tested as per test sponsor's request.

Specimen '2a' was comprised of a 100 mm by 100 mm by nominal 1 mm thick by 1,400 mm long trunking filled with 60% of 5 mm diameter 'CAT 6' cables. The cables were protected by 'CFS-BL' firestop blocks and 'CFS-F FX' firestop foam.

Specimen '2b' was comprised of a 100 mm by 100 mm by nominal 1 mm thick by 1,400 mm long trunking filled with 60% of 5 mm diameter 'CAT 6' cables. The cables were protected by 'CFS-BL' firestop blocks.

Specimen '3' was comprised of a 200 mm by 200 mm by nominal 1.2 mm thick by 1,400 mm long trunking filled with 60% of 5 mm diameter 'CAT 6' cables. The cables were protected by 'CFS-F FX' firestop foam.

Specimen '6' was comprised of a nominal 110 mm diameter 'CFS-SL' speed sleeve filled with 60% of 3 mm diameter AV cables.

Specimens '8', '9' and '10' were comprised of a fire barrier with sizes of 600 mm wide by 600 mm high, upper and lower cable trays with electrical cables. The upper and lower cable trays were with a separation of 250 mm. The upper and lower cable tray had a 250 mm wide by 1.2 mm thick and a 150 mm wide by 1.2 mm thick cable trays respectively. 3 nos. of 30 mm diameter 'Armoured Cable 35' and 3 nos. of 40 mm diameter 'Armoured Cable 70' electrical cables were incorporated into the upper and lower 250 mm wide by 1.2 mm thick cable tray respectively. The electrical cables were fixed to the cable tray by nominal 3 mm thick rings with 2 nos. of M5 bolts and nuts on both sides.

For specimen '8', the cable trays with electrical cables were penetrated through a fire barrier which constructed by a layer of 50 mm thick 'ROCKWOOL' mineral wool boards with density of 160 kg/m^3 with nominal 0.7 mm thick (dry thickness) 'Hilti CP 670' fire safety coating applied on both sides. For specimen '9', the cable trays with electrical cables were penetrated through a fire barrier which constructed by nominal 100 mm thick 'CFS-F FX' firestop foam. While for specimen '10', the cable trays with electrical cables were penetrated through a fire barrier which constructed by a layer of 50 mm thick 'ROCKWOOL'

mineral wool boards with density of 100 kg/m^3 with nominal 15 mm thick 'FS-ONE MAX' intumescent firestop sealant applied on both sides.

The trunkings of specimens '2a', '2b' and '3', AV cables of specimen '6' and cable trays of specimen '8', '9' and '10' were fixed to 42 mm by 20 mm by 3 mm thick steel channels, located at 500 mm from the concrete wall, by M5 bolts and nuts on both sides. The steel channels were supported by an external steel framework constructed by 50 mm by 50 mm by 3 mm steel L-angles which in turn fixed to the concrete lining of test rig by 2 nos. of M10 anchor bolts.

The specimens satisfied the performance requirements specified in BS 476: Part 20: 1987 for the following periods:

	Integrity	Insulation
Specimen '2a'	**121** Minutes (No failure)	N/A
Specimen '2b'	**121** Minutes (No failure)	N/A
Specimen '3'	**121** Minutes (No failure)	N/A
Specimen '6'	**121** Minutes (No failure)	N/A
Specimen '8'	**121** Minutes (No failure)	**38** Minutes
Specimen '9'	**121** Minutes (No failure)	**61** Minutes
Specimen '10'	**121** Minutes (No failure)	**42** Minutes

The test was discontinued after a heating period of 121 minutes.

2 INTRODUCTION

The objective of the test is to determine the fire resistance performance of 7 nos. of penetration systems when tested in accordance with BS 476: Part 20: 1987, 'Methods for determination of the fire resistance of elements of construction (general principles)'.

3 TEST INFORMATION

3.1 Test Sponsor

Hilti (Hong Kong) Limited

701-704, 7/F, Tower A, Manulife Financial Centre,

223 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong

3.2 Testing Location

Research Engineering Development Façade Consultants Limited, Hong Kong Main Laboratory of DD 134, Lung Kwu Tan, Tuen Mun, New Territories, Hong Kong.

3.3 Date of Test

20th January 2017

3.4 Witness of the test

The test was led by Mr. Solaris Chan of Research Engineering Development Façade Consultants Limited (RED) and was witnessed by Miss Selina Lin, Miss Dorothy Wai, Mr. Jimmy Chen, Mr. Dennis Yeung and Mr. Andrew Lau, the representatives of test sponsor.

4 EQUIPMENT

Nine (9) 'type K' thermocouples to monitor the temperature of the furnace, which were kept at 100 mm from the exposed face of the specimen (see Figure 1).

Twenty-two (22) 'type K' thermocouples to monitor the temperature of the unexposed face of the specimens (see Figure 2).

A 'type K' roving thermocouple to measure temperature on hot spots of unexposed surface of specimens.

A micro-manometer provided to monitor the furnace pressure.

Cotton pads, 6 mm and 25 mm gap gauges.

A radiometer placed at 1,000 mm away from the unexposed surface to measure the radiation of unexposed surface of the specimens.

5 CONDITIONING

The specimens' storage, construction, and test preparation took place in the test laboratory over a total, combined time of 5 days. Throughout this period of time, both of the temperature and humidity of the laboratory were measured and recorded as being within a range of 14 °C to 22 °C and 68 % to 89 % respectively.

6 TEST SPECIMEN CONSTRUCTION

The specimens were installed into a concrete specimen holder with pre-prepared opening to form the test construction. The details of the fixings were outlined in Appendix D.

A comprehensive description of the test specimens construction was presented in the appendix, which was based on a survey of the specimens and information supplied by the test sponsor.

7 TEST PROCEDURES

The test was conducted in accordance with the procedures specified in BS 476: Part 20: 1987. The ambient temperature of the test area during the test was measured. After the first 5 minutes of the test, the furnace pressure was maintained at 0 ± 2 Pa relative to atmosphere, at 1,000 mm from the notional floor level.

The furnace was monitored by nine (9) thermocouples so that the mean furnace temperature complied with the requirements of Clause 3.1 of BS 476: Part 20: 1987.

The temperature of the unexposed face was monitored by means of twenty-two (22) thermocouples fixed to the unexposed surface (see Figure 2 for the locations and reference numbers of the thermocouples). For specimen '8', thermocouples S52 - S54 were fixed on the electric cables and cable tray for monitoring both of the mean and maximum surface temperatures. Thermocouples S49 - S51 were the fixed the fire barrier for monitoring the maximum surface temperature only. For specimen '9', thermocouples S46 - S48 were fixed on the electric cables and cable tray for monitoring both of the mean and maximum surface temperatures. Thermocouples S43 - S45 were the fixed the fire barrier for monitoring the maximum surface temperature only. For specimen '10', thermocouples S40 - S42 were fixed on the electric cables and cable tray for monitoring both of the mean and maximum surface temperatures. Thermocouples S37 - S39 were the fixed the fire barrier for monitoring the maximum surface temperature only. Thermocouple S24 was fixed on specimen '2a', thermocouples S21 and S22 were fixed on specimen '3' and thermocouple S15 were fixed on specimen '6' for additional information only. The mean and maximum temperatures were recorded.

The cotton pads and gap gauges were used, if considered appropriate, to determine compliance with the integrity criterion of the standard. The occurrence of sustained flaming on the unexposed surface was monitored to determine compliance with this criterion. The lateral deflection of the specimen was measured by a steel ruler relative to a taut wire and recorded. The radiation of the specimen was measured and recorded.

8 TEST DATA AND INFORMATION

The ambient temperature of the test area during the test was 20 °C.

The furnace was controlled so that the mean furnace temperature complied with the requirements of BS 476: Part 20: 1987. The temperature record was shown graphically in Figure 3.

The maximum temperatures of the unexposed surface of specimen '2a' was shown graphically in Figure 4.

The maximum temperatures of the unexposed surface of specimen '3' was shown graphically in Figure 5.

The maximum temperatures of the unexposed surface of specimen '6' was shown graphically in Figure 6.

The mean and maximum temperatures of the unexposed surface of specimen '8' were shown graphically in Figure 7.

The mean and maximum temperatures of the unexposed surface of specimen '9' were shown graphically in Figure 8.

The mean and maximum temperatures of the unexposed surface of specimen '10' were shown graphically in Figure 9.

The furnace pressure was shown graphically in Figure 10.

The radiation was shown graphically in Figure 11.

A summary of the observations made on the general behaviour of the specimen is given in 'APPENDIX B - OBSERVATION'.

The mean furnace temperature obtained was summarized in Table 1.

The temperature rises of specimen obtained were summarized in Tables 2 and 3.

The test was discontinued after a heating period of 121 minutes.

9 RESULTS

When tested in accordance with BS 476: Part 20: 1987, the requirements of the standard were satisfied for the following periods:

	Integrity	Insulation
Specimen '2a'	**121** Minutes (No failure)	N/A
Specimen '2b'	**121** Minutes (No failure)	N/A
Specimen '3'	**121** Minutes (No failure)	N/A
Specimen '6'	**121** Minutes (No failure)	N/A
Specimen '8'	**121** Minutes (No failure)	**38** Minutes
Specimen '9'	**121** Minutes (No failure)	**61** Minutes
Specimen '10'	**121** Minutes (No failure)	**42** Minutes

Insulation - It is required that the mean temperature rise of the unexposed surface shall not be greater than 140 °C and that maximum temperature rise shall not be greater than 180 °C. Insulation failure also occurs simultaneously with integrity failure.

Specimen '8'

The 140 °C rise of the mean temperature of the unexposed surface of specimen reached after a heating period of 38 minutes. The 180 °C rise of the maximum temperature of the unexposed surface of specimen reached and measured by thermocouple S54 after a heating period of 45 minutes. The maximum temperature rise was 403 °C measured by thermocouple S54 after a heating period of 121 minutes.

Specimen '9'

The 140 °C rise of the mean temperature of the unexposed surface of specimen reached after a heating period of 67 minutes. The 180 °C rise of the maximum temperature of the unexposed surface of specimen reached and measured by thermocouple S47 after a heating period of 61 minutes. The maximum temperature rise was 404 °C measured by thermocouple S48 after a heating period of 121 minutes.

Specimen '10'

The 140 °C rise of the mean temperature of the unexposed surface of specimen reached after a heating period of 67 minutes. The 180 °C rise of the maximum temperature of the unexposed surface of specimen reached and measured by thermocouple S37 after a heating period of 42 minutes. The maximum temperature rise was 392 °C measured by thermocouple S37 after a heating period of 121 minutes.

Integrity - It is required that there is no collapse for the specimen, no sustained flaming on the unexposed surface and no loss of impermeability.

Specimen '2a'

The specimen met the integrity requirements after a heating period of 121 minutes.

Specimen '2b'

The specimen met the integrity requirements after a heating period of 121 minutes.

Specimen '3'

The specimen met the integrity requirements after a heating period of 121 minutes.

Specimen '6'

The specimen met the integrity requirements after a heating period of 121 minutes.

Specimen '8'

The specimen met the integrity requirements after a heating period of 121 minutes.

Specimen '9'

The specimen met the integrity requirements after a heating period of 121 minutes.

Specimen '10'

The specimen met the integrity requirements after a heating period of 121 minutes.

10 LIMITATIONS

The results relate only to the behaviour of the specimen of the element of construction under the particular conditions of the 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 (see Clause 12 of BS 476: Part 20: 1987).

The fire resistance performance of the specimen may change if substantially different gaps are used. Application of the results to the specimen of different dimensions or supported other than by a concrete wall or incorporating different components shall be the subject of a design appraisal.

APPENDIX A – Photos and Test Record

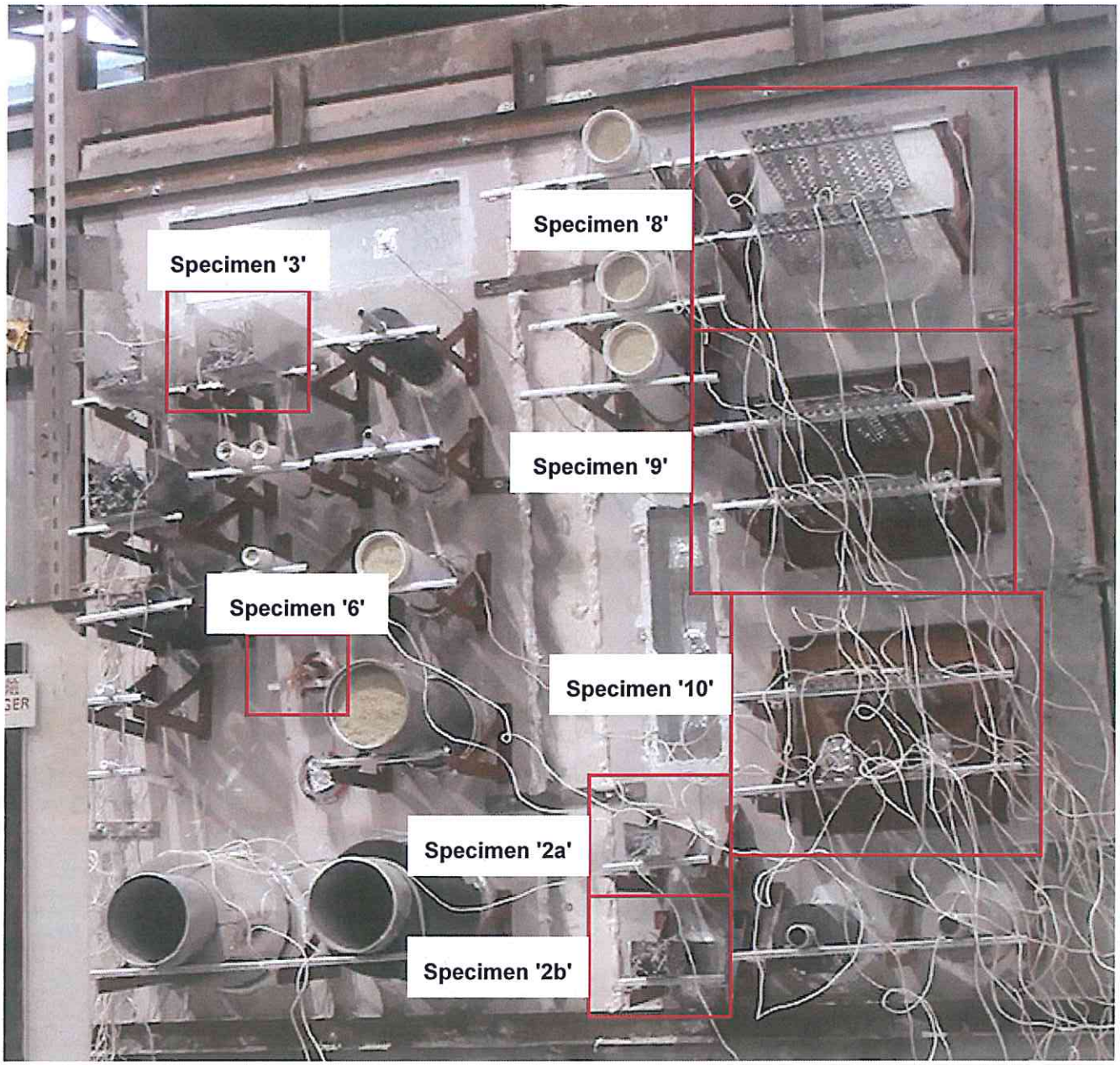


Photo 1: The unexposed face of the specimens before the test.

Note: In this test report, only specimens '2a', '2b', '3', '6', '8', '9' and '10' were considered.

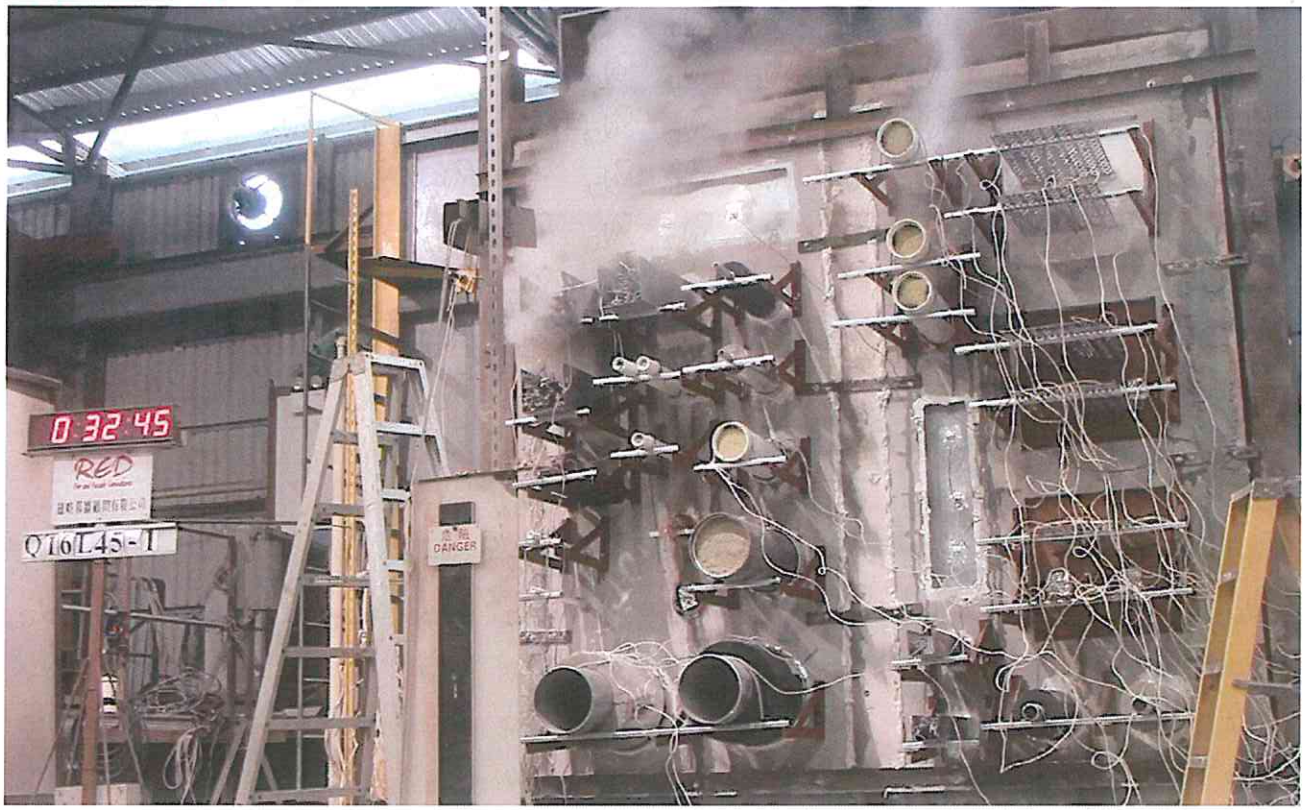


Photo 2: The unexposed face of the specimens after a heating period of 32 minutes.

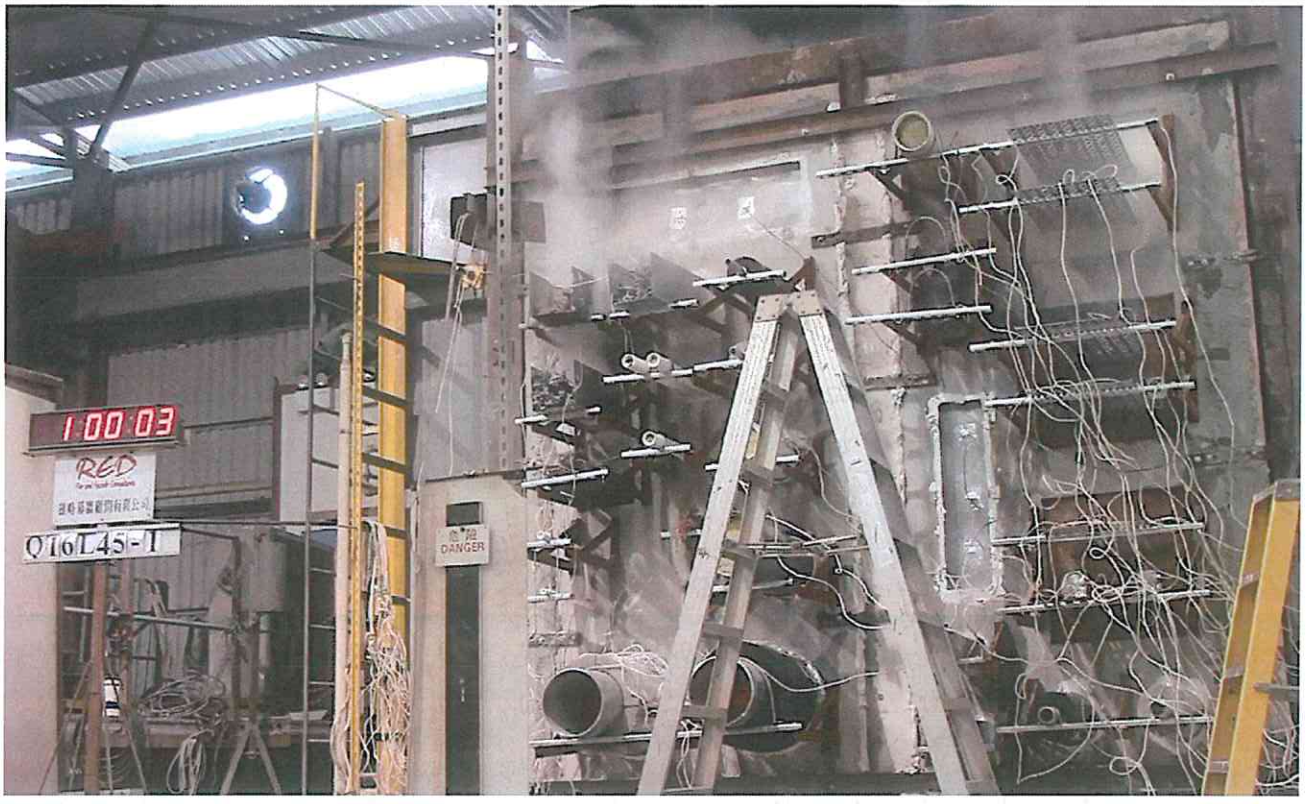


Photo 3: The unexposed face of the specimens after a heating period of 60 minutes.

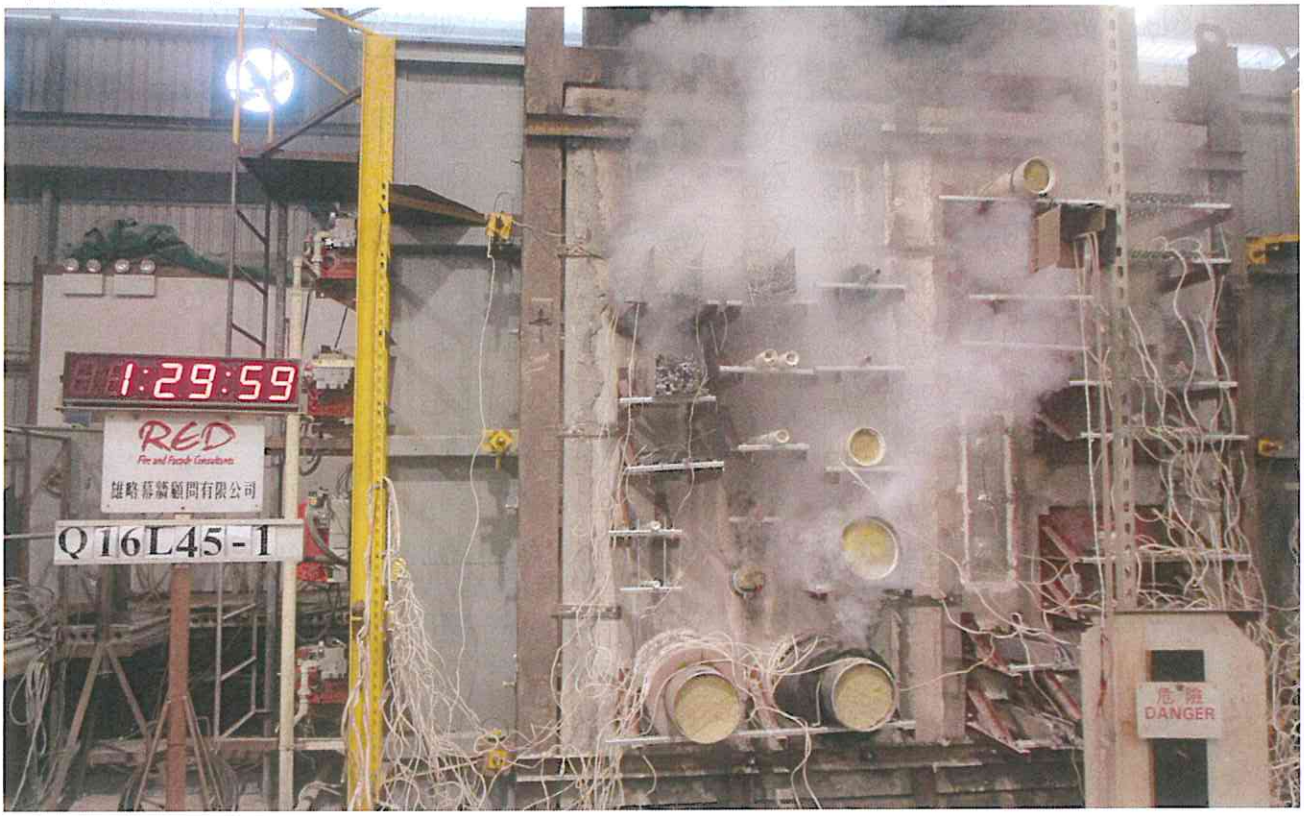


Photo 4: The unexposed face of the specimens after a heating period of 89 minutes.

Photo 5: The unexposed face of the specimens after the test.

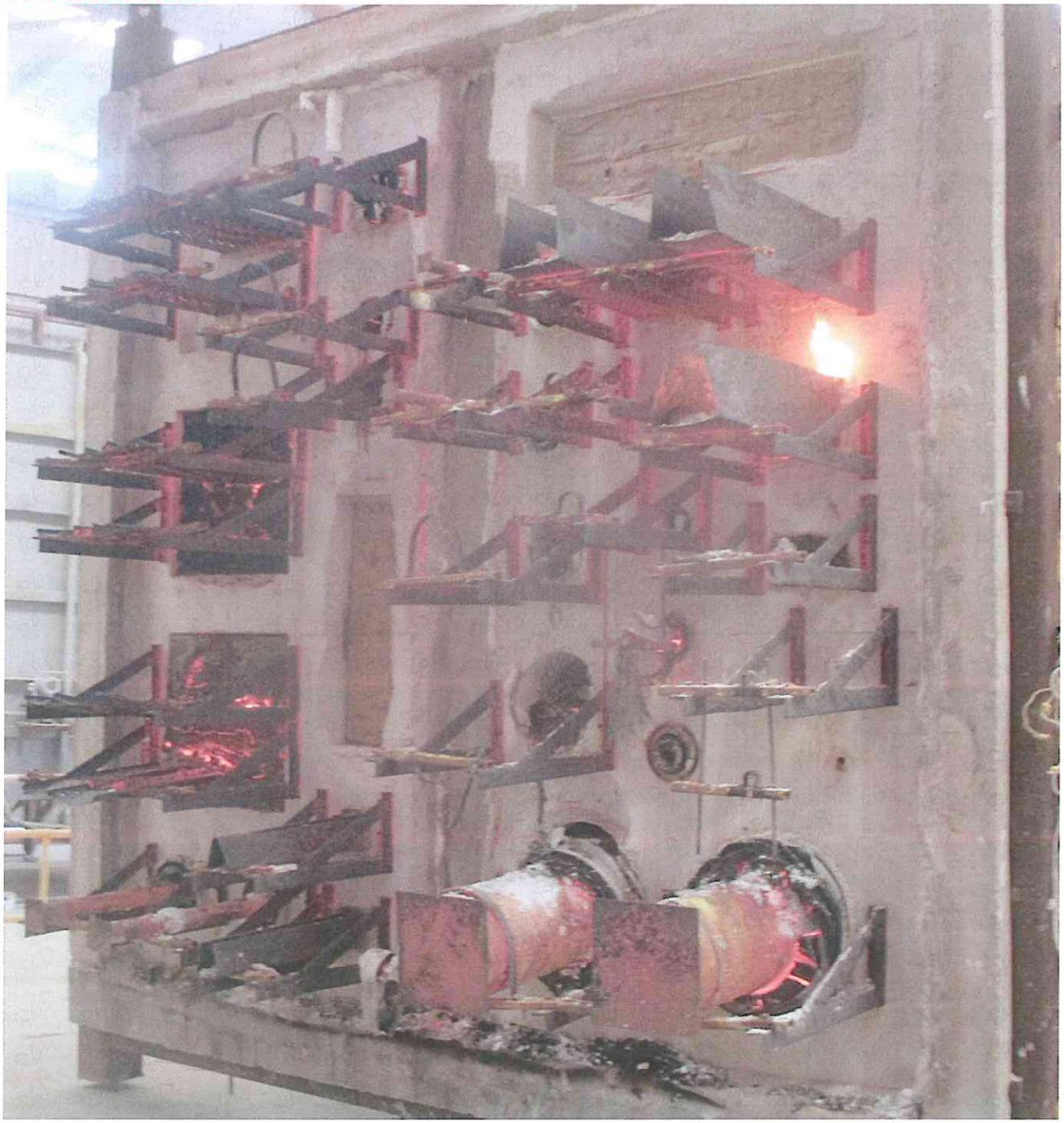


Photo 6: The exposed face of the specimens after the test.

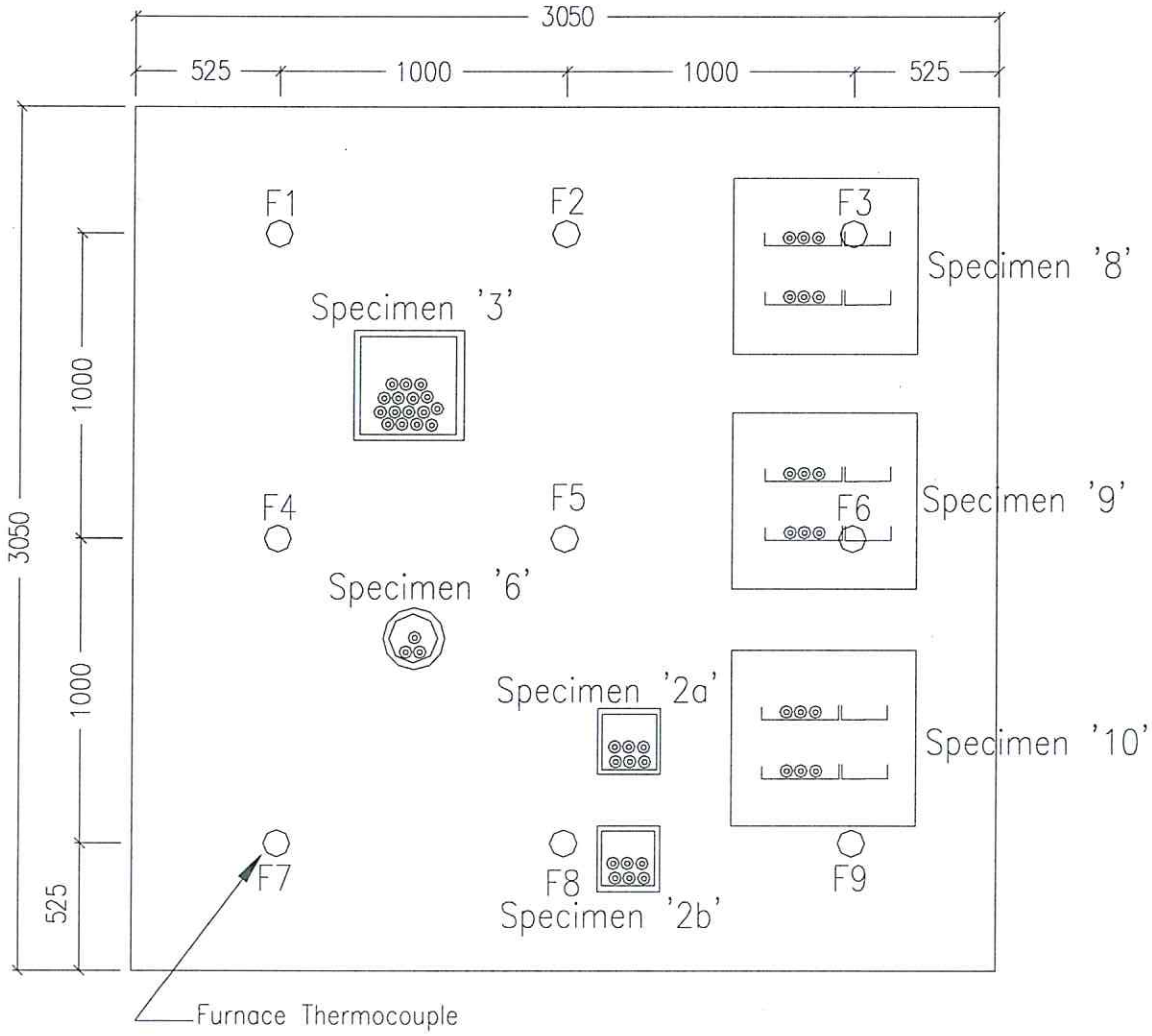


Figure 1 – Locations and reference numbers of furnace thermocouples.
(This figure is not to scale and all dimensions are in millimetres.)

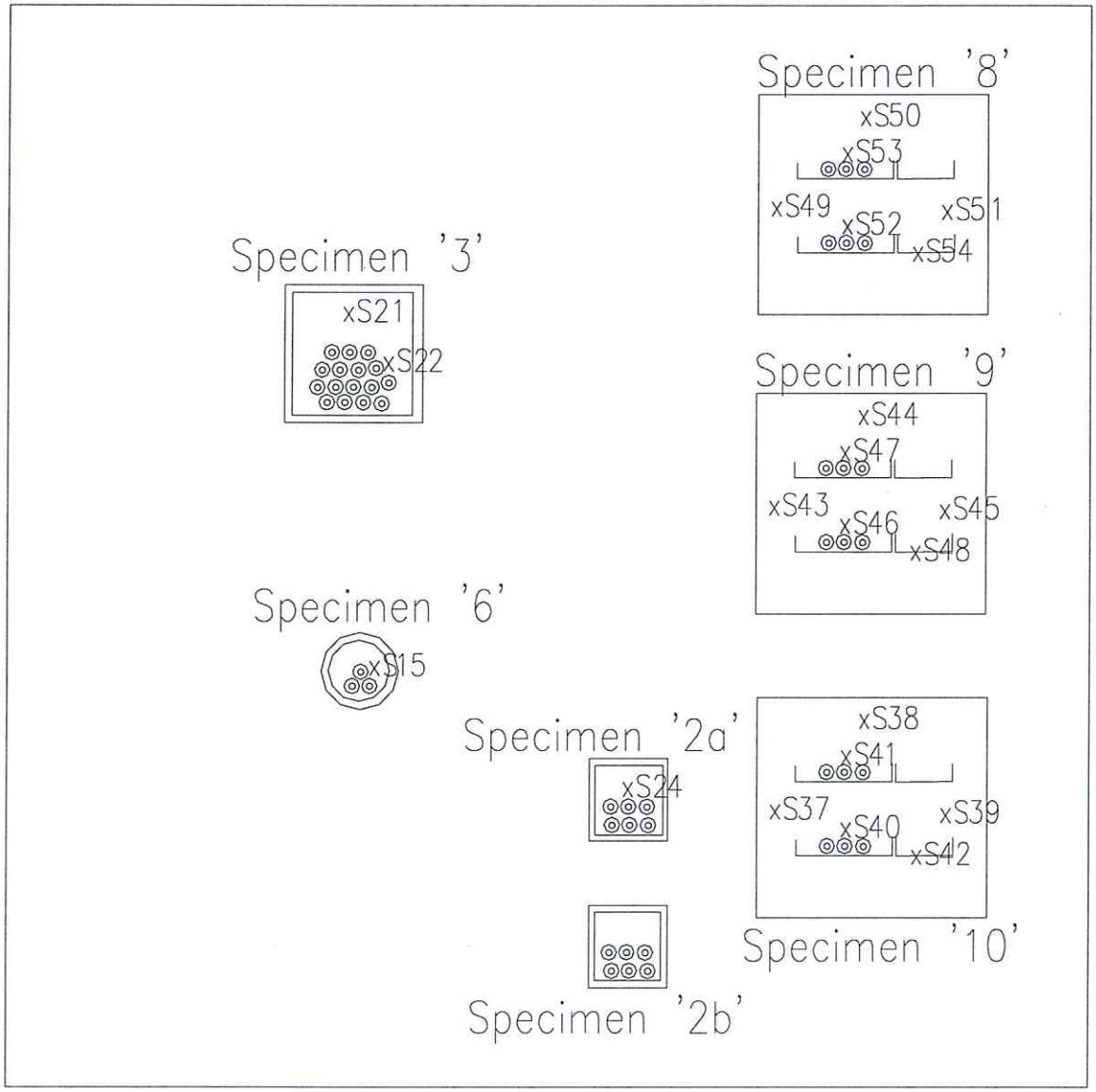


Figure 2 – Locations and reference number of thermocouples to monitor the temperature of unexposed surface of the specimens.

(This figure is not to scale.)

Notes: Thermocouples S40 - S42, S46 - S48 and S52 - S54 were fixed on the electric cables and cable trays.

Thermocouples S37 - S39, S43 - S45 and S49 - S51 were fixed on the fire barriers.

Thermocouples S15, S21, S22 and S24 were fixed for additional information only.

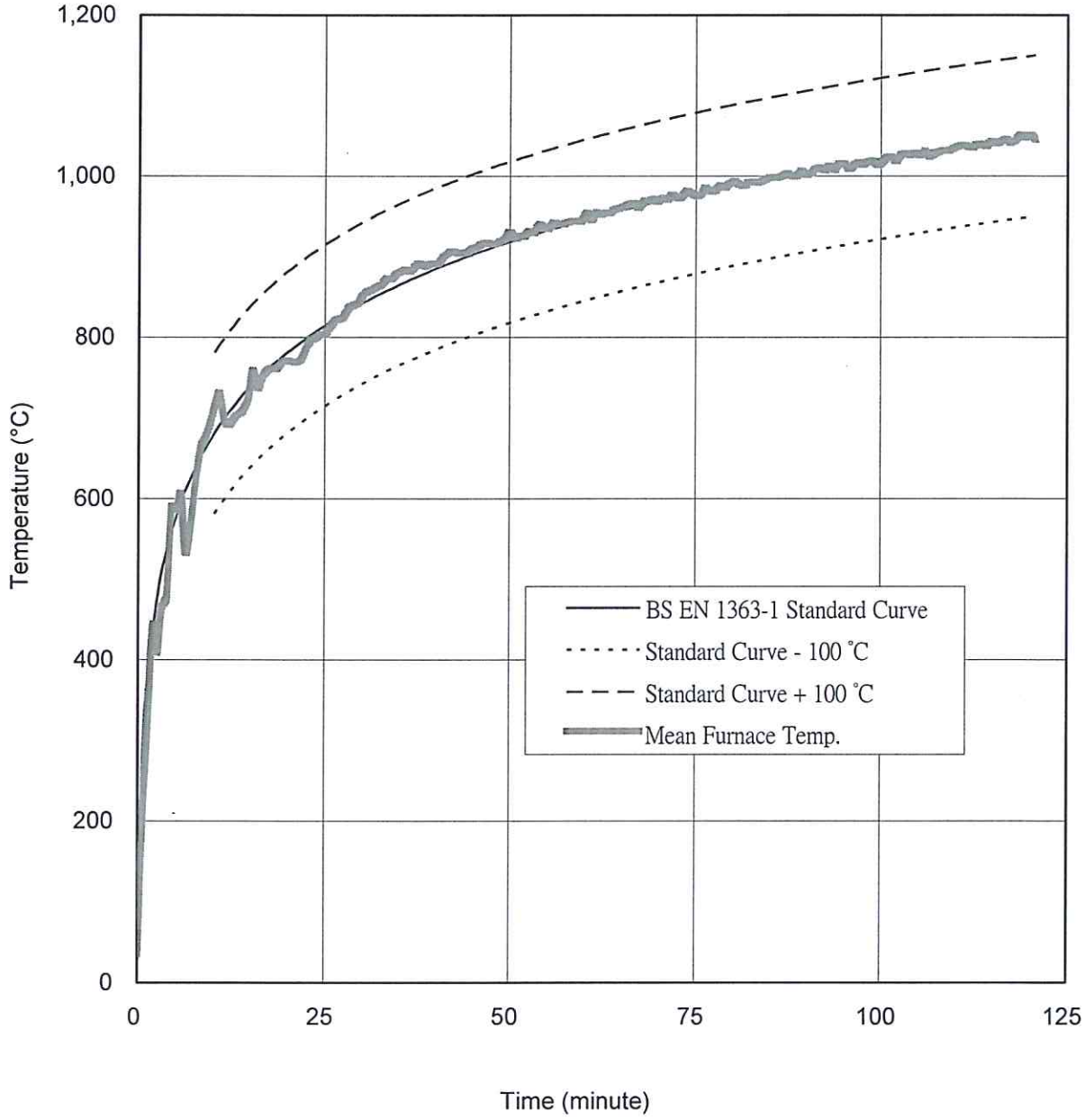


Figure 3 – Mean furnace temperature.

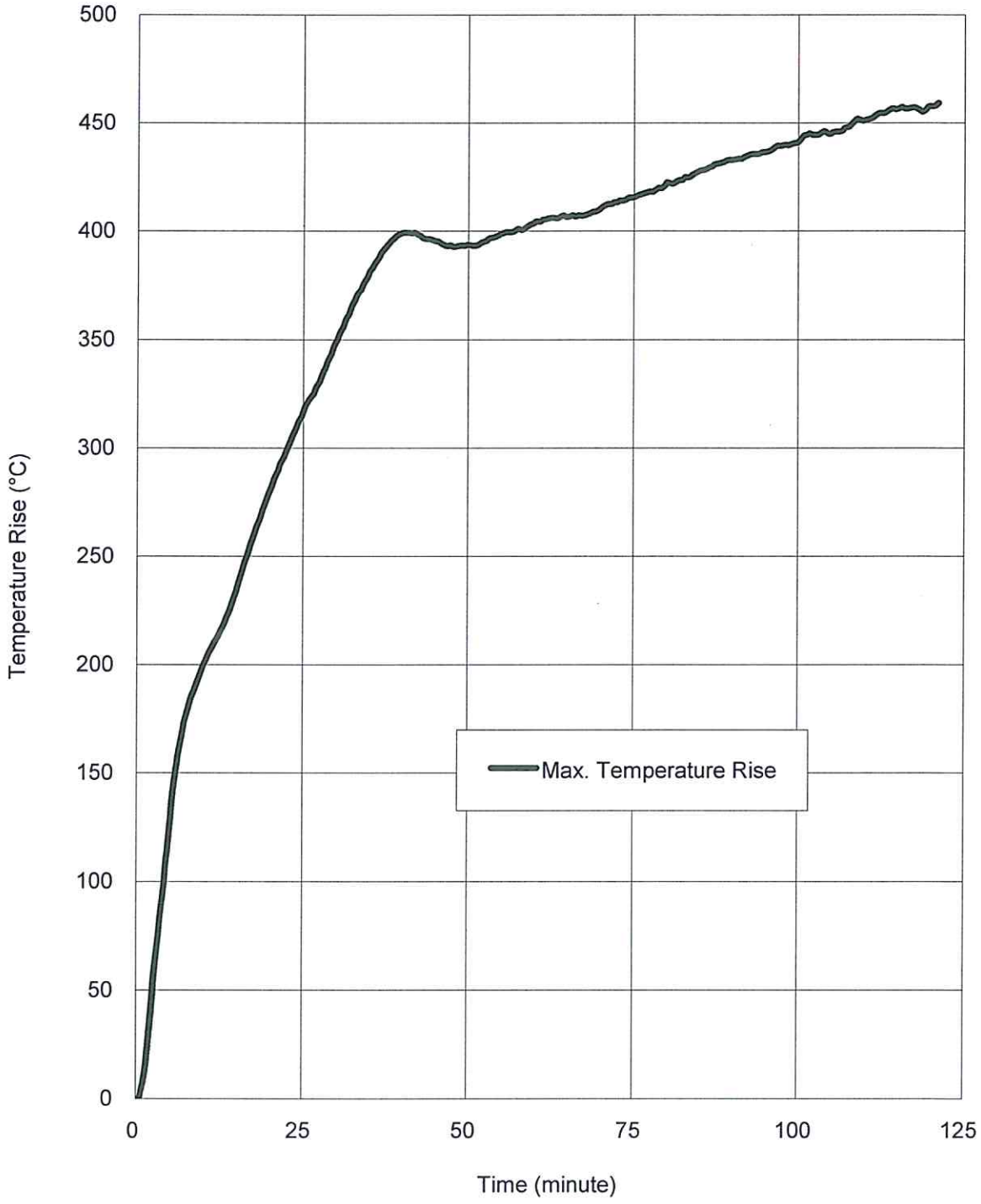


Figure 4 – Temperature rises of unexposed surface of specimen '2a'.

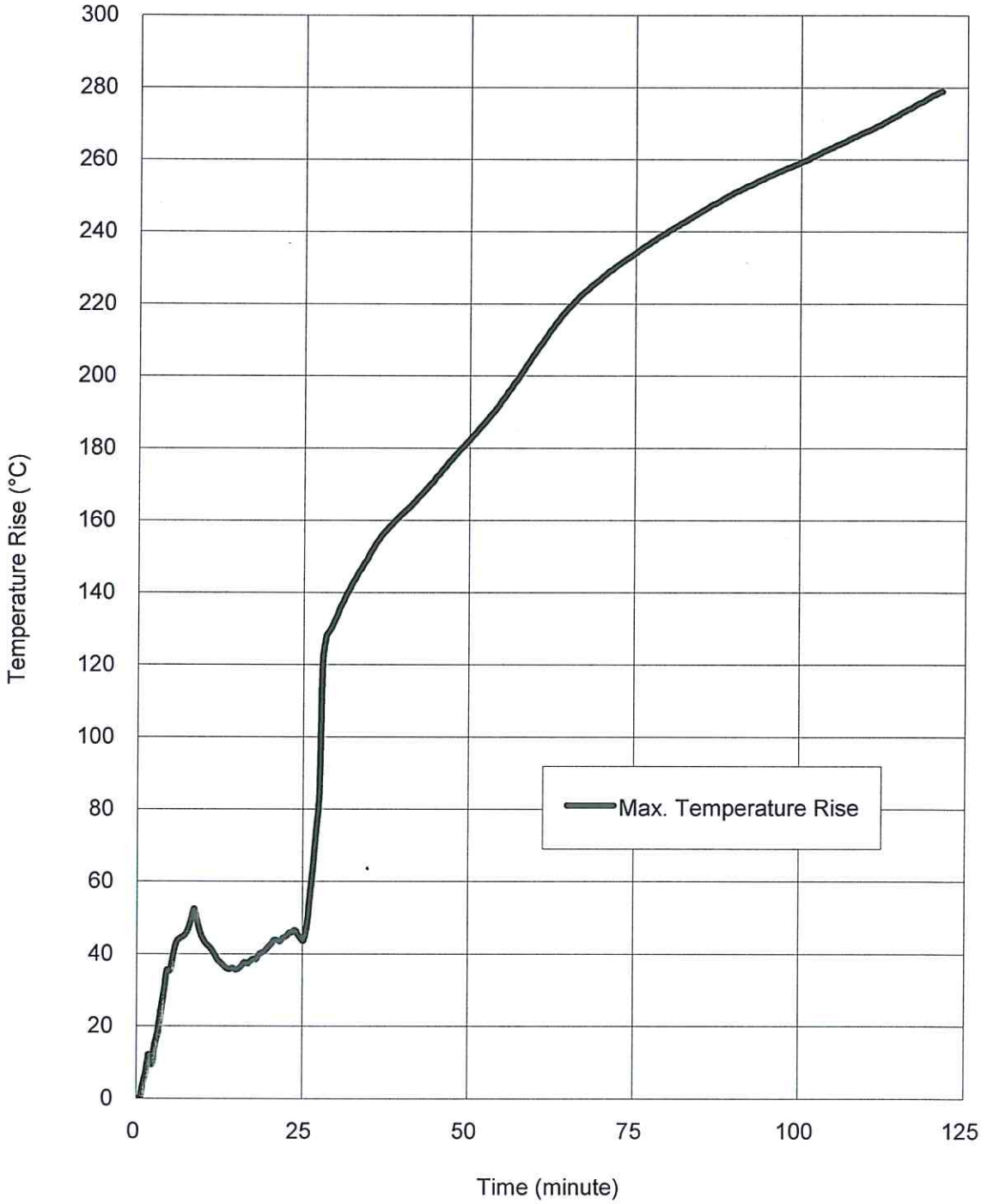


Figure 5 – Temperature rises of unexposed surface of specimen '3'.

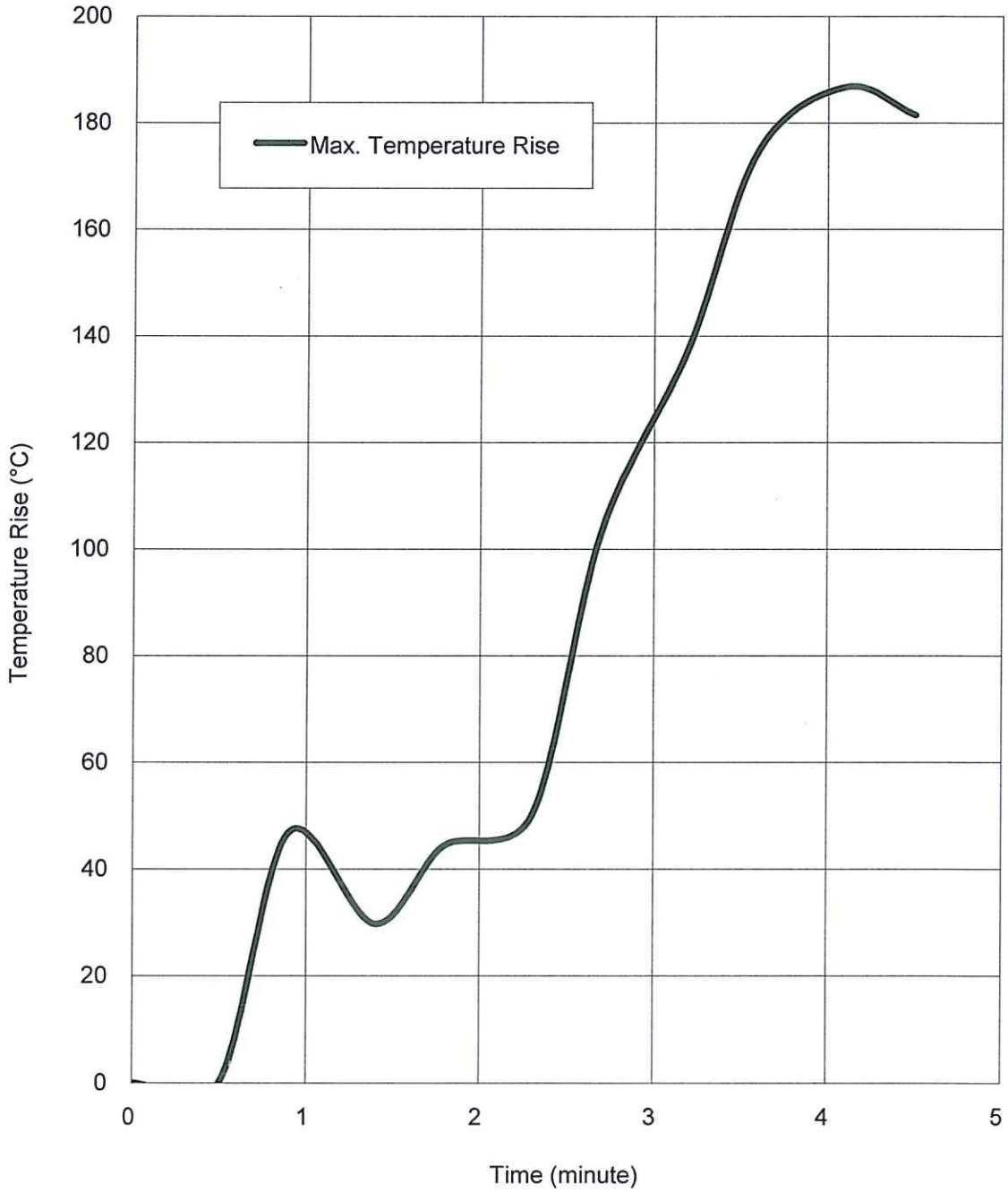


Figure 6 – Temperature rises of unexposed surface of specimen '6'.

Note: Thermocouple S15 was detached after a heating period of 5 minutes.

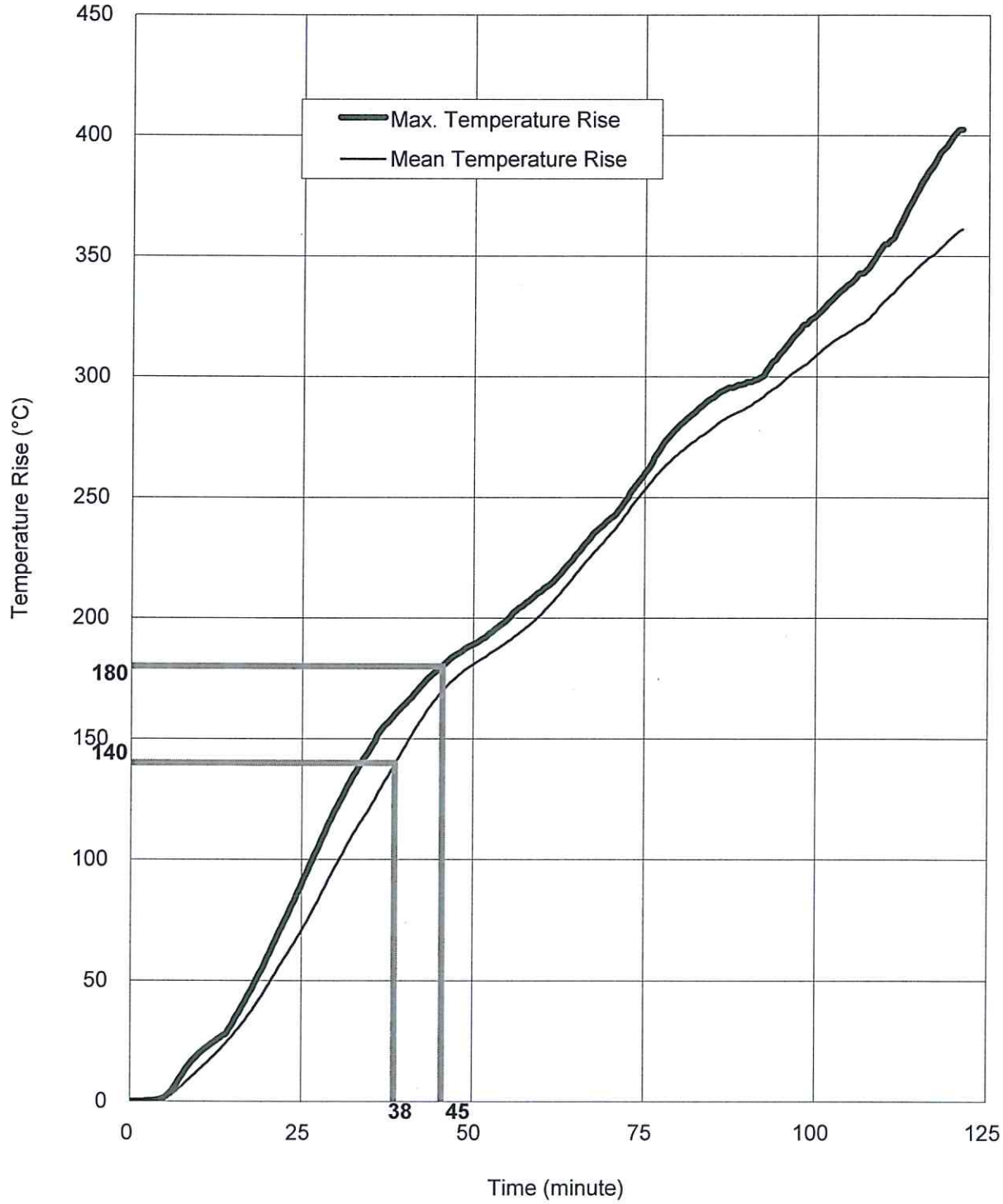


Figure 7 – Temperature rises of unexposed surface of specimen '8'.

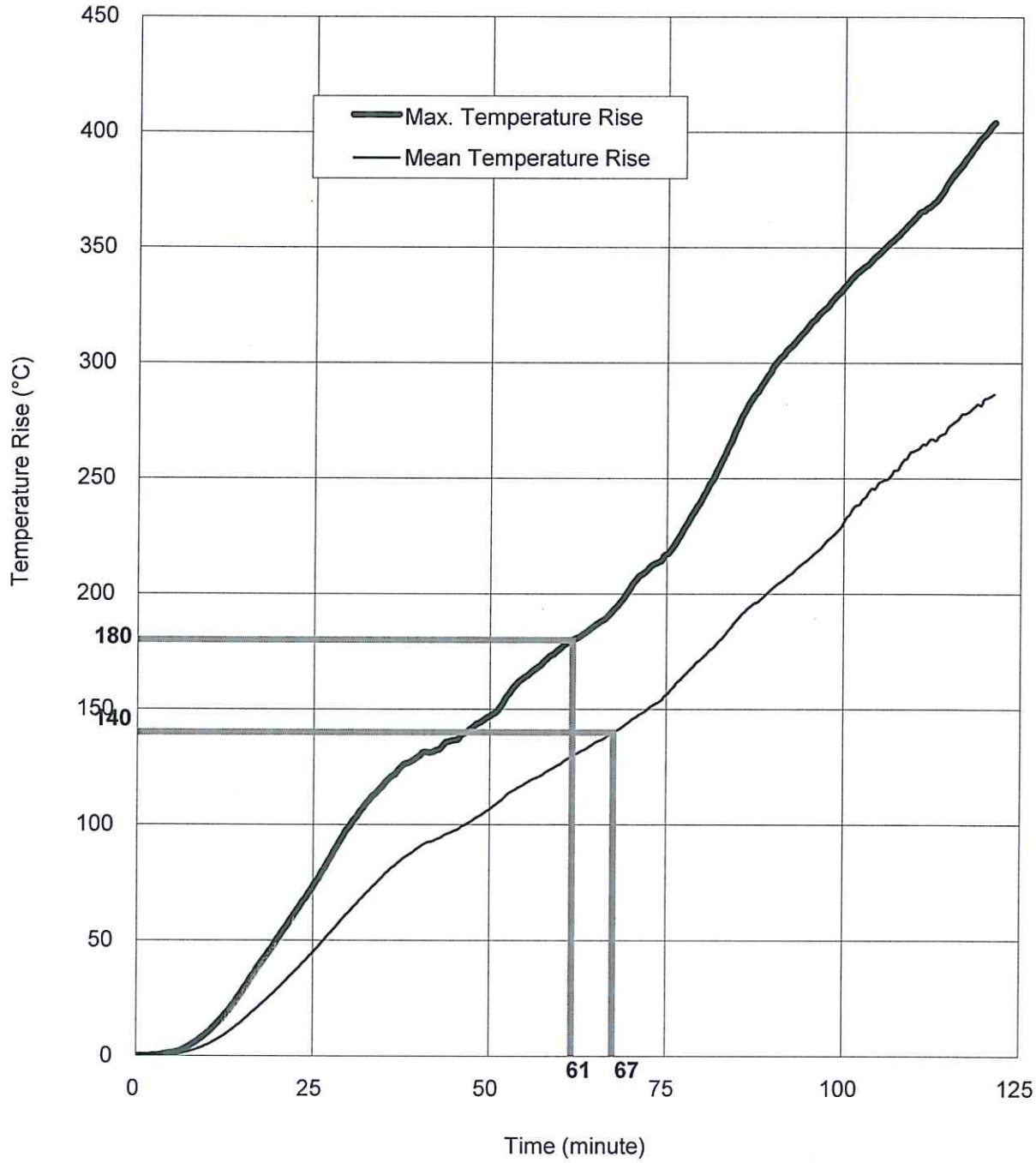


Figure 8 – Temperature rises of unexposed surface of specimen '9'.

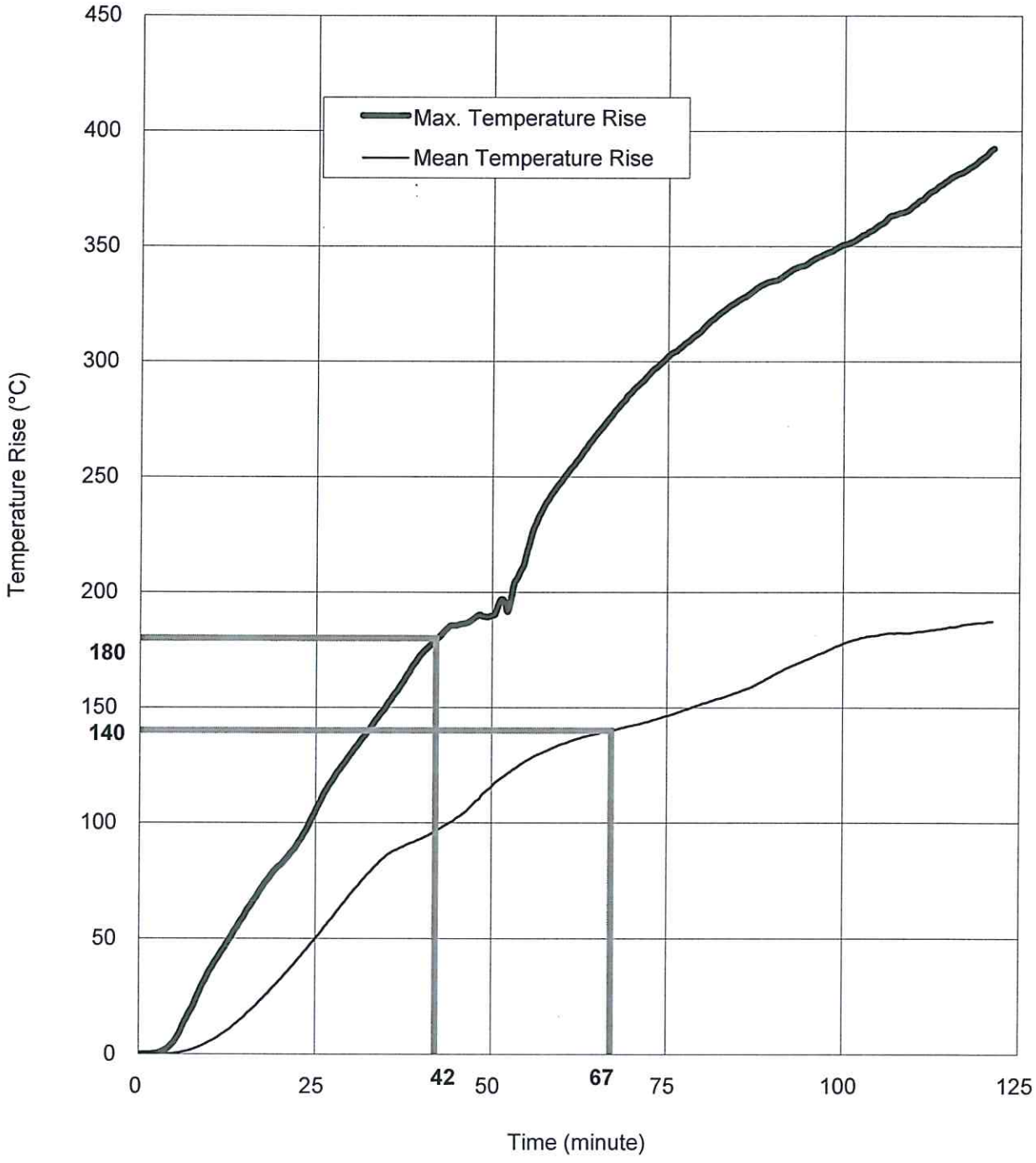


Figure 9 – Temperature rises of unexposed surface of specimen '10'.

After the first 5 minutes of the test, the furnace pressure was maintained at 0 ± 2 Pa relative to atmosphere, at 1,000 mm from the notional floor level.

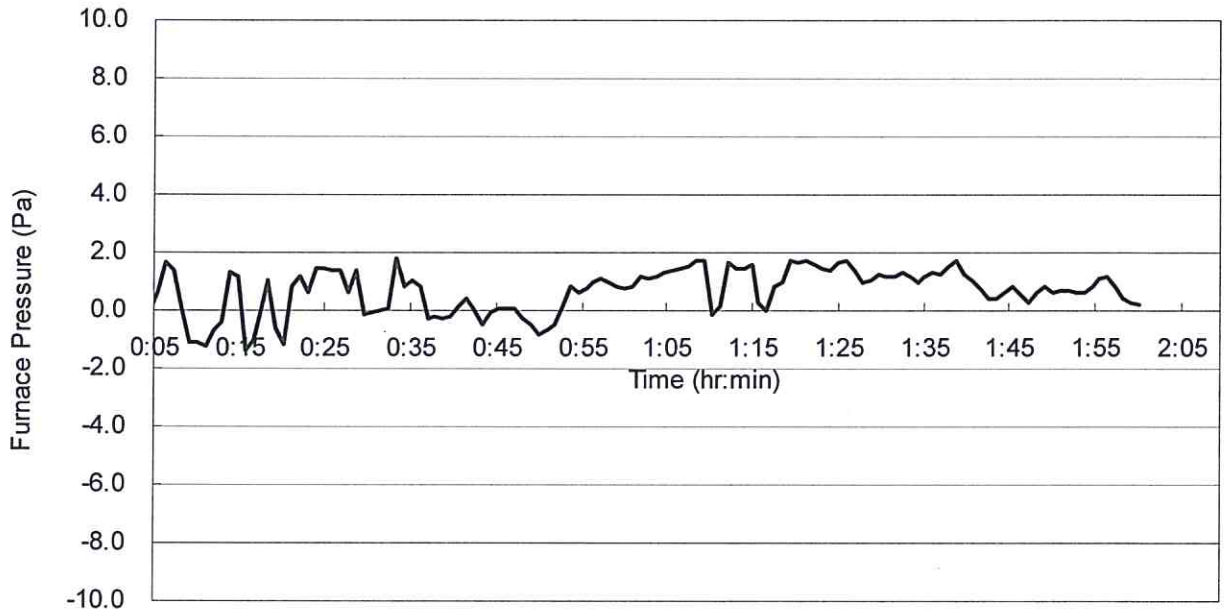


Figure 10 – Furnace pressure.

A radiometer placed at 1,000 mm away from the unexposed surface to measure the radiation of unexposed surface of the specimens.

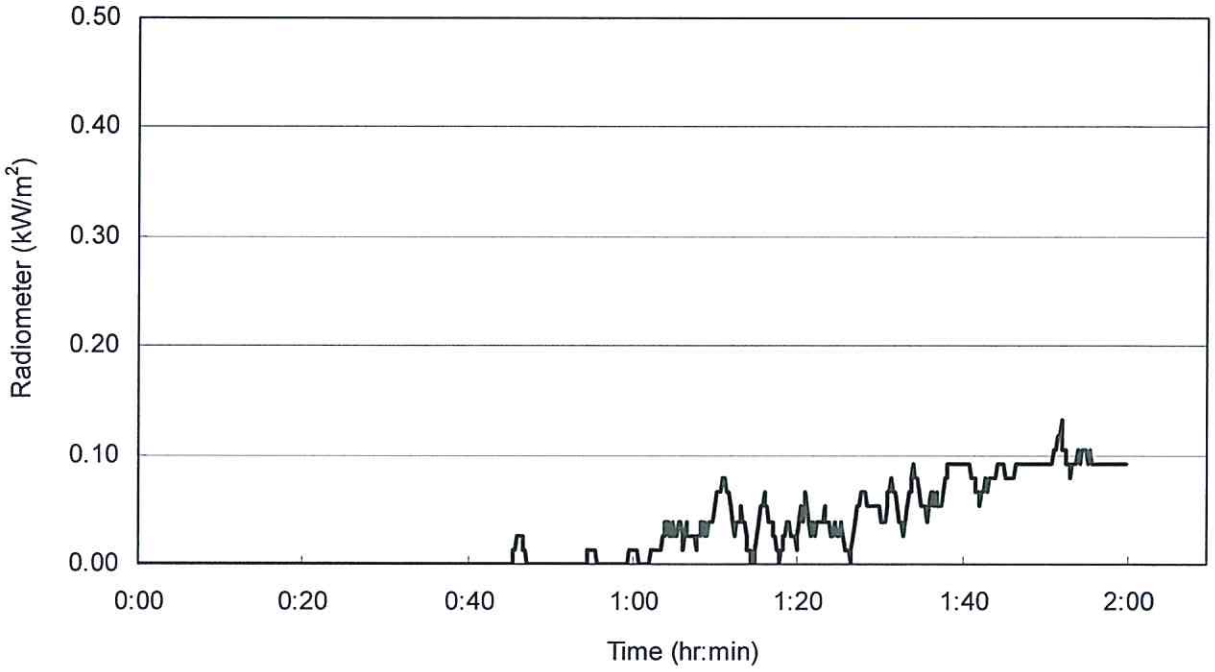


Figure 11 – Radiation.

APPENDIX B – Observation

Time (min.sec)	Exposed (E) or Unexposed (U)	Observation
00.00	-	Test started.
01.15	U	Smoke started releasing from the perimeter of specimen '3'.
02.45	U	Smoke release from specimen'3' increased.
04.00	U	Smoke started releasing from the perimeter of specimens '2a', '2b', '6' and '9'.
08.00	U	Smoke started releasing from the perimeter of specimen '10'.
14.30	U	Pop sound was heard from the specimens.
15.00	U	Intermitted flaming was observed from specimen '2b'.
21.55	U	Smoke started releasing from the perimeter of specimen '8'.
30.00	U	Specimens '2a', '2b', '3' and '6' satisfied the integrity requirements performance. Specimens '8', '9' and '10' satisfied the integrity and insulation requirements performance.
60.00	U	Specimens '2a', '2b', '3', '6', '8' and '10' satisfied the integrity requirements performance. Specimen '9' satisfied the integrity and insulation requirements performance.
90.00	U	Specimens '2a', '2b', '3', '6', '8', '9' and '10' satisfied the integrity requirements performance.
91.00	U	Smoke release from specimens '8' and '9' increased.
95.00	U	The surface of specimen '9' turned dark.
120.00	U	Specimens '2a', '2b', '3', '6', '8', '9' and '10' satisfied the integrity requirements performance.
121.11	-	Test was terminated as requested by test sponsor.

APPENDIX C – Data Recorded During the Test

Table 1 - Mean furnace temperature

Time (minute)	BS 476: Part 20 Standard Temp. Curve (°C)	Actual Mean Furnace Temp. (°C)
0	20	36
5	578	586
10	681	715
15	742	758
20	780	771
25	814	804
30	842	851
35	866	881
40	886	892
45	902	910
50	918	930
55	933	935
60	946	954
65	958	963
70	968	968
75	979	975
80	989	994
85	998	999
90	1006	1002
95	1014	1015
100	1022	1016
105	1029	1026
110	1037	1037
115	1043	1043
120	1049	1051
121	1050	1046

Notes: Locations of furnace thermocouples are shown in Figure 1.

The test was terminated as requested by the test sponsor after a heating period of 121 minutes.

Table 2 - Time and related temperature rise measured by thermocouples S15, S21, S22, S24, S37 - S45

Time (min)	S15	S21	S22	S24	S37	S38	S39	S40	S41	S42	S43	S44	S45
0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	-	39	1	140	7	0	0	0	1	1	2	0	0
10	-	44	7	199	35	0	0	0	5	10	6	1	3
15	-	36	14	238	62	2	1	2	19	32	13	1	9
20	-	43	22	282	83	5	5	6	36	58	19	3	15
25	-	44	29	318	107	10	12	10	58	85	23	8	20
30	-	134	31	350	131	15	20	15	83	111	26	12	23
35	-	151	28	381	151	21	27	21	108	129	31	17	29
40	-	162	27	399	174	28	34	27	119	135	34	20	34
45	-	172	29	396	186	36	41	32	128	146	38	22	41
50	-	183	26	393	190	43	48	39	150	162	41	25	47
55	-	194	24	399	222	48	53	45	165	173	42	28	53
60	-	208	25	405	250	52	58	51	172	180	43	31	59
65	-	219	22	407	270	55	62	55	176	186	45	33	67
70	-	228	25	411	288	57	65	58	178	191	46	35	80
75	-	234	26	416	303	60	67	60	185	195	48	38	99
80	-	240	27	423	315	62	68	61	193	201	51	40	116
85	-	246	31	428	327	63	69	62	202	206	53	43	122
90	-	251	30	433	335	65	70	62	218	213	56	47	131
95	-	256	31	437	344	67	71	62	233	220	59	53	143
100	-	260	24	443	351	68	72	62	248	226	62	66	159
105	-	264	29	446	360	68	73	61	255	229	65	83	173
110	-	268	32	452	368	68	73	61	258	230	71	74	179
115	-	273	33	457	380	69	74	61	261	234	75	70	189
120	-	278	37	458	390	69	74	61	263	238	78	73	206
121	-	279	39	459	392	69	75	61	263	238	80	74	209

Notes: Locations of thermocouples S15, S21, S22, S24, S37 - S45 are shown in Figure 2.

Thermocouple S15 detached after a heating period of 5 minutes.

The test was terminated as requested by the test sponsor after a heating period of 121 minutes.

Table 3 - Time and related temperature rise measured by thermocouples S46 - S54

Time (min)	S46	S47	S48	S49	S50	S51	S52	S53	S54
0	0	0	0	0	0	0	0	0	0
5	0	0	1	1	1	2	2	1	2
10	0	4	9	6	14	15	19	6	13
15	1	17	29	14	28	29	30	22	35
20	3	35	52	20	38	41	42	43	61
25	5	58	74	25	49	55	55	69	91
30	8	81	100	30	58	65	76	97	122
35	11	106	118	35	73	81	98	123	146
40	17	124	130	40	86	91	129	148	165
45	24	132	137	44	102	109	154	171	179
50	29	146	148	49	126	135	174	181	190
55	32	165	159	55	141	156	188	184	201
60	33	177	171	60	151	175	200	197	212
65	35	187	186	68	161	195	214	217	227
70	37	196	204	75	170	211	228	237	242
75	38	215	217	83	180	224	241	261	260
80	40	242	235	94	191	240	253	280	273
85	41	273	253	102	201	254	262	292	284
90	44	298	265	110	216	261	269	298	296
95	50	318	281	118	236	267	281	304	312
100	63	334	303	126	254	273	296	307	327
105	69	349	329	130	265	280	310	310	340
110	67	364	356	132	274	294	327	316	355
115	64	376	381	136	284	306	337	323	380
120	65	390	401	141	296	313	344	333	401
121	63	393	404	141	298	315	347	334	403

Notes: Locations of thermocouples S46 - S54 are shown in Figure 2.

The test was terminated as requested by the test sponsor after a heating period of 121 minutes.

APPENDIX D – Information from Test Sponsor

(The information provided by the test sponsor, which was not verified by RED or unless specified.)

For specimens '2a'. '2b' and '3'

Item	Description	
1	**Trunking**	
	Overall dimensions	: Specimen '2a'- 100 mm x 100 mm x 1 mm thick x 1,400 mm long.* Specimen '2b'- 100 mm x 100 mm x 1 mm thick x 1,400 mm long.* Specimen '3'- 200 mm x 200 mm x 1.2 mm thick x 1,400 mm long.*
	Fixing details	: Each trunking was fixed to 42 mm x 20 mm x 3 mm thick steel channels, located at 500 mm from the concrete wall, by 1 no. of M5 bolts and nuts on both sides. The steel channels were supported by an external steel framework constructed by 50 mm x 50 mm x 3 mm steel L-angles which in turn fixed to the concrete lining of test rig by 2 nos. of M10 anchor bolts.*
2	**Electric Cable**	
	Model	: CAT 6.
	Diameter	: 5 mm.*
	Material	: Copper with PVC coated.
	Applied locations	: Filled 60% of trunkings of specimens '2a', '2b' and '3'.*
3	**Firestop Blocks**	
	Brand & Model	: Hilti firestop Block CFS-BL.#
	Material	: Intumescent polyurethane synthetic material.
	Density	: 240-440 kg/m^3.
	Applied locations	: Filled 40% of trunkings of specimens '2a' and '2b'.*
4	**Firestop Foam**	
	Brand & Model	: Hilti firestop foam CFS-F FX.
	Material	: Acrylic based Polyol and Isozynad.
	Applied locations	: Filled the trunkings of specimens '2a' and '3'.*
5	**Fire Sealant**	
	Brand & Model	: Hilti CP 606 flexible firestop sealant.#
	Material	: Acrylic based.
	Thickness	: 10 mm.
	Applied locations	: At the gaps between the specimens and concrete wall.

*Notes: * Verified on site by RED.*

 # As shown on the test construction.

Appendix D – Information from Test Sponsor

(The information provided by test sponsor, which is not verified by RED or unless specified.)

For specimen '6'

Item	Description		
1	**Speed Sleeve**		
	Brand & Model	:	Hilti firestop sleeve CFS-SL.
	Sizes	:	110 mm internal diameter.*
2	**AV Cable**		
	Diameter	:	3 mm.*
	Material	:	Copper with PVC coated.
	Applied locations	:	Filled 60% of the speed sleeve.*
	Holding method	:	Placed on 42 mm x 20 mm x 3 mm thick steel channels, located at 500 mm from the concrete wall, by 1 no. of M5 bolts and nuts on both sides. The steel channels were supported by an external steel framework constructed by 50 mm x 50 mm x 3 mm steel L-angles which in turn fixed to the concrete lining of test rig by 2 nos. of M10 anchor bolts.*
3	**Fire Sealant**		
	Brand & Model	:	Hilti CP 606 flexible firestop sealant.#
	Material	:	Acrylic based.
	Thickness	:	10 mm.
	Applied locations	:	At the gaps between the specimen and concrete wall.

*Notes: * Verified on site by RED.*

 # As shown on the test construction.

Appendix D – Information from Test Sponsor

(The information provided by test sponsor, which is not verified by RED or unless specified.)

For specimen '8'

Item	Description
1	**Fire Barrier** Sizes : 600 mm wide x 600 mm high.* Construction details : 1 layer of 50 mm thick 'ROCKWOOL' mineral wool boards with density of 160 kg/m^3 with nominal 0.7 mm thick (dry thickness) 'Hilti CP 670' fire safety coating applied on both sides.
2	**Mineral Wool Board** Brand : ROCKWOOL. Material : Mineral wool. Thickness : 50 mm.* Density : 160 kg/m^3.# Fixing method : Fixed by 'Hilti CP 606' flexible firestop sealant applied at the gaps between the fire barrier and concrete lining of test rig.
3	**Fire Safety Coating** Brand & Model : Hilti fire safety coating CP670.# Applied locations : Both sides of the nominal 50 mm thick 'ROCKWOOL' mineral wool boards.

For specimen '9'

Item	Description
1	**Fire Barrier** Sizes : 600 mm wide x 600 mm high.* Construction details: Nominal 100 mm thick 'CFS-F FX' foam.
2	**Firestop Foam** Brand & Model : Firestop foam CFS-F FX.# Material : Acrylic based Polyol and Isozynad Applied location : Filled void between cable tray and linign of conrete of specimen '9'.

*Notes: * Verified on site by RED.*

 # As shown on the test construction.

Appendix D – Information from Test Sponsor

(The information provided by test sponsor, which is not verified by RED or unless specified.)

For specimen '10'

Item	Description
1	**Fire Barrier** Sizes : 600 mm wide x 600 mm high.* Construction details : 1 layer of 50 mm thick 'ROCKWOOL' mineral wool boards with density of 100 kg/m^3 with nominal 15 mm thick 'FS-ONE MAX' intumescent firestop sealant applied on both sides.
2	**Mineral Wool Board** Brand : ROCKWOOL.# Material : Mineral wool. Thickness : 50 mm.* Density : 100 kg/m^3.# Fixing method : Fixed by 'Hilti CP 606' flexible firestop sealant applied at the gaps between the fire barrier and concrete lining of test rig.
3	**Firestop Sealant** Brand & Model : FS-ONE MAX intumescent firestop sealant.# Applied locations : Both sides of the nominal 50 mm thick 'ROCKWOOL' mineral wool boards.

*Notes: * Verified on site by RED.*

 # As shown on the test construction.

Appendix D – Information from Test Sponsor

(The information provided by test sponsor, which is not verified by RED or unless specified.)

For specimen '8', '9' and '10'

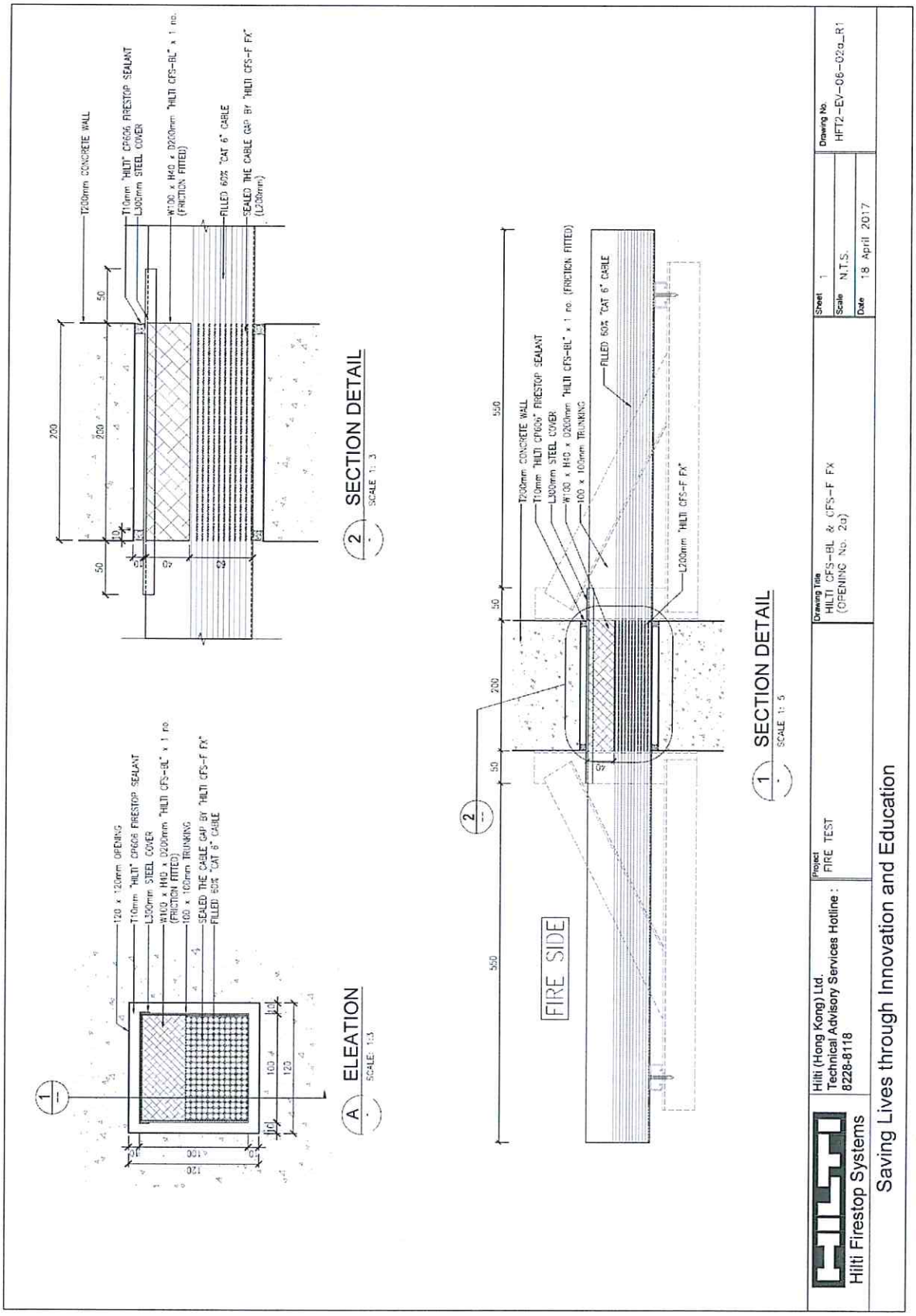
Item	Description
1	**Cable Tray**
	Overall sizes : Upper level - 1 no. of 250 mm wide x 1.2 mm thick and 1 no. of 150 mm wide x 1.2 mm thick cable trays.
	: Lower level - 1 no. of 250 mm wide x 1.2 mm thick and
	: 1 no. of 150 mm wide x 1.2 mm thick cable trays.
	Material : G.M.S.
	Fixing method : Fixed to 42 mm x 20 mm x 3 mm thick steel channels, located at 500 mm from the concrete wall, by 2 nos. of M5 bolts and nuts (for each cable tray) on both sides. The steel channels were supported by an external steel framework constructed by 50 mm x 50 mm x 3 mm steel L-angles which in turn fixed to the concrete lining of test rig by 2 nos. of M10 anchor bolts.
2	**Electric Cable**
	Model : Upper cable tray - 'Armoured Cable 35'.
	Lower cable tray - 'Armoured Cable 70'.
	Diameter and number: Upper cable tray - 3 nos. of 30 mm diameter 'Armoured Cable 35'.
	Lower cable tray - 3 nos. of 40 mm diameter 'Armoured Cable 70'.
	Material : Copper with PVC coated.
	Fixing method : Fixed to the cable tray by nominal 3 mm thick rings with 2 nos. of M5 bolts and nuts on both sides.
3	**Fire Sealant**
	Brand & Model : Hilti CP 606 flexible firestop sealant.#
	Material : Acrylic based.
	Thickness : 10 mm.
	Applied locations : At the gaps between the cable trays, fire barriers and concrete wall.

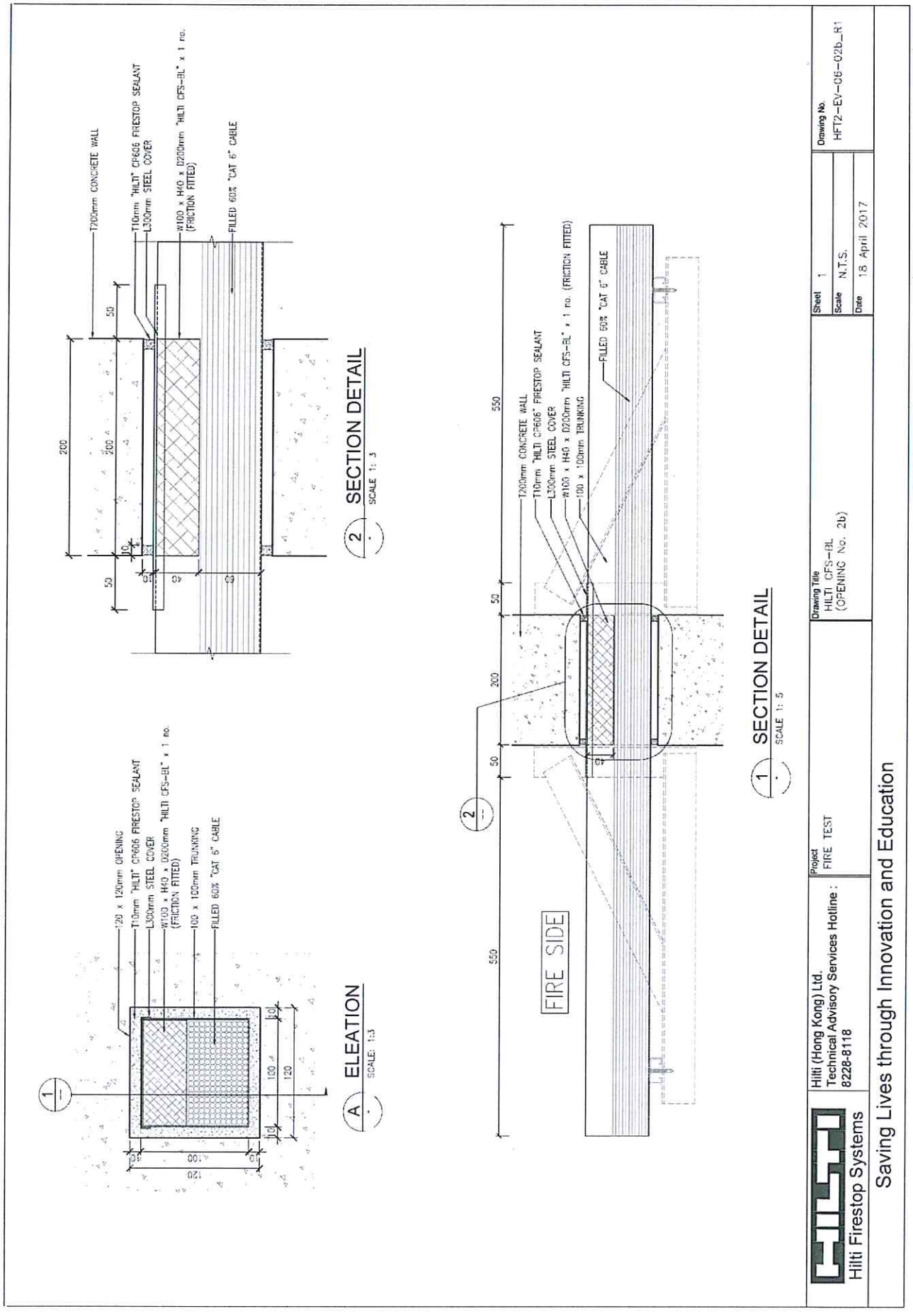
*Notes: * Verified on site by RED.*

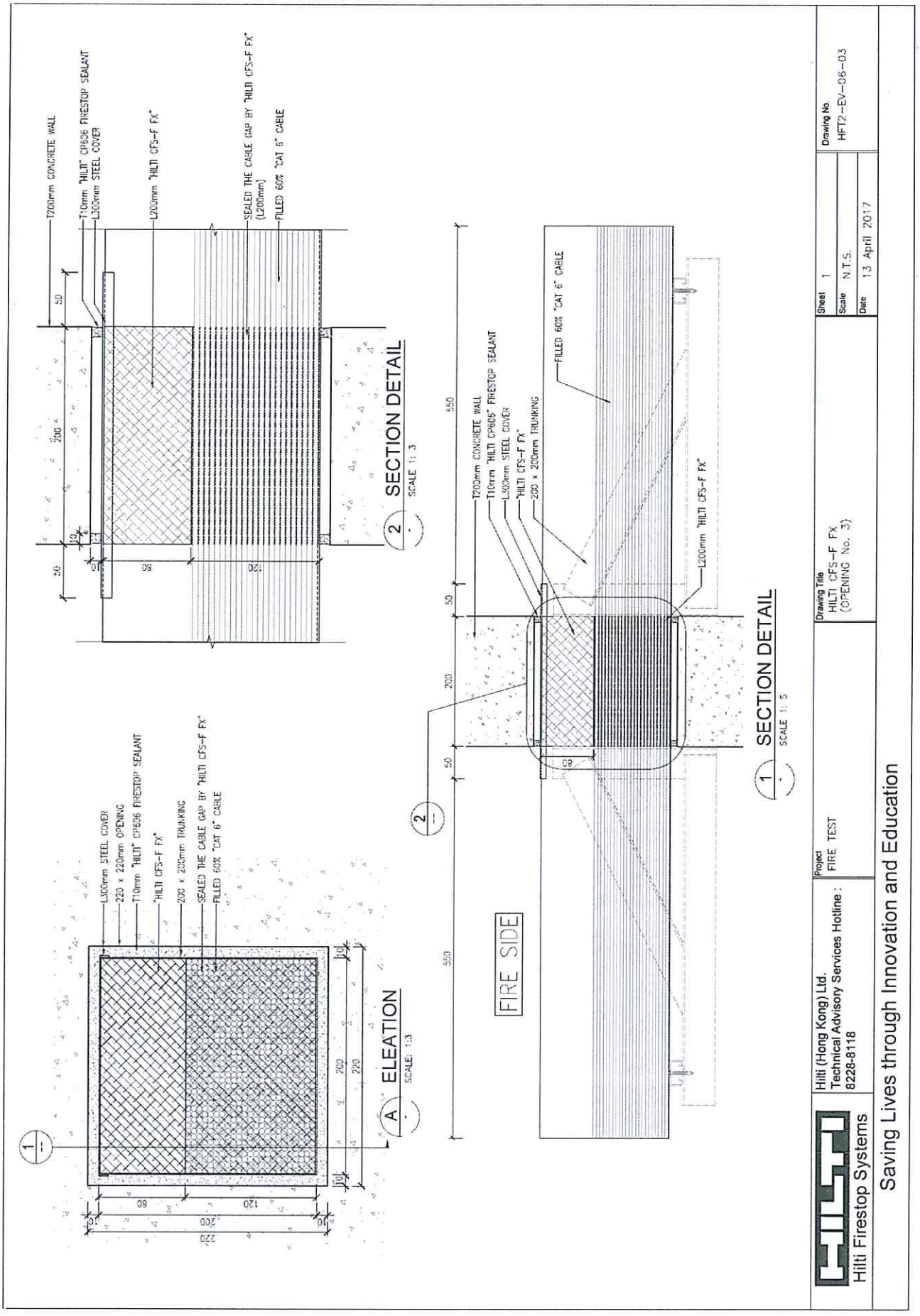
 # As shown on the test construction.

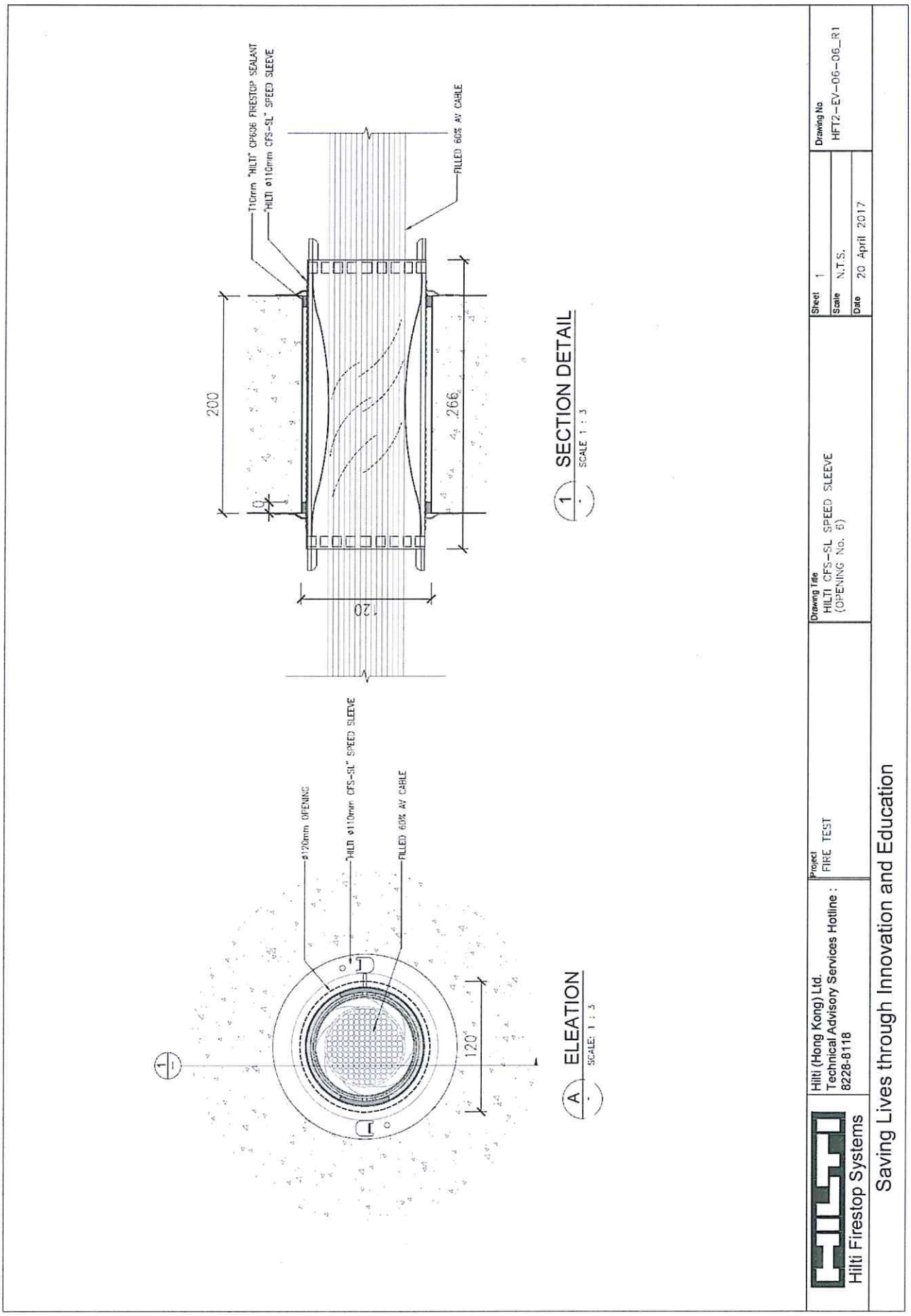
Drawings from Test Sponsor

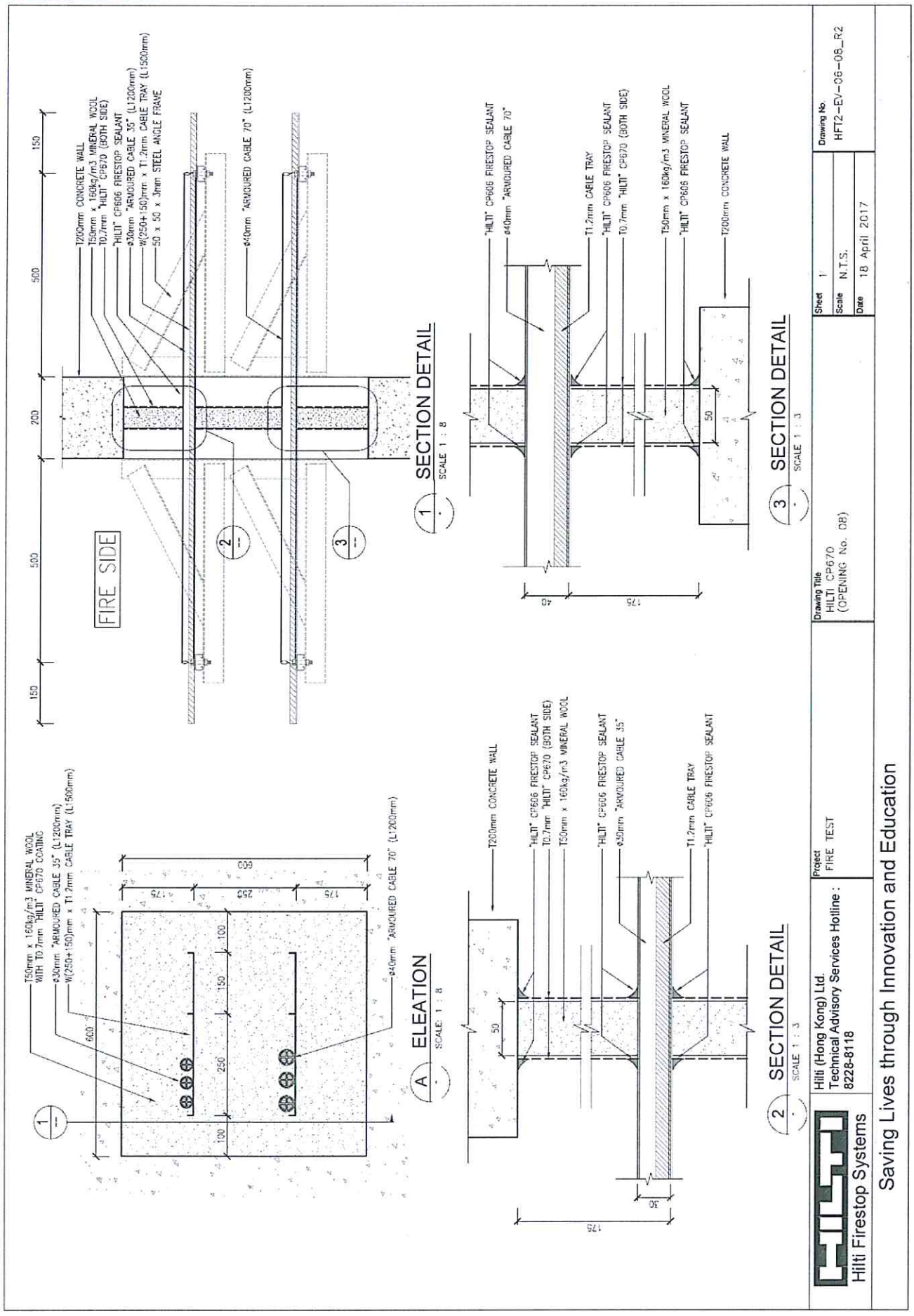
(The drawings provided by test sponsor, which was not verified by RED, except those specified and described in 'information from test sponsor'.)




T200mm CONCRETE WALL
T110mm "HILTI" CP606 FIRESTOP SEALANT
L300mm STEEL COVER
W100 x H40 x D200mm "HILTI CFS-BL" x 1 no. (FRICTION FITTED)
FILLED 60% "CAT 6" CABLE
SECTION DETAIL
SCALE 1: 5
120 x 120mm OPENING
100 x 100mm TRUNKING
ELEATION
SCALE: 1:5
FIRE SIDE
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-8118
Project FIRE TEST
Drawing Title HILTI CFS-BL (OPENING No. 2b)
Sheet 1
Scale N.T.S.
Date 18 April 2017
Drawing No. HFT2-EV-06-02b_R1
Hilti Firestop Systems
Saving Lives through Innovation and Education


T200mm CONCRETE WALL
T10mm "HILTI" CP606 FIRESTOP SEALANT
L300mm STEEL COVER
L200mm "HILTI CFS-F FX"
SEALED THE CABLE GAP BY "HILTI CFS-F FX" (L200mm)
FILLED 60% "CAT 6" CABLE
2 SECTION DETAIL
SCALE 1: 3
L300mm STEEL COVER
220 x 220mm OPENING
T10mm "HILTI" CP606 FIRESTOP SEALANT
"HILTI CFS-F FX"
200 x 200mm TRUNKING
SEALED THE CABLE GAP BY "HILTI CFS-F FX"
FILLED 60% "CAT 6" CABLE
A ELEATION
SCALE: 1:3
FIRE SIDE
T200mm CONCRETE WALL
T10mm "HILTI CP606" FIRESTOP SEALANT
L300mm STEEL COVER
"HILTI CFS-F FX"
200 x 200mm TRUNKING
FILLED 60% "CAT 6" CABLE
L200mm "HILTI CFS-F FX"
1 SECTION DETAIL
SCALE 1: 5
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-8118
Project FIRE TEST
Drawing Title HILTI CFS-F FX (OPENING No. 3)
Sheet 1
Scale N.T.S.
Date 13 April 2017
Drawing No. HFT2-EV-06-03
Hilti Firestop Systems
Saving Lives through Innovation and Education


T10mm "HILTI" CP606 FIRESTOP SEALANT
"HILTI ø110mm CFS-SL" SPEED SLEEVE
FILLED 60% AV CABLE
200
266
120
SECTION DETAIL
SCALE 1 : 3
ø120mm OPENING
"HILTI ø110mm CFS-SL" SPEED SLEEVE
FILLED 60% AV CABLE
120
ELEATION
SCALE: 1 : 3
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-8118
Project FIRE TEST
Drawing Title HILTI CFS-SL SPEED SLEEVE (OPENING No. 6)
Sheet 1
Scale N.T.S.
Date 20 April 2017
Drawing No HFT2-EV-06-06_R1
Hilti Firestop Systems
Saving Lives through Innovation and Education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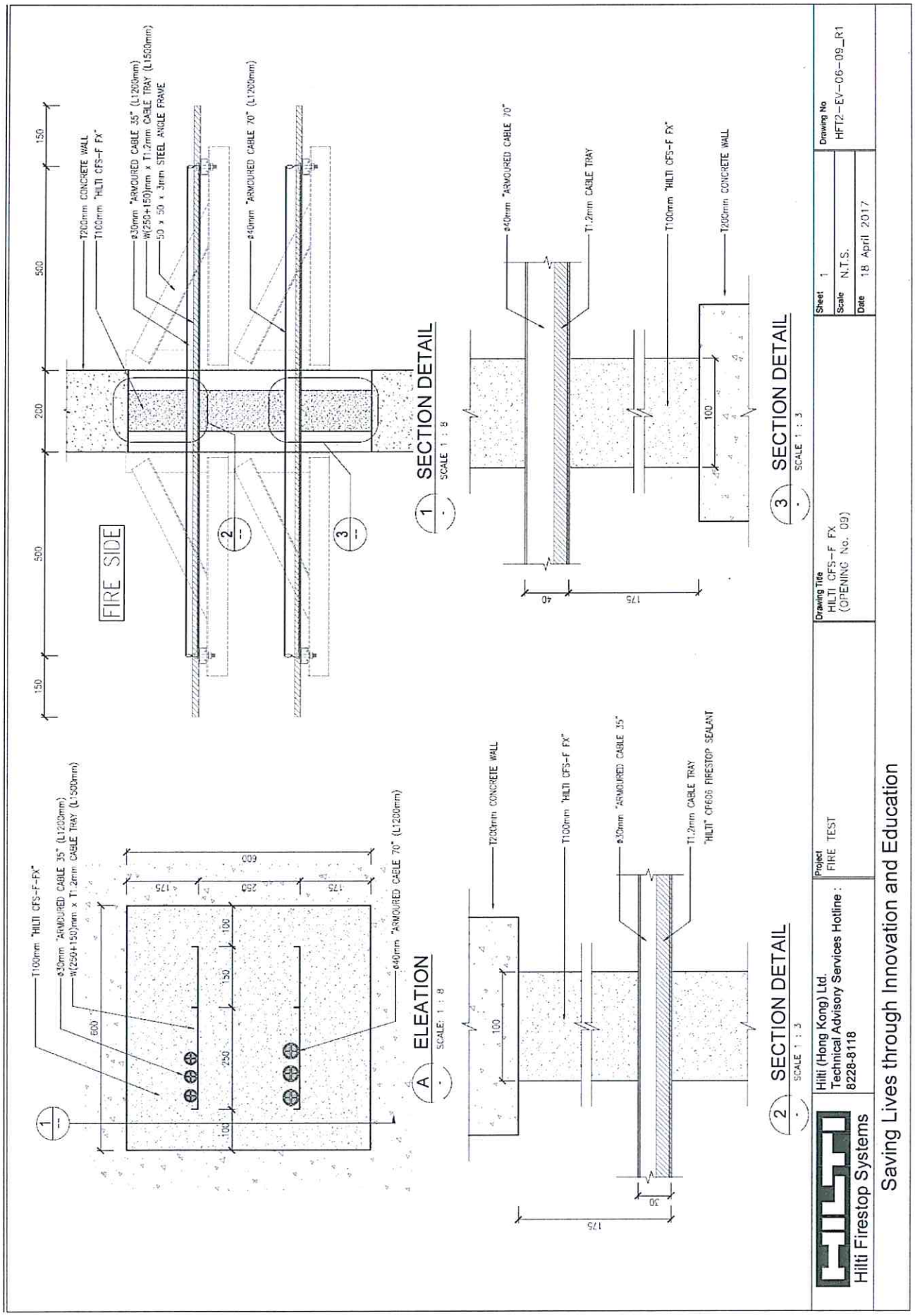
150mm x 160kg/m3 MINERAL WOOL
T0.7mm "HILTI" CP670 (BOTH SIDE)
"HILTI" CP606 FIRESTOP SEALANT
ø30mm "ARMOURED CABLE 35" (L1200mm)
W(250+150)mm x T1.2mm CABLE TRAY (L1500mm)
50 x 50 x 3mm STEEL ANGLE FRAME
ø40mm "ARMOURED CABLE 70" (L1200mm)
FIRE SIDE
1 SECTION DETAIL
SCALE 1 : 8
T50mm x 160kg/m3 MINERAL WOOL
WITH T0.7mm "HILTI" CP670 COATING
A ELEATION
SCALE 1 : 8
T1.2mm CABLE TRAY
2 SECTION DETAIL
SCALE 1 : 3
3 SECTION DETAIL
SCALE 1 : 3
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline :
8228-8118
Project
FIRE TEST
Drawing Title
HILTI CP670
(OPENING No. 08)
Sheet 1
Scale N.T.S.
Date 18 April 2017
Drawing No.
HFT2-EV-06-08_R2
Hilti Firestop Systems
Saving Lives through Innovation and Education


FIRE SIDE
T200mm CONCRETE WALL
T100mm "HILTI CFS-F FX"
ø30mm "ARMOURED CABLE 35" (L1200mm)
W(250+150)mm x T1.2mm CABLE TRAY (L1500mm)
50 x 50 x 3mm STEEL ANGLE FRAME
ø40mm "ARMOURED CABLE 70" (L1200mm)
1 SECTION DETAIL
SCALE 1 : 8
ø40mm "ARMOURED CABLE 70"
T1.2mm CABLE TRAY
T100mm "HILTI CFS-F FX"
T200mm CONCRETE WALL
3 SECTION DETAIL
SCALE 1 : 3
T100mm "HILTI CFS-F-FX"
ø30mm "ARMOURED CABLE 35" (L1200mm)
W(250+150)mm x T1.2mm CABLE TRAY (L1500mm)
ø40mm "ARMOURED CABLE 70" (L1200mm)
A ELEATION
SCALE 1 : 8
T200mm CONCRETE WALL
T100mm "HILTI CFS-F FX"
ø30mm "ARMOURED CABLE 35"
T1.2mm CABLE TRAY
"HILTI" CP606 FIRESTOP SEALANT
2 SECTION DETAIL
SCALE 1 : 3
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline :
8228-8118
Project FIRE TEST
Drawing Title HILTI CFS-F FX (OPENING No. 09)
Sheet 1
Scale N.T.S.
Date 18 April 2017
Drawing No HFT2-EV-06-09_R1
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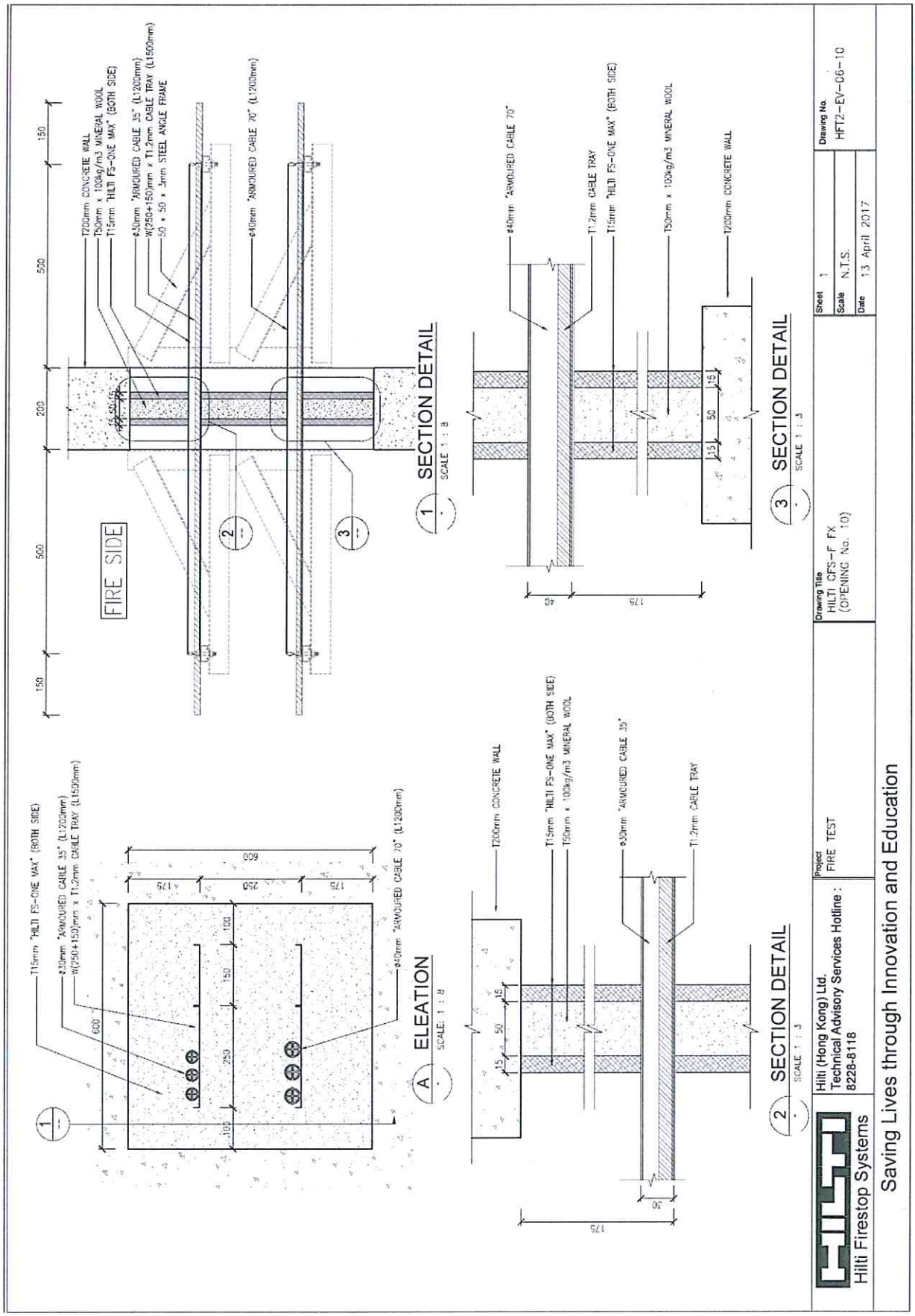


- End of report -

FIRE RESISTANCE TEST IN ACCORDANCE WITH BS 476: PART 20: 1987

On 4 nos. of Penetration Systems (Specimens '1', '3a', '3b' and '6')

Test Report No.: R16L28-2B

Identification No.: Q16L45-2

Issue Date: 25 August 2017

Testing Location:

RED Hong Kong Main Laboratory
DD 134, Lung Kwu Tan, Tuen Mun,
N.T., Hong Kong

Test Sponsor

Hilti (Hong Kong) Limited
701-704, 7/F, Tower A, Manulife Financial Centre,
223 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong

APPROVED SIGNATORY: _____ **DATE:** 25 AUG 2017

Ir. Dr. YUEN Sai-wing, MHKIE (FIRE)

CONTENT

1 SUMMARY

Fire resistance test conducted in accordance with BS 476: Part 20: 1987 on 4 nos. of penetration systems (specimens '1', '3a', '3b' and '6')

Twenty-one specimens of penetration systems had been subjected to a test in accordance with BS 476: Part 20: 1987, in order to determine their fire resistance performances. In this test report, only trunking and cable tray, namely specimens '1', '3a', '3b' and '6' (refer to figure 1), were considered. As requested by the test sponsor, the specimens were mounted within concrete line specimen holder as shown in the test sponsor's drawings (see the appendix). The specimens were symmetrical and only one side of specimens was tested as per test sponsor's request.

Specimen '1' was comprised of a fire barrier with sizes of 1,000 mm wide by 1.000 mm high, left and right cable trays with electrical cables. The left and right cable trays were with a separation of 400 mm and had 2 nos. of 250 mm wide by 1.2 mm thick cable trays. 3 nos. of 40 mm diameter 'Armoured Cable 70' and 3 nos. of 30 mm diameter 'Armoured Cable 35' electrical cables were incorporated into one of the left and right 250 mm wide by 1.2 mm thick cable tray respectively. The electrical cables were fixed to the cable tray by nominal 3 mm thick rings with 2 nos. of M5 bolts and nuts on both sides. The cable trays with electrical cables were penetrated through a fire barrier which constructed by 2 layers of nominal 50 mm thick 'ROCKWOOL' mineral wool boards with density of 160 kg/m^3 with nominal 0.7 mm thick (dry thickness) 'Hilti CP 670' fire safety coating applied on both sides.

Specimen '3a' was comprised of a fire barrier with sizes of 600 mm wide by 600 mm high, left and right cable trays with electrical cables. The left and right cable trays were with a separation of 200 mm. The left and right cable tray had a 250 mm wide by 1.2 mm thick and a 150 mm wide by 1.2 mm thick cable trays respectively. 3 nos. of 40 mm diameter 'Armoured Cable 70' and 3 nos. of 30 mm diameter 'Armoured Cable 35' electrical cables were incorporated into the left and right 250 mm wide by 1.2 mm thick cable tray respectively. The electrical cables were fixed to the cable tray by nominal 3 mm thick rings with 2 nos. of M5 bolts and nuts on both sides. The cable trays with electrical cables were penetrated through a fire barrier which constructed by a layer of nominal 150 mm thick 'CFS-F FX' firestop foam at the unexposed side and a layer of nominal 50 mm thick 'ROCKWOOL' mineral wool boards with density of 100 kg/m^3 at the exposed side.

Specimen '3b' was comprised of a fire barrier with sizes of 600 mm wide by 600 mm high, left and right cable trays with electrical cables. The left and right cable trays were with a separation of 200 mm. The left and right cable tray had a 250 mm wide by 1.2 mm thick and a 150 mm wide by 1.2 mm thick cable trays respectively. 3 nos. of 40 mm diameter 'Armoured Cable 70' and 3 nos. of 30 mm diameter 'Armoured Cable 35' electrical cables were incorporated into the left and right 250 mm wide by 1.2 mm thick cable tray respectively. The electrical cables were fixed to the cable tray by nominal 3 mm thick rings with 2 nos.

of M5 bolts and nuts on both sides. The cable trays with electrical cables were penetrated through a fire barrier which constructed by a layer of nominal 150 mm thick 'ROCKWOOL' mineral wool boards with density of 100 kg/m^3 with nominal 15 mm thick 'FS-ONE MAX' intumescent firestop sealant applied at the unexposed side.

Specimen '6' was comprised of a 100 mm by 100 mm by nominal 1 mm thick by 1,000 mm long trunking filled with 60% of 5 mm diameter 'CAT 6' cables. The cables were protected by 'CFS-BL' firestop blocks and 'CFS-F FX' firestop foam.

The trunkings of specimen '6' and cable trays of specimens '1', '3a' and '3b' were fixed to 50 mm by 50 mm by 3 mm thick steel brackets, located at 300 mm from the concrete floor, by M5 bolts and nuts on both sides. The steel brackets were supported by an external steel framework constructed by 50 mm by 50 mm by 3 mm steel brackets which in turn fixed to the concrete lining of test rig by 2 nos. of M10 anchor bolts.

The specimens satisfied the performance requirements specified in BS 476: Part 20: 1987 for the following periods:

	Integrity	Insulation
Specimen '1'	**174** Minutes	**82** Minutes
Specimen '3a'	**177** Minutes	**101** Minutes
Specimen '3b'	**173** Minutes	**96** Minutes
Specimen '6'	**130** Minutes	N/A

The test was discontinued after a heating period of 241 minutes.

2 INTRODUCTION

The objective of the test is to determine the fire resistance performance of 4 nos. of penetration systems when tested in accordance with BS 476: Part 20: 1987, 'Methods for determination of the fire resistance of elements of construction (general principles)'.

3 TEST INFORMATION

3.1 Test Sponsor

Hilti (Hong Kong) Limited

701-704, 7/F, Tower A, Manulife Financial Centre,

223 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong

3.2 Testing Location

Research Engineering Development Façade Consultants Limited, Hong Kong Main Laboratory of DD 134, Lung Kwu Tan, Tuen Mun, New Territories, Hong Kong.

3.3 Date of Test

10th May 2017

3.4 Witness of the test

The test was led by Mr. Solaris Chan of Research Engineering Development Façade Consultants Limited (RED) and was witnessed by Miss Selina Lin and Mr. Dennis Yeung, the representatives of test sponsor.

4 EQUIPMENT

Nine (9) 'type K' thermocouples to monitor the temperature of the furnace, which were kept at 100 mm from the exposed face of the specimen (see Figure 1).

Nineteen (19) 'type K' thermocouples to monitor the temperature of the unexposed face of the specimens (see Figure 2).

A 'type K' roving thermocouple to measure temperature on hot spots of unexposed surface of specimens.

A micro-manometer provided to monitor the furnace pressure.

Cotton pads, 6 mm and 25 mm gap gauges.

5 CONDITIONING

The specimens' 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 of the temperature and humidity of the laboratory were measured and recorded as being within a range of 24 °C to 35 °C and 58 % to 91 % respectively.

6 TEST SPECIMEN CONSTRUCTION

The specimens were installed into a concrete specimen holder with pre-prepared opening to form the test construction. The details of the fixings were outlined in Appendix D.

A comprehensive description of the test specimens construction was presented in the appendix, which was based on a survey of the specimens and information supplied by the test sponsor.

7 TEST PROCEDURES

The test was conducted in accordance with the procedures specified in BS 476: Part 20: 1987. The ambient temperature of the test area during the test was measured. After the first 5 minutes of the test, the furnace pressure was maintained at 20 ± 2 Pa relative to atmosphere, at 100 mm from the exposed side of specimen.

The furnace was monitored by nine (9) thermocouples so that the mean furnace temperature complied with the requirements of Clause 3.1 of BS 476: Part 20: 1987.

The temperature of the unexposed face was monitored by means of nineteen (19) thermocouples fixed to the unexposed surface (see Figure 2 for the locations and reference numbers of the thermocouples). For specimen '1', thermocouples S52 - S54 were fixed on the electric cables and cable tray for monitoring both of the mean and maximum surface temperatures. Thermocouples S49 - S51 were the fixed the fire barrier for monitoring the maximum surface temperature only. For specimen '3a', thermocouples S10 - S12 were fixed on the electric cables and cable tray for monitoring both of the mean and maximum surface temperatures. Thermocouples S7 - S9 were the fixed the fire barrier for monitoring the maximum surface temperature only. For specimen '3b', thermocouples S28 - S30 were fixed on the electric cables and cable tray for monitoring both of the mean and maximum surface temperatures. Thermocouples S25 - S27 were the fixed the fire barrier for monitoring the maximum surface temperature only. Thermocouple S1 was fixed on specimen '6' for additional information only. The mean and maximum temperatures were recorded.

The cotton pads and gap gauges were used, if considered appropriate, to determine compliance with the integrity criterion of the standard. The occurrence of sustained flaming on the unexposed surface was monitored to determine compliance with this criterion.

8 TEST DATA AND INFORMATION

The ambient temperature of the test area during the test was 31 °C.

The furnace was controlled so that the mean furnace temperature complied with the requirements of BS 476: Part 20: 1987. The temperature record was shown graphically in Figure 3.

The mean and maximum temperatures of the unexposed surface of specimen '1' were shown graphically in Figure 4.

The mean and maximum temperatures of the unexposed surface of specimen '3a' were shown graphically in Figure 5.

The mean and maximum temperatures of the unexposed surface of specimen '3b' were shown graphically in Figure 6.

The maximum temperatures of the unexposed surface of specimen '6' was shown graphically in Figure 7.

The furnace pressure was shown graphically in Figure 8.

A summary of the observations made on the general behaviour of the specimen is given in 'APPENDIX B - OBSERVATION'.

The mean furnace temperature obtained was summarized in Table 1.

The temperature rises of specimen obtained were summarized in Table 2.

The test was discontinued after a heating period of 241 minutes.

9 RESULTS

When tested in accordance with BS 476: Part 20: 1987, the requirements of the standard were satisfied for the following periods:

	Integrity	Insulation
Specimen '1'	**174** Minutes	**82** Minutes
Specimen '3a'	**177** Minutes	**101** Minutes
Specimen '3b'	**173** Minutes	**96** Minutes
Specimen '6'	**130** Minutes	N/A

Insulation - It is required that the mean temperature rise of the unexposed surface shall not be greater than 140 °C and that maximum temperature rise shall not be greater than 180 °C. Insulation failure also occurs simultaneously with integrity failure.

Specimen '1'

The 140 °C rise of the mean temperature of the unexposed surface of specimen reached after a heating period of 95 minutes. The 180 °C rise of the maximum temperature of the unexposed surface of specimen reached and measured by thermocouple S54 after a heating period of 82 minutes. The maximum temperature rise was 1,000 °C measured by thermocouple S51 after a heating period of 201 minutes.

Specimen '3a'

The 140 °C rise of the mean temperature of the unexposed surface of specimen reached after a heating period of 146 minutes. The 180 °C rise of the maximum temperature of the unexposed surface of specimen reached and measured by thermocouple S12 after a heating period of 101 minutes. The maximum temperature rise was 494 °C measured by thermocouple S12 after a heating period of 180 minutes.

Specimen '3b'

The 140 °C rise of the mean temperature of the unexposed surface of specimen reached after a heating period of 113 minutes. The 180 °C rise of the maximum temperature of the unexposed surface of specimen reached and measured by thermocouple S30 after a heating

period of 96 minutes. The maximum temperature rise was 687 °C measured by thermocouple S30 after a heating period of 174 minutes.

Integrity - It is required that there is no collapse for the specimen, no sustained flaming on the unexposed surface and no loss of impermeability.

Specimen '1'

Sustained flaming was observed on specimen '1' after a heating period of 174 minutes.

The specimen did not meet the integrity requirements after a heating period of 174 minutes.

Specimen '3a'

Sustained flaming was observed on specimen '3a' after a heating period of 177 minutes.

The specimen did not meet the integrity requirements after a heating period of 177 minutes.

Specimen '3b'

Sustained flaming was observed on specimen '3b' after a heating period of 173 minutes.

The specimen did not meet the integrity requirements after a heating period of 173 minutes.

Specimen '6'

Sustained flaming was observed on specimen '6' after a heating period of 130 minutes.

The specimen did not meet the integrity requirements after a heating period of 130 minutes.

10 LIMITATIONS

The results relate only to the behaviour of the specimen of the element of construction under the particular conditions of the 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 (see Clause 12 of BS 476: Part 20: 1987).

The fire resistance performance of the specimen may change if substantially different gaps are used. Application of the results to the specimen of different dimensions or supported other than by a concrete wall or incorporating different components shall be the subject of a design appraisal.

APPENDIX A – Photos and Test Record

Photo 1: The unexposed face of the specimens before the test.

Note: In this test report, only specimens '1', '3a', '3b' and '6' were considered.

Photo 2: The unexposed face of the specimens after a heating period of 30 minutes.

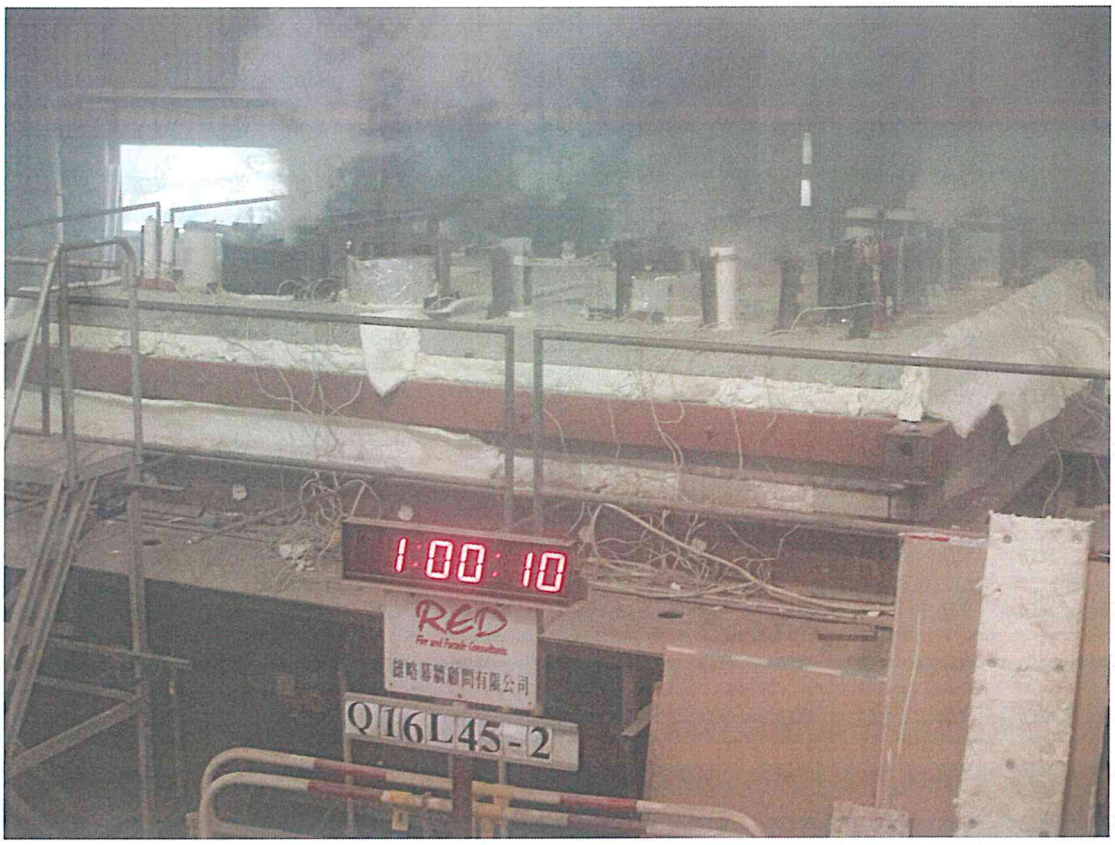


Photo 3: The unexposed face of the specimens after a heating period of 60 minutes.

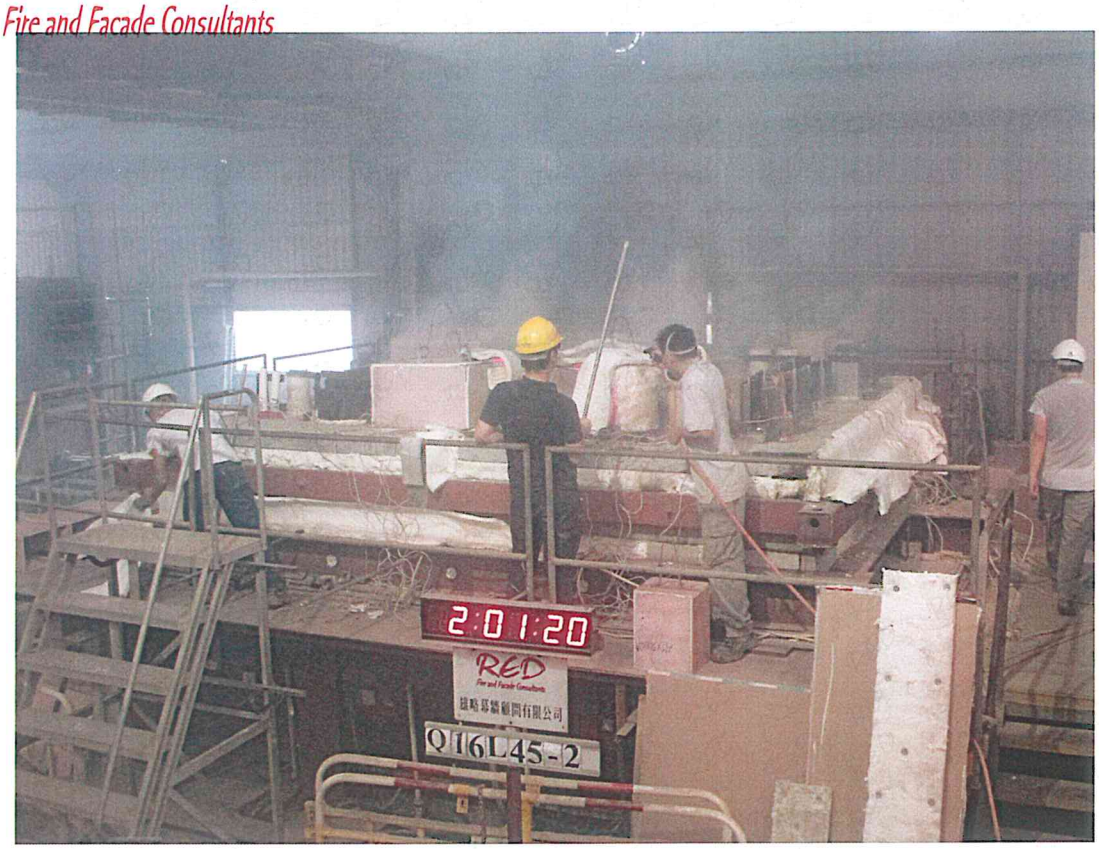


Photo 4: The unexposed face of the specimens after a heating period of 121 minutes.

Photo 5: The unexposed face of the specimens after a heating period of 181 minutes.

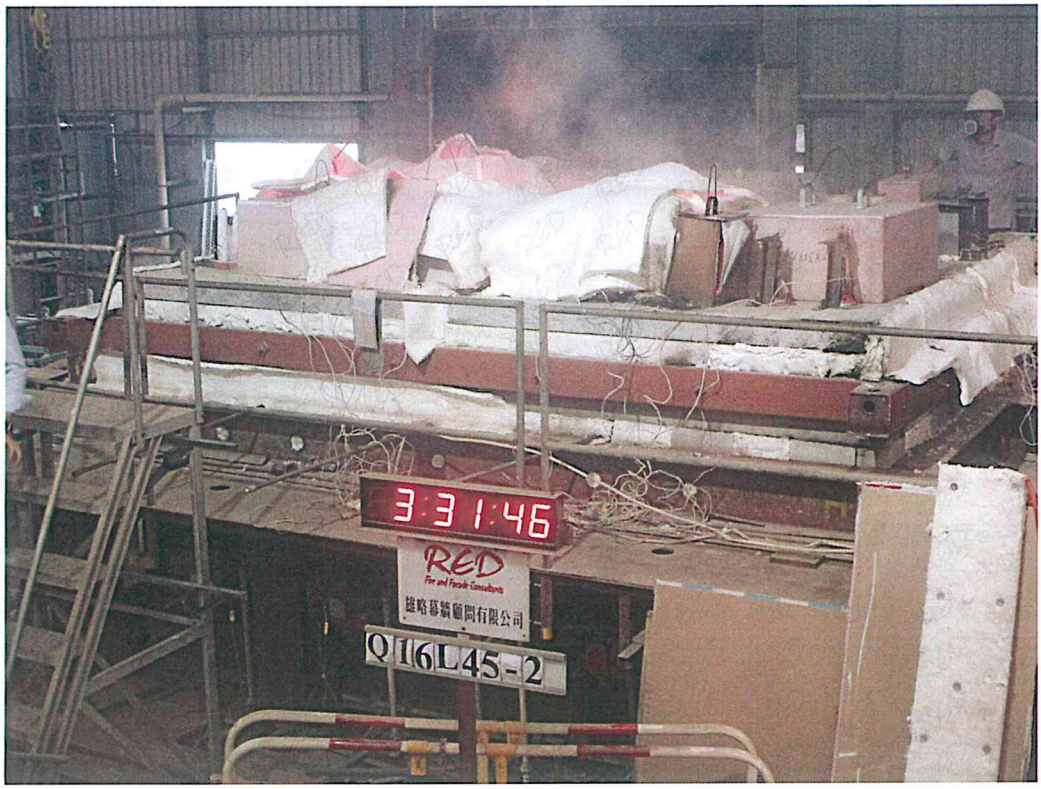


Photo 6: The unexposed face of the specimens after a heating period of 211 minutes.

Photo 7: The unexposed face of the specimens after the test.

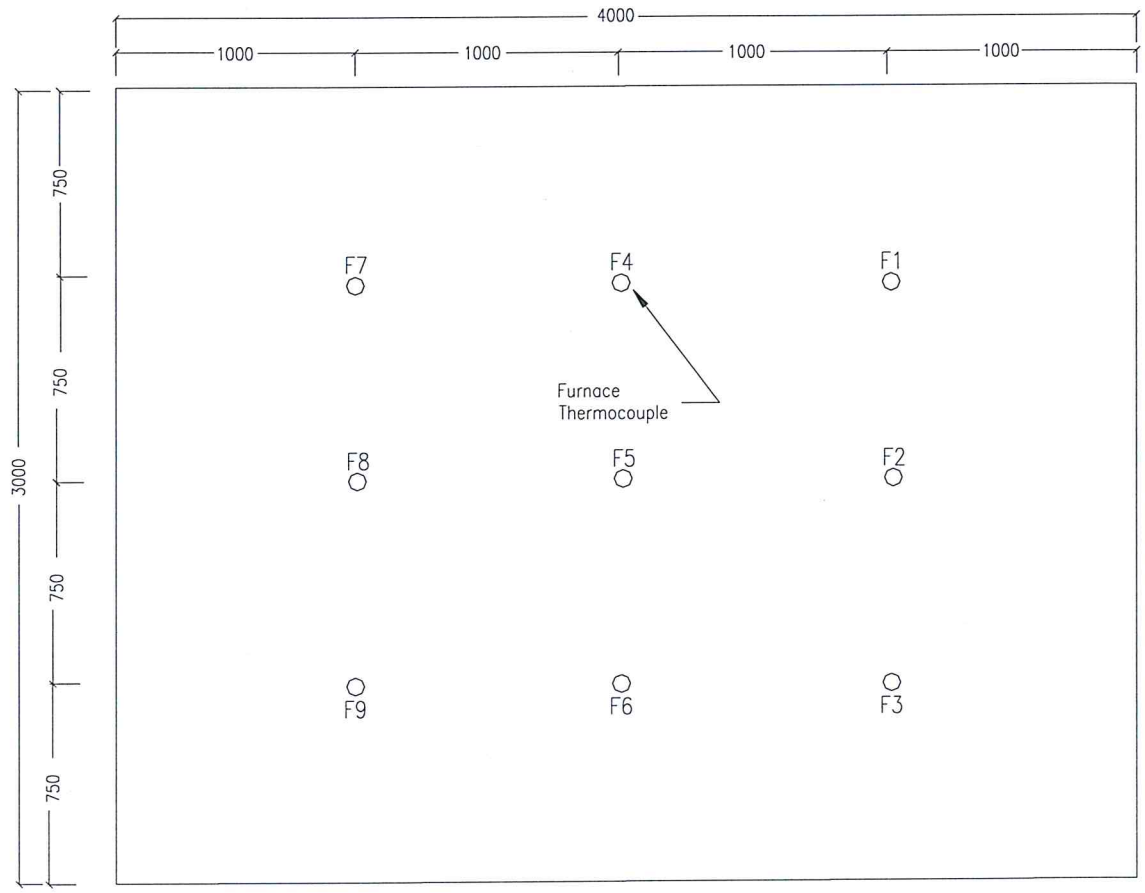


Figure 1 – Locations and reference numbers of furnace thermocouples.

(This figure is not to scale and all dimensions are in millimetres.)

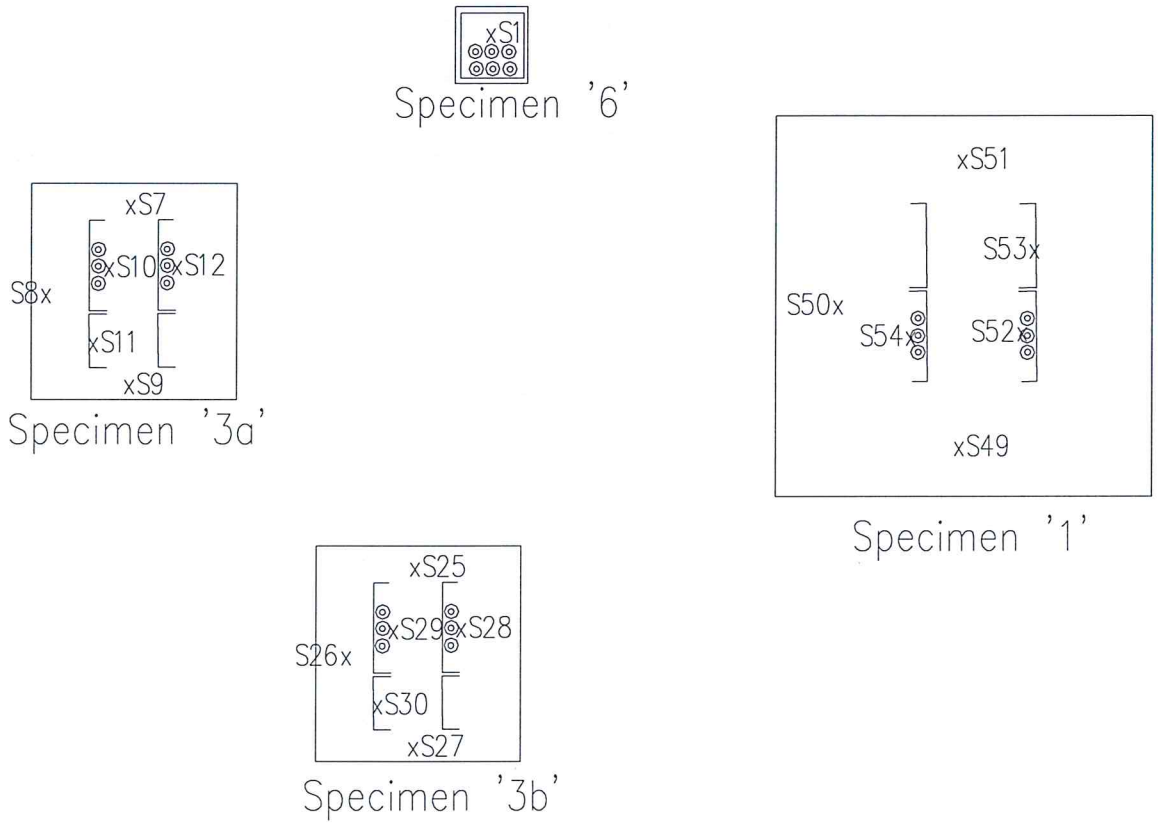


Figure 2 – Locations and reference number of thermocouples to monitor the temperature of unexposed surface of the specimens.

(This figure is not to scale.)

Notes: Thermocouples S10 - S12, S28 - S30 and S52 - S54 were fixed on the electric cables and cable trays.

Thermocouples S7 - S9, S25 - S27 and S49 - S51 were fixed on the fire barriers.

Thermocouple S1 was fixed for additional information only.

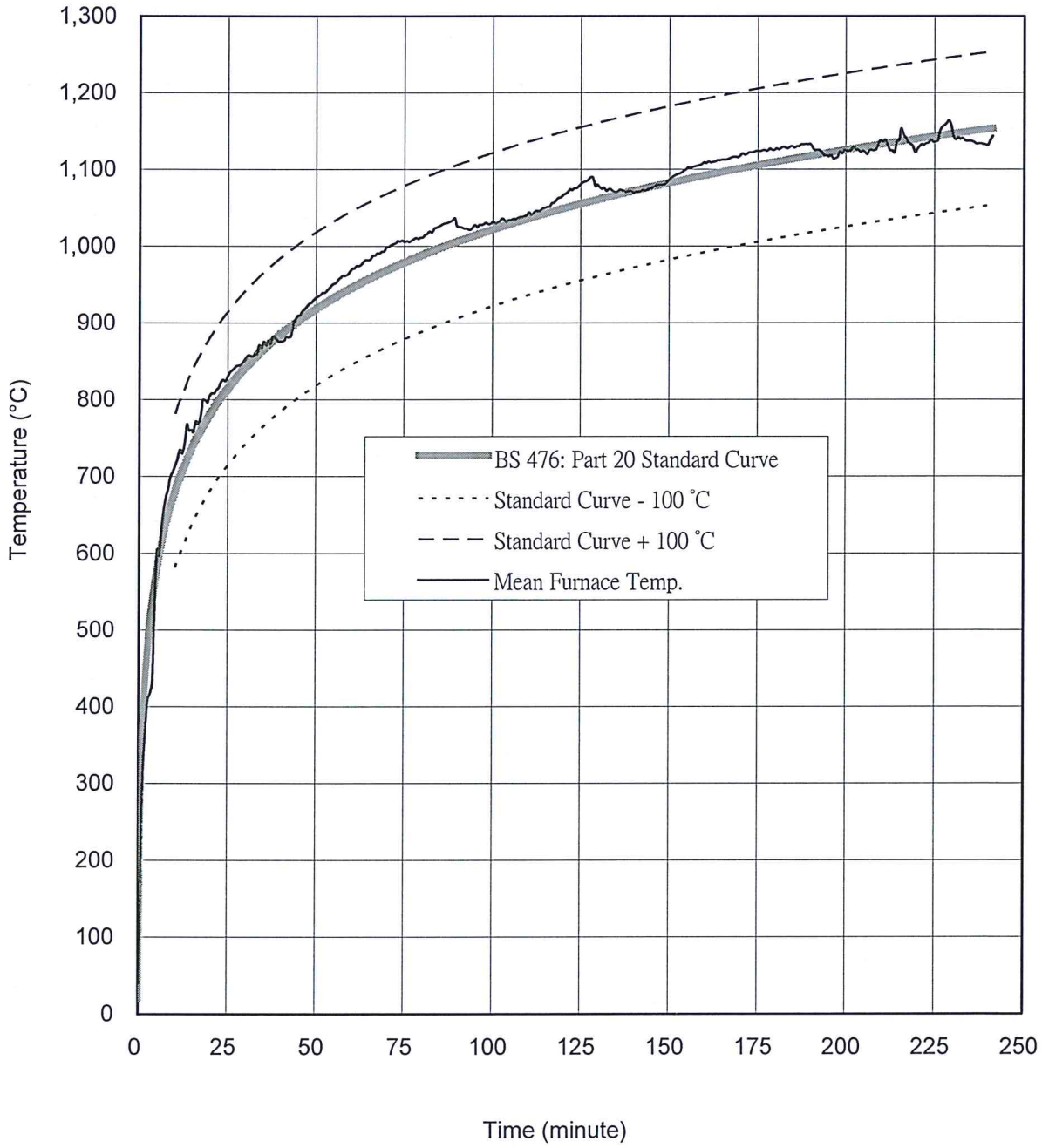


Figure 3 – Mean furnace temperature.

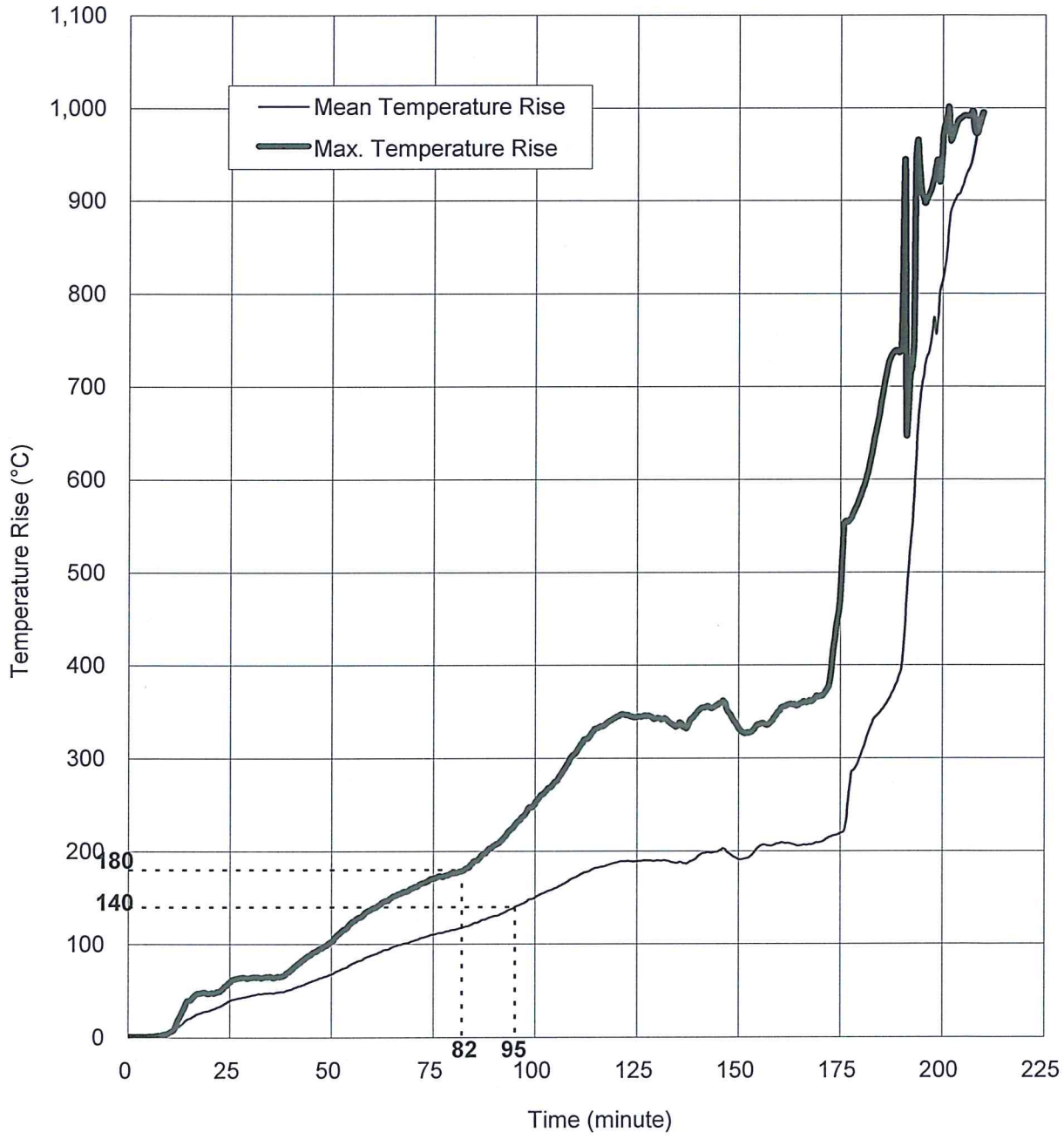


Figure 4 – Temperature rises of unexposed surface of specimen '1'.

Note: Thermocouples S49, S52 and S54 detached after a heating period of 207 minutes.
Thermocouple S50, S51 and S53 detached after a heating period of 190, 201 and 209 minutes respectively.

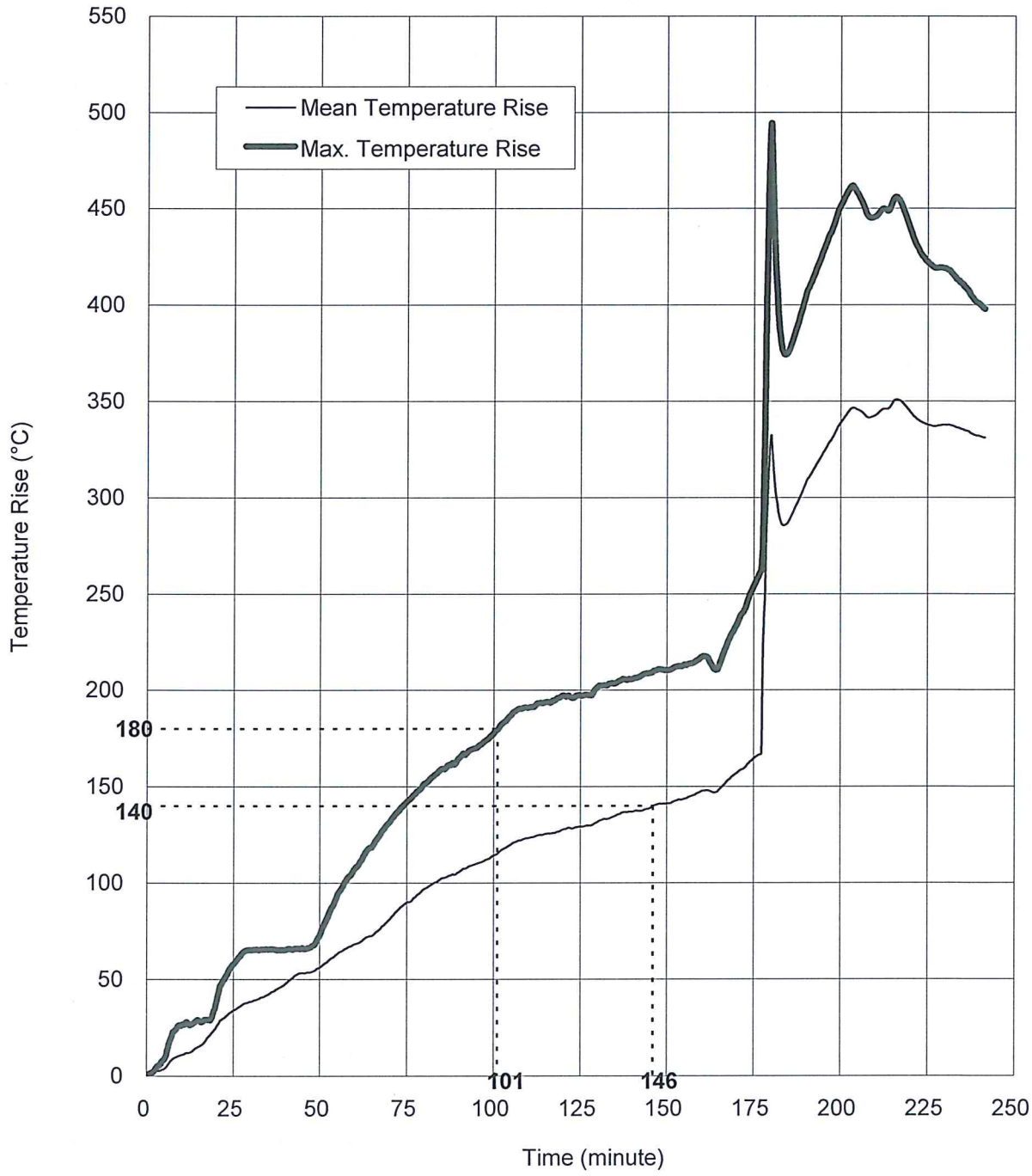


Figure 5 – Temperature rises of unexposed surface of specimen '3a'.

Note: Thermocouple S11 detached after a heating period of 177 minutes.

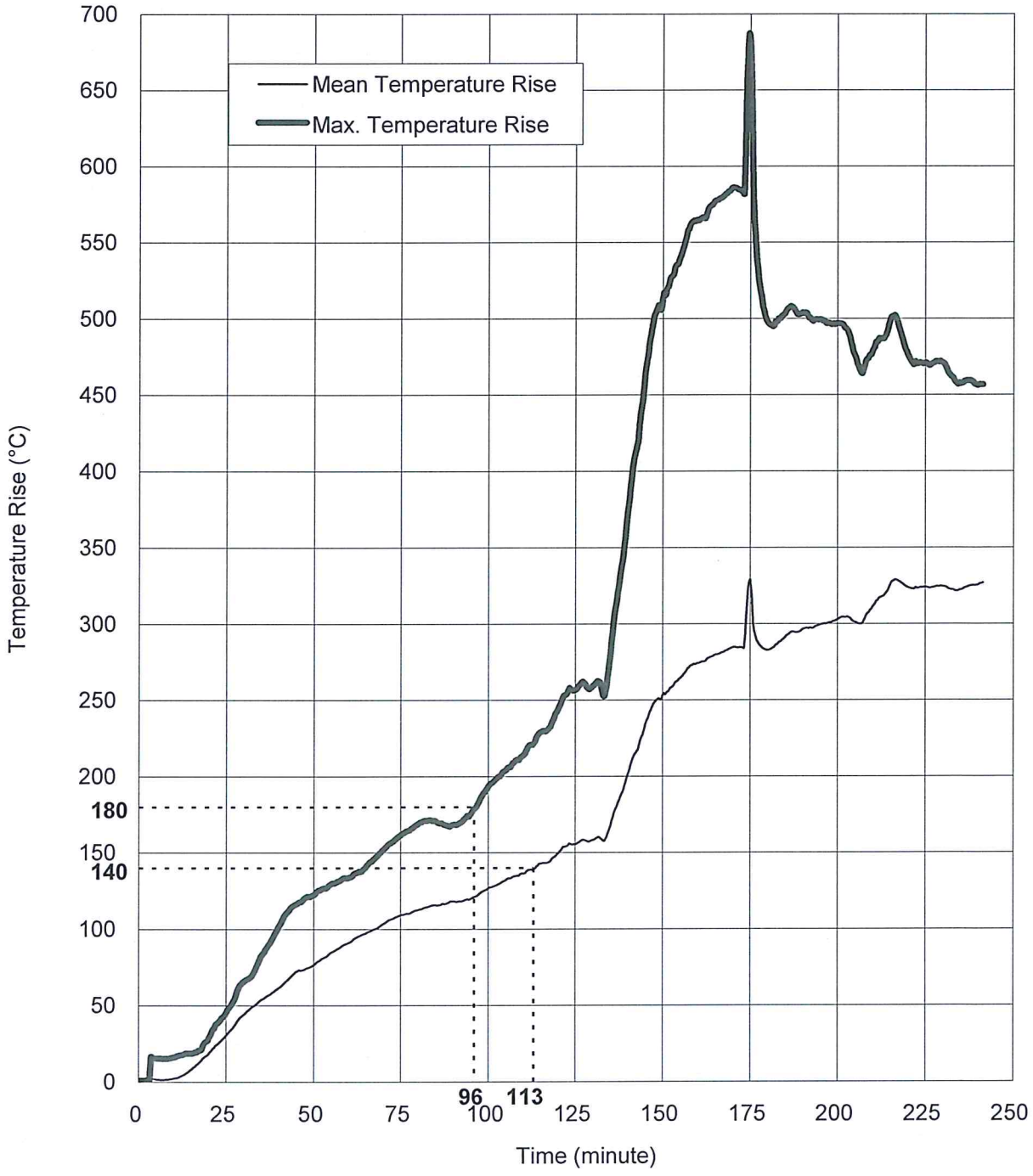


Figure 6 – Temperature rises of unexposed surface of specimen '3b'.

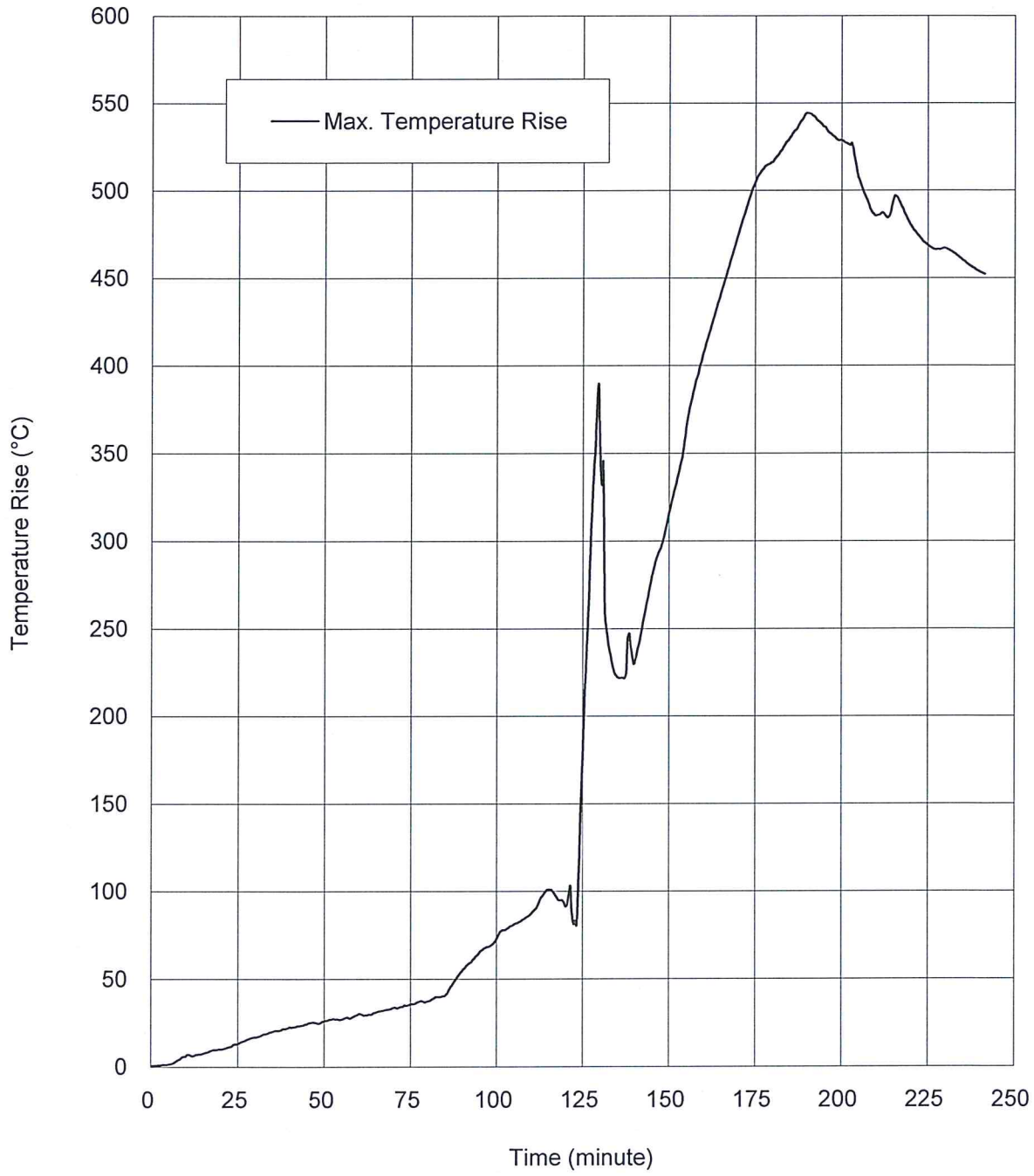


Figure 7 – Temperature rises of unexposed surface of specimen '6'.
(for additional information only)

After the first 5 minutes of the test, the furnace pressure was maintained at 20 ± 2 Pa relative to atmosphere, at 100 mm from the exposed side of specimen.

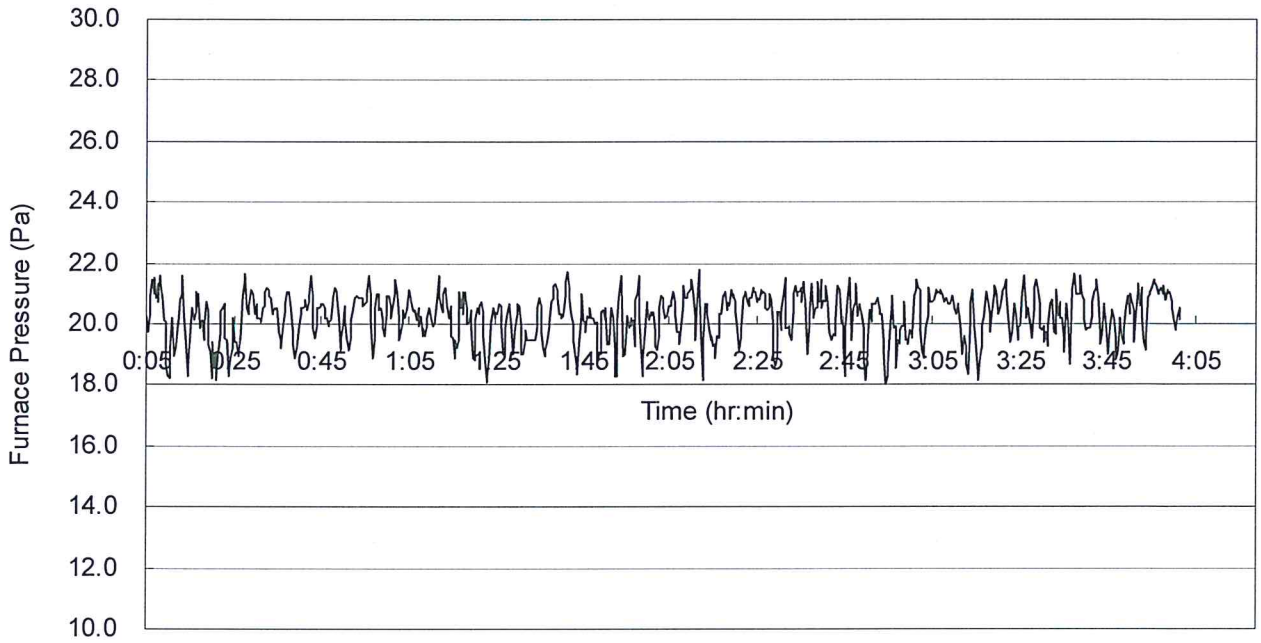


Figure 10 – Furnace pressure.

APPENDIX B – Observation

Time (min.sec)	Exposed (E) or Unexposed (U)	Observation
00.00	-	Test started.
07.30	U	Smoke started releasing from all specimens.
10.00	U	Smoke release increased from all specimens.
28.00	U	Smoke release decreased.
30.00	U	Specimen '6' satisfied the integrity requirements performance. Specimens '1', '3a' and '3b' satisfied the integrity and insulation requirements performance.
56.02	U	Cotton pad test was applied on specimen '3a' and the test passed.
57.08	U	Cotton pad test was applied on specimen '3b' and the test passed.
57.42	U	Cotton pad test was applied on specimen '1' and the test passed.
60.00	U	Specimen '6' satisfied the integrity requirements performance. Specimens '1', '3a' and '3b' satisfied the integrity and insulation requirements performance.
90.00	U	Specimen '1' and '6' satisfied the integrity requirements performance. Specimens '3a' and '3b' satisfied the integrity and insulation requirements performance.
120.00	U	Specimens '1', '3a', '3b' and '6' satisfied the integrity and insulation requirements performance.
130.10	U	Sustained flaming was observed from specimen '6'. **Integrity failed.**
131.06	U	Specimen '6' was covered by fire rated board with ceramic fibre blank as requested by the test sponsor. **Integrity failed.**
150.00	U	Specimens '1', '3a' and '3b' satisfied the integrity and insulation requirements performance.
173.20	U	Sustained flaming was observed from specimen '3b'. **Integrity failed.**
174.24	U	Specimen '3b' was covered by fire rated board with ceramic fibre blank as requested by the test sponsor. **Integrity failed.**
174.30	U	Sustained flaming was observed from specimen '1'. **Integrity failed.**
177.21	U	Specimen '1' was covered by fire rated board with ceramic fibre blank as requested by the test sponsor. **Integrity failed.**
177.31	U	Sustained flaming was observed from specimen '3a'. **Integrity failed.**
179.49	U	Specimen '3a' was covered by fire rated board with ceramic fibre blank as requested by the test sponsor. **Integrity failed.**
241.08	-	Test was terminated as requested by test sponsor.

APPENDIX C – Data Recorded During the Test

Table 1 - Mean furnace temperature

Time (minute)	BS 476: Part 20 Standard Temp. Curve (°C)	Actual Mean Furnace Temp. (°C)
0	20	39
5	578	604
10	681	714
15	742	758
20	780	805
25	814	831
30	842	854
35	866	876
40	886	876
45	902	910
50	918	933
55	933	951
60	946	971
65	958	983
70	968	999
75	979	1005
80	989	1011
85	998	1027
90	1007	1025
95	1014	1028
100	1022	1032
105	1029	1034
110	1037	1044
115	1042	1050
120	1049	1067
125	1055	1082
130	1061	1077
135	1067	1071
140	1072	1070

(To be continued)

Table 1 - Mean furnace temperature

Time (minute)	BS 476: Part 20 Standard Temp. Curve (°C)	Actual Mean Furnace Temp. (°C)
145	1077	1076
150	1083	1087
155	1088	1103
160	1093	1108
165	1097	1113
170	1101	1118
175	1106	1124
180	1110	1127
185	1114	1128
190	1118	1134
195	1122	1117
200	1126	1124
205	1130	1123
210	1133	1138
215	1136	1139
220	1140	1126
225	1143	1136
230	1147	1143
235	1150	1137
240	1153	1131
241	1154	1144

Notes: Locations of furnace thermocouples are shown in Figure 1.

The test was terminated as requested by the test sponsor after a heating period of 241 minutes.

Table 2 - Time and related temperature rise measured by thermocouples S1, S7 - S12, S25 - S30 and S49 - S54

Time (min)	S1	S7	S8	S9	S10	S11	S12	S25	S26	S27	S28	S29	S30	S49	S50	S51	S52	S53	S54
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	2	1	1	1	1	10	2	16	3	-1	1	3	1	1	1	1	1	1	1
10	7	2	1	2	2	27	5	16	3	0	1	4	3	2	3	2	5	4	6
15	8	4	2	2	5	29	13	19	4	1	11	5	9	7	9	5	13	9	40
20	10	4	2	3	9	29	39	20	4	1	30	7	21	12	15	10	27	14	48
25	13	4	2	3	16	28	58	19	6	2	46	8	40	16	18	16	41	17	60
30	17	6	2	3	24	26	65	19	7	4	66	8	59	18	19	20	56	15	64
35	20	6	3	3	34	26	66	20	9	8	70	9	82	23	21	23	61	17	65
40	23	5	3	4	49	28	65	22	10	14	73	10	101	31	23	26	62	21	72
45	25	5	3	5	64	30	66	16	11	20	90	11	117	36	25	29	70	23	90
50	26	6	4	6	65	31	75	13	12	28	100	9	123	37	30	27	77	24	103
55	27	7	4	7	65	32	95	16	15	33	115	11	130	39	35	27	88	26	125
60	30	7	5	8	65	33	108	19	18	38	128	12	134	41	42	30	101	27	139
65	31	8	5	9	66	33	119	23	22	41	141	14	138	44	47	34	112	29	152
70	34	9	6	10	77	35	132	26	25	43	152	15	144	46	50	38	122	30	161
75	36	10	7	13	91	37	142	30	29	45	162	17	150	49	54	42	131	31	171
80	37	11	8	15	101	38	151	34	32	46	169	17	152	52	64	47	138	33	177
85	40	13	9	18	108	40	159	37	36	47	171	18	158	54	77	50	145	34	189
90	56	14	10	21	114	39	166	41	39	49	166	20	168	56	88	53	150	35	208
95	66	15	11	22	120	40	170	44	41	50	164	20	177	57	101	62	156	37	230
100	74	17	12	22	124	41	179	47	44	51	165	22	194	58	112	75	161	40	254
105	82	19	13	23	129	44	188	49	45	52	168	24	204	60	121	85	166	41	275
110	88	22	14	24	133	46	191	51	46	52	170	24	214	61	129	93	169	42	307
115	101	26	16	26	136	46	194	52	47	53	174	25	229	63	135	101	172	42	332
120	91	30	17	28	138	48	197	53	49	54	178	27	244	64	143	108	175	44	345
125	183	34	19	29	141	49	197	54	50	55	180	30	257	66	148	112	177	46	345
130	351	37	20	28	143	51	202	55	51	56	183	32	259	71	157	120	179	48	343
135	222	42	22	29	148	54	204	55	52	57	188	36	287	82	163	127	180	48	338
140	233	49	23	31	151	55	206	55	53	58	191	41	378	101	161	140	185	50	352

(To be continued)

Table 2 - Time and related temperature rise measured by thermocouples S1, S7 - S12, S25 - S30 and S49 - S54 (con't)

Time (min)	S1	S7	S8	S9	S10	S11	S12	S25	S26	S27	S28	S29	S30	S49	S50	S51	S52	S53	S54
145	282	58	23	34	151	57	209	56	54	59	193	45	468	194	161	150	189	54	359
150	318	65	25	35	154	60	210	57	55	60	198	48	517	167	168	150	189	53	331
155	368	81	26	37	156	62	213	57	56	61	200	52	542	224	173	149	194	84	337
160	409	90	29	38	160	66	217	58	58	62	203	55	564	187	179	147	201	73	352
165	442	99	30	37	164	68	213	58	59	63	205	57	577	164	194	158	196	64	359
170	475	104	31	39	166	71	234	59	61	64	209	59	586	146	280	210	196	66	367
175	505	106	32	38	167	73	254	60	66	67	222	83	682	139	475	458	198	79	380
180	518	214	37	131	176	-	471	68	74	71	239	114	496	160	588	538	230	193	503
185	532	118	64	102	201	-	378	73	74	74	246	126	506	210	691	551	270	260	529
190	544	117	72	103	211	-	407	73	76	75	254	133	504	289	790	613	299	351	579
195	536	122	83	109	219	-	429	75	76	75	263	137	500	491	-	903	480	851	800
200	529	132	94	123	226	-	452	76	77	75	273	139	497	749	-	973	714	915	828
205	506	137	104	136	234	-	457	76	79	76	288	140	475	823	-	985	827	939	991
210	486	150	113	149	240	-	446	76	80	76	316	139	479	-	-	-	-	-	-
215	495	165	123	162	245	-	454	76	81	76	338	141	499	-	-	-	-	-	-
220	480	172	135	169	249	-	439	75	83	75	357	139	477	-	-	-	-	-	-
225	468	181	147	176	254	-	422	77	90	76	365	136	471	-	-	-	-	-	-
230	467	186	158	180	257	-	419	76	93	76	366	136	471	-	-	-	-	-	-
235	460	191	168	182	260	-	410	76	100	76	374	136	457	-	-	-	-	-	-
240	453	195	177	185	264	-	399	77	107	76	387	135	457	-	-	-	-	-	-
241	452	195	178	185	264	-	398	77	108	76	389	135	457	-	-	-	-	-	-

Notes: Locations of thermocouples S1, S7 - S12, S25 - S30 and S49 - S54 are shown in Figure 2.

Thermocouple S1 was fixed for additional information only.

Thermocouples S49, S52 and S54 detached after a heating period of 207 minutes.

Thermocouple S11, S50, S51 and S53 detached after a heating period of 177, 190, 201 and 209 minutes respectively.

The test was terminated as requested by the test sponsor after a heating period of 241 minutes.

APPENDIX D – Information from Test Sponsor

(The information provided by the test sponsor, which was not verified by RED or unless specified.)

For specimen '1', '3a' and '3b'

Item	Description		
1	**Cable Tray**		
	Overall sizes	:	Specimen '1' Left hand side- 2 nos. of 250 mm wide x 1.2 mm thick cable trays. Right hand side- 2 nos. of 250 mm wide x 1.2 mm thick cable trays. Specimens '3a' and '3b' Left hand side- 1 no. of 250 mm wide x 1.2 mm thick and 1 no. of 150 mm wide x 1.2 mm thick cable trays. Right hand side -1 no. of 250 mm wide x 1.2 mm thick and 1 no. of 150 mm wide x 1.2 mm thick cable trays.
	Material	:	G.M.S.
	Fixing method	:	Fixed to 50 mm x 50 mm x 3 mm thick steel brackets, located at 300 mm from the concrete floor, by 2 nos. of M5 bolts and nuts (for each cable tray) on both sides. The steel brackets were supported by an external steel framework constructed by 50 mm x 50 mm x 3 mm steel brackets which in turn fixed to the concrete lining of test rig by 2 nos. of M10 anchor bolts.
2	**Electric Cable**		
	Model	:	Left cable tray - 'Armoured Cable 35'. Right cable tray - 'Armoured Cable 70'.
	Diameter and number	:	Left cable tray - 3 nos. of 30 mm diameter 'Armoured Cable 35'. Right cable tray - 3 nos. of 40 mm diameter 'Armoured Cable 70'.
	Material	:	Copper with PVC coated.
	Fixing method	:	Fixed to the cable tray by nominal 3 mm thick rings with 2 nos. of M5 bolts and nuts on both sides.
3	**Fire Sealant**		
	Brand & Model	:	Hilti CP 606 flexible firestop sealant.#
	Material	:	Acrylic based.
	Thickness	:	10 mm.
	Applied locations	:	At the gaps between the cable trays, fire barriers and concrete floor.

*Notes: * Verified on site by RED.*

 # As shown on the test construction.

Appendix D – Information from Test Sponsor

(The information provided by test sponsor, which is not verified by RED or unless specified.)

For specimen '1'

Item	Description
1	**Fire Barrier** Sizes : 1,000 mm wide x 1,000 mm high.* Construction details : 2 layers of 50 mm thick 'ROCKWOOL' mineral wool boards with density of 160 kg/m^3 with nominal 0.7 mm thick (dry thickness) 'Hilti CP 670' fire safety coating applied on both sides.
2	**Mineral Wool Board** Brand : ROCKWOOL.# Material : Mineral wool. Number of layers : 2.* Thickness : 50 mm (each layer).* Density : 160 kg/m^3.# Fixing method : 'Hilti CP 606' flexible firestop sealant applied at the gaps between the fire barrier and concrete lining of test rig.
3	**Fire Safety Coating** Brand & Model : Hilti fire safety coating CP670.# Applied locations : Both sides of the nominal 100 mm thick 'ROCKWOOL' mineral wool boards without coat back on the cables.

*Notes: * Verified on site by RED.*

 # As shown on the test construction.

Appendix D – Information from Test Sponsor

(The information provided by test sponsor, which is not verified by RED or unless specified.)

For specimen '3a'

Item	Description
1	**Fire Barrier** Sizes : 600 mm wide x 600 mm high.* Construction details : A layer of nominal 150 mm thick 'CFS-F FX' firestop foam at the unexposed side and a layer of nominal 50 mm thick 'ROCKWOOL' mineral wool boards with density of 100 kg/m^3 at the exposed side.
2	**Mineral Wool Board** Brand : ROCKWOOL.# Material : Mineral wool. Thickness : 50 mm.* Density : 100 kg/m^3.# Fixing method : 'Hilti CP 606' flexible firestop sealant applied at the gaps between the fire barrier and concrete lining of test rig.
3	**Firestop Foam** Brand & Model : Firestop foam CFS-F FX.# Material : Acrylic based Polyol and Isozynad. Thickness : 150 mm. Applied location : Filled void between cable tray and lining of conrete of specimen '3a'.

*Notes: * Verified on site by RED.*

 # As shown on the test construction.

Appendix D – Information from Test Sponsor

(The information provided by test sponsor, which is not verified by RED or unless specified.)

For specimen '3b'

Item	Description
1	**Fire Barrier** Sizes : 600 mm wide x 600 mm high.* Construction details : A layer of nominal 150 mm thick 'ROCKWOOL' mineral wool boards with density of 100 kg/m^3 with nominal 15 mm thick 'CFS-F FX' firestop foam applied at the unexposed side.
2	**Mineral Wool Board** Brand : ROCKWOOL.# Material : Mineral wool. Thickness : 150 mm.* Density : 100 kg/m^3.# Fixing method : 'Hilti CP 606' flexible firestop sealant applied at the gaps between the fire barrier and concrete lining of test rig.
3	**Firestop Sealant** Brand & Model : FS-ONE MAX intumescent firestop sealant.# Thickness : Nominal 15 mm thick on unexposed side. Applied locations : At the unexposed side of 'ROCKWOOL' mineral wool boards.

*Notes: * Verified on site by RED.*

 # As shown on the test construction.

Appendix D – Information from Test Sponsor

(The information provided by test sponsor, which is not verified by RED or unless specified.)

For specimen '6'

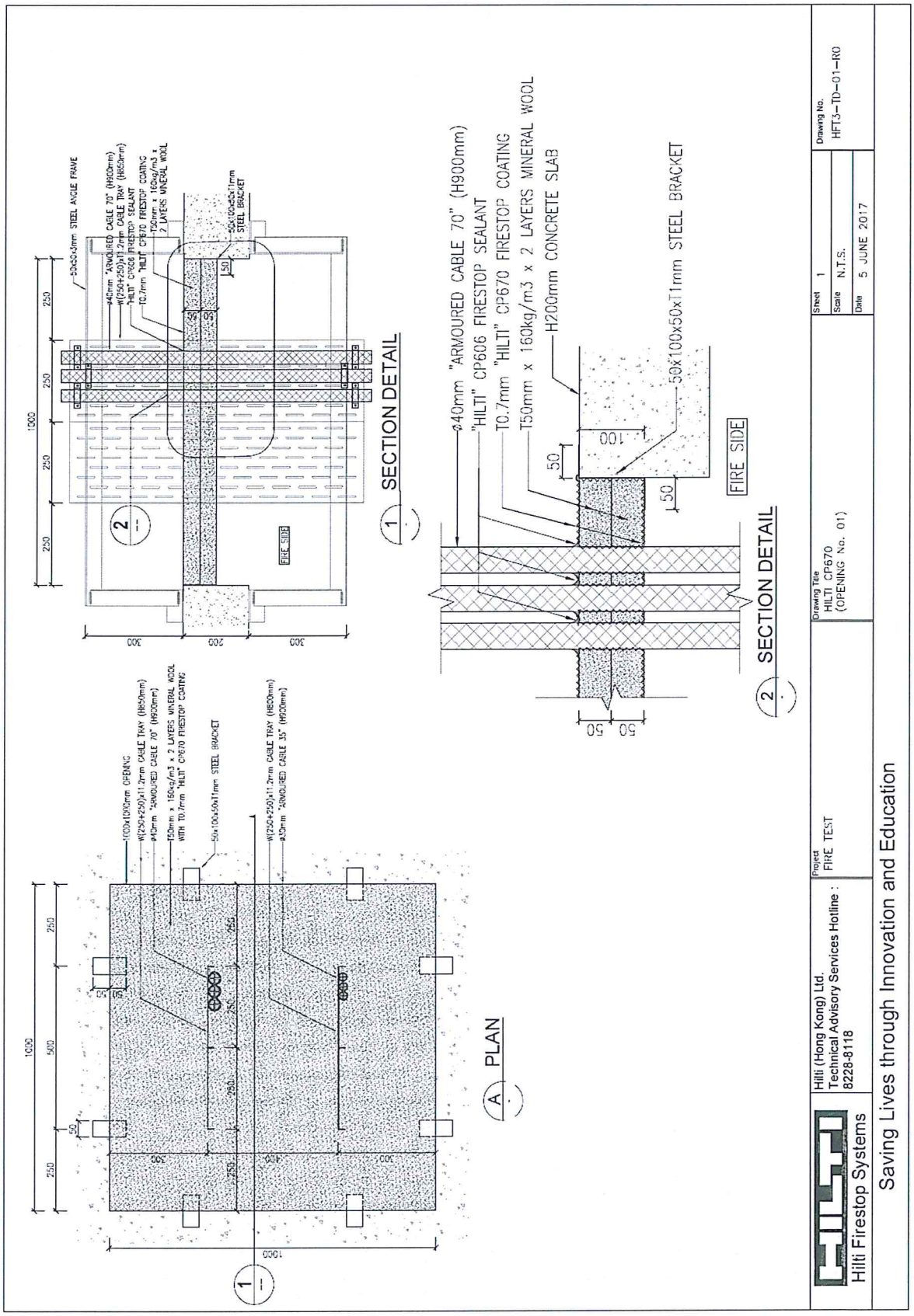
Item	Description	
1	**Trunking**	
	Overall dimensions	: 100 mm x 100 mm x 1 mm thick x 1,000 mm long.*
	Fixing details	: Fixed to 50 mm x 50 mm x 3 mm thick steel brackets, located at 300 mm from the concrete floor, by 2 nos. of M5 bolts and nuts (for each cable tray) on both sides. The steel brackets were supported by an external steel framework constructed by 50 mm x 50 mm x 3 mm steel brackets which in turn fixed to the concrete lining of test rig by 2 nos. of M10 anchor bolts.*
2	**Electric Cable**	
	Model	: CAT 6.
	Diameter	: 5 mm.*
	Material	: Copper with PVC coated.
	Applied locations	: Filled 60% of trunkings of specimen '6'.*
3	**Firestop Blocks**	
	Brand & Model	: Hilti firestop Block CFS-BL.#
	Material	: Intumescent polyurethane synthetic material.
	Density	: 240-440 kg/m^3.
	Applied locations	: Filled 40% of trunkings of specimen '6.*
4	**Firestop Foam**	
	Brand & Model	: Hilti firestop foam CFS-F FX.
	Material	: Acrylic based Polyol and Isozynad.
	Applied locations	: Filled the trunkings of specimen '6'.*
5	**Fire Sealant**	
	Brand & Model	: Hilti CP 606 flexible firestop sealant.#
	Material	: Acrylic based.
	Thickness	: 10 mm.
	Applied locations	: At the gaps between the specimens and concrete wall.

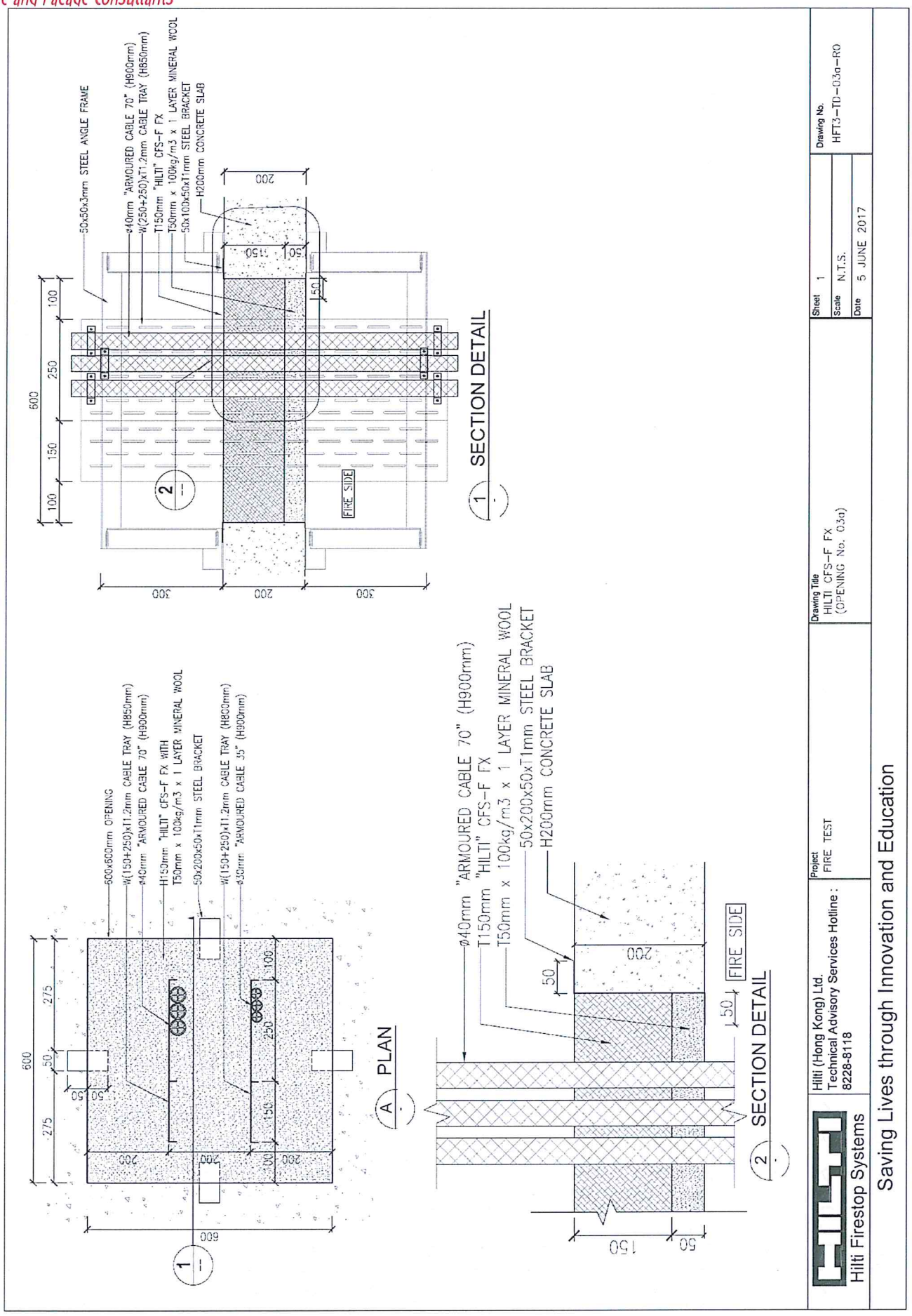
*Notes: * Verified on site by RED.*

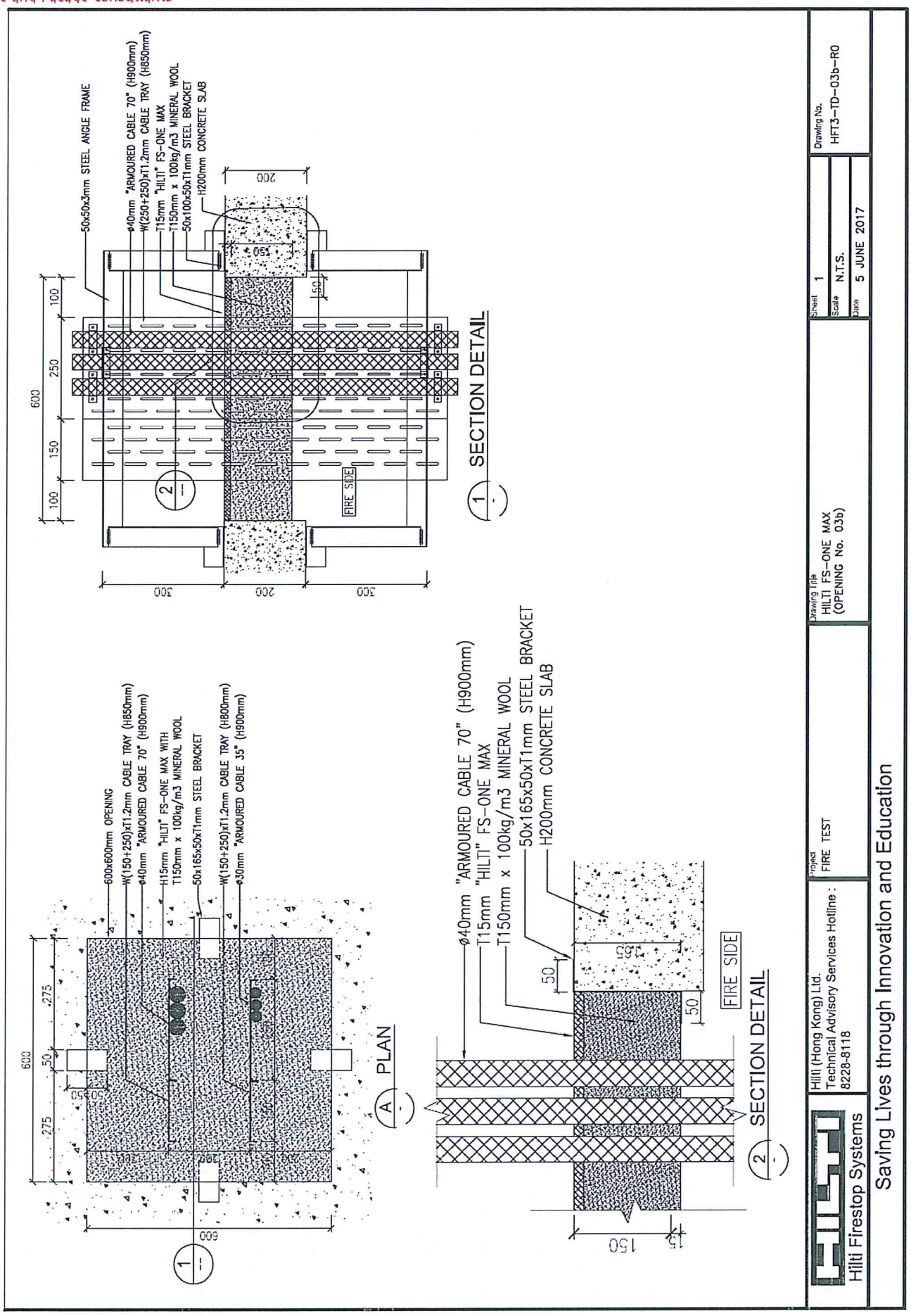
 # As shown on the test construction.

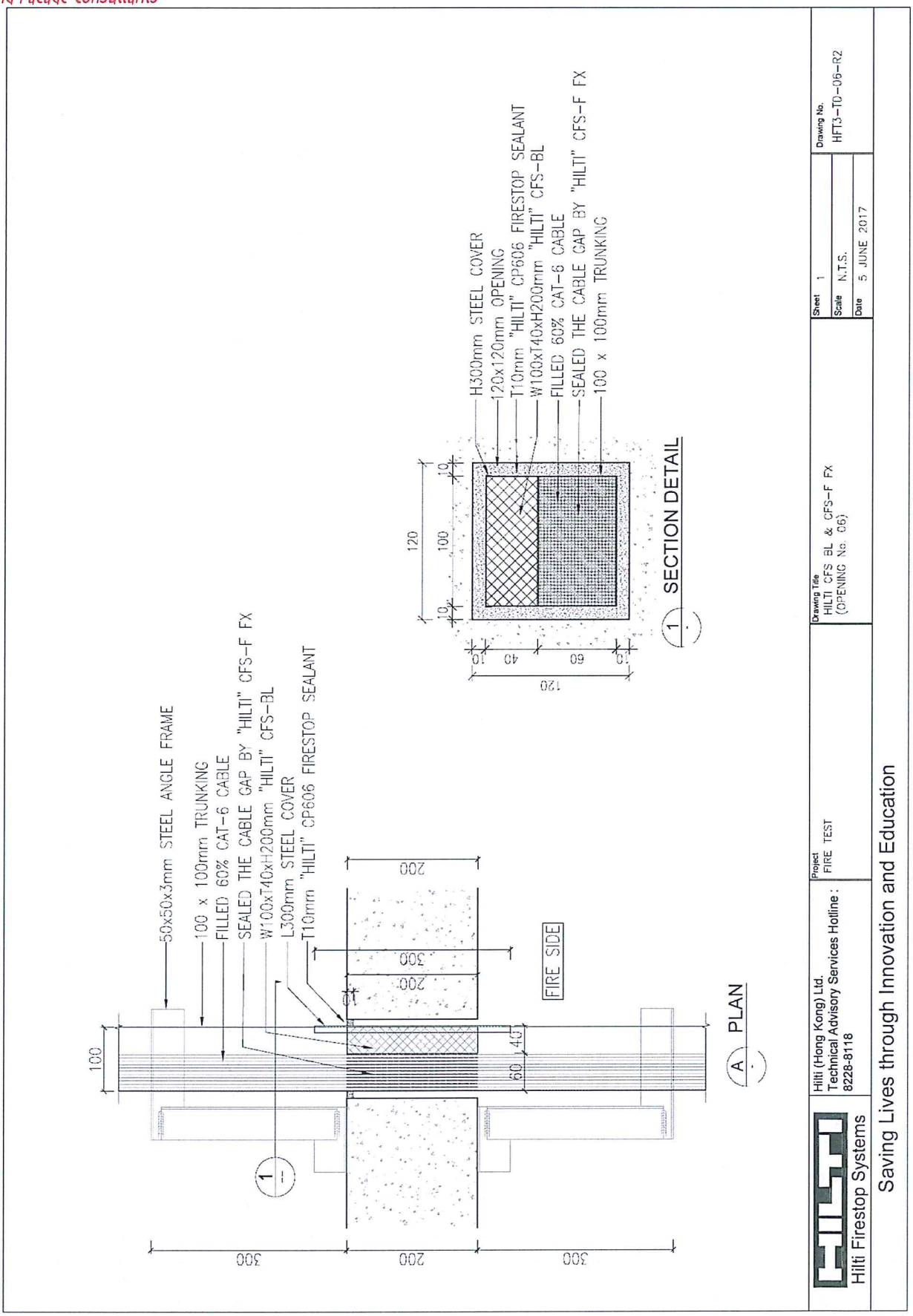
Drawings from Test Sponsor

(The drawings provided by test sponsor, which was not verified by RED, except those specified and described in 'information from test sponsor'.)




50x50x3mm STEEL ANGLE FRAME
ø40mm "ARMOURED CABLE 70" (H900mm)
W(250+250)x11.2mm CABLE TRAY (H850mm)
T150mm "HILTI" CFS-F FX
T50mm x 100kg/m3 x 1 LAYER MINERAL WOOL
50x100x50xT1mm STEEL BRACKET
H200mm CONCRETE SLAB
FIRE SIDE
SECTION DETAIL
600x600mm OPENING
W(150+250)x11.2mm CABLE TRAY (H850mm)
ø40mm "ARMOURED CABLE 70" (H900mm)
H150mm "HILTI" CFS-F FX WITH
T50mm x 100kg/m3 x 1 LAYER MINERAL WOOL
50x200x50xT1mm STEEL BRACKET
W(150+250)x11.2mm CABLE TRAY (H850mm)
ø30mm "ARMOURED CABLE 35" (H900mm)
PLAN
ø40mm "ARMOURED CABLE 70" (H900mm)
T150mm "HILTI" CFS-F FX
T50mm x 100kg/m3 x 1 LAYER MINERAL WOOL
50x200x50xT1mm STEEL BRACKET
H200mm CONCRETE SLAB
FIRE SIDE
SECTION DETAIL
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline :
8228-8118
Project FIRE TEST
Drawing Title HILTI CFS-F FX (OPENING No. 03a)
Sheet 1
Scale N.T.S.
Date 5 JUNE 2017
Drawing No. HFT3-TD-03a-RO
Hilti Firestop Systems
Saving Lives through Innovation and Education


50x50x3mm STEEL ANGLE FRAME
ø40mm "ARMOURED CABLE 70" (H900mm)
W(250+250)xT1.2mm CABLE TRAY (H850mm)
T15mm "HILTI" FS-ONE MAX
T150mm x 100kg/m3 MINERAL WOOL
50x100x50xT1mm STEEL BRACKET
H200mm CONCRETE SLAB
FIRE SIDE
SECTION DETAIL
600x600mm OPENING
W(150+250)xT1.2mm CABLE TRAY (H850mm)
ø40mm "ARMOURED CABLE 70" (H900mm)
H15mm "HILTI" FS-ONE MAX WITH
T150mm x 100kg/m3 MINERAL WOOL
50x165x50xT1mm STEEL BRACKET
W(150+250)xT1.2mm CABLE TRAY (H800mm)
ø30mm "ARMOURED CABLE 35" (H900mm)
PLAN
ø40mm "ARMOURED CABLE 70" (H900mm)
T15mm "HILTI" FS-ONE MAX
T150mm x 100kg/m3 MINERAL WOOL
50x165x50xT1mm STEEL BRACKET
H200mm CONCRETE SLAB
FIRE SIDE
SECTION DETAIL
Hilti Firestop Systems
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-8118
Project FIRE TEST
Drawing Title HILTI FS-ONE MAX (OPENING No. 03b)
Sheet 1
Scale N.T.S.
Date 5 JUNE 2017
Drawing No. HFT3-TD-03b-R0
Saving Lives through Innovation and Education



- End of report -

LEGEND
Technical Services, Inc.
www.legend-group.com
88 Empire Drive • St. Paul, Minnesota • 55103
(651) 642-1150 • fax (651) 642-1239

VOC Content Test Certificate

November 3, 2014

Supplier: Hilti Entwicklungsgesellschaft mbH
BU Chemicals
Hiltistrasse 6
86916 Kaufering
GERMANY

Sample Description: Hilti FS-One Max

Date Tested: October 16, 2014

Test Method: SCAQMD method 304-91 "Determination of Volatile Organic Compounds (VOC) in Various Materials" as referenced by South Coast Air Quality Management District (SCAQMD) Rule 1168. The values also comply with the requirements of EPA test method #24.

Test Data:

Specification	Product
LEED 2009 (LEED 3.0) **LEED 2.2** IEQ-4.1: Low-Emitting Materials – Adhesives and Sealants	**FS-One Max**
Green Building Council of Australia Green Star Office Design 3.0, IEQ-13 Green Star Office Design 2.0, IEQ-13 Green Star Office Interiors 1.1, IEQ-11	
Architectural Sealant; **VOC Limit: 250 g/L**	**Product contains: 9 g/L of VOC**

Tom Barrett
Vice President/Strategic Analytical Services

Scott Creekmur
Chemist

Buildings Department

屋宇署

Our Ref. 本署檔號：(24) BD GR/BM/2(185)
Your Ref. 來函檔號：
Tel. No. 電　話：848 2838
Fax No. 圖文傳真：840 0451

26 May 1994

Hilti (Hong Kong) Ltd.
Unit 3 5/F Harbour Centre Tower 2
8 Hok Cheung Street Hung Hom
Kowloon

Dear Sirs,

Fire Resisting Penetration Sealing System
As Supplied By Hilti (GB) Ltd.

Thank you for your letters dated 4.3.94 and 27.4.94 and the accompanying test/assessment reports on the above. You are asking for comments on the acceptability of the fire resisting product in the context of relevant provisions of the Buildings Ordinance, Chapter 123 of the Law of Hong Kong and its subsidiary legislation.

Under the Buildings Ordinance, "authorized persons" (i.e. architects, engineers or surveyors registered with the Building Authority) are required to supervise building works including the selection and installation of fire resisting products and to certify compliance with the Buildings Ordinance upon completion of works. Authorized persons are therefore responsible for ensuring the safety requirements inter alia of fire resisting products in the building projects which they have been appointed by the developer to coordinate and supervise.

In establishing the acceptability of fire resisting products, reference may be made to the performance standards laid down in Building (Construction) Regulation 90, the current Code of Practice for Fire Resisting Construction issued by the Building Authority and British Standard 476: Parts 20 to 24. Reliance may also be placed on the test/assessment report prepared by a recognized laboratory or an equivalent establishment.

The Buildings Department has a list of recognized laboratories. This is available for reference at our office :

Technical Administration (Building) Unit
Buildings Department
11/F Murray Building
Garden Road Hong Kong

Before fire resisting products are installed in a building project, the authorized person appointed for the project should be approached for advice and guidance.

Your test/assessment reports are returned herewith. In this respect, please note that paragraph 3 of my letter dated 25 January 1994 is no longer applicable. The delay in replying is regretted.

Yours faithfully,

(Patrick H. Tsui)
Technical Secretary/Building
for Director of Buildings

PT/fcy/ac

4/F-12/F, Murray Building, Garden Road, Hong Kong 香港花園道美利大廈四樓至十二樓

消 防 處
防 火 組
香港九龍尖沙咀東部康莊道1號
消防總部大廈

FIRE SERVICES DEPARTMENT,
FIRE PROTECTION BUREAU,
FIRE SERVICES HEADQUARTERS BUILDING,
No. 1 Hong Chong Road,
Tsim Sha Tsui, East, Kowloon,
Hong Kong.

本處檔號 Our Ref.: FPB 207/0005
來函檔號 Your Ref.: L026/92HK
電訊掛號 Telex: 39607 HKFSD HX
圖文傳真 Fax: 852-3110066
852-3689744
(24 小時 Hours)
電話 Tel. No.: 733 7596

29 April 1992

Hilti (Hong Kong) Ltd.,
Unit 3, 5/F, Harbour Centre,
Tower 2,
8 Hok Cheung Street,
Hunghom, Kowloon.

Dear Sirs,

"HILTI" Fire Prevention System

I refer to your letter of 30.3.92 and the enclosures attached thereto.

Based on the information contained in your letter under reference and the given test report, I understand that the captioned product is a building material which should be approved by the Director of Buildings and Lands. As such, I am not in a position to process your application and you are advised to refer your enquiry to the Director of Buildings and Lands, whose address is listed hereunder :-

The Director of Buildings and Lands,
(Attn.: Technical Secretary/Building, B.O.O.)
Murray Building,
Garden Road,
Central,
Hong Kong.

Please feel free to contact us should you have any other question in this matter.

Yours faithfully,

(TSE Yu-hing)
for Director of Fire Services

TYH/jt

ARCHITECTURAL SERVICES DEPARTMENT 建築署
QUEENSWAY GOVERNMENT OFFICES, 66 QUEENSWAY, HONG KONG. 香港金鐘道六十六號金鐘道政府合署
FAX 852-2869 0289

Our Ref : ASD 16/92101/AML/APP 06 June 1997
Your Ref. : --------
Tel. No. : 2867 3631
Fax No. : 2877 0594

Hilti (HK) Ltd
17/F, Tower 6, China HK City,
33 Canton Rd,. TST

Dear Sirs,

Architectural Services Department
List of Acceptable Materials
Hilti Firestop Products
Ref. no. 0001P

I am pleased to inform you that approval has been given to include the above product/material in this Department's List of Acceptable Materials. Initially, this listing is for a probationary status and this will be reviewed after the submission of satisfactory performance reports on completion of projects undertaken by this Department where your product has been used.

The Architectural Services Department List of Acceptable Materials is a restricted internal document. This letter should not be used for commercial or marketing purposes and failure to comply with this may result in the removal of the product from the List.

Yours faithfully,

WM Tang

(W.M. TANG)
Technical Secretary/2
for Chief Architect/ Central Management Branch
Architectural Services Department

Filecode : 95202 - LIST_LE.DOC
WMT/WHY/by

Attn. : To whom it may concern

Date : 26 September 2023
Ref. : 113/FP/DY/23

Subject : Country of Origin- Hilti FS-ONE MAX High Performance Intumescent Firestop Sealant

Dear Sir / Madam,

Enclosed please find the information of Hilti FS-ONE MAX High Performance Intumescent Firestop Sealant. .

Brand Name : Hilti

Model Name : Hilti FS-ONE MAX High Performance Intumescent Firestop Sealan

Manufacturer : Hilti Corporation

Address of Manufacturer : FL-9494, Principality of Liechtenstein.

Manufacturer Contact Person : Dennis Yeung

Supplier : Hilti (Hong Kong) Ltd

Address of Supplier : 701-704, 7/F, Tower A, Manulife Financial Centre,
223 Wai Yip Street, Kwun Tong, Kowloon, Hong Kong

Supplier Contact Person : Dennis Yeung (+852 9723 4621)

Country of Origin : Germany

Should you have further questions, please do not hesitate to contact our Technical Representatives, Customer Service Hotline at 8228-8118, or email us at hksales@hilti.com.

Yours faithfully,

Dennis Yeung
Head of Product Leadership Strategy, F&P

Hilti (Hong Kong) Ltd.
701-704 | Tower A | Manulife Financial Centre
223 Wai Yip Street | Kwun Tong
Kowloon | Hong Kong
P +852-8228 8118 I **F** +852-2954 1751
www.hilti.com.hk

Date: 24 June 2021

Ref.: 045/FP/BL/21

Subject: FS-ONE MAX High Performance Intumescent Firestop Sealant – LEED Information

To Whom It May Concern:

- The FS-ONE MAX High Performance Intumescent Firestop Sealant is manufactured in Germany.
- There is no post-consumer or post-industrial content in the Hilti FS-ONE MAX and it cannot be recycled.
- FS-ONE MAX is not regulated as a hazardous waste by the Federal EPA Standards. The regulations for the disposal of non-regulated industrial waste can vary from state to state and even city to city. For this reason, you should consult your local and state regulatory agencies for direction on disposal.
- The VOC content of the Hilti FS-ONE MAX is 9 g/l.

If you would like to know more about Hilti solutions for LEED buildings or should you have any further questions, please do not hesitate to contact our Customer Service Hotline at 8228-8118 or email us at hksales@hilti.com.

Yours faithfully,

Bill Lee
Product Portfolio Manager
Hilti (Hong Kong) Ltd.

Hilti (Hong Kong) Ltd.
701-704 | Tower A | Manulife Financial Centre
223 Wai Yip Street | Kwun Tong
Kowloon | Hong Kong
P +852-8228 8118 I **F** +852-2954 1751
www.hilti.com.hk

FS-ONE MAX; CFS-FIL

Safety Data Sheet

according to the United Nations GHS (Rev. 4, 2011)

Date of issue: 12/03/2019 Revision date: 12/03/2019 Supersedes: 17/12/2015

Version: 1.3

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form	Mixture
Trade name	FS-ONE MAX; CFS-FIL
Product code	BU Fire Protection

1.2. Relevant identified uses of the substance or mixture and uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet

Hilti (Hong Kong) Ltd.
701-704, 7/F, Tower A, Manulife Financial Centre
223 Wai Yip Street, Kwun Tong
Kowloon - Hong Kong
T +852 27734 700
hksales@hilti.com

Supplier
Hilti (Hong Kong) Ltd.
701-704, 7/F, Tower A, Manulife Financial Centre
223 Wai Yip Street, Kwun Tong
Kowloon - Hong Kong
T +852 27734 700
hksales@hilti.com

Department issuing data specification sheet
Hilti AG
Feldkircherstraße 100
9494 Schaan - Liechtenstein
T +423 234 2111
chemicals.hse@hilti.com

1.4. Emergency telephone number

Emergency number	Schweizerisches Toxikologisches Informationszentrum – 24h Service +41 44 251 51 51 (international) +852 27734 700

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to the United Nations GHS (Rev. 4, 2011)

Not classified

2.2. Label elements

Labelling according to the United Nations GHS (Rev. 4, 2011)

No labelling applicable

2.3. Other hazards

No additional information available

SECTION 3: Composition/information on ingredients

3.1. Substances

Not applicable

3.2. Mixtures

This mixture does not contain any substances to be mentioned according to the applicable regulations

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures after inhalation	Get medical advice/attention if you feel unwell.
First-aid measures after skin contact	Wash skin with plenty of water. If skin irritation occurs: Get medical advice/attention.
First-aid measures after eye contact	Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
First-aid measures after ingestion	Get medical advice/attention if you feel unwell.

4.2. Most important symptoms and effects, both acute and delayed

No additional information available

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media	Water spray. Dry powder. Foam. Carbon dioxide.

5.2. Special hazards arising from the substance or mixture

No additional information available

5.3. Advice for firefighters

Protection during firefighting	Self-contained breathing apparatus. Complete protective clothing.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1.For non-emergency personnel

No additional information available

6.1.2.For emergency responders

Protective equipment	For further information refer to section 8: "Exposure controls/personal protection".

6.2. Environmental precautions

No additional information available

6.3. Methods and material for containment and cleaning up

Methods for cleaning up	Mechanically recover the product.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling	Wear personal protective equipment.
Hygiene measures	Wash contaminated clothing before reuse. Do not eat, drink or smoke when using this product. Always wash hands after handling the product.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions	Keep cool. Store in a dry place.
Storage temperature	5 - 25 °C

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Additional information	The product has a pasty consistency. Exposure limit values for respirable dusts are not relevant for this product.

8.2. Appropriate engineering controls

No additional information available

8.3. Individual protection measures, such as personal protective equipment (PPE)

Hand protection: Protective gloves. EN 374

Type	Material	Permeation	Thickness (mm)	Penetration	Standard
Disposable gloves	Nitrile rubber (NBR)	1 (> 10 minutes)	>0.4		EN 374

Eye protection: Chemical goggles or safety glasses

Type	Use	Characteristics	Standard
Safety glasses			EN 166, EN 170

Skin and body protection: Wear suitable protective clothing

8.4. Exposure limit values for the other components

No additional information available

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	Solid
Appearance	Pasty.
Molecular mass	Not determined
Colour	red.
Odour	characteristic.

Odour threshold	Not determined
pH	≈ 7.85
Relative evaporation rate (butylacetate=1)	No data available
Melting point	Not applicable
Freezing point	No data available
Boiling point	No data available
Flash point	Not applicable
Auto-ignition temperature	No data available
Decomposition temperature	No data available
Flammability (solid, gas)	Not applicable
Vapour pressure	No data available
Relative vapour density at 20 °C	No data available
Relative density	No data available
Density	≈ 1.35 g/cm³
Solubility	No data available
Log Pow	No data available
Viscosity, kinematic	No data available
Viscosity, dynamic	No data available
Explosive properties	No data available
Oxidising properties	No data available
Explosive limits	No data available

9.2. Other information

VOC content 9 g/l

SECTION 10: Stability and reactivity

10.1. Reactivity

The product is non-reactive under normal conditions of use, storage and transport.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

No dangerous reactions known under normal conditions of use.

10.4. Conditions to avoid

None under recommended storage and handling conditions (see section 7).

10.5. Incompatible materials

No additional information available

10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity (oral) Not classified

Acute toxicity (dermal)	Not classified
Acute toxicity (inhalation)	Not classified
Skin corrosion/irritation	Not classified pH: ≈ 7.85
Serious eye damage/irritation	Not classified pH: ≈ 7.85
Respiratory or skin sensitisation	Not classified
Germ cell mutagenicity	Not classified
Carcinogenicity	Not classified
Reproductive toxicity	Not classified
STOT-single exposure	Not classified
STOT-repeated exposure	Not classified
Aspiration hazard	Not classified

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general	The product is not considered harmful to aquatic organisms nor to cause long-term adverse effects in the environment.
Acute aquatic toxicity	Not classified
Chronic aquatic toxicity	Not classified

12.2. Persistence and degradability

No additional information available

12.3. Bioaccumulative potential

No additional information available

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Ozone	Not classified
Other adverse effects	No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste treatment methods	Dispose in a safe manner in accordance with local/national regulations.
Product/Packaging disposal recommendations	Dispose in a safe manner in accordance with local/national regulations.

SECTION 14: Transport information

In accordance with ADR / RID / IMDG / IATA / ADN

ADR	IMDG	IATA	RID
14.1. UN number			
Not applicable	Not applicable	Not applicable	Not applicable
14.2. UN proper shipping name			
Not applicable	Not applicable	Not applicable	Not applicable
14.3. Transport hazard class(es)			
Not applicable	Not applicable	Not applicable	Not applicable
14.4. Packing group			
Not applicable	Not applicable	Not applicable	Not applicable
14.5. Environmental hazards			
Dangerous for the environment : No	Dangerous for the environment : No Marine pollutant : No	Dangerous for the environment : No	Dangerous for the environment : No
No supplementary information available			

14.6. Special precautions for user

- Overland transport

- Transport by sea

No data available

- Air transport

No data available

- Rail transport

Carriage prohibited (RID) No

14.7. Transport in bulk according to Annex II of MARPOL and the IBC Code

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

No additional information available

SECTION 16: Other information

SDS Major/Minor	None
Date of issue	12/03/2019
Revision date	12/03/2019
Supersedes	17/12/2015

Indication of changes:

Section	Changed item	Change	Comments
			general update
			layout

SDS_UN_Hilti

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

Hilti FS-ONE MAX High-Performance Intumescent Firestop Sealant Job Reference

Year	Project Name	Customer Name	Project type
2020	HKIA AIRPORT SKYCITY REGAL HOTEL	FEI LUNG ENGINEERING CO LTD	Hospitality
2021	HKIA AIRPORT SKYCITY REGAL HOTEL	FEI LUNG ENGINEERING CO LTD	Hospitality
2021	TO SHEK ST (609)	FEI LUNG ENGINEERING CO LTD	Residential
2023	6 DAI SHING ST - MAXIM'S ADVANCED SMART FOOD MANUFACT	CR CONSTRUCTION COMPANY LIMITED	Industrial