Hilti CFS-C EL Firestop Collar Endless

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

Firestop collar endless CFS-C EL NEW

APPLICATIONS

- Suitable for use on shaft walls, coated board, drywall, aerated concrete, masonry and concrete
- Zero distance required to CFS-C EL firestop endless collar
- Approved for use with PVC, PP, PE and a wide array of standard acoustic pipes.
- Configurations tested include pipe elbows, inclined pipes and pipes with limited clearance to the wall
- Acoustic pipes tested with insulation and sound decoupling

ADVANTAGES

- Flexible solution for waste water, roof drainage and pneumatic pipes
- Problem solver for non-standard applications
- Endless solution: one product for all applications
- Well-suited to complex pipe configurations
- Easy installation

Acoustic

Mould & Mildew

Technical data	
Base materials	Drywall, Aerated concrete, Concrete, Masonry
Expansion temperature (approx.)	210 °C
Expansion ratio (unrestricted, up to)	1:19
Storage and transportation temperature range	-30 - 50 °C
Length	3 m

Order Now

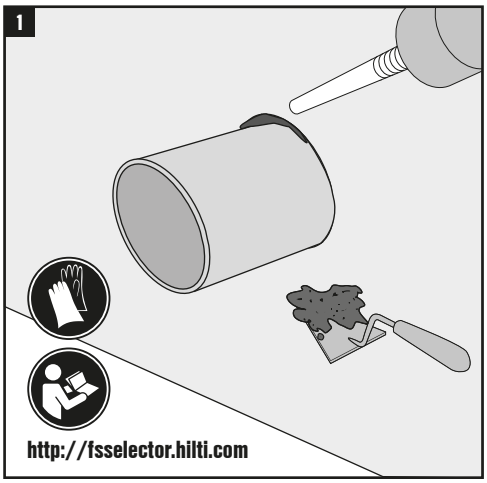
Watch Video

Ordering designation	Pipe diameter - range	Package contents	Sales pack quantity	Item number
CFS-C EL	16 -160 mm	1x Firestop bandage CFS-C EL, 18x Closure plate CFS-C EL, 22x Hook CFS-C EL short	1 pc	**2075120**

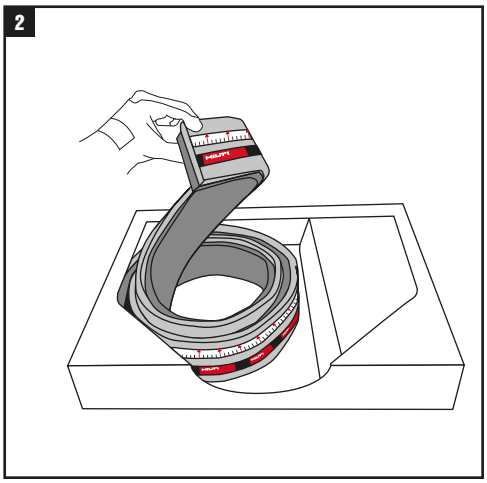
Please visit Hilti website for the latest item numbers and related products

2079278 A1-05.2014

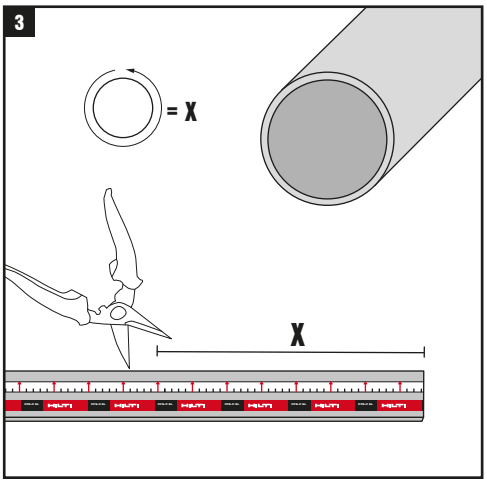
1



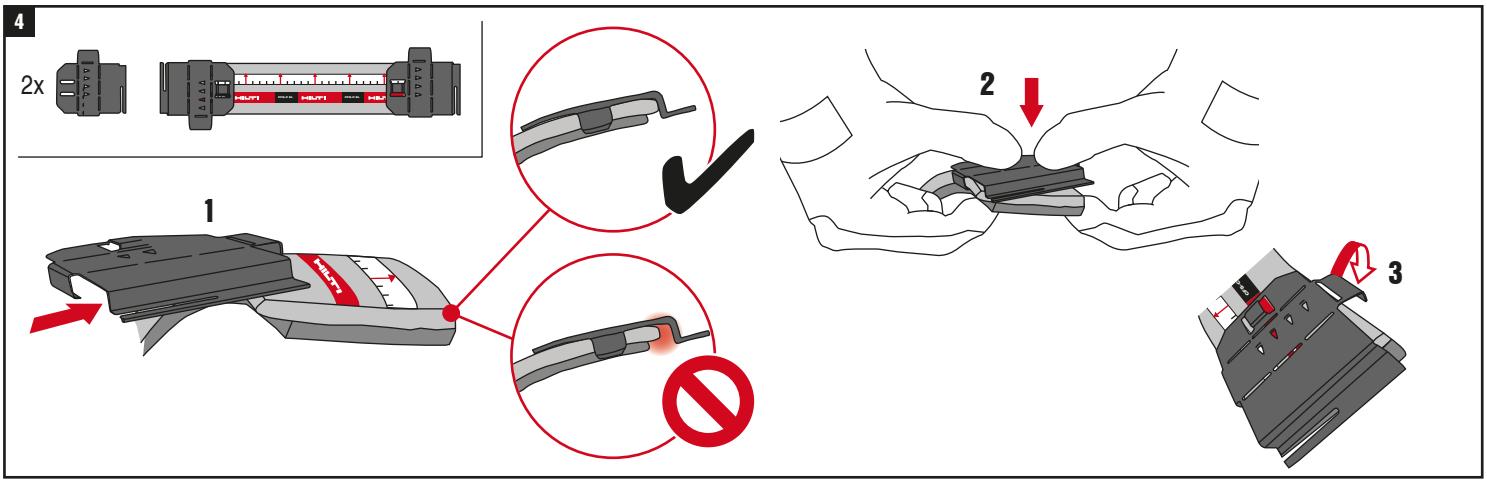
2



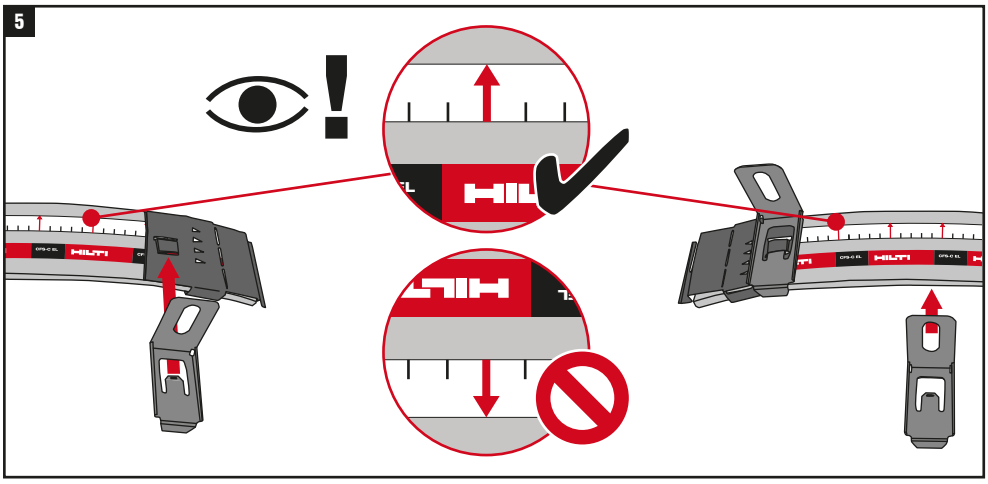
3



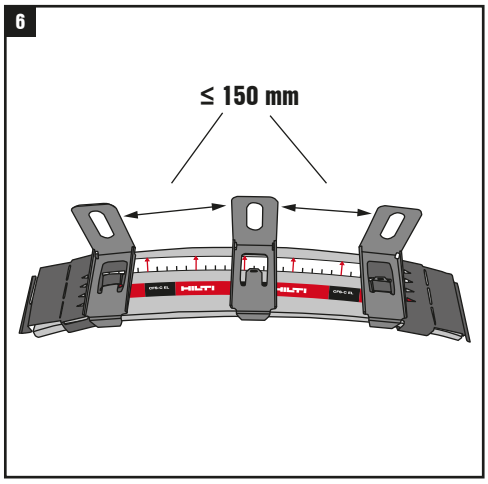
4



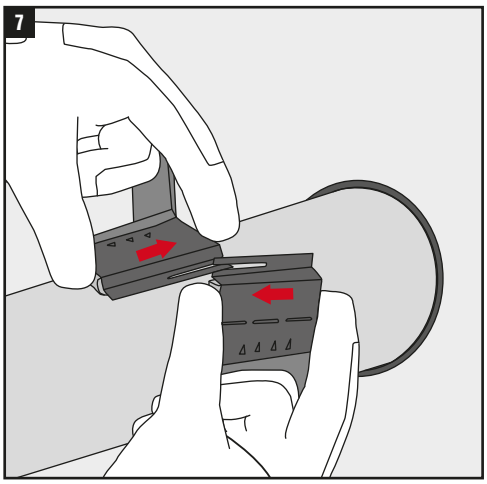
5



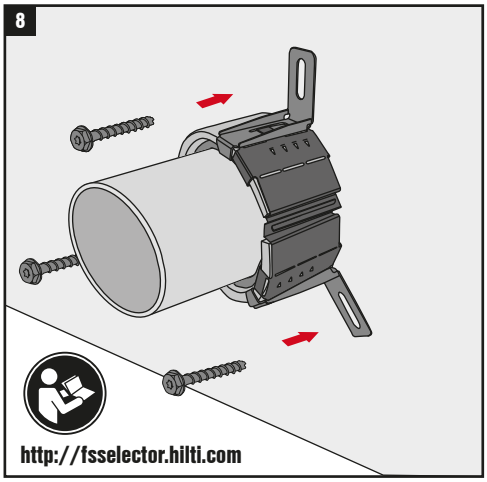
6



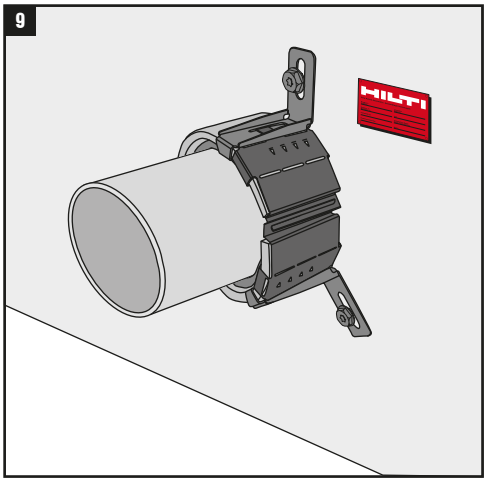
7



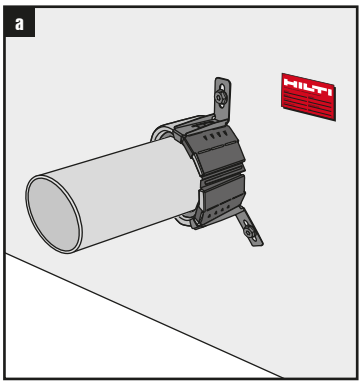
8



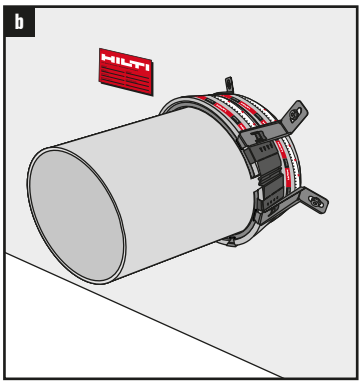
9



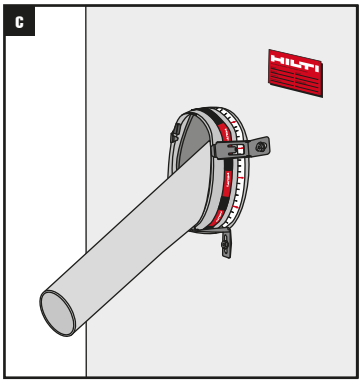
a



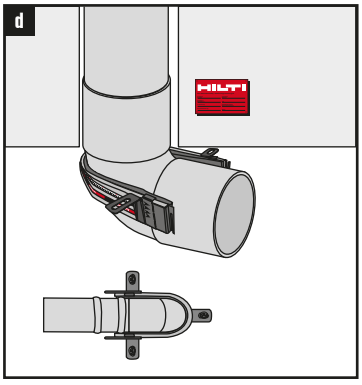
b



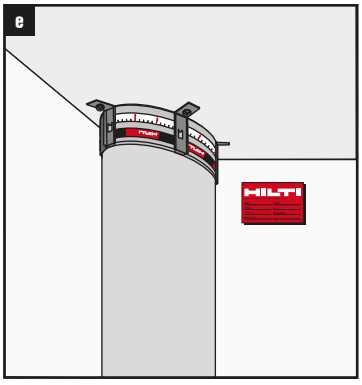
c

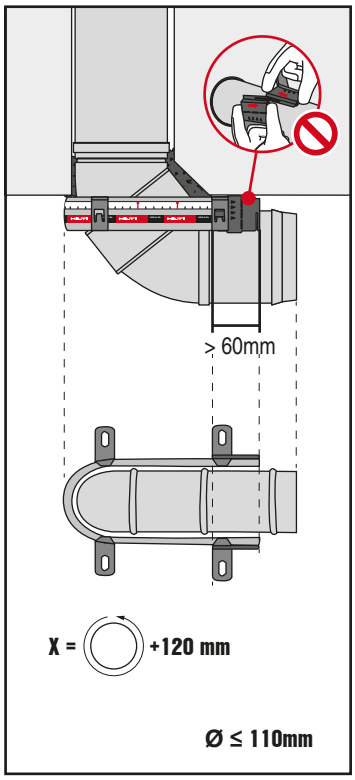


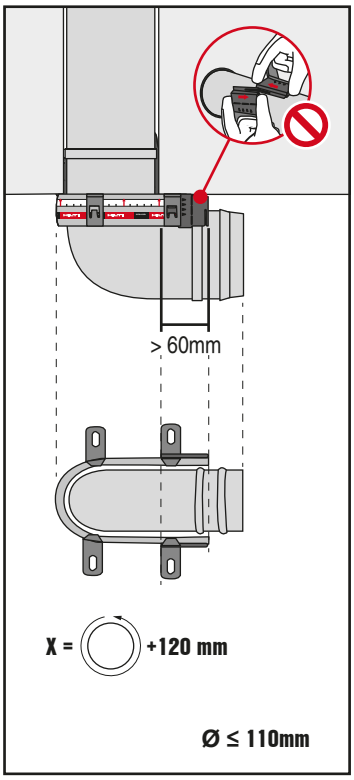
d

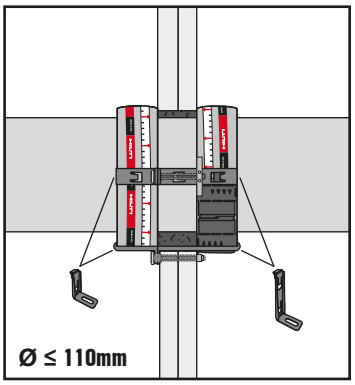


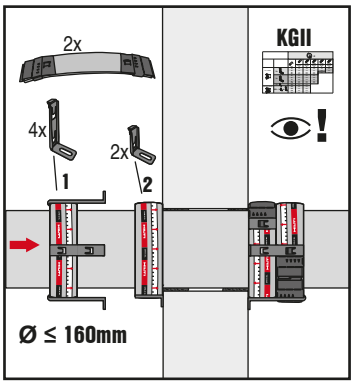
e

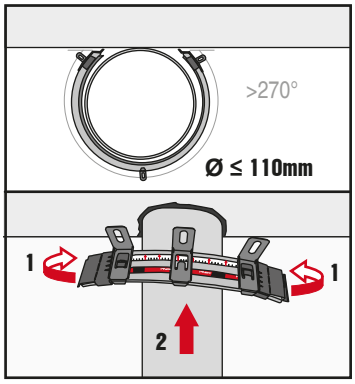


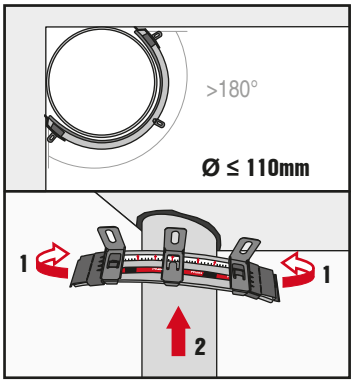


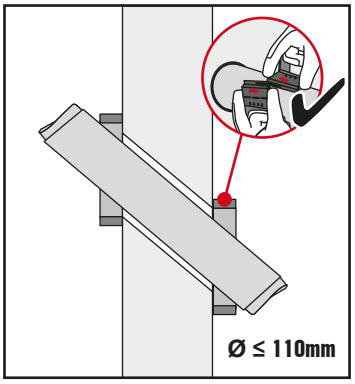








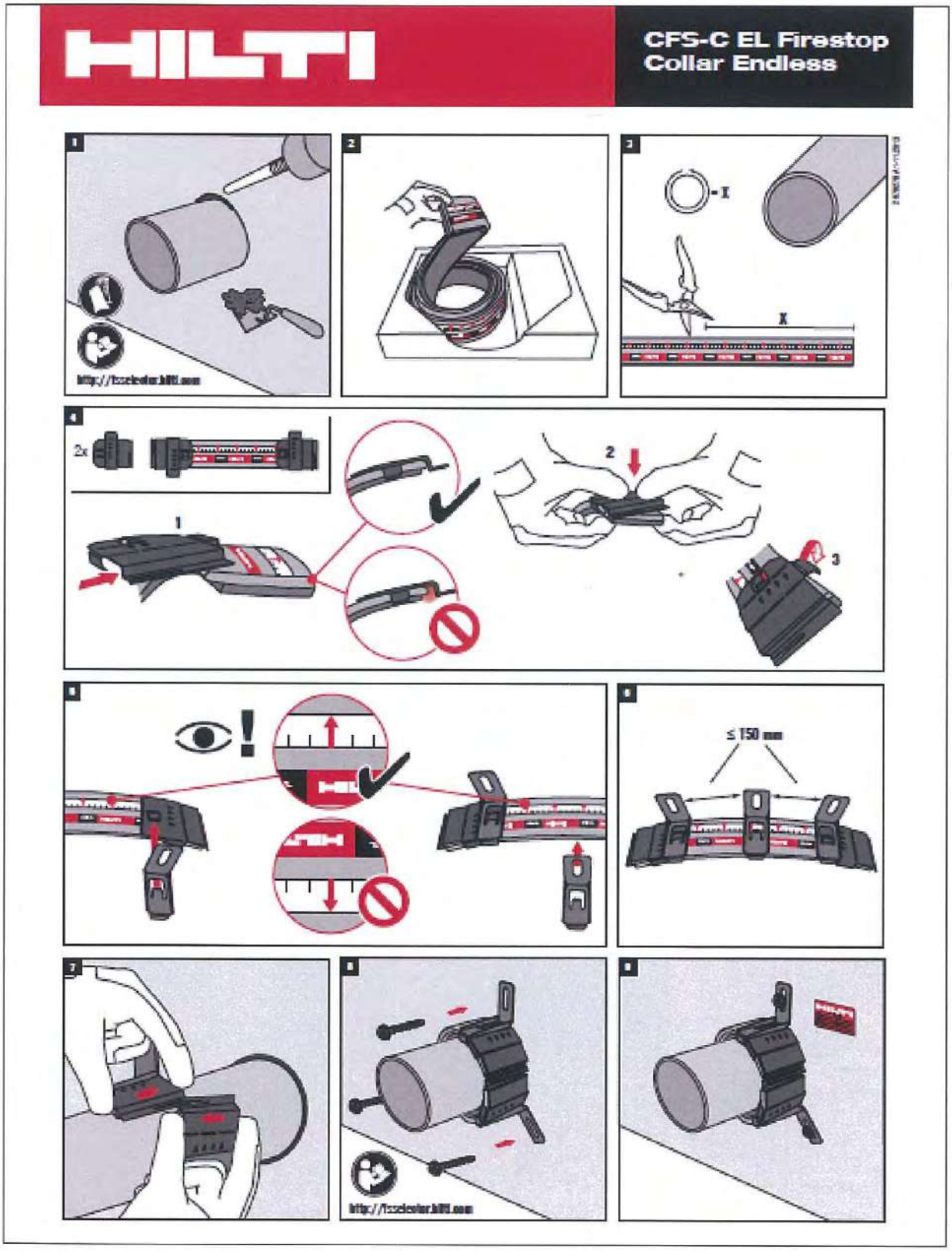




= X		Ø mm	-	4 mm	9 mm	13 mm	25 mm
			CFS C-EL mm	CFS C-EL mm	CFS C-EL mm	CFS C-EL mm	CFS C-EL mm
Ø ≤ 125mm	2x	16	130	130	160	180	260
		32	150	180	210	230	310
		40	180	200	230	260	340
		50	210	230	270		
	3x	56	230	250	290		
		63	250	280	310		
		75	290	310	340		
		90	340	360	390		
		110	400	420	450		
125 ≤ Ø ≤ 160mm	KGII= 2x 4x	125	450	470	500		
		135	480	500	530		
		140	490	520	550		
		160	560	580	610		

Member of EOTA

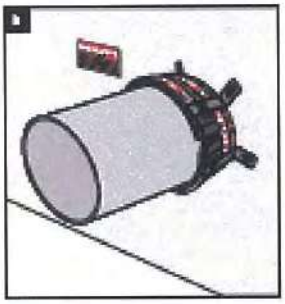
ANNEX 5
INSTRUCTION FOR USE

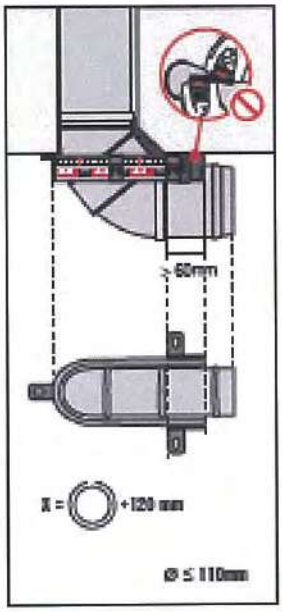


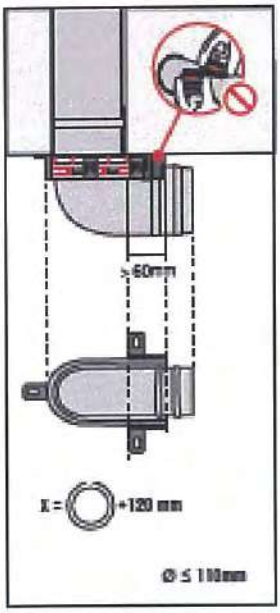
OiB Member of EOTA

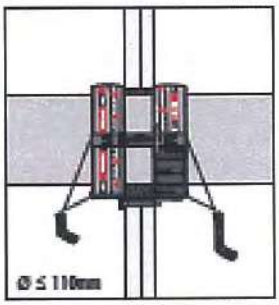
HILTI

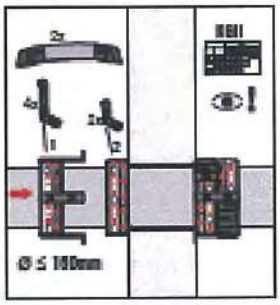
CFS-C EL Firestop Collar Endless

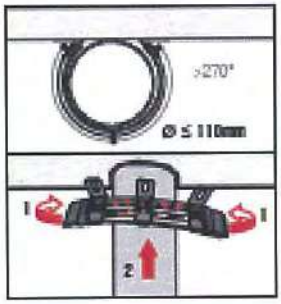


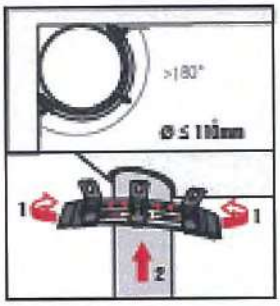


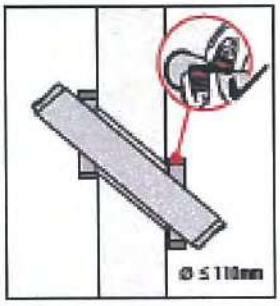


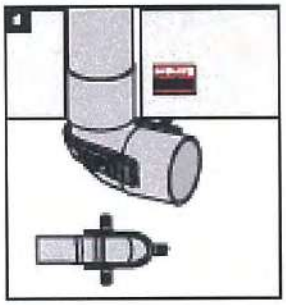












= X	mm	-	4 mm	8 mm	13 mm	26 mm
		CFS C-EL mm	CFS C-EL mm	CFS C-EL mm	CFS C-EL mm	CFS C-EL mm
Ø ≤ 125mm, 2x	18	130	130	155	180	260
	32	150	175	205	230	310
	40	175	200	230	260	335
	50	205	230	265		
3x	50	225	250	285		
	63	250	275	305		
	75	285	310	340		
	90	335	360	390		
	110	395	420	450		
4x	125	445	470	500		
125 ≤ Ø ≤ 160mm, KBII= 2x 4x	125	445	470	500		
	135	475	500	530		
	140	490	515	545		
	160	555	580	610		

OIB-205-098/15-028

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

On 6 nos. of PVC Pipes and Conduits (Specimens '20', '22', '23', '24', '25' and '26')

Test Report No.: R16L28-1C

Identification No.: Q16L45-1

Issue Date: 11 September 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:** 11 SEP 2017

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

CONTENT

1 SUMMARY

Fire resistance test conducted in accordance with BS 476: Part 20: 1987 on 6 nos. of PVC pipes and conduits (specimens '20', '22', '23', '24', '25' and '26')

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 PVC pipes and conduits, namely specimens '20', '22', '23', '24', '25' and '26' (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 '20', '22', and '23' were asymmetrical and the fire side of specimen was determined by the test sponsor. The specimens '24', '25', and '26' were symmetrical and only one side of specimen was tested as per test sponsor's request.

Specimen '20' was comprised of 2 nos. of 50 mm internal diameter by nominal 2.5 mm thick by 1,400 mm long PVC pipes filled with a layer of 20 mm thick 'ROCKWOOL' mineral wool boards with density of 100 kg/m^3 with and 'Hilti CP606' sealant. The pipes were protected by 'CFS-CID 50' firestop cast-in device.

Specimen '22' was comprised of 1 no. of 50 mm internal diameter by nominal 2.5 mm thick by 1,400 mm long PVC pipe filled with a layer of 20 mm thick 'ROCKWOOL' mineral wool boards with density of 100 kg/m^3 with and 'Hilti CP606' sealant. The pipe was protected by 'CFS-CID 50' firestop cast-in device.

Specimen '23' was comprised of 1 no. of 150 mm internal diameter by nominal 2.5 mm thick by 1,400 mm long PVC pipe filled with a layer of 20 mm thick 'ROCKWOOL' mineral wool boards with density of 100 kg/m^3 with and 'Hilti CP606' sealant. The pipe was protected by 'CFS-CID 160' firestop cast-in device.

Specimen '24' was comprised of 1 no. of 32 mm diameter by nominal 2.5 mm thick by 1,400 mm long PVC conduit filled with 'Hilti CP606' sealant. The conduit was protected by 2 nos. of 'CFS-D 25' firestop cable disc.

Specimen '25' was comprised of 1 no. of 25 mm internal diameter by nominal 1.5 mm thick by 1,400 mm long PVC conduit filled with 'Hilti CP606' sealant. The conduit was protected by 1 no. of 'CFS-D 25' firestop cable disc.

Specimen '26' was comprised of 1 no. of 150 mm internal diameter by nominal 5 mm thick by 1,400 mm long PVC pipe filled with a layer of 20 mm thick 'ROCKWOOL' mineral wool boards with density of 100 kg/m^3 with and 'Hilti CP606' sealant. The pipe was protected by 2 stacks of 'CFS-C EL' firestop endless collars.

All specimens were penetrated through a nominal 200 mm thick concrete wall. The PVC pipes and conduits were fixed to 42 mm by 20 mm by 3 mm thick steel channels, located at 500 mm from the concrete wall, by nominal 3 mm thick rings 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 '20'	**121** Minutes (No failure)	N/A
Specimen '22'	**121** Minutes (No failure)	N/A
Specimen '23'	**121** Minutes (No failure)	**96** Minutes
Specimen '24'	**121** Minutes (No failure)	N/A
Specimen '25'	**121** Minutes (No failure)	N/A
Specimen '26'	**121** Minutes (No failure)	**48** 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 6 nos. of PVC pipes and conduits 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).

Ten (10) '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 ten (10) thermocouples fixed to the unexposed surface (see Figure 2 for the locations and reference numbers of the thermocouples).

Thermocouples S32 and S34 were fixed at 100 mm away from the concrete wall for monitoring both of the mean and maximum surface temperatures of specimen '23'. Thermocouples S30 and S31 were fixed at 50 mm away from the concrete wall for monitoring the maximum surface temperature of specimen '23' only. Thermocouples S28 and S29 were fixed at 100 mm away from the concrete wall for monitoring both of the mean and maximum surface temperatures of specimen '26'. Thermocouples S26 and S27 were fixed at 50 mm away from the concrete wall for monitoring the maximum surface temperature of specimen '26' only. Thermocouple S18 was fixed on specimen '22' and thermocouple S13 was fixed on specimen '25' 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 '22' was shown graphically in Figure 4.

The mean and maximum temperatures of the unexposed surface of specimen '23' were shown graphically in Figure 5.

The maximum temperatures of the unexposed surface of specimen '25' was shown graphically in Figure 6.

The mean and maximum temperatures of the unexposed surface of specimen '26' were shown graphically in Figure 7.

The furnace pressure was shown graphically in Figure 8.

The radiation was shown graphically in Figure 9.

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 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 '20'	**121** Minutes (No failure)	N/A
Specimen '22'	**121** Minutes (No failure)	N/A
Specimen '23'	**121** Minutes (No failure)	**96** Minutes
Specimen '24'	**121** Minutes (No failure)	N/A
Specimen '25'	**121** Minutes (No failure)	N/A
Specimen '26'	**121** Minutes (No failure)	**48** 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 '23'

The 140 °C rise of the mean temperature of the unexposed surface of specimen did not reach during the test. 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 398 °C measured by thermocouple S31 after a heating period of 121 minutes.

Specimen '26'

The 140 °C rise of the mean temperature of the unexposed surface of specimen reached after a heating period of 91 minutes. The 180 °C rise of the maximum temperature of the unexposed surface of specimen reached and measured by thermocouple S26 after a heating period of 48 minutes. The maximum temperature rise was 283 °C measured by thermocouple S26 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 '20'

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

Specimen '22'

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

Specimen '23'

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

Specimen '24'

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

Specimen '25'

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

Specimen '26'

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

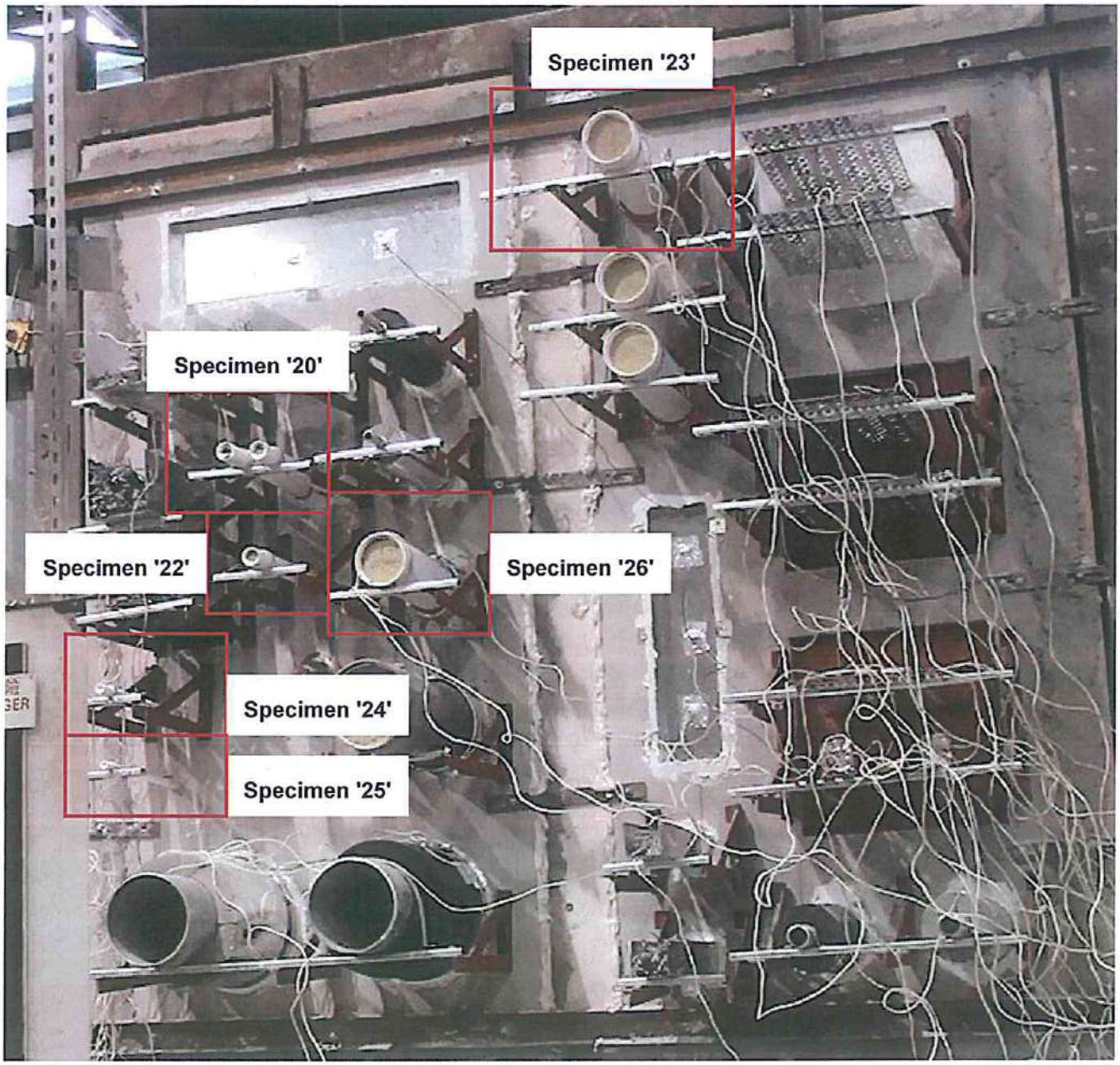


Photo 1: The unexposed face of the specimens before the test.

Note: In this test report, only specimens '20', '22', '23', '24', '25' and '26' were considered.

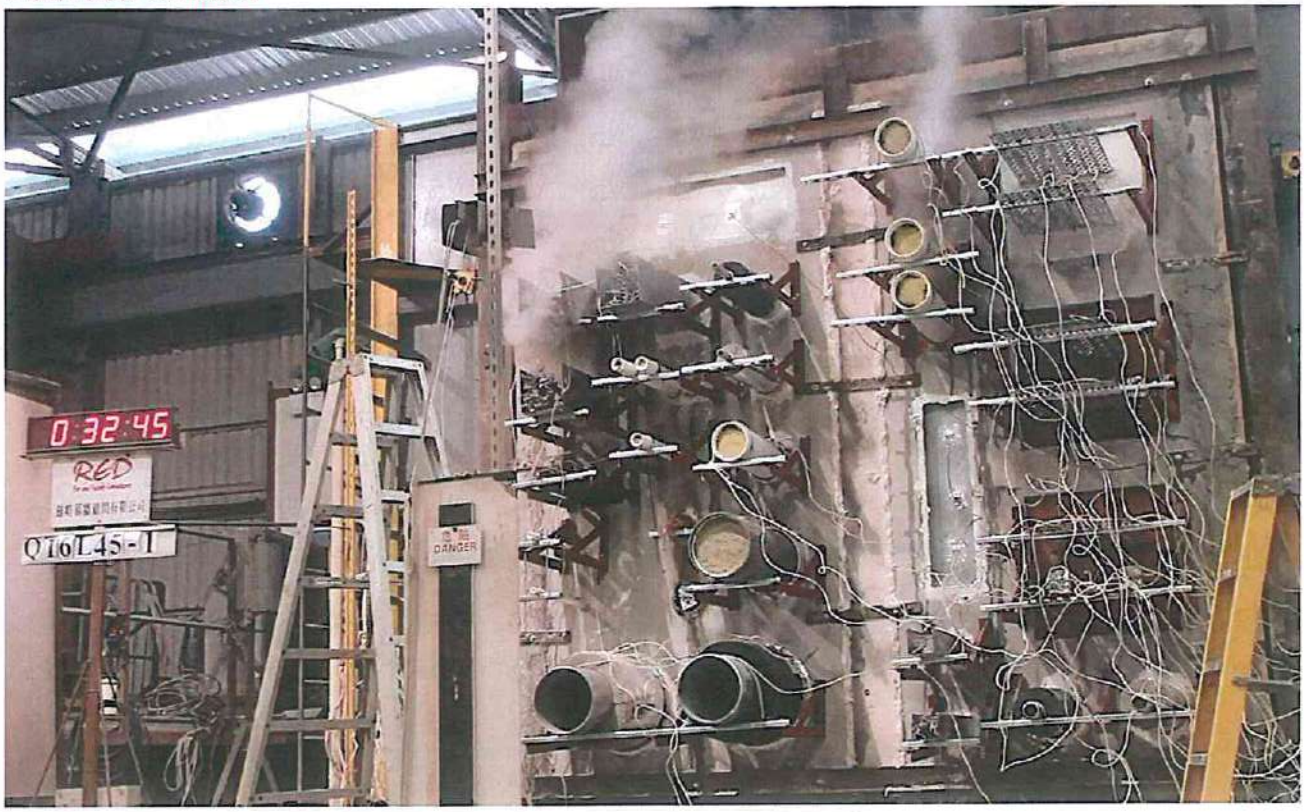


Photo 2: The unexposed face of the specimens after a heating period of 32 minutes.

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

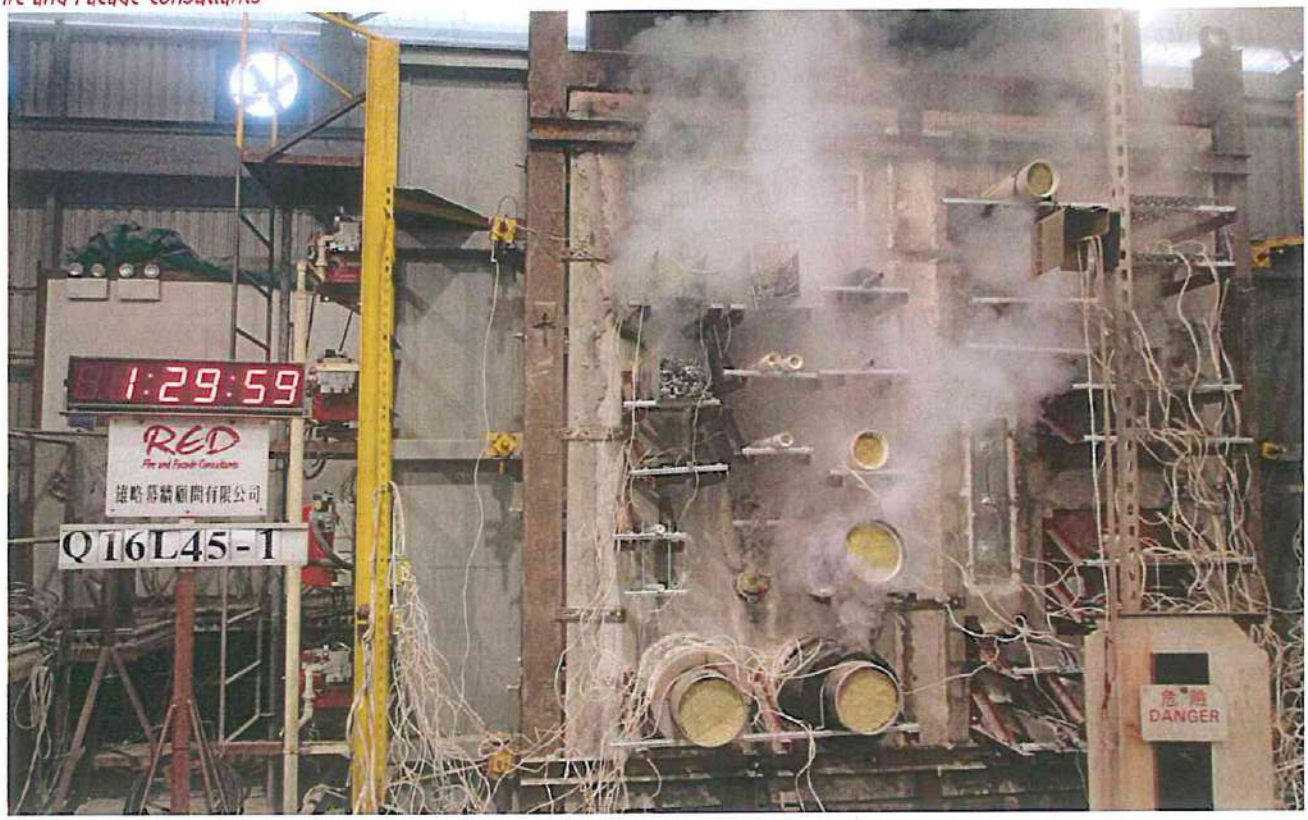


Photo 4: The unexposed face of the specimens after a heating period of 89 minutes.

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

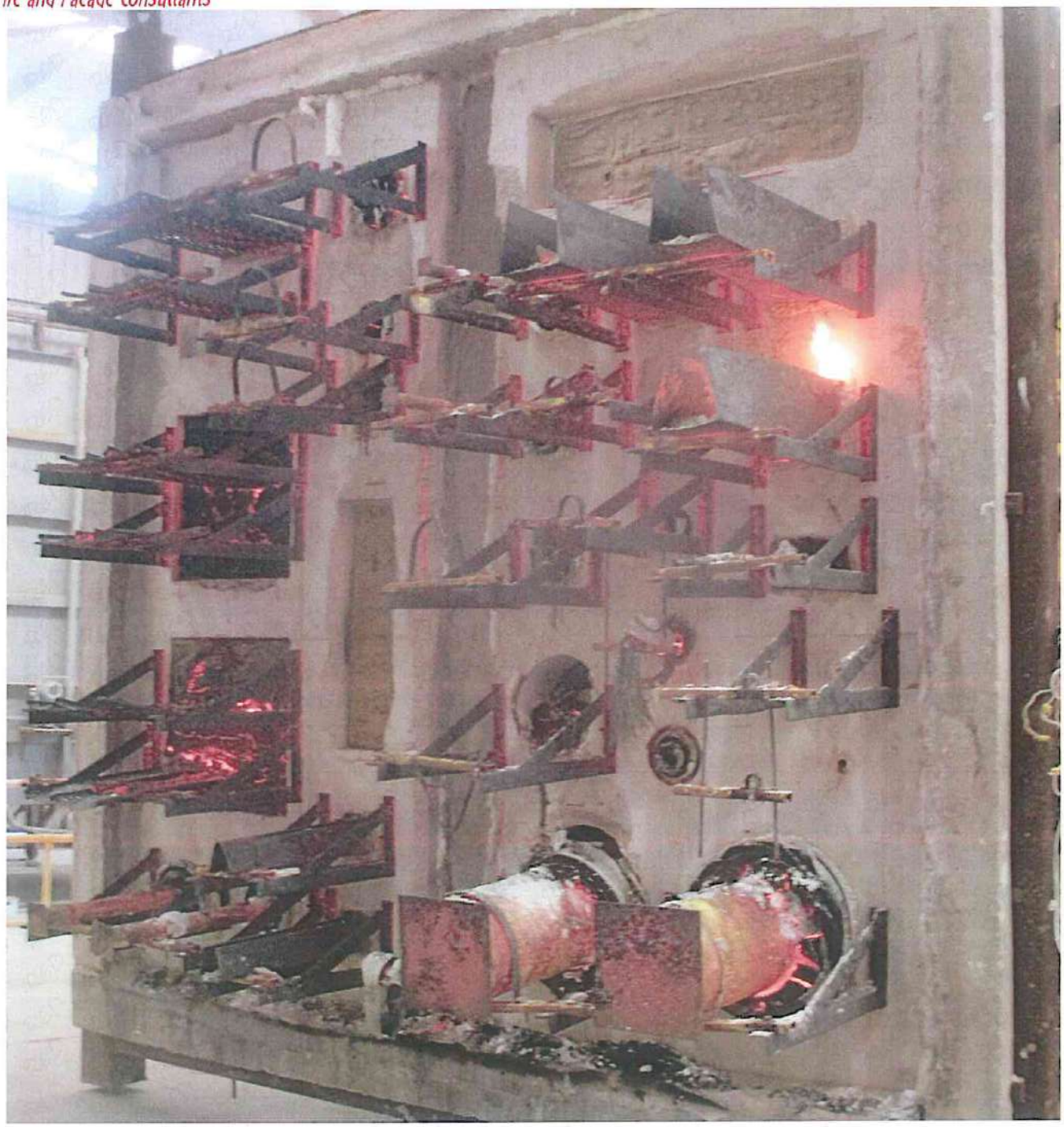


Photo 6: The exposed face of the specimens after the test.

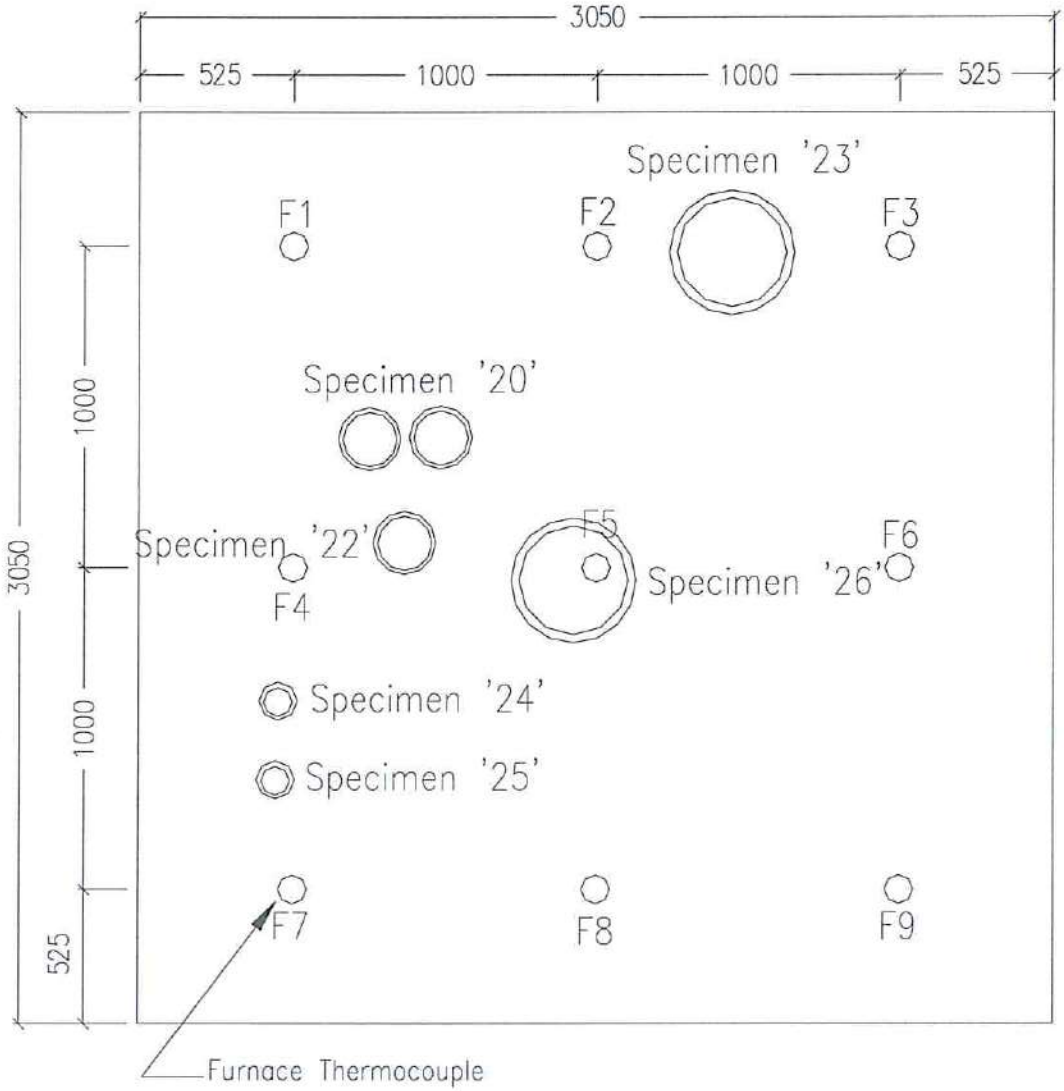


Figure 1 – Locations and reference numbers of furnace thermocouples.
(This figure is not to scale and all dimensions are in millimetres.)

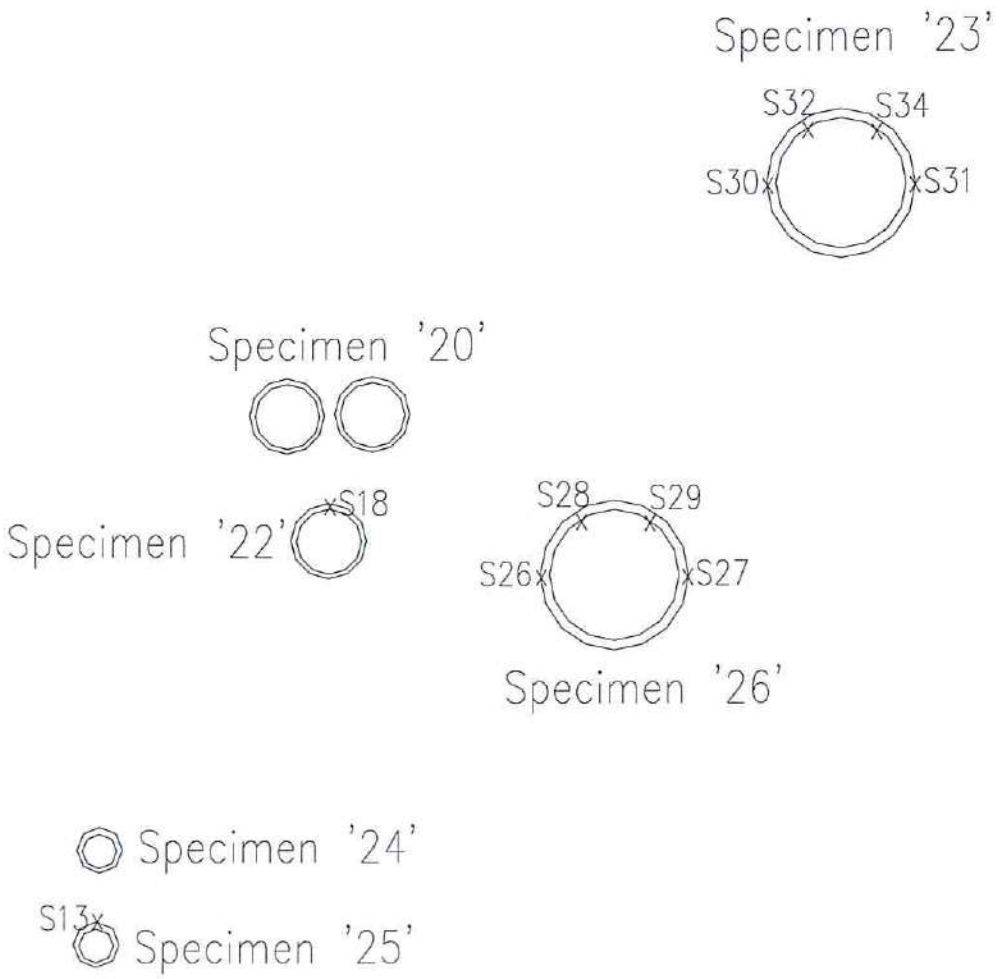


Figure 2 – Locations and reference number of thermocouples to monitor the temperature of unexposed surface of the specimens.
(This figure is not to scale.)

Note: Thermocouples S26, S27, S30 and S31 were fixed at 50 mm away from the concrete wall.
Thermocouples S28, S29, S32 and S34 were fixed at 100 mm away from the concrete wall.
Thermocouples S18 and S13 was fixed for additional information only.

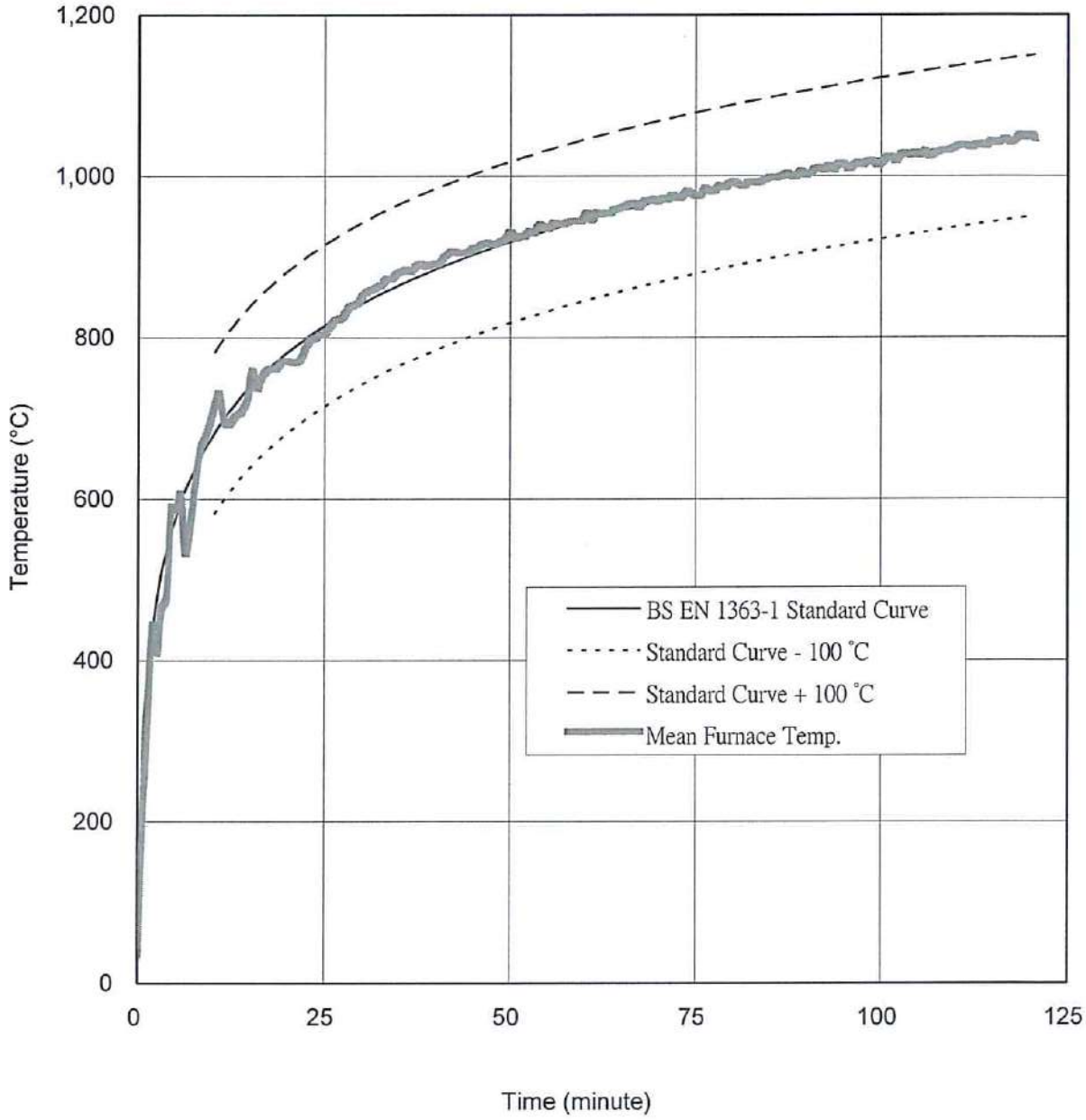


Figure 3 – Mean furnace temperature.

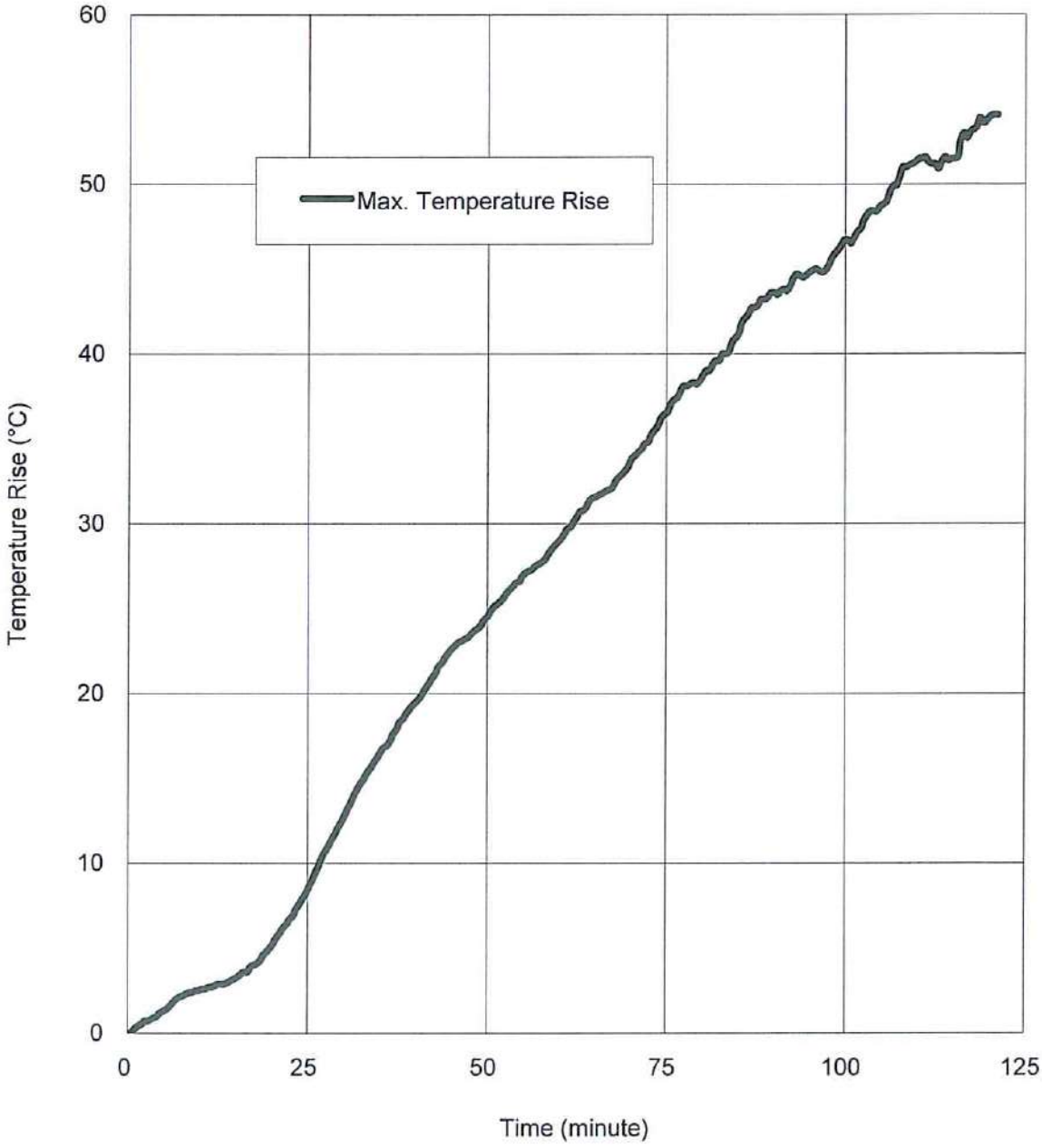


Figure 4 – Temperature rises of unexposed surface of specimen '22' (for additional information only).

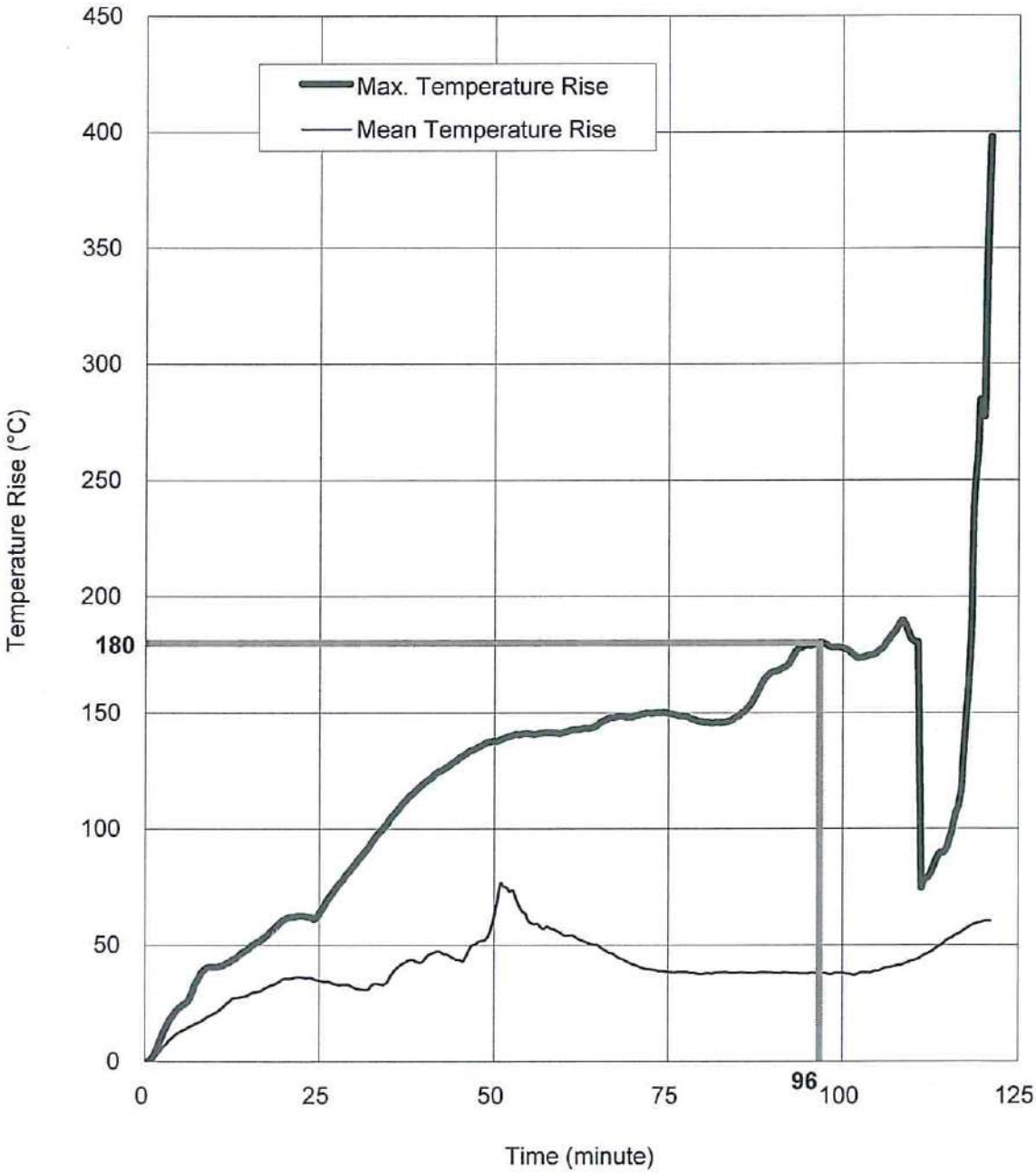


Figure 5 – Temperature rises of unexposed surface of specimen '23'.

Note: Thermocouple S30 detached after a heating period of 111 minutes.

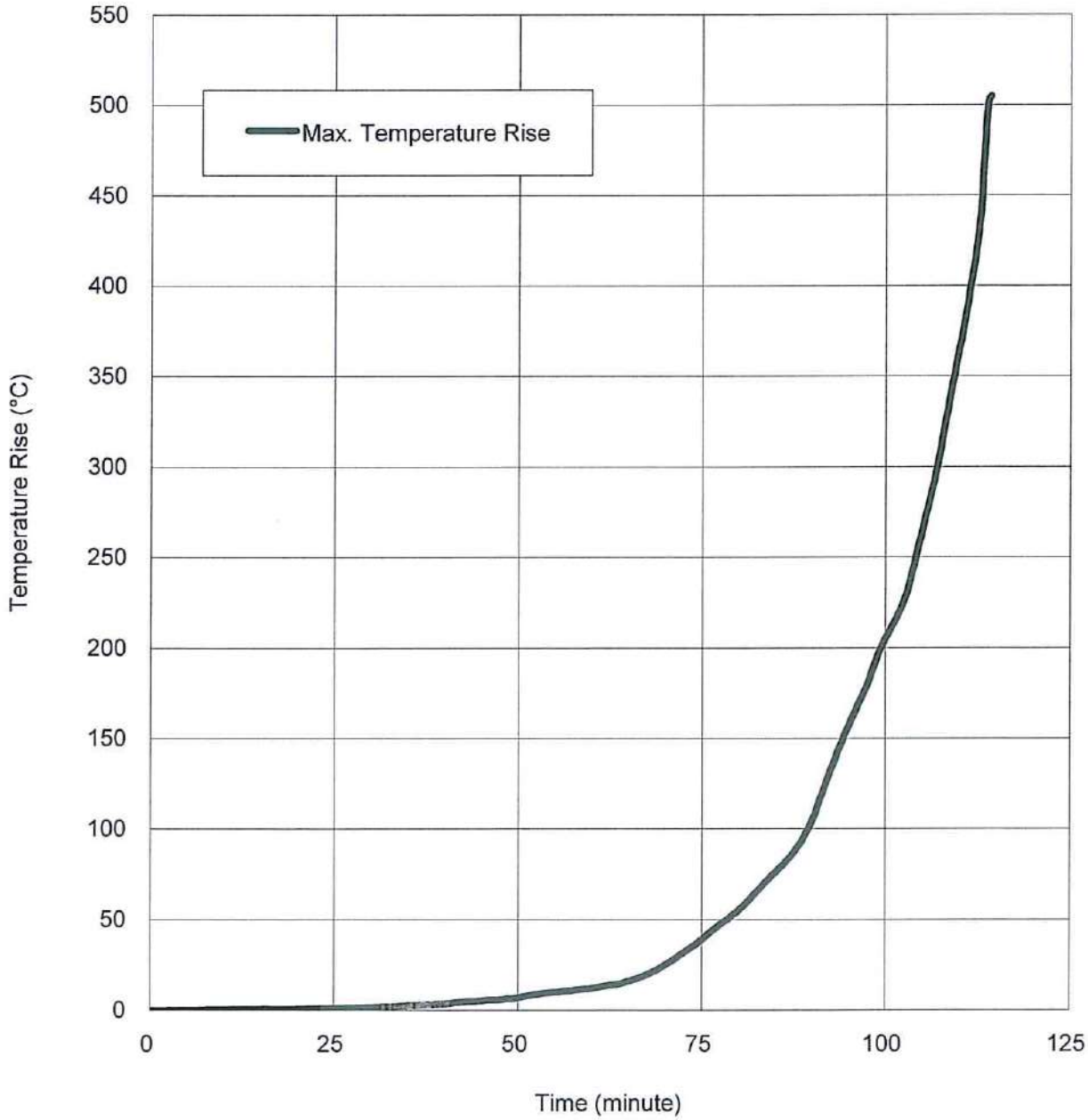


Figure 6 – Temperature rises of unexposed surface of specimen '25' (for additional information only).

Note: Thermocouple S13 was detached after a heating period of 114 minutes.

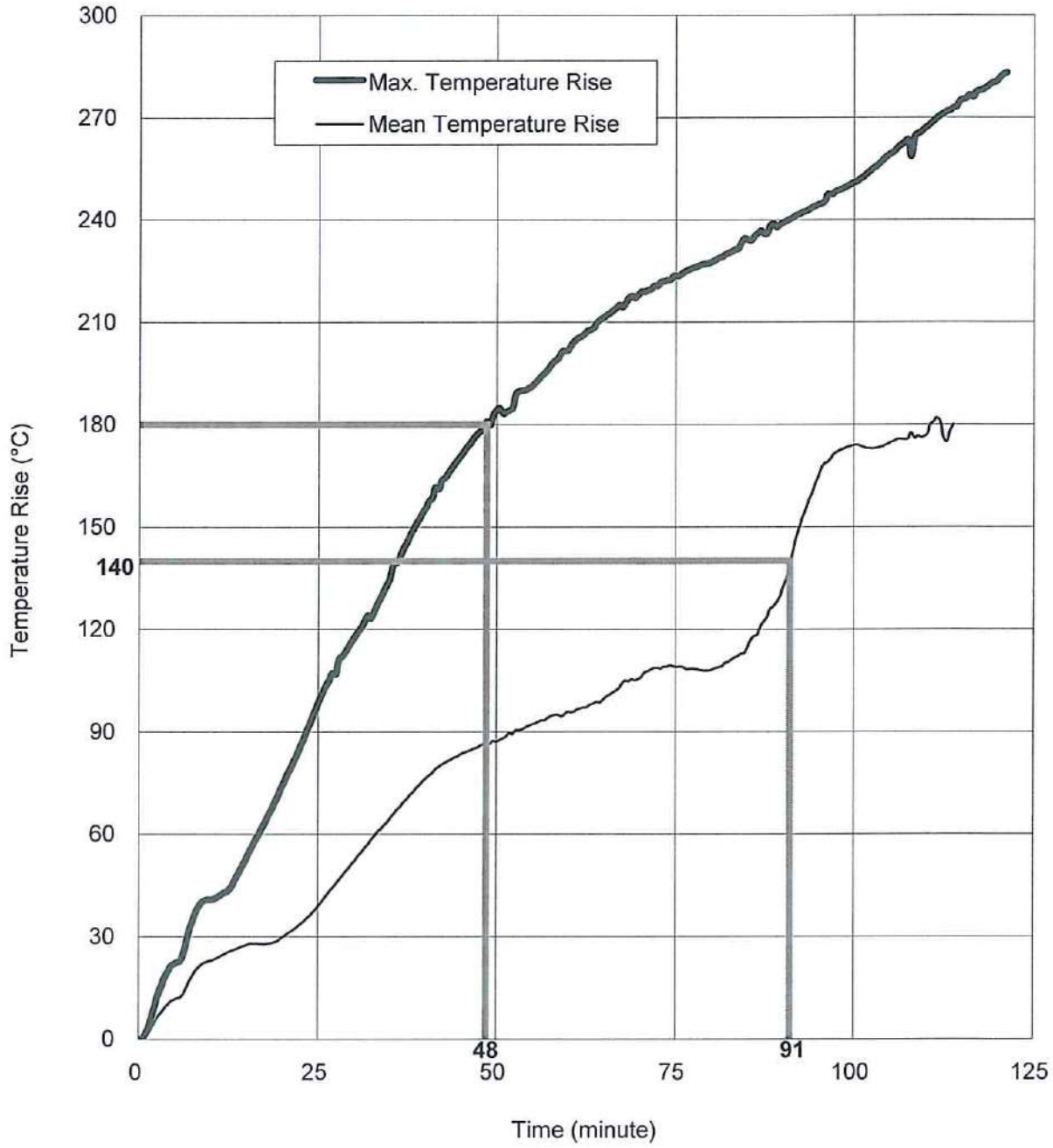


Figure 7 – Temperature rises of unexposed surface of specimen '26'.

Note: Thermocouples S27-S29 were detached after a heating period of 114 minutes.

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.

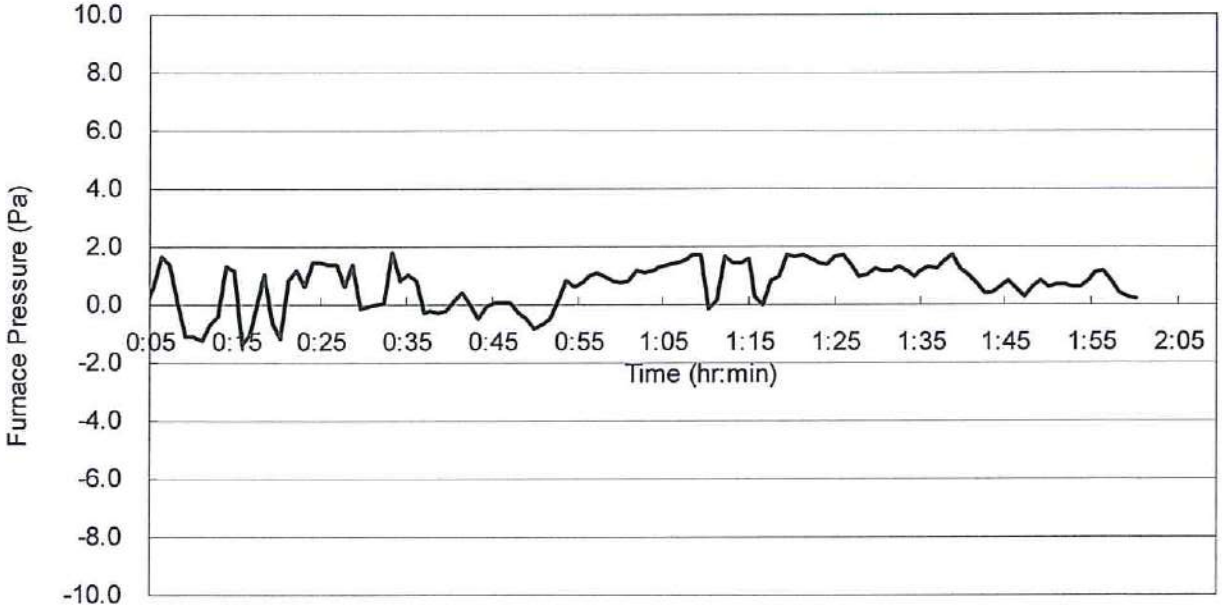


Figure 8 – Furnace pressure.

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

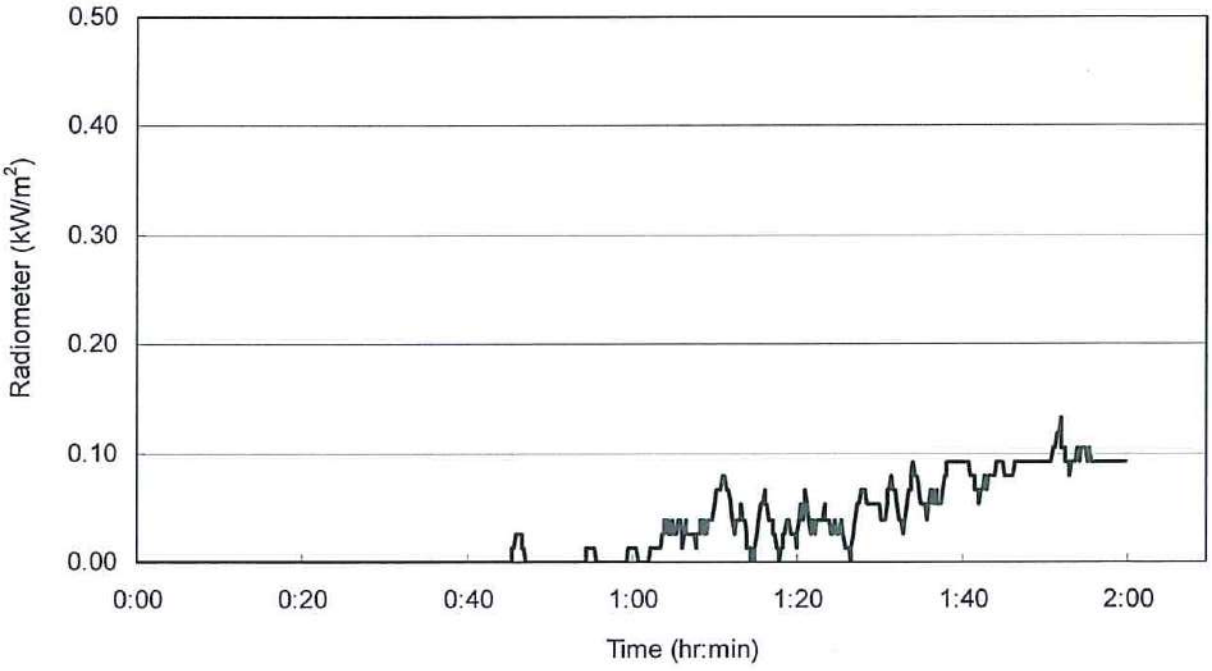


Figure 9 – Radiation.

APPENDIX B – Observation

Time (min.sec)	Exposed (E) or Unexposed (U)	Observation
00.00	-	Test started.
08.00	U	Smoke started releasing from the perimeter of specimens '22' and '23'.
14.30	U	Pop sound was heard from the specimens.
19.45	U	Smoke started releasing from the perimeter of specimen '26'.
30.00	U	Specimens '20', '22', '24' and '25' satisfied the integrity requirements performance. Specimens '23' and '26' satisfied the integrity and insulation requirements performance.
38.00	U	Smoke release from specimen '23' increased.
60.00	U	Specimens '20', '22', '24', '25' and '26' satisfied the integrity requirements performance. Specimens '23' satisfied the integrity and insulation requirements performance.
75.30	U	Water leakage was observed from specimen '22'.
90.00	U	Specimens '20', '22', '24', '25' and '26' satisfied the integrity requirements performance. Specimens '23' satisfied the integrity and insulation requirements performance.
120.00	U	Specimens '20', '22', '23', '24', '25' and '26' 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 S13, S18, S26 - S32 and S34

Time (min)	S13	S18	S26	S27	S28	S29	S30	S31	S32	S34
0	0	0	0	0	0	0	0	0	0	0
5	0	1	3	3	1	23	23	3	2	24
10	1	3	30	4	5	41	41	8	5	36
15	1	3	54	7	10	46	46	16	9	50
20	1	5	75	10	13	47	48	33	10	61
25	1	9	99	13	16	63	65	35	9	60
30	2	13	118	17	21	84	85	33	10	53
35	3	17	135	26	27	102	104	39	25	48
40	4	20	156	33	35	118	120	36	42	46
45	5	23	171	36	41	126	131	49	35	52
50	7	25	185	42	46	130	138	70	73	64
55	10	27	192	46	52	133	141	73	47	71
60	12	29	203	51	56	136	142	56	40	69
65	16	32	212	54	59	142	146	50	35	64
70	25	34	219	61	61	151	149	46	25	58
75	39	37	224	67	65	153	150	44	21	56
80	55	39	228	76	67	149	146	43	20	56
85	76	41	234	96	75	155	149	42	20	56
90	104	44	239	101	101	163	168	42	20	57
95	160	45	245	104	161	173	179	47	20	56
100	208	47	251	101	178	170	177	49	19	56
105	270	49	260	151	176	174	177	57	19	59
110	370	52	267	173	181	173	181	72	22	65
115	-	52	275	-	-	-	-	95	25	81
120	-	54	282	-	-	-	-	278	27	93
121	-	54	283	-	-	-	-	398	28	93

Notes: Locations of thermocouples S13, S18, S26 - S32 and S34 are shown in Figure 2.

Thermocouples S13, S27 - S29 detached after a heating period of 114 minutes.

Thermocouple S30 detached after a heating period of 111 minutes.

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 '20', '22', '23', '24', '25' and '26'

Item	Description	
1	**PVC Pipes and Conduits**	
	Supplier	: Hilti Corporation.
	Internal dimensions	: Specimen '20'- 50 mm diameter x 2.5 mm thick x 1,400 mm long (2 nos.).* Specimen '22'- 50 mm diameter x 2.5 mm thick x 1,400 mm long.* Specimen '23'- 150 mm diameter x 2.5 mm thick x 1,400 mm long.* Specimen '24'- 32 mm diameter x 2.5 mm thick x 1,400 mm long.* Specimen '25'- 25 mm diameter x 1.5 mm thick x 1,400 mm long.* Specimen '26'- 150 mm diameter x 5 mm thick x 1,400 mm long.*
	Fixing details	: The PVC pipes and conduits were fixed to 42 mm x 20 mm x 3 mm thick steel channels, located at 500 mm from the concrete wall, by nominal 3 mm thick rings 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.*
	End cover	Specimens '20', '22', '23' & '26'- Filled with a layer of 20 mm thick 'ROCKWOOL' mineral wool boards with density of 100 kg/m^3 with and 'Hilti CP606' sealant. Specimens '24' & '25'- Filled with 'Hilti CP606' sealant.
2a	**Firestop Cast-In Device**	
	Brand & Model	: Hilti Firestop Cast-In Device CFS-CID 50.
	Material	: Consists of a plastic housing, an intumescent inlay and rubber seal.
	Fixing details	: Precast before concrete pouring.
	Applied location	: At the gap between concrete test rig and specimens '20' and '22'.

*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.)

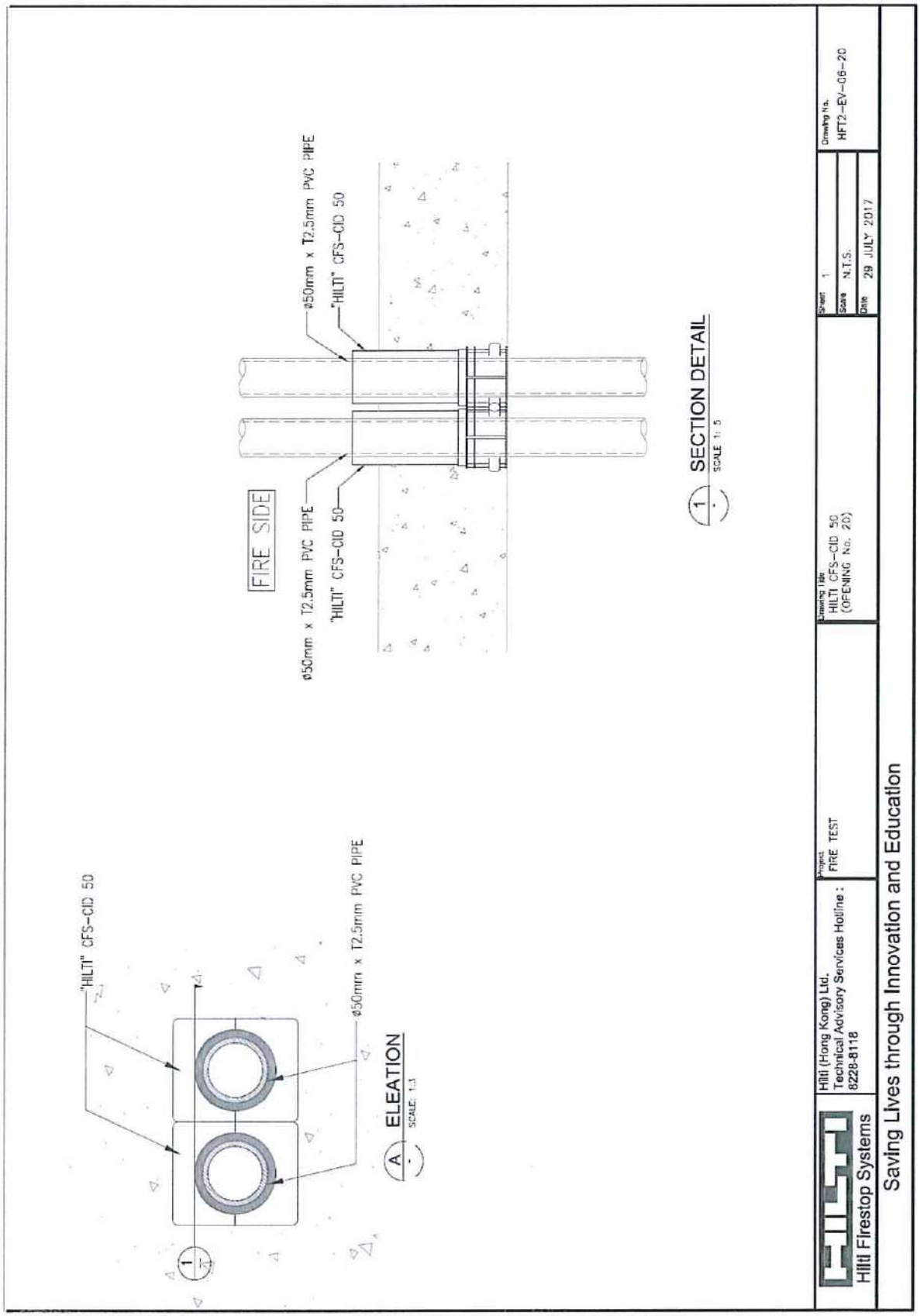
For Specimens '20', '22', '23', '24', '25' and '26'

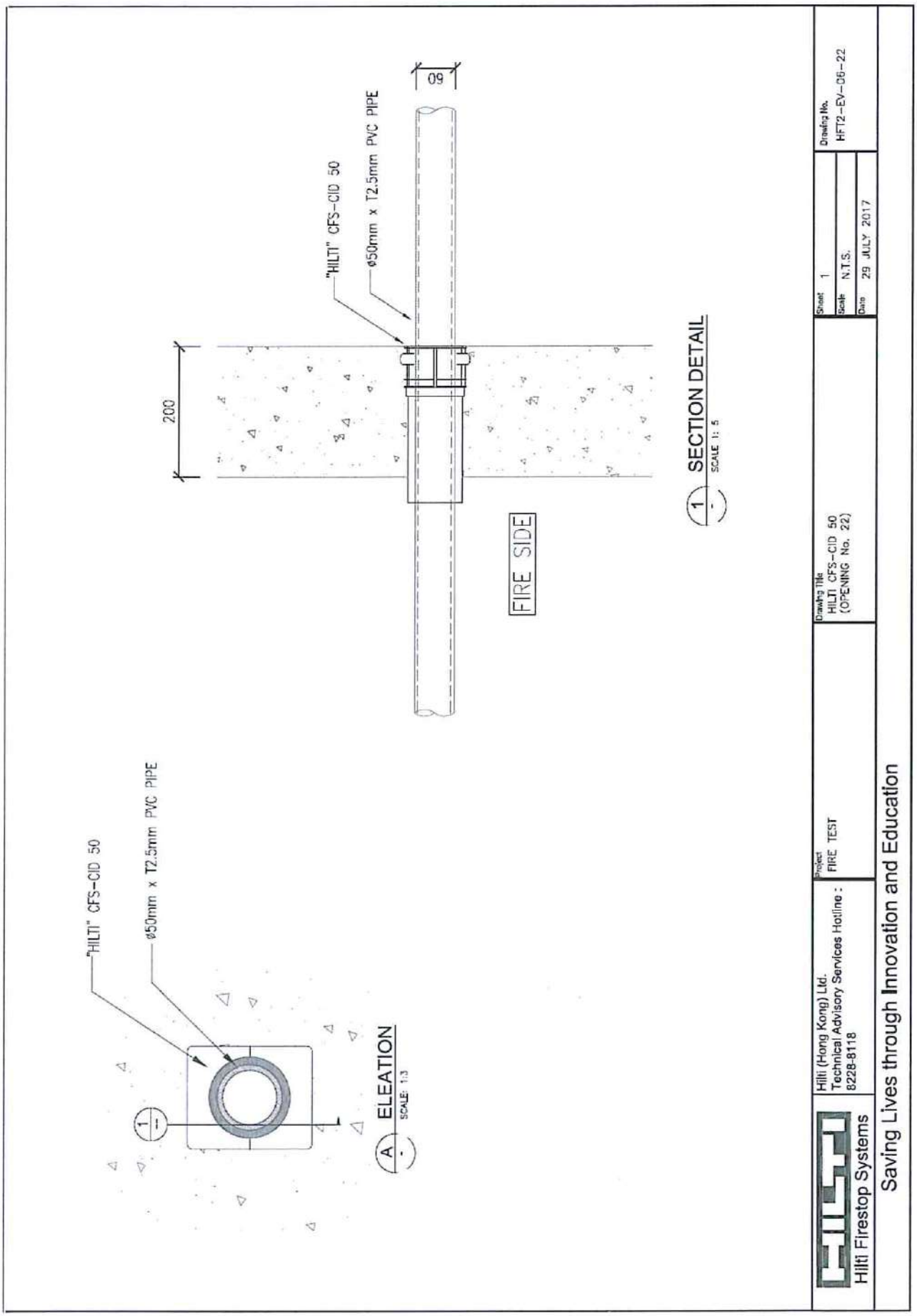
Item	Description	
2b	**Firestop Cast-In Device**	
	Brand & Model	: Hilti Firestop Cast-In Device CFS-CID 160.
	Material	: Consists of a plastic housing, an intumescent inlay and rubber seal.
	Fixing details	: Precast before concrete pouring.
	Applied location	: At the gap between concrete test rig and specimen '23'.
3	**Firestop Cable Disc**	
	Brand & Model	: Hilti Firestop Cable Disc CFS-D 25.
	Material	: Tris(2-ethylhexyl) phosphate.
	Density	: 1.6 g/cm³.
	Fixing details	: Wrap around and paste against PVC conduits with overlapping to form an entity.
	Applied location	: At the gap between concrete test rig and specimens '24' and '25.
4	**Firestop Collar Endless**	
	Brand & Model	: Hilti Firestop Collar Endless CFS-C EL.
	Material	: Consists of one intumescent strip with a soft polyurethane foam layer.
	Fixing details	: Install against the wall with fixing hooks.
	Applied location	: At the gap between concrete test rig and specimen '26' (2 stacks).
5	**Fire Sealant**	
	Brand & Model	: Hilti flexible firestop sealant CP 606
	Material	: Acrylic based.
	Applied locations	: Filled in all the pipes and conduits.
6	**Mineral Wool Board**	
	Brand	: ROCKWOOL.#
	Material	: Mineral wool.
	Thickness	: 20 mm.*
	Density	: 100 kg/m^3.#
	Applied locations	: Filled in specimens '20', '22', '23' and '26'.

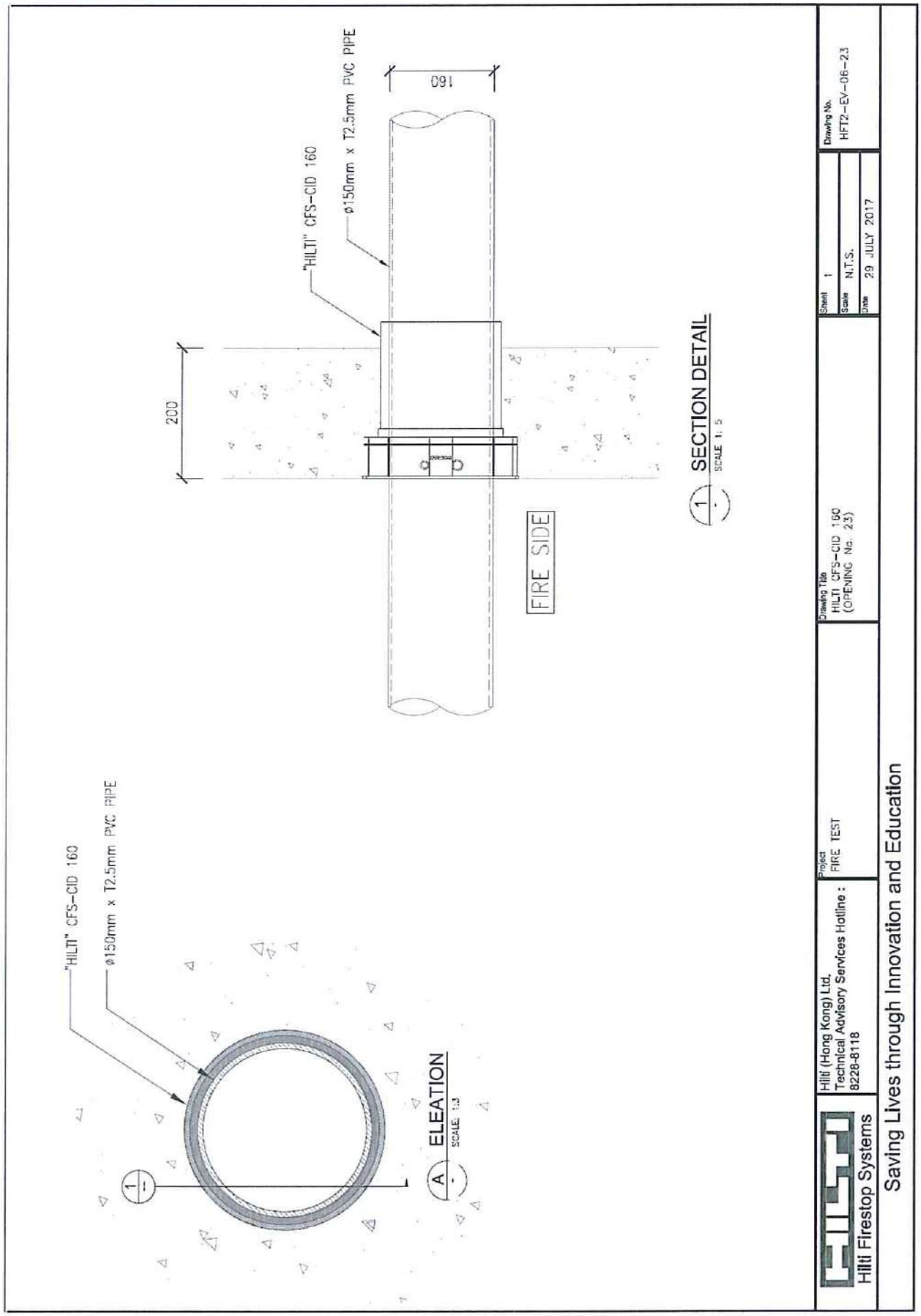
** and # see notes on page 24*

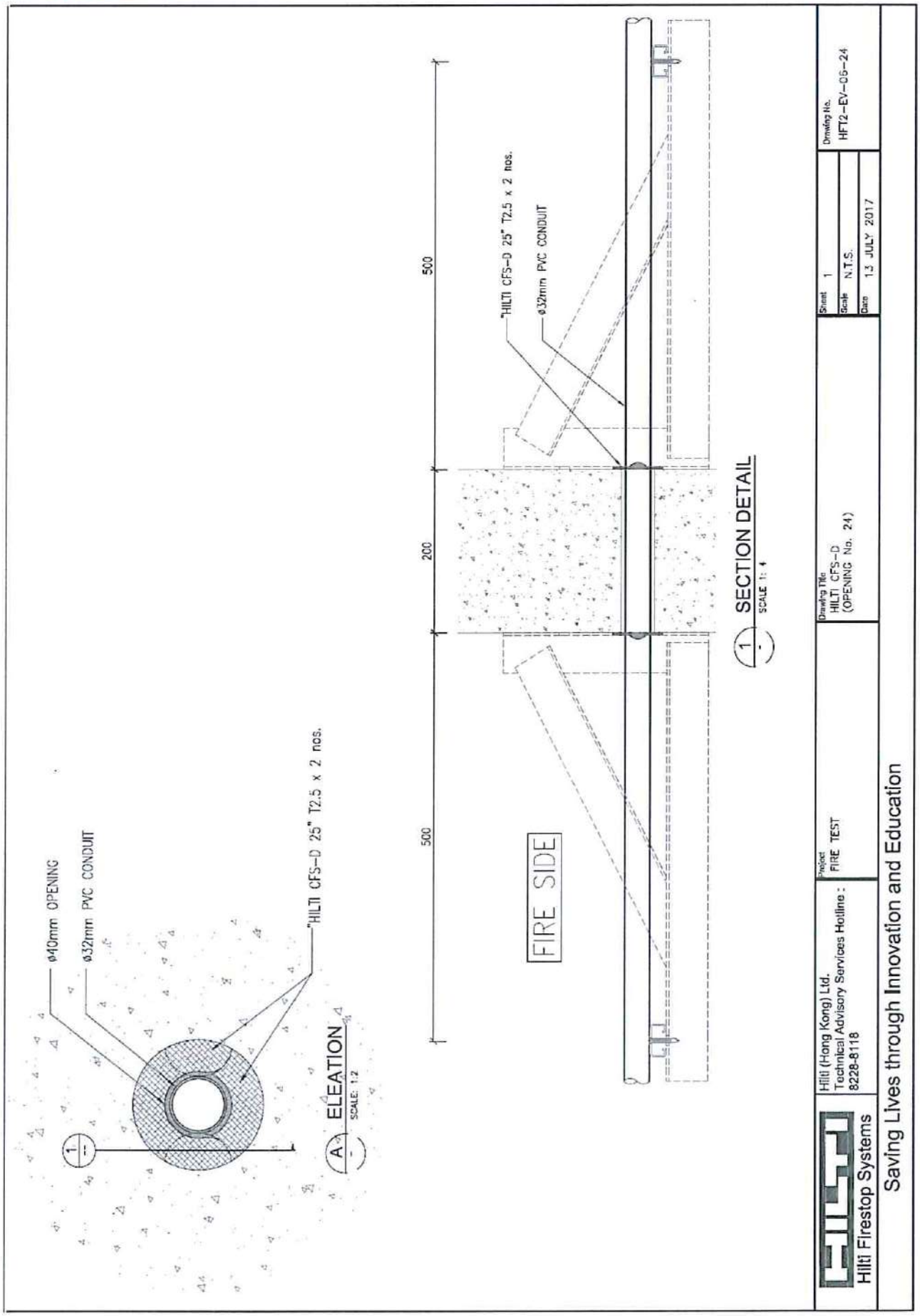
Drawings from Test Sponsor

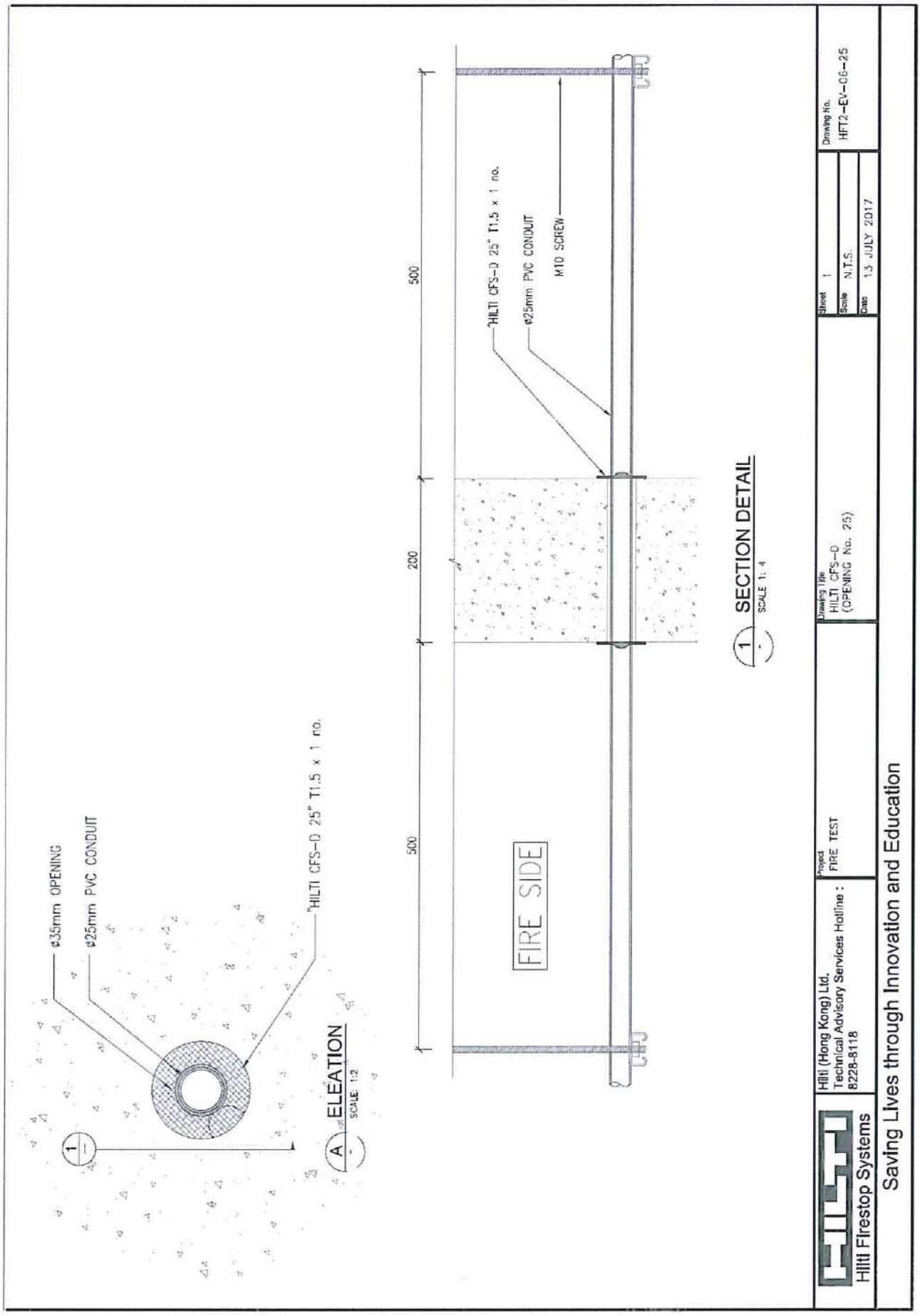
(The drawings provided by test sponsor, which was not verified by RED, except those specified and described in 'information from test sponsor'.)

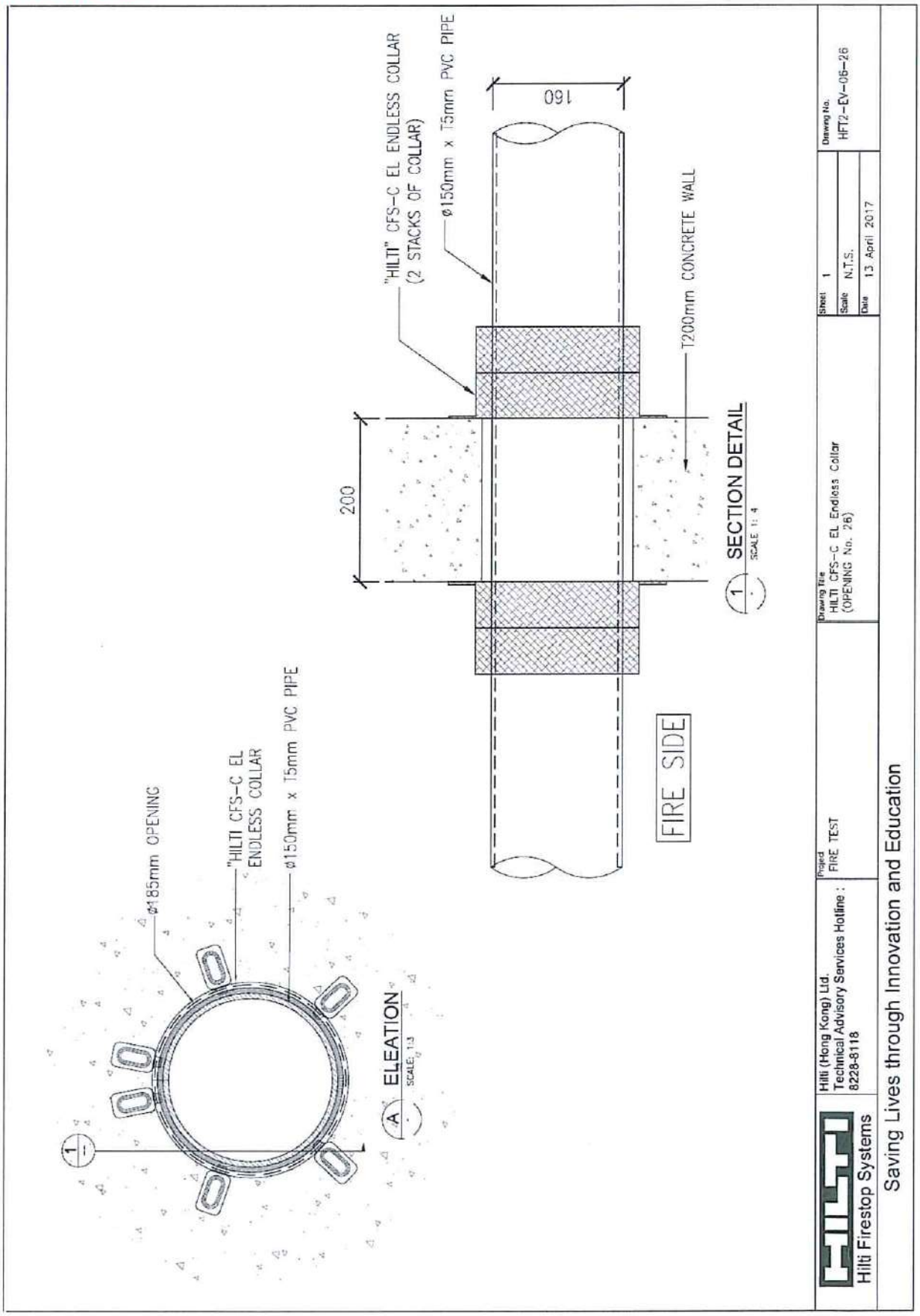



60
"HILTI" CFS-CID 50
Ø50mm x T2.5mm PVC PIPE
200
FIRE SIDE
1 - SECTION DETAIL
SCALE 1: 5
"HILTI" CFS-CID 50
Ø50mm x T2.5mm PVC PIPE
1 - A - ELEATION
SCALE: 1:3
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-8118
Project FIRE TEST
Drawing Title HILTI CFS-CID 50 (OPENING No. 22)
Sheet 1
Scale N.T.S.
Date 29 JULY 2017
Drawing No. HFT2-EV-06-22
Hilti Firestop Systems
Saving Lives through Innovation and Education


"HILTI" CFS-CID 160
ø150mm x T2.5mm PVC PIPE
160
200
FIRE SIDE
1 - SECTION DETAIL
SCALE 1 : 5
"HILTI" CFS-CID 160
ø150mm x T2.5mm PVC PIPE
1
A - ELEATION
SCALE 1:3
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-8118
Project FIRE TEST
Drawing Title HILTI CFS-CID 160 (OPENING No. 23)
Sheet 1
Scale N.T.S.
Date 29 JULY 2017
Drawing No. HFT2-EV-06-23
Hilti Firestop Systems
Saving Lives through Innovation and Education


"HILTI CFS-D 25" T2.5 x 2 nos.
ø32mm PVC CONDUIT
500
200
500
FIRE SIDE
1 SECTION DETAIL
SCALE 1: 4
ø40mm OPENING
ø32mm PVC CONDUIT
"HILTI CFS-D 25" T2.5 x 2 nos.
A ELEATION
SCALE: 1:2
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline :
8228-8118
Project
FIRE TEST
Drawing Title
HILTI CFS-D
(OPENING No. 24)
Sheet 1
Scale N.T.S.
Date 13 JULY 2017
Drawing No.
HFT2-EV-06-24
Hilti Firestop Systems
Saving Lives through Innovation and Education


ø35mm OPENING
ø25mm PVC CONDUIT
"HILTI CFS-D 25" T1.5 x 1 no.
A ELEATION
SCALE: 1:2
500
200
500
FIRE SIDE
"HILTI CFS-D 25" T1.5 x 1 no.
ø25mm PVC CONDUIT
M10 SCREW
1 SECTION DETAIL
SCALE 1: 4
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-8118
Project FIRE TEST
Drawing title HILTI CFS-D (OPENING No. 25)
Sheet 1
Scale N.T.S.
Date 13 JULY 2017
Drawing No. HFT2-EV-06-25
Hilti Firestop Systems
Saving Lives through Innovation and Education



- End of report -

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

On 9 nos. of Penetration Systems

Test Report No.: R18G14-2A
Identification No.: Q18A11-2

Issue Date: 19th October 2018

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: _____

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

Hong Kong Accreditation Service (HKAS) has accredited this laboratory (HOKLAS 091- TEST) under Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific laboratory activities as listed in the HOKLAS directory of accreditation laboratories. The results shown in this test report were determined by this laboratory in accordance with its terms of accreditation. This report may not be reproduced except in full.

CONTENT

1 SUMMARY

Fire resistance test conducted in accordance with BS 476: Part 20: 1987 on 9 nos. of penetration systems.

Nine specimens of penetration systems, namely specimens '12', '13', '14', '15', '16', '17', '18', '19' and '20' (refer to photos 1 and 2), had been subjected to a test in accordance with BS 476: Part 20: 1987, in order to determine their fire resistance performances. 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 asymmetrical and only one side of specimens was tested, in which the fire side was determined by the test sponsor.

Specimen '12' was comprised of Firestop Composite Sheets. The overall and exposed sizes of the Firestop Composite Sheets were 910 mm wide by 910 mm high by 3.8 mm thick. The Firestop Composite Sheets were joined together with M5 by 25 mm long screws at 250 mm nominal centres and fixed to L-angles with sizes of 50 mm by 50 mm by 5 mm thick at four sides. The L-angles was fixed the concrete with M6 by 54 mm long anchor bolts at 250 mm nominal centres. Stainless steel facing was faced at exposed side (refer to test sponsor's drawings).

Specimen '13' had overall dimensions 910 mm wide by 1,200 mm high by 3.8 mm thick with exposed area 610 mm wide by 1,100 mm high. It was comprised of Firestop Composite Sheets and a G.I. squared pipe. The G.I. squared pipe with sizes of 250 mm wide by 250 mm high by 1 mm thick was penetrated in the centre of specimen. The Firestop Composite Sheets were joined together with M5 by 25 mm long screws at 250 mm nominal centres and fixed to the concrete with M6 by 54 mm long anchor bolts at 250 mm nominal centres. Stainless steel facing was faced at unexposed side (refer to test sponsor's drawings).

Specimen '14' had overall dimensions of 1,010 mm wide by 910 mm high by 3.8 mm thick with clear opening area 900 mm wide by 810 mm high. It was comprised of two layers of Firestop Composite Sheets and a G.I. pipe. The G.I. pipe with sizes of 500 mm wide by 200 mm high by 1 mm thick was penetrated in the centre of specimen. The Firestop Composite Sheets were joined together with M5 by 25 mm long screws at 250 mm nominal centres and fixed to the concrete with M6 by 54 mm long anchor bolts at 250 mm nominal centres. Stainless steel facing was faced at both sides (refer to test sponsor's drawings).

Specimen '15' had overall dimensions of 600 mm wide by 300 mm high by 81 mm thick. It was comprised of two nos. of socket boxes with 'Hilti CP617' firestop putty pad incorporated with 75 mm thick 'Ytong' lightweight block wall with nominal 3 mm thick plaster on both sides. Each socket box with cover with sizes of 70 mm by 70 mm by 50 mm deep by 3.5 mm thick was incorporated in each side of block wall. 'Hilti CP617' firestop putty pad was placed inside the socket boxes (refer to test sponsor's drawings).

Specimen '16' had overall dimensions of 90 mm diameter by 1,200 mm long. It was comprised of a PVC pipe with sizes of 48 mm outer diameter by 4 mm thick, wrapped with a layer of nominal 25 mm thick by 750 mm long 'Armaflex' foam. The gaps between the pipe and concrete wall were applied with two layers of 'CFS-B' bandage and 'CP606' sealant (refer to test sponsor's drawings).

Specimen '17' had overall dimensions of 160 mm diameter by 1,200 mm long. It was comprised of a PVC pipe with sizes of 25 mm outer diameter by 2 mm thick, and 3 pairs of copper pipes with sizes of 12.7 mm outer diameter by 1 mm thick and 6.4 mm outer diameter by 1 mm thick. All pipes wrapped with a layer of nominal 25 mm thick by 750 mm long 'Armaflex' foam individually. The gaps between all the pipes and concrete wall were applied with 'CFS-F FX' foam and with 'Hilti CFS-C EL' collar endless at both opening ends (refer to test sponsor's drawings).

Specimen '18' had overall dimensions of 160 mm diameter by 1,200 mm long. It was comprised of a PVC pipe with sizes of 25 mm outer diameter by 2 mm thick, and 3 pairs of copper pipes with sizes of 12.7 mm outer diameter by 1 mm thick and 6.4 mm outer diameter by 1 mm thick. All pipes wrapped with a layer of nominal 25 mm thick by 750 mm long 'Armaflex' foam individually. The gaps between all the pipes and concrete wall were applied with two layers of 'CFS-B' bandage and 'Hilti CP606' sealant. Three pairs of copper pipes were wrapped together by the bandage and the PVC pipe was wrapped individually (refer to test sponsor's drawings).

Specimen '19' had overall dimensions of 160 mm diameter by 1,200 mm long. It was comprised of a G.M.S. pipe with sizes of 138 mm inner diameter by 1.5 mm thick. The gaps between the pipe and concrete wall were applied with 'Hilti CP606' sealant and 'Hilti CF-F 750' filling foam (refer to test sponsor's drawings).

Specimen '20' had overall dimensions of 160 mm diameter by 1,200 mm long. It was comprised of a PVC pipe with sizes of 25 mm outer diameter by 2 mm thick, and 3 pairs of copper pipes with sizes of 12.7 mm outer diameter by 1 mm thick and 6.4 mm outer diameter by 1 mm thick. All pipes wrapped with a layer of nominal 25 mm thick by 750 mm long 'Armaflex' foam individually. The gaps between all the pipe and concrete wall were applied with two layers of 'CFS-B' bandage and 'Hilti CP606' sealant. All pipes were wrapped together by the bandage (refer to test sponsor's drawings).

All penetrated pipes were supported by fixed to 40 mm by 20 mm by 3 mm thick steel L-angles, located at 100 mm from the concrete wall on both sides. The steel angles were supported by 2 nos. of M10 steel rods to the concrete lining. The opening was covered by nominal 40 mm thick rockwool with density 160 kg/m^3.

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

	Integrity	Insulation
Specimen '12'	242 Minutes (No failure)	8 Minutes
Specimen '13'	242 Minutes (No failure)	6 Minutes
Specimen '14'	242 Minutes (No failure)	27 Minutes
Specimen '15'	242 Minutes (No failure)	242 Minutes
Specimen '16'	242 Minutes (No failure)	242 Minutes
Specimen '17'	242 Minutes (No failure)	242 Minutes
Specimen '18'	242 Minutes (No failure)	242 Minutes
Specimen '19'	242 Minutes (No failure)	242 Minutes
Specimen '20'	242 Minutes (No failure)	242 Minutes

The test was discontinued after a heating period of 242 minutes.

2 INTRODUCTION

The objective of the test is to determine the fire resistance performance of 9 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

28th September 2018

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 Dorothy Wai, the representative 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-seven (27) '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 3,000 mm away from the unexposed surface to measure the radiation of unexposed surface of specimens.

5 CONDITIONING

The specimens' storage, construction, and test preparation took place in the test laboratory over a total, combined time of 12 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 26 °C to 38 °C and 50 % to 86 % 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-eight (28) thermocouples fixed to the unexposed surface (see Figure 2 for the locations and reference numbers of the thermocouples). Thermocouples S1 – S3 were fixed on specimen '12' for mean and maximum temperatures of the unexposed surface of specimen '12'.

Thermocouples S4 – S6 were fixed on specimen '13' for mean and maximum temperatures of the unexposed surface of specimen '13'. Thermocouple S7 was fixed on the pipe of specimen '13' for maximum temperature of the unexposed surface of specimen '13' only.

Thermocouples S8 – S10 were fixed on specimen '14' for mean and maximum temperatures of the unexposed surface of specimen '14'. Thermocouple S11 was fixed on the pipe of specimen '14' for maximum temperature of the unexposed surface of specimen '14' only.

Thermocouples S13 – S14 were fixed on specimen '15' for mean and maximum temperatures of the unexposed surface of specimen '15'. Thermocouples S12 & S15 were fixed on socket box or backed with socket box respectively of specimen '15' for maximum temperature of the unexposed surface of specimen '16' only. Thermocouple S16 was fixed inside the socket box for additional information only.

Thermocouples S19 – S20 were fixed on specimen '17' for mean and maximum temperatures of the unexposed surface of specimen '17'. Thermocouples S21 & S22 were fixed on the collar of specimen '17' for maximum temperature of the unexposed surface of specimen '17' only.

Thermocouples S23 – S24 were fixed on specimen '18' for mean and maximum temperatures of the unexposed surface of specimen '18'.

Thermocouples S25 – S26 were fixed on specimen '19' for mean and maximum temperatures of the unexposed surface of specimen '19'.

Thermocouples S27 – S28 were fixed on specimen '20' for mean and maximum temperatures of the unexposed surface of specimen '20'.

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 radiation of specimens was measured and recorded.

8 TEST DATA AND INFORMATION

The ambient temperature of the test area during the test was 35 °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 '12' were shown graphically in Figure 4.

The mean and maximum temperatures of the unexposed surface of specimen '13' were shown graphically in Figure 5.

The mean and maximum temperatures of the unexposed surface of specimen '14' were shown graphically in Figure 6.

The mean and maximum temperatures of the unexposed surface of specimen '15' were shown graphically in Figure 7.

The mean and maximum temperatures of the unexposed surface of specimen '16' were shown graphically in Figure 8.

The mean and maximum temperatures of the unexposed surface of specimen '17' were shown graphically in Figure 9.

The mean and maximum temperatures of the unexposed surface of specimen '18' were shown graphically in Figure 10.

The mean and maximum temperatures of the unexposed surface of specimen '19' were shown graphically in Figure 11.

The mean and maximum temperatures of the unexposed surface of specimen '20' were shown graphically in Figure 12.

The furnace pressure obtained was shown graphically in Figure 13.

The radiation obtained was shown graphically in Figure 14.

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 and 3.

The test was discontinued after a heating period of 242 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 '12'	242 Minutes (No failure)	8 Minutes
Specimen '13'	242 Minutes (No failure)	6 Minutes
Specimen '14'	242 Minutes (No failure)	27 Minutes
Specimen '15'	242 Minutes (No failure)	242 Minutes
Specimen '16'	242 Minutes (No failure)	242 Minutes
Specimen '17'	242 Minutes (No failure)	242 Minutes
Specimen '18'	242 Minutes (No failure)	242 Minutes
Specimen '19'	242 Minutes (No failure)	242 Minutes
Specimen '20'	242 Minutes (No failure)	242 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 '12'

The 140 °C rise of the mean temperature of the unexposed surface of specimen reached after a heating period of 8 minutes. The 180 °C rise of the maximum temperature of the unexposed surface of specimen reached and measured by thermocouple S3 after a heating period of 9 minutes. The maximum temperature rise was 584 °C measured by thermocouple S2 after a heating period of 110 minutes.

Specimen '13'

The 140 °C rise of the mean temperature of the unexposed surface of specimen reached after a heating period of 6 minutes. The 180 °C rise of the maximum temperature of the unexposed surface of specimen reached and measured by thermocouple S5 after a heating period of 7 minutes. The maximum temperature rise was 859 °C measured by thermocouple S4 after a heating period of 181 minutes.

Specimen '14'

The 140 °C rise of the mean temperature of the unexposed surface of specimen reached after a heating period of 27 minutes. The 180 °C rise of the maximum temperature of the unexposed surface of specimen reached and measured by thermocouple S8 after a heating period of 32 minutes. The maximum temperature rise was 375 °C measured by thermocouple S8 after a heating period of 242 minutes.

Specimen '15'

The 140 °C rise of the mean temperature of the unexposed surface of specimen did not reach during the test. The 180 °C rise of the maximum temperature of the unexposed surface of specimen did not reach during the test. The maximum temperature rise was 111 °C measured by thermocouple S15 after a heating period of 242 minutes.

Specimen '16'

The 140 °C rise of the mean temperature of the unexposed surface of specimen did not reach during the test. The 180 °C rise of the maximum temperature of the unexposed surface of specimen did not reach during the test. The maximum temperature rise was 29 °C measured by thermocouple S17 after a heating period of 169 minutes.

Specimen '17'

The 140 °C rise of the mean temperature of the unexposed surface of specimen did not reach during the test. The 180 °C rise of the maximum temperature of the unexposed surface of specimen did not reach during the test. The maximum temperature rise was 170 °C measured by thermocouple S21 after a heating period of 242 minutes.

Specimen '18'

The 140 °C rise of the mean temperature of the unexposed surface of specimen did not reach during the test. The 180 °C rise of the maximum temperature of the unexposed surface of specimen did not reach during the test. The maximum temperature rise was 81 °C measured by thermocouple S25 after a heating period of 235 minutes.

Specimen '19'

The 140 °C rise of the mean temperature of the unexposed surface of specimen did not reach during the test. The 180 °C rise of the maximum temperature of the unexposed surface of specimen did not reach during the test. The maximum temperature rise was 179 °C measured by thermocouple S25 after a heating period of 242 minutes.

Specimen '20'

The 140 °C rise of the mean temperature of the unexposed surface of specimen did not reach during the test. The 180 °C rise of the maximum temperature of the unexposed surface of specimen did not reach during the test. The maximum temperature rise was 76 °C measured by thermocouple S27 after a heating period of 242 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 '12'

The specimen met the integrity requirements after a heating period of 242 minutes.

Specimen '13'

The specimen met the integrity requirements after a heating period of 242 minutes.

Specimen '14'

The specimen met the integrity requirements after a heating period of 242 minutes.

Specimen '15'

The specimen met the integrity requirements after a heating period of 242 minutes.

Specimen '16'

The specimen met the integrity requirements after a heating period of 242 minutes.

Specimen '17'

The specimen met the integrity requirements after a heating period of 242 minutes.

Specimen '18'

The specimen met the integrity requirements after a heating period of 242 minutes.

Specimen '19'

The specimen met the integrity requirements after a heating period of 242 minutes.

Specimen '20'

The specimen met the integrity requirements after a heating period of 242 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

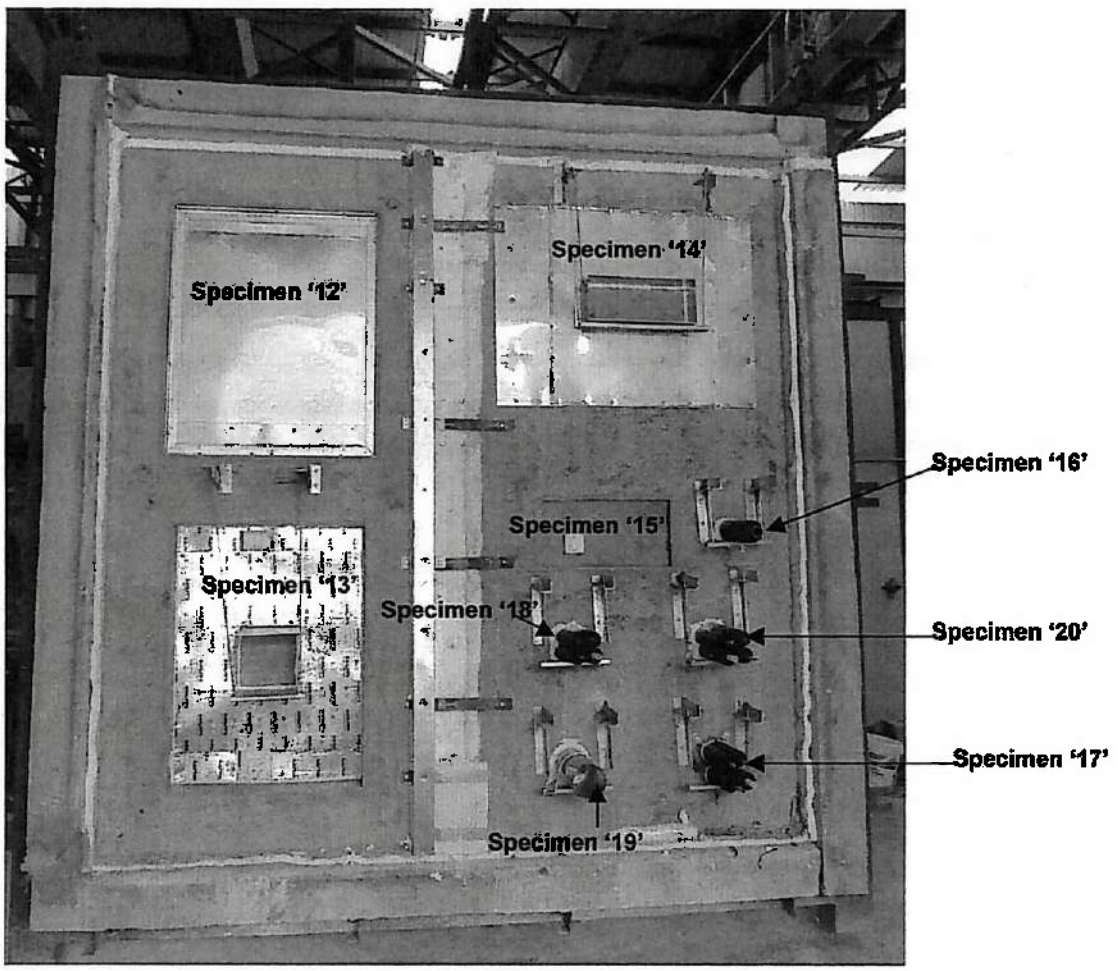


Photo 1: The exposed face of the specimens before the test.

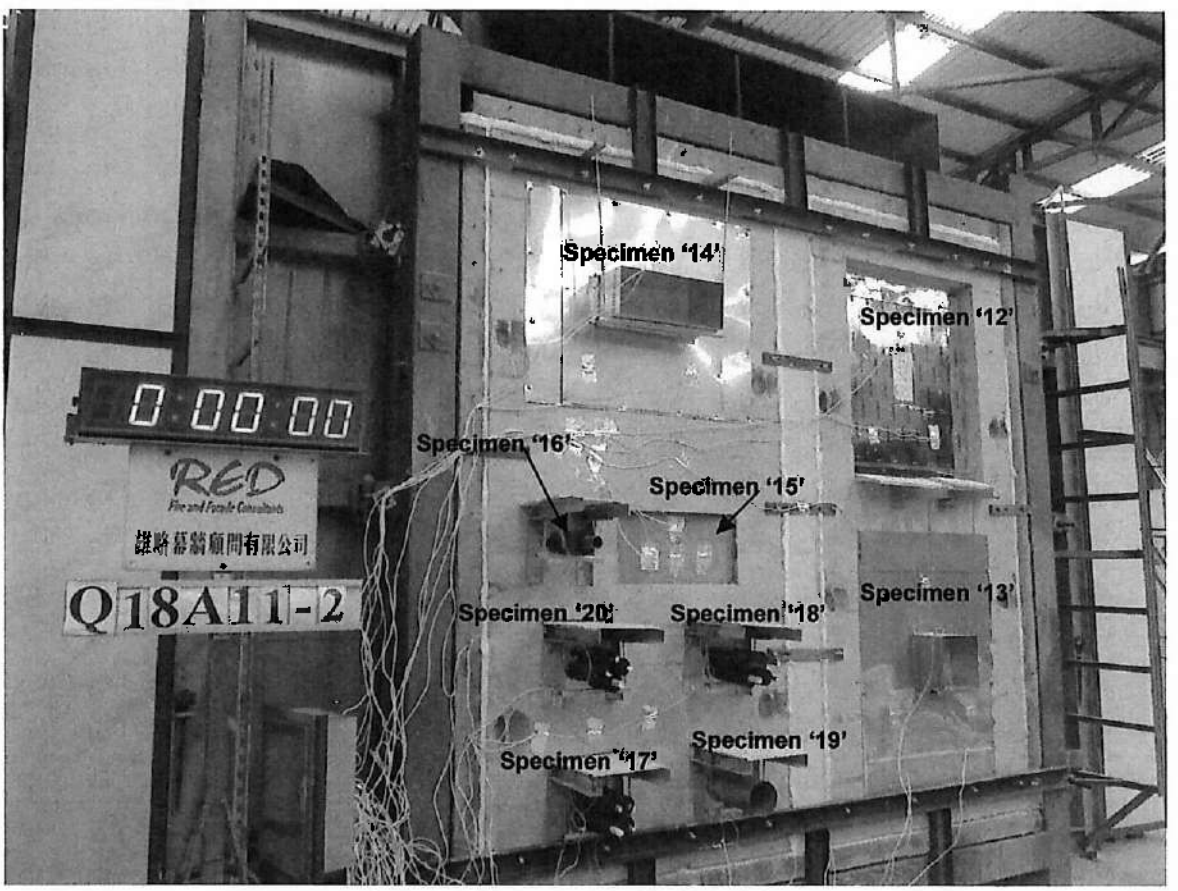


Photo 2: The unexposed face of the specimens before the test.

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

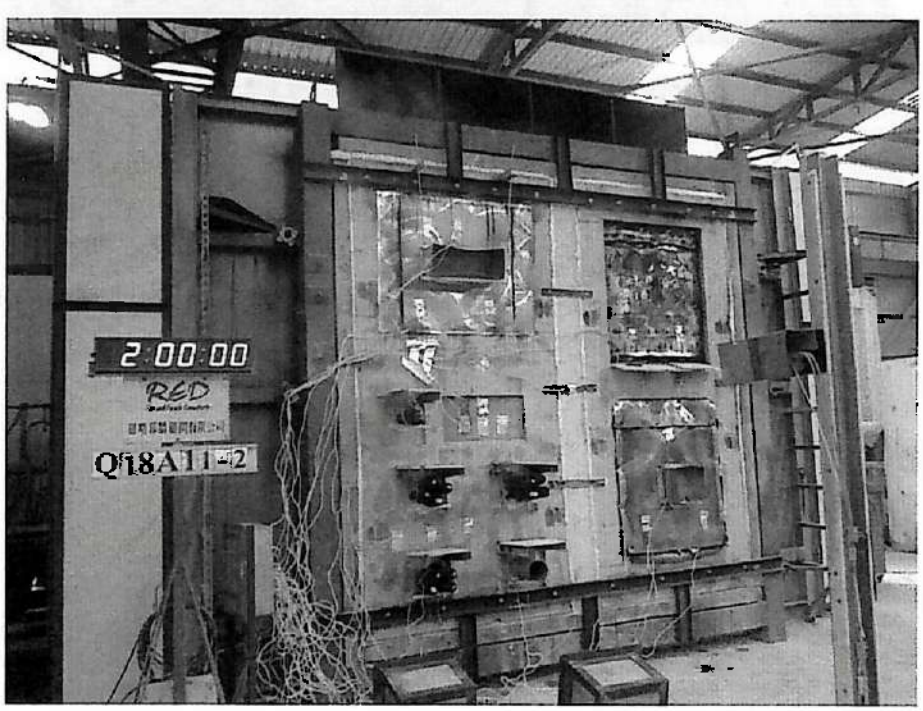


Photo 4: The unexposed face of the specimens after a heating period of 120 minutes.

Photo 5: The unexposed face of the specimens after a heating period of 180 minutes.

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

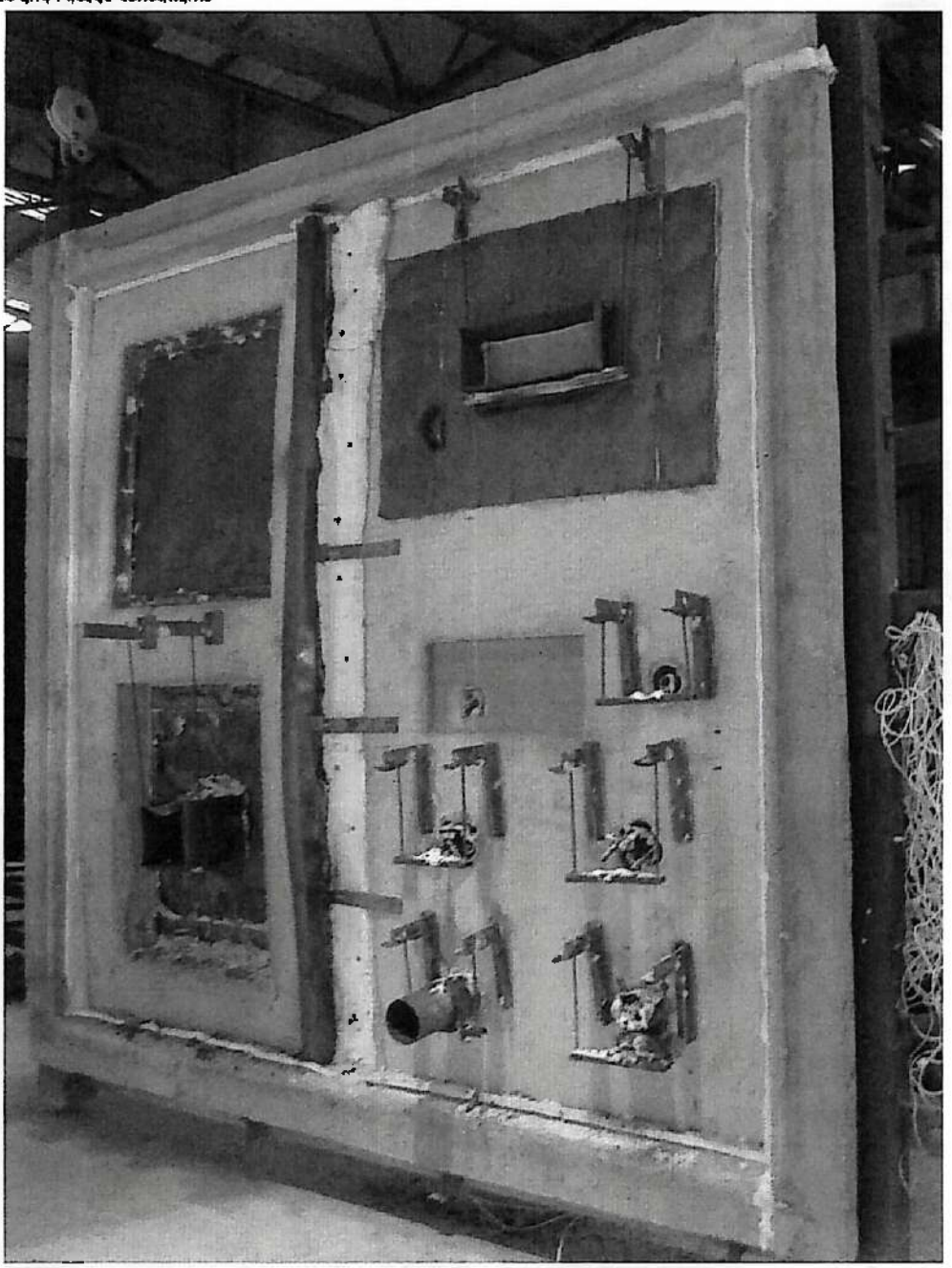


Photo 7: The exposed face of the specimens after the test.

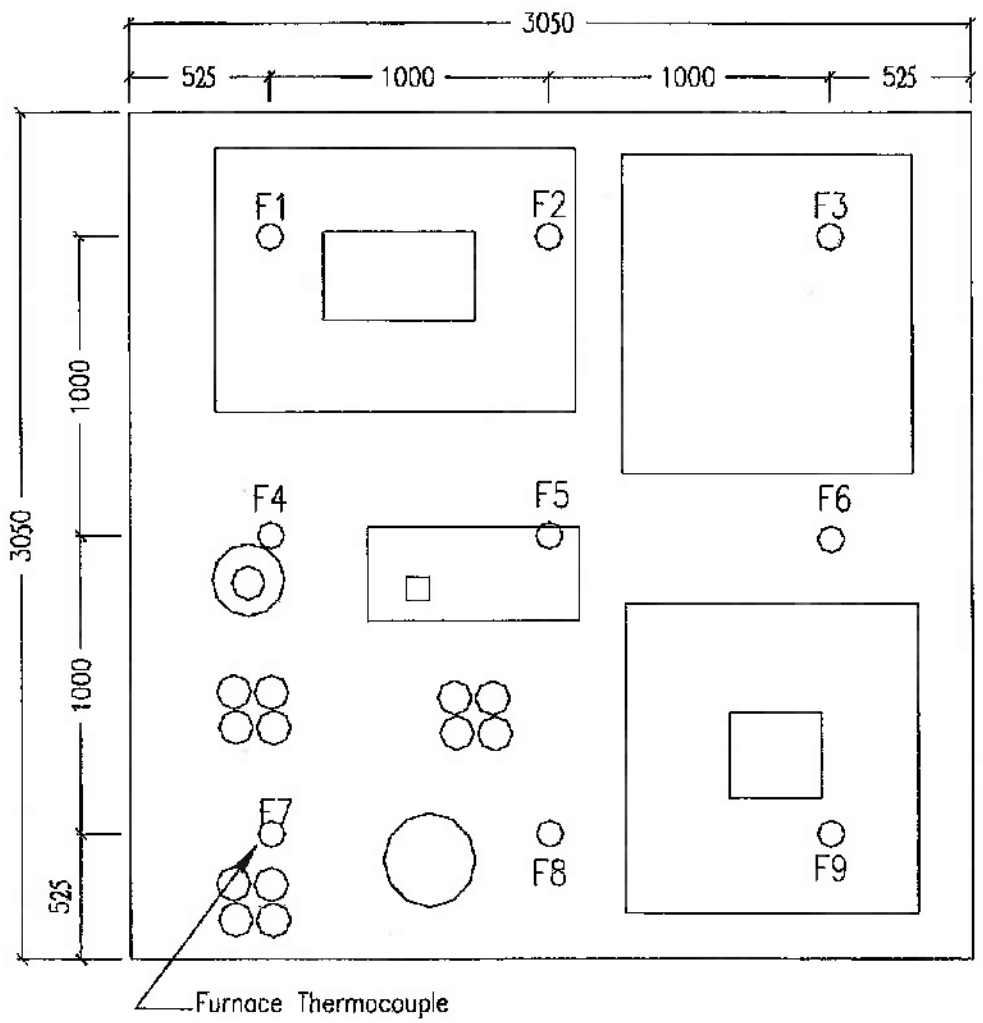


Figure 1 – Locations and reference numbers of furnace thermocouples.
(This figure is not to scale and all dimensions are in millimetres.)

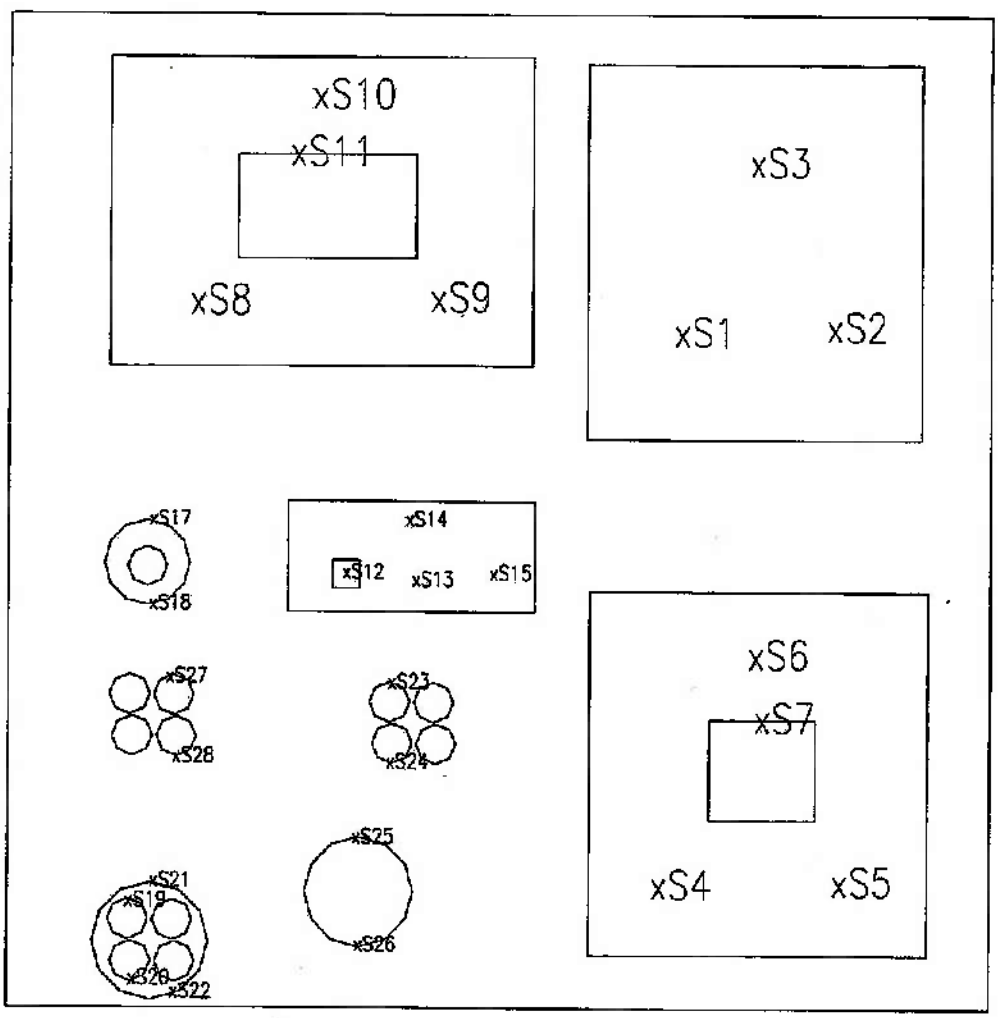


Figure 2 – Locations and reference number of thermocouples to monitor the temperature of unexposed surface of the specimens.
(This figure is not to scale.)

Note: Thermocouple S16 was fixed inside the socket box of specimen '15' for additional information only.

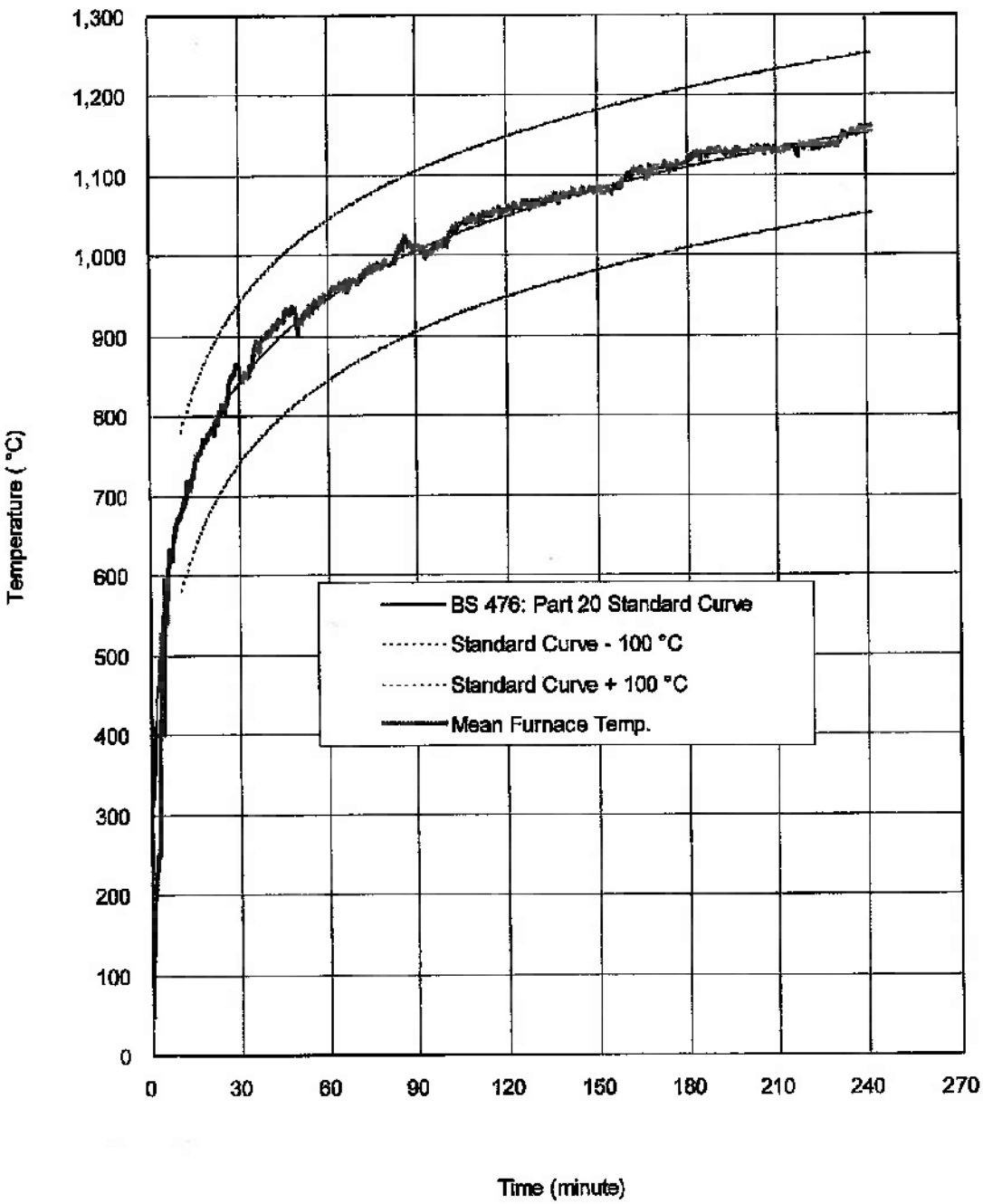


Figure 3 – Mean furnace temperature.

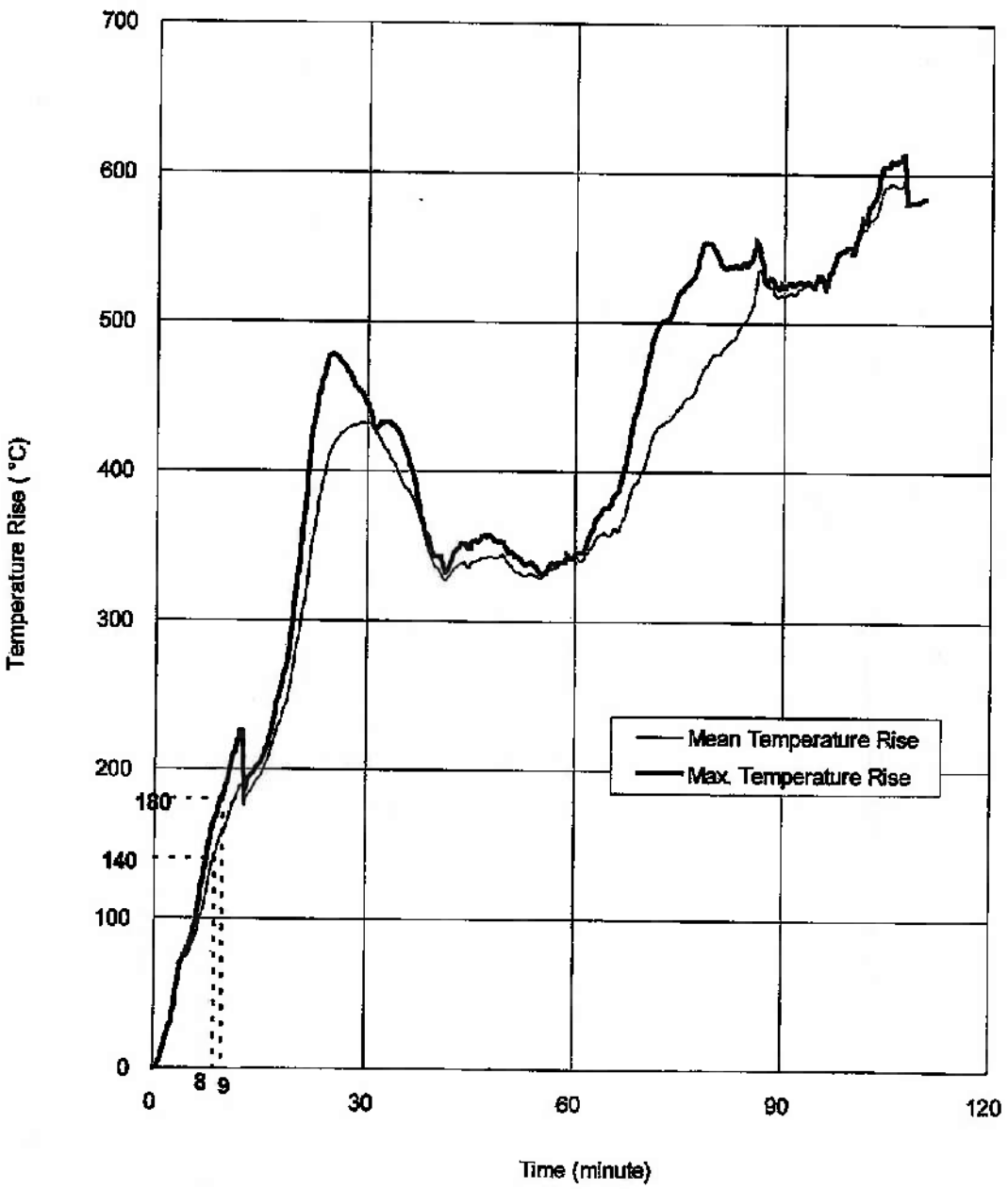


Figure 4 – Temperature rises of unexposed surface of specimen '12'.

Note: Thermocouples S1 – S3 malfunctioned after a heating period of 110 minutes.

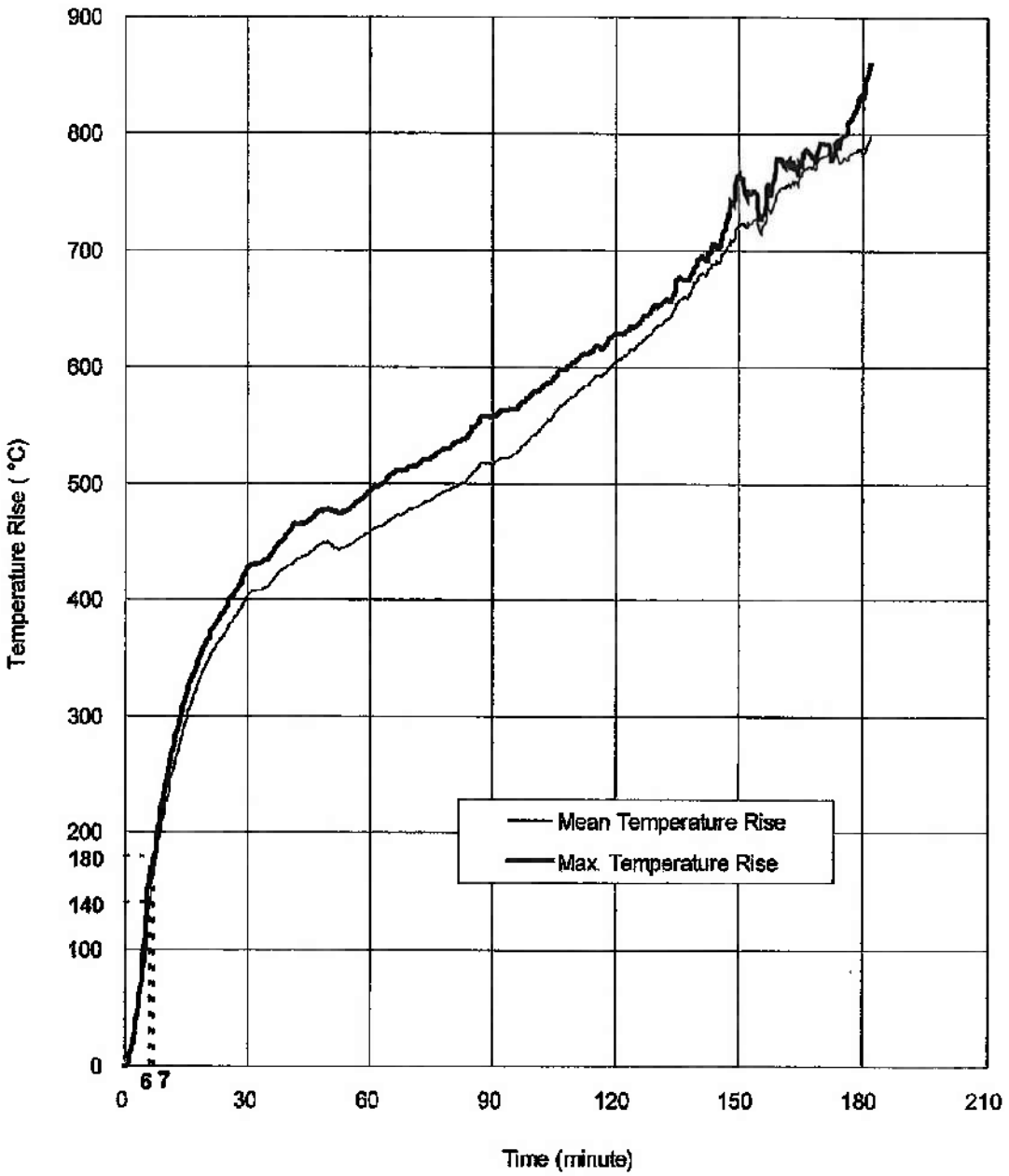


Figure 5 – Temperature rises of unexposed surface of specimen '13'.

Note: Thermocouples S4 - S7 malfunctioned after a heating period of 161 minutes.

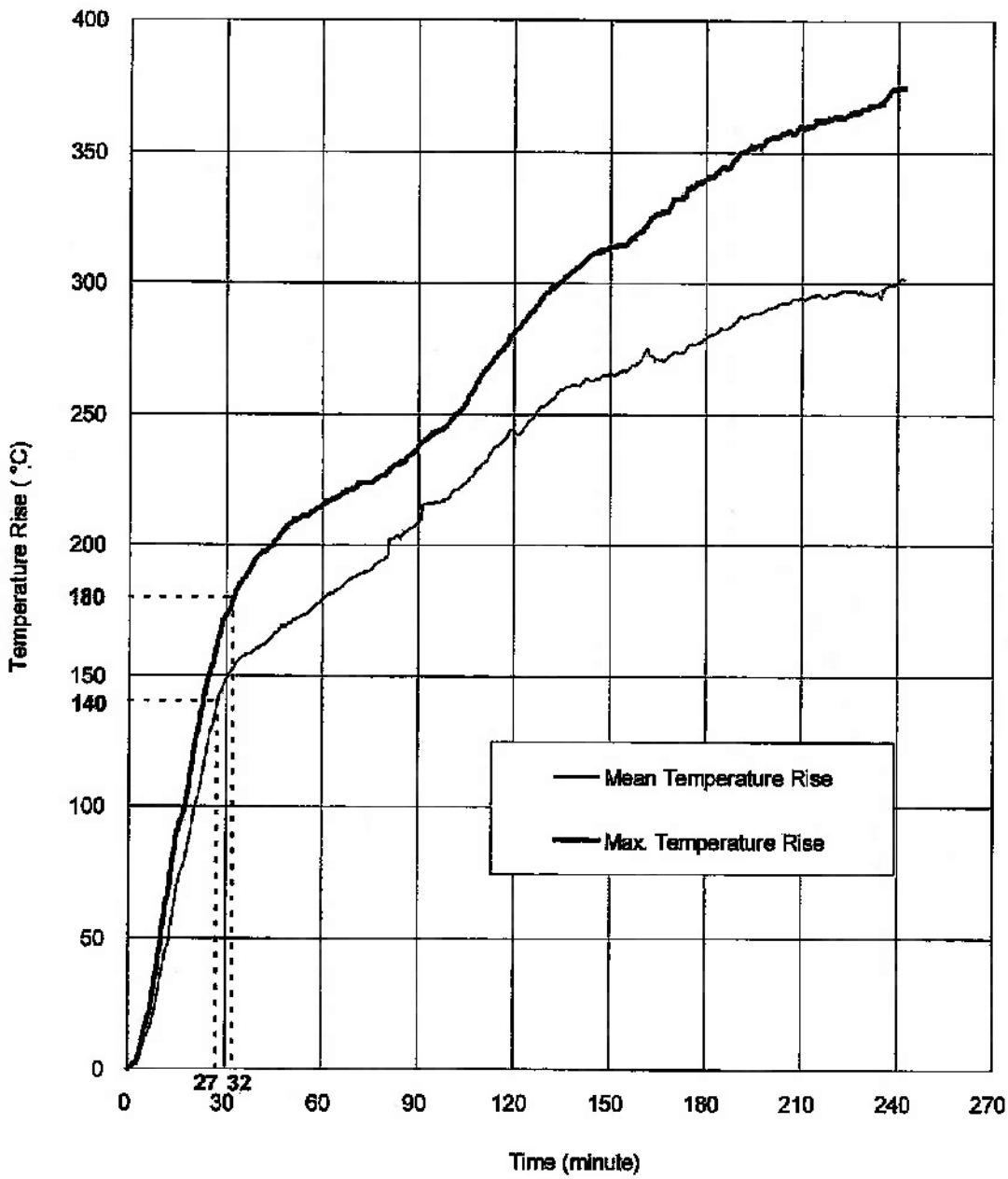


Figure 6 – Temperature rises of unexposed surface of specimen '14'.

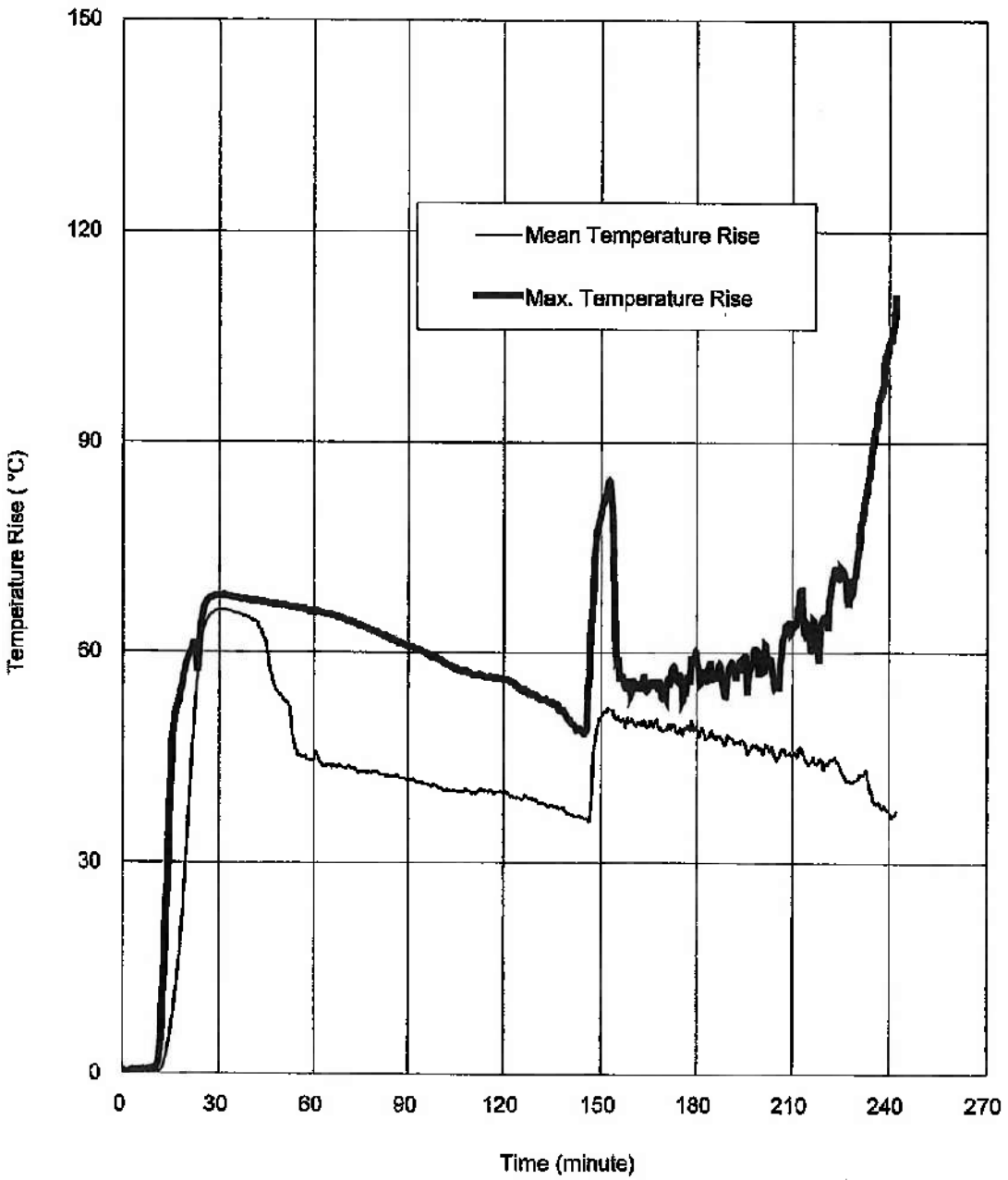


Figure 7 – Temperature rises of unexposed surface of specimen '15'.

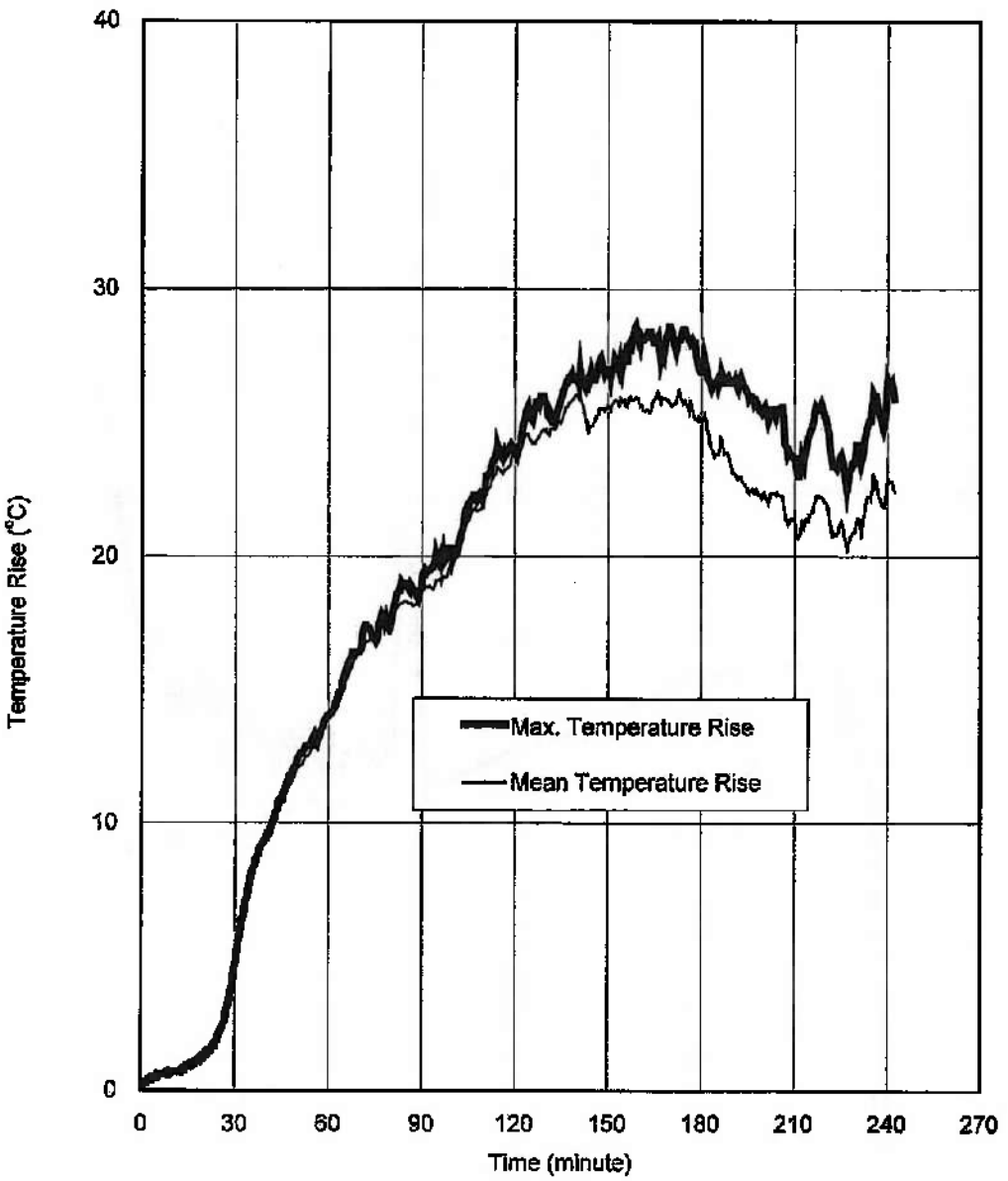


Figure 8 – Temperature rises of unexposed surface of specimen '16'.

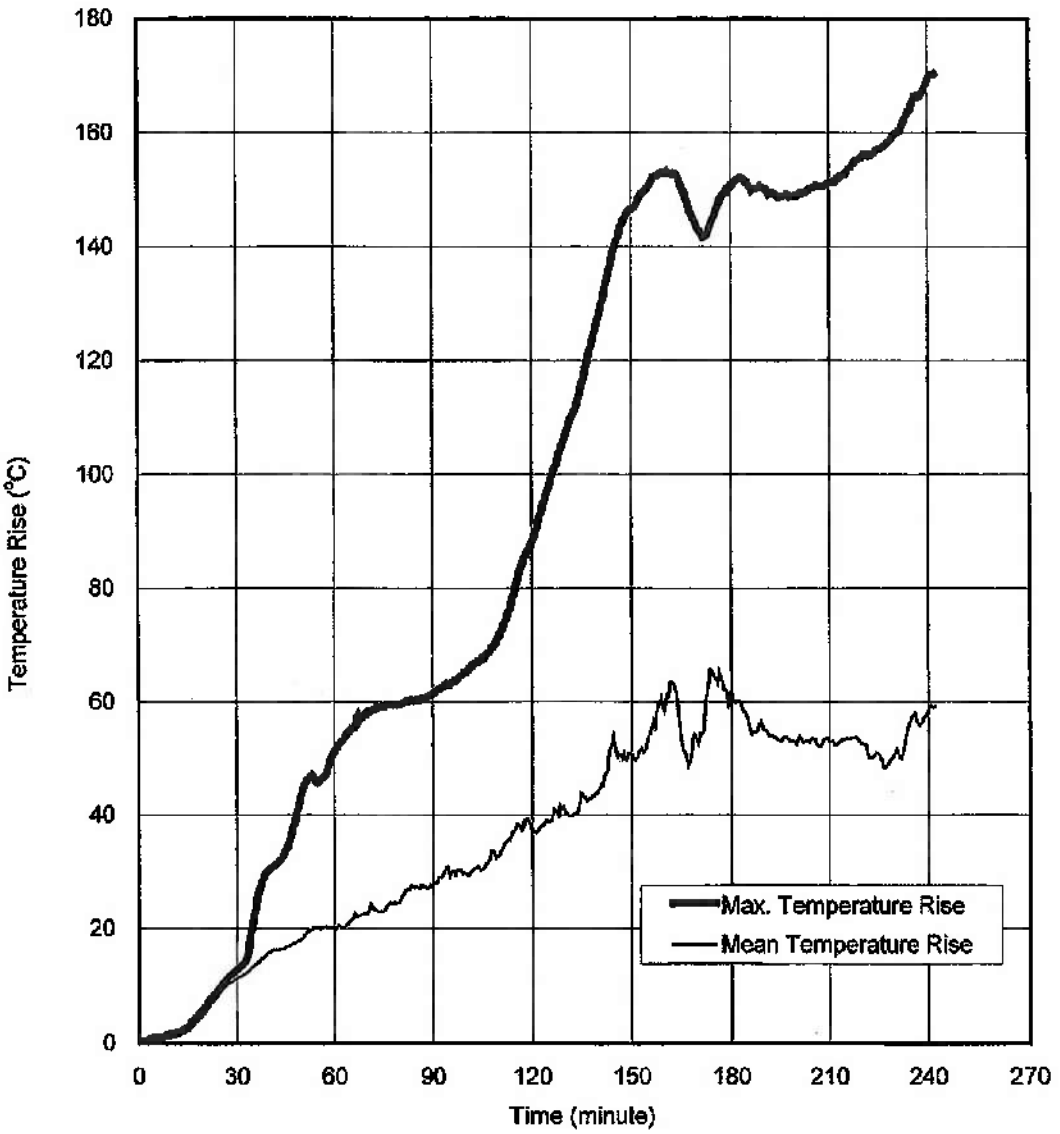


Figure 9 – Temperature rises of unexposed surface of specimen '17'.

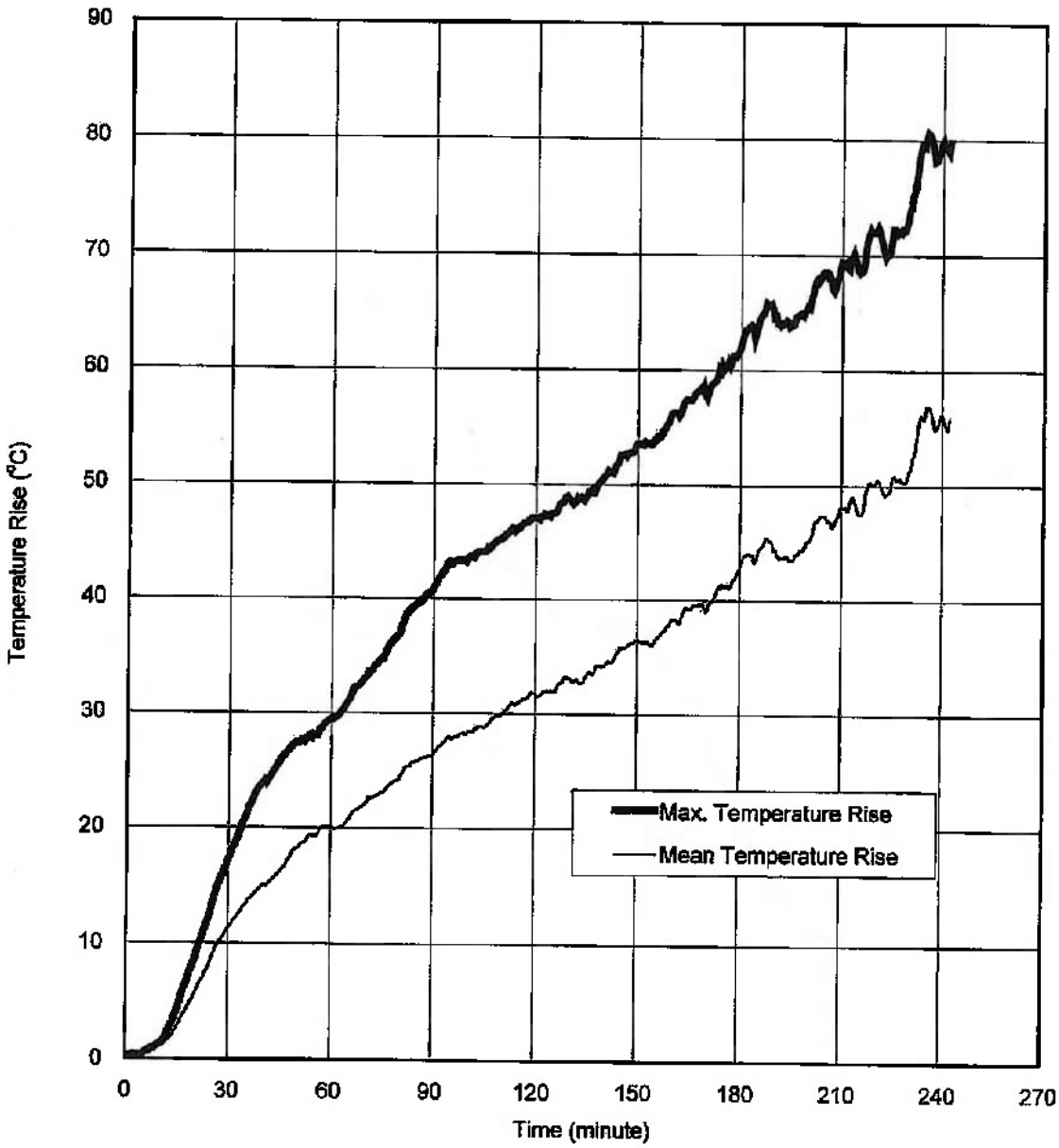


Figure 10 – Temperature rises of unexposed surface of specimen '18'.

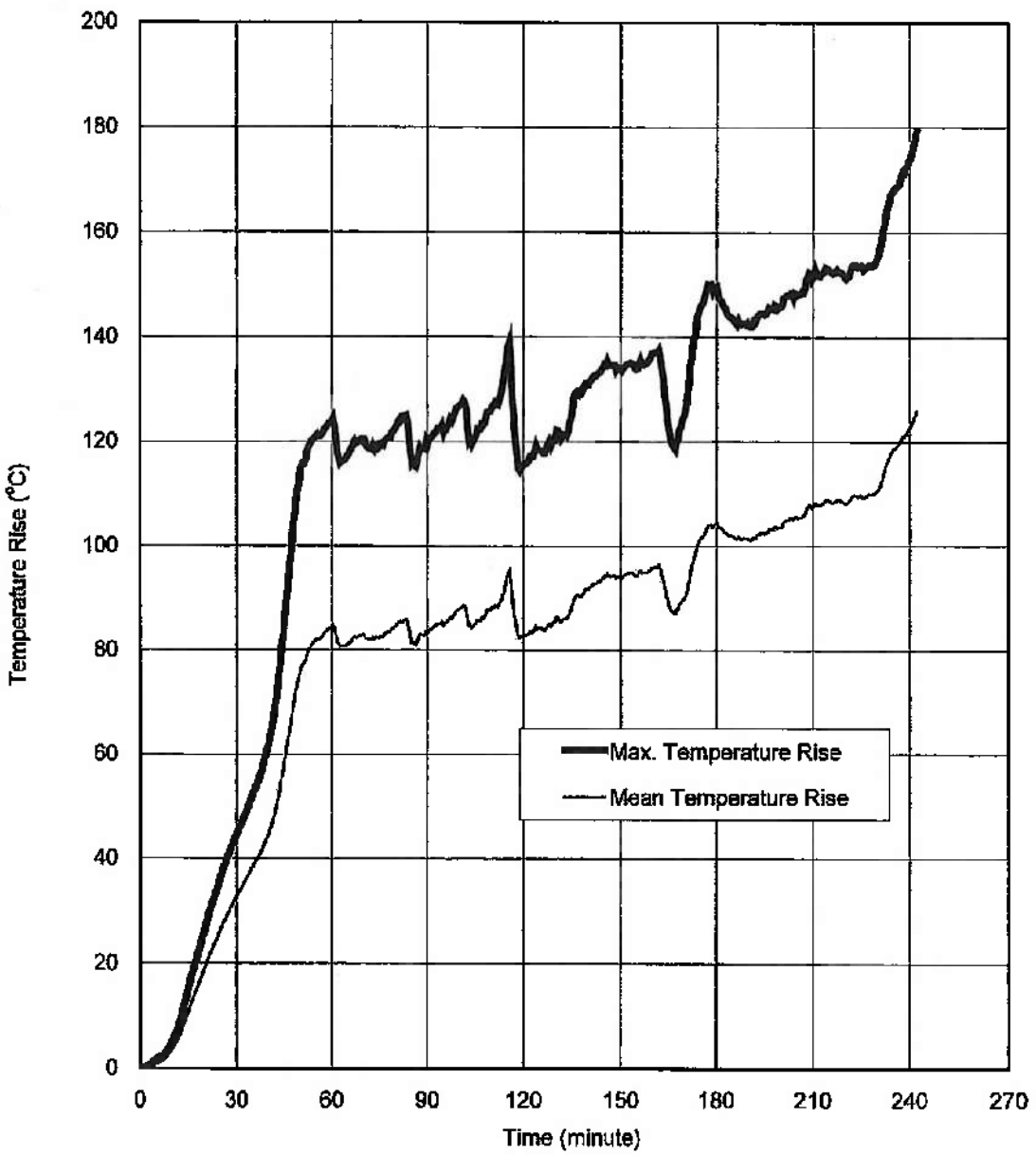


Figure 11 – Temperature rises of unexposed surface of specimen '19'.

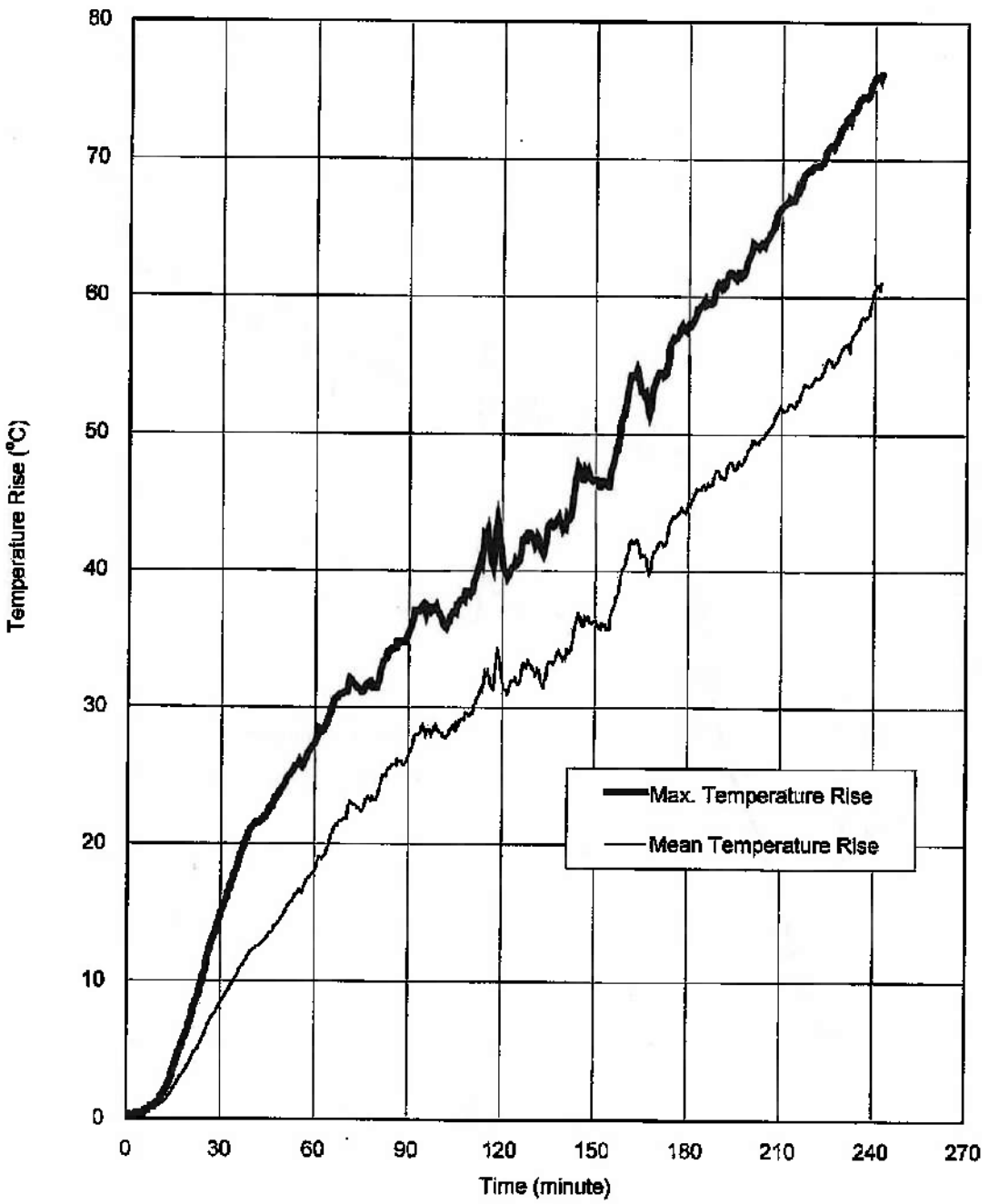


Figure 12 – Temperature rises of unexposed surface of specimen '20'.

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

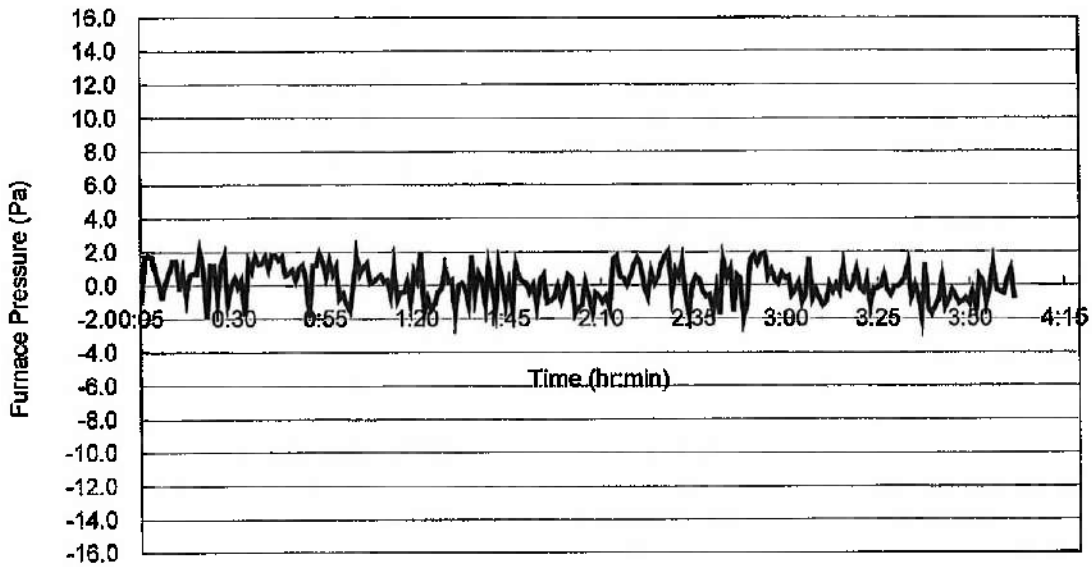


Figure 13 – Furnace pressure.

A radiometer placed at 3,000 mm away from the unexposed surface to measure the radiation of unexposed surface of specimens.

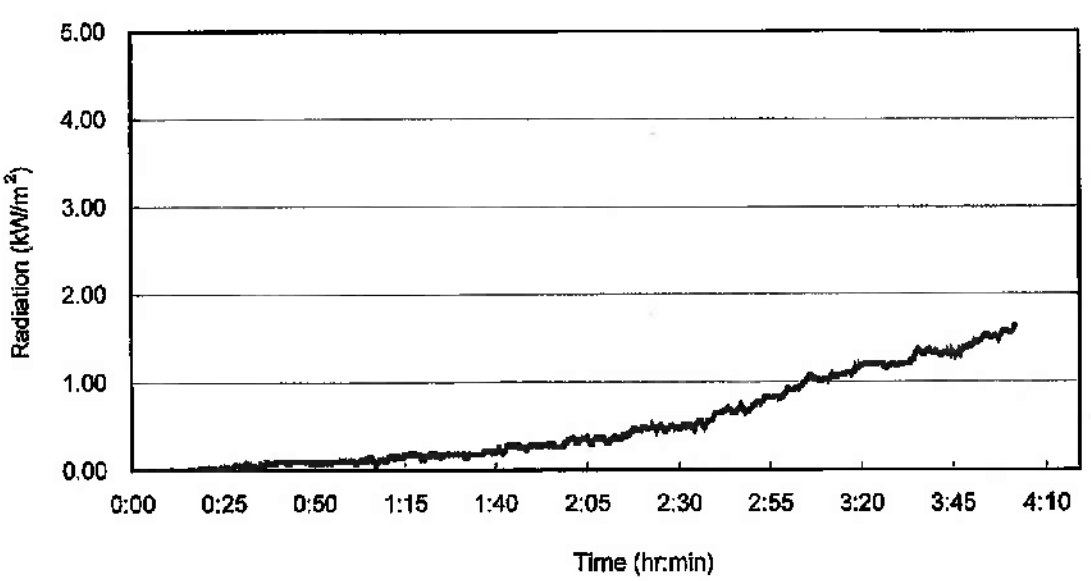


Figure 14 – Radiation.

APPENDIX B – Observation

Time (min.sec)	Exposed (E) or Unexposed (U)	Observation
00.00	-	Test started.
01.30	U	Smoke started releasing from specimen '18'.
01.49	U	Smoke started releasing from specimens '17' & '20'
02.21	U	Bubbles was observed from specimen '12'.
03.16	U	The pipe of specimen '14' deformed.
03.30	U	Smoke started releasing from specimens '13' & '14'
03.45	U	Specimen '12' deformed and moved away from the furnace.
09.37	U	Intumescent materials of specimens '12' & '13' reacted.
21.00	U	Specimen '12' turned dark.
21.34	U	Specimen '13' turned brown.
21.53	U	Water mark was observed at specimen '15'.
25.31	U	Smoke release increased from specimen '16'.
52.54	U	Joint of firestop composite sheet of specimens '12' & '13' turned red.
53.52	U	Cotton pad test applied at top of specimen '17' and the test passed.
54.13	U	Cotton pad test applied at top of specimen '20' and the test passed.
54.32	U	Cotton pad test applied at top of specimen '16' and the test passed.
54.51	U	Cotton pad test applied at top of specimen '19' and the test passed.
55.11	U	Cotton pad test applied at top of specimen '18' and the test passed.
55.25	U	Cotton pad test applied at top of specimen '15' and the test passed.
60.00	U	Specimens '12', '13' & '14' satisfied the integrity performance requirements. Specimens '15', '16', '17', '18', '19' & '20' satisfied the integrity and insulation performance requirements.
88.00	U	The sealant of specimen '18' turned brown.
102.00	U	Area above the socket box of specimen '15' turned yellow.
104.50	U	Intermitted flaming was observed at top of specimen '12'.
116.11	U	Cotton pad test applied at top of specimen '17' and the test passed.
116.28	U	Cotton pad test applied at top of specimen '20' and the test passed.
116.58	U	Cotton pad test applied at top of specimen '16' and the test passed.
117.14	U	Cotton pad test applied at top of specimen '19' and the test passed.
117.32	U	Cotton pad test applied at top of specimen '18' and the test passed.
117.50	U	Cotton pad test applied at top of specimen '15' and the test passed.

(To be continued)

Appendix B – Observation (Con't)

Time (min.sec)	Exposed (E) or Unexposed (U)	Observation
120.00	U	Specimens '12', '13' & '14' satisfied the integrity performance requirements. Specimens '15', '16', '17', '18', '19' & '20' satisfied the integrity and insulation performance requirements.
150.00	U	No significant change was observed from all specimens.
179.00	U	Specimens '12' & '13' turned red.
180.00	U	No significant change was observed from specimens '14' to '20'. Specimens '12', '13' & '14' satisfied the integrity performance requirements. Specimens '15', '16', '17', '18', '19' & '20' satisfied the integrity and insulation performance requirements.
200.00	U	Sealant of specimens '18' & '19' turned dark.
205.00	U	Putty pad of specimen '15' reacted.
211.00	U	All copper pipes turned dark.
233.45	U	Cotton pad test applied at top of specimen '20' and the test passed.
234.10	U	Cotton pad test applied at top of specimen '17' and the test passed.
234.25	U	Cotton pad test applied at top of specimen '16' and the test passed.
234.50	U	Cotton pad test applied at top of specimen '19' and the test passed.
235.10	U	Cotton pad test applied at top of specimen '18' and the test passed.
235.30	U	Cotton pad test applied at top of specimen '15' and the test passed.
238.17	U	No significant change was observed from specimens '12' to '14'.
240.00	U	Specimens '12', '13' & '14' satisfied the integrity performance requirements. Specimens '15', '16', '17', '18', '19' & '20' satisfied the integrity and insulation performance requirements.
242.05	–	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 Curve (°C)	Actual Mean Furnace Temp. (°C)
0	20	49
5	576	541
10	678	680
15	739	747
20	781	778
25	815	804
30	842	852
35	865	883
40	885	903
45	902	920
50	918	906
55	932	939
60	945	950
65	957	964
70	968	963
75	979	982
80	988	990
85	997	1007
90	1006	1013
95	1014	1004
100	1022	1011
105	1029	1040
110	1036	1043
115	1043	1049
120	1049	1056
125	1055	1061
130	1061	1066
135	1067	1069

(To be continued)

Table 1 - Mean furnace temperature (con't).

Time (minute)	BS 476: Part 20 Standard Curve (°C)	Actual Mean Furnace Temp. (°C)
140	1072	1073
145	1077	1082
150	1082	1082
155	1087	1085
160	1092	1098
165	1097	1103
170	1101	1109
175	1106	1112
180	1110	1120
185	1114	1128
190	1118	1130
195	1122	1124
200	1126	1131
205	1129	1134
210	1133	1133
215	1136	1135
220	1140	1136
225	1143	1136
230	1146	1138
235	1150	1153
240	1153	1160
242	1154	1162

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 242 minutes.

Table 2 - Time and related temperature rises measured by thermocouples S1 – S14.

Time (min)	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	77	74	83	119	84	78	25	10	8	15	4	1	0	0
10	155	143	188	215	240	218	94	34	21	48	20	1	0	0
15	204	187	–	271	318	299	144	71	45	89	29	42	1	12
20	313	238	–	318	364	353	169	99	66	118	37	58	22	41
25	478	360	–	356	398	377	185	140	93	152	47	42	66	61
30	445	420	–	382	428	403	194	173	101	173	55	37	68	64
35	363	421	–	387	436	413	199	186	107	178	62	34	68	63
40	344	327	–	402	458	428	207	196	113	173	71	25	67	62
45	353	325	–	412	468	439	211	201	118	178	77	22	67	54
50	350	333	–	421	479	447	214	208	120	183	82	16	67	40
55	332	325	–	417	479	445	213	211	124	185	94	18	66	24
60	343	344	–	427	494	455	216	215	128	194	101	21	66	23
65	339	376	–	436	506	462	218	219	132	199	110	22	66	22
70	347	470	–	446	515	475	219	222	137	204	115	24	65	22
75	369	521	–	452	522	486	219	224	141	207	114	24	64	22
80	409	548	–	461	533	494	222	228	146	212	116	24	63	23
85	477	542	–	472	547	506	225	232	160	220	118	26	62	23
90	525	512	–	478	557	516	229	238	163	225	118	26	61	23
95	526	533	–	484	564	526	230	243	176	230	123	24	60	22
100	545	548	–	502	579	542	231	247	176	234	123	24	59	23
105	606	578	–	516	590	570	236	254	178	239	124	25	58	23
110	–	583	–	534	605	589	241	265	180	247	128	27	57	23
115	–	–	–	552	619	608	247	273	184	258	133	29	57	24
120	–	–	–	567	628	622	247	281	188	263	132	28	56	24
125	–	–	–	583	636	637	248	288	181	274	137	28	55	23
130	–	–	–	608	653	645	251	296	185	281	140	29	54	24
135	–	–	–	633	675	659	254	301	186	291	146	30	53	24
140	–	–	–	655	690	680	254	306	185	292	149	32	51	24
145	–	–	–	673	703	693	260	311	181	297	148	35	49	24

(To be continued)

T: +852 2807 0930 F: +852 2662 6105 E: fire@red.com.hk W: www.red.com.hk

Table 2 - Time and related temperature rises measured by thermocouples S1 – S14 (con't).

Time (min)	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
150	--	--	--	690	765	711	259	314	183	299	152	80	52	49
155	--	--	--	705	727	727	258	315	185	300	154	59	51	50
160	--	--	--	740	779	744	270	320	191	307	156	56	50	50
165	--	--	--	761	774	760	272	326	175	311	155	55	49	50
170	--	--	--	779	792	769	272	332	175	315	154	54	48	50
175	--	--	--	798	760	775	282	336	176	320	159	56	47	50
180	--	--	--	829	726	794	286	340	176	321	163	59	48	50
185	--	--	--	--	--	--	--	344	178	326	164	56	47	50
190	--	--	--	--	--	--	--	348	180	331	166	58	46	51
195	--	--	--	--	--	--	--	352	182	331	164	60	44	51
200	--	--	--	--	--	--	--	355	182	335	165	58	41	52
205	--	--	--	--	--	--	--	358	183	337	167	56	40	51
210	--	--	--	--	--	--	--	360	184	339	166	64	39	52
215	--	--	--	--	--	--	--	362	185	340	167	63	38	51
220	--	--	--	--	--	--	--	363	186	338	168	66	36	52
225	--	--	--	--	--	--	--	365	185	341	167	72	36	51
230	--	--	--	--	--	--	--	367	183	339	169	71	35	49
235	--	--	--	--	--	--	--	369	184	339	174	75	35	43
240	--	--	--	--	--	--	--	374	185	342	175	73	34	41
242	--	--	--	--	--	--	--	375	186	344	178	78	36	39

Notes: Locations of thermocouples S1 – S14 are shown in Figure 2.

Thermocouples S1, S2 & S3 malfunctioned after heating periods of 107, 111 and 12 minutes respectively.

Thermocouples S4, S5, S6 & S7 malfunctioned after a heating period 181 minutes.

The test was terminated as requested by the test sponsor after a heating period of 242 minutes.

Table 3 - Time and related temperature rises measured by thermocouples S15 – S28.

Time (min)	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	1	1	1	1	1	0	0	0	0	1	0	0	0
10	0	1	1	1	1	2	0	0	1	1	5	2	1	1
15	1	53	1	1	3	3	1	0	4	1	15	6	3	1
20	6	67	1	1	6	5	1	0	8	2	26	12	7	1
25	18	67	2	2	10	8	3	1	13	4	37	17	11	2
30	31	67	5	5	13	10	4	1	17	5	45	21	15	2
35	44	67	8	8	17	11	22	2	21	6	52	25	18	3
40	52	67	9	9	20	13	31	3	24	6	62	28	21	3
45	55	66	11	11	21	13	34	4	26	7	85	31	22	4
50	56	66	12	12	23	14	44	6	28	9	114	38	24	5
55	56	66	13	13	26	15	46	9	28	11	121	43	26	7
60	55	65	14	14	25	15	51	27	30	11	124	45	27	9
65	55	65	16	15	27	16	55	52	31	10	117	45	30	11
70	55	64	17	16	28	17	58	57	33	11	121	45	31	13
75	54	64	17	17	29	17	59	59	35	11	119	46	31	14
80	54	66	18	17	30	20	60	57	37	12	123	46	32	15
85	54	75	19	18	32	22	60	57	40	12	116	47	34	17
90	54	64	19	18	33	23	61	58	41	12	119	47	36	18
95	54	53	20	18	36	24	63	59	43	13	122	48	37	19
100	54	53	20	19	36	23	65	55	43	13	127	49	37	20
105	54	57	22	21	39	22	67	53	44	14	121	49	37	20
110	54	66	22	22	42	24	71	52	45	14	126	49	39	21
115	53	72	24	23	51	25	80	51	46	16	138	51	43	22
120	53	75	24	24	50	24	88	53	47	16	116	50	40	23
125	52	80	25	24	53	25	98	52	48	16	118	50	41	23
130	46	86	26	24	55	26	107	52	49	18	122	51	42	23
135	44	92	26	24	59	29	116	50	49	18	126	51	43	23
140	43	96	27	25	62	27	128	50	51	18	131	53	43	24
145	41	102	27	23	67	38	140	49	53	19	135	54	47	26

(To be continued)

Table 3 - Time and related temperature rises measured by thermocouples S15 – S28 (con't).

Time (min)	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28
150	51	124	27	24	71	31	147	53	54	19	134	54	47	26
155	50	133	27	24	77	29	150	53	54	19	134	55	47	26
160	47	136	28	23	80	41	153	53	56	20	137	55	53	30
165	42	138	28	24	73	32	150	53	57	21	122	55	53	29
170	39	138	29	23	64	41	143	54	58	20	126	55	54	30
175	35	141	28	23	83	45	146	61	60	22	146	57	57	31
180	37	152	27	23	76	47	151	75	62	24	150	59	58	32
185	36	153	27	21	66	48	151	84	64	24	144	60	60	33
190	37	162	27	20	64	46	150	88	65	24	142	61	61	33
195	37	171	26	19	57	49	149	91	64	23	144	61	61	34
200	37	181	26	19	59	47	149	94	66	25	146	61	63	35
205	39	192	26	19	59	47	150	99	69	26	148	63	64	36
210	42	197	24	19	56	50	151	101	69	27	152	64	67	37
215	48	202	25	19	58	50	153	105	69	27	153	65	68	37
220	54	203	25	19	57	48	156	107	72	28	151	65	70	38
225	62	195	24	19	54	48	157	108	72	29	153	66	71	40
230	73	191	24	19	57	45	160	107	74	29	155	66	73	40
235	89	191	26	20	66	49	165	119	80	33	168	69	74	41
240	104	196	27	19	64	52	169	128	80	33	174	71	76	45
242	111	196	26	19	62	57	170	131	80	32	179	72	76	46

Notes: Locations of thermocouples S15 - S28 are shown in Figure 2.

Thermocouple S16 was for additional information only.

The test was terminated as requested by the test sponsor after a heating period of 242 minutes.

APPENDIX D – Information from Test Sponsor

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

Specimen '12'

Item	Description		
1	**Firestop Composite Sheets**		
	Brand	:	Hilti.#
	Model	:	CFS-COS.#
	Material	:	Intumescent stainless steel composite sheet.
	Overall sizes	:	910 mm wide by 910 mm high by 3.8 mm thick.*
	Exposed area	:	910 mm wide by 910 mm high.*
	Fixing method	:	The Firestop Composite Sheets were joined together with M5 by 25 mm long screws at 250 mm nominal centres and fixed to L-angles with sizes of 50 mm by 50 mm by 3 mm thick at four sides. The L-angles was fixed the concrete with M6 by 54 mm long anchor bolts at 250 mm nominal centres..#
	Direction	:	Stainless steel facing was faced at fire exposed side.#

*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.)

Specimen '13'

Item	Description		
1	**Firestop Composite Sheets**		
	Brand	:	Hilti.#
	Model	:	CFS-COS.#
	Material	:	Intumescent stainless steel composite sheet.
	Overall sizes	:	910 mm wide by 1,200 mm high by 3.8 mm thick.*
	Exposed area	:	810 mm wide by 1,110 mm high.*
	Fixing method	:	The Firestop Composite Sheets were joined together with M5 by 25 mm long screws at 250 mm nominal centres and fixed to L-angles with sizes of 50 mm by 50 mm by 5 mm thick at four sides. The L-angles was fixed the concrete with M6 by 54 mm long anchor bolts at 250 mm nominal centres..#
	Direction	:	Stainless steel facing was faced at unexposed side.#
2	**Rockwool**		
	Brand	:	ROCKWOOL.#
	Thickness	:	50 mm.*
	Density	:	160 kg/m^3.*
	Applied location	:	Cover opening of metal sleeve.#
3	**G.I. Pipe**		
	Sizes	:	250 mm by 250 mm by 1 mm thick.*
	Materials	:	Galvanized steel.#
	Fixing method	:	The pipes were supported by fixed to 40 mm by 20 mm by 3 mm thick steel L-angles, located at 120 mm from the concrete wall on both sides. The steel angles were supported by 2 nos. of M10 steel rods to the concrete lining.

*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.)

Specimen '14'

Item	Description		
1	**Firestop Composite Sheets**		
	Brand	:	Hilti.#
	Model	:	CFS-COS 36x36.#
	Material	:	2 layers intumescent stainless steel composite sheet.
	Overall sizes	:	1,010 mm wide by 910 mm high by 3.8 mm thick.*
	Exposed area	:	900 mm wide by 810 mm high.*
	Fixing method	:	The Firestop Composite Sheets were joined together with M5 by 25 mm long screws at 250 mm nominal centres and fixed to L-angles with sizes of 50 mm by 50 mm by 5 mm thick at four sides. The L-angles was fixed the concrete with M6 by 54 mm long anchor bolts at 250 mm nominal centres..#
	Direction	:	Stainless steel facing was faced at both sides.#
2	**Rockwool**		
	Brand	:	ROCKWOOL.#
	Thickness	:	40 mm.*
	Density	:	160 kg/m^3.*
	Applied location	:	Covered the opening.#
3	**G.I. Pipe**		
	Sizes	:	500 mm by 200 mm by 1 mm thick.*
	Materials	:	Galvanized steel.#
	Fixing method	:	The pipes were supported by fixed to 40 mm by 20 mm by 3 mm thick steel L-angles, located at 120 mm from the concrete wall on both sides. The steel angles were supported by 2 nos. of M10 steel rods to the concrete lining.

*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.)

Specimen '15'

Item	Description
1	**Lightweight Blocks**
	Brand : Ytong.#
	Material : Lightweight concrete.
	Overall sizes of wall : 600 mm wide by 300 mm high by 81 mm thick.*
	Sizes for each block : 600 mm wide by 300 mm high by 75 mm thick.*
	Density of block : 750 kg/m^3.
	Thickness of plaster : 3 mm thick on both sides of block.*
2	**Socket Boxes**
	Sizes : 2 nos. of 70 mm by 70 mm by 50 mm deep by 3.5 mm thick.*
	Materials : PVC.#
	Applied location : Embedded in both fire side and non-fire side of blockwall.#
3	**Firestop Putty Pad**
	Brand : Hilti.#
	Model : CP617.#
	Materials : firestop putty pad.
	Applied location : Inner side of PVC socket box.#

*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.)

Specimen '16'

Item	Description		
1	**PVC Pipe**		
	Material	:	PVC.#
	Overall sizes	:	48 mm outer diameter by 4 mm thick by 1,200 mm long.*
	Fixing method	:	The pipe was supported by fixed to 40 mm by 20 mm by 3 mm thick steel L-angles, located at 120 mm from the concrete wall on both sides. The steel angles ware supported by 2 nos. of M10 steel rods to the concrete lining.
2	**Rockwool**		
	Brand	:	ROCKWOOL.#
	Thickness	:	50 mm.*
	Density	:	160 kg/m^3.*
	Applied location	:	Covered the opening of pipes.#
3	**Insulation**		
	Brand & Model	:	Armacell Classo Armaflex.
	Sizes	:	25 mm thick by 750 mm long.*
	Applied location	:	Wrapped outside the PVC pipe.#
4	**Bandage**		
	Brand & Model	:	Hilti CFS-B.#
	Quantity	:	2 layers in the middle of wall.
	Applied location	:	Wrapped around insulated pipe.#
5	**Sealant**		
	Brand & Model	:	Hilti CP606.#
	Applied location	:	Filled the gaps between the pipe and concrete lining.

*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.)

Specimen '17'

Item	Description		
1a	**PVC Pipe**		
	Material	:	PVC.#
	Overall sizes	:	1 no. of 25 mm outer diameter by 2 mm thick by 1,200 mm long.*
	Fixing method	:	The pipe was supported by fixed to 40 mm by 20 mm by 3 mm thick steel L-angles, located at 120 mm from the concrete wall on both sides. The steel angles were supported by 2 nos. of M10 steel rods to the concrete lining.
1b	**Copper Pipes**		
	Material	:	Copper.#
	Overall sizes	:	3 pairs of 12.7 mm outer diameter by 1 mm thick and 6.4 mm outer diameter by 1 mm thick 48 mm outer diameter by 4 mm thick by 1,200 mm long.*
	Fixing method	:	The pipes were supported by fixed to 40 mm by 20 mm by 3 mm thick steel L-angles, located at 120 mm from the concrete wall on both sides. The steel angles were supported by 2 nos. of M10 steel rods to the concrete lining.
2	**Rockwool**		
	Brand	:	ROCKWOOL.#
	Thickness	:	50 mm.*
	Density	:	160 kg/m^3.*
	Applied location	:	Covered the opening.#
3	**Insulation**		
	Brand & Model	:	Armacell Classo Armaflex.
	Sizes	:	25 mm thick by 750 mm long.*
	Applied location	:	Wrapped outside the pipes individually.#
4	**Collar**		
	Brand & Model	:	Hilti CFS-C EL.#
	Applied location	:	Wrapped around insulated pipes at both opening ends.#
5	**Foam**		
	Brand & Model	:	Hilti CFS-F FX.#
	Applied location	:	Filled the gaps between the pipe and concrete lining.

*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.)

Specimen '18'

Item	Description		
1a	**PVC Pipe**		
	Material	:	PVC.#
	Overall sizes	:	1 no. of 25 mm outer diameter by 2 mm thick by 1,200 mm long.*
	Fixing method	:	The pipe was supported by fixed to 40 mm by 20 mm by 3 mm thick steel L-angles, located at 120 mm from the concrete wall on both sides. The steel angles were supported by 2 nos. of M10 steel rods to the concrete lining.
1b	**Copper Pipes**		
	Material	:	Copper.#
	Overall sizes	:	3 pairs of 12.7 mm outer diameter by 1 mm thick and 6.4 mm outer diameter by 1 mm thick 48 mm outer diameter by 4 mm thick by 1,200 mm long.*
	Fixing method	:	The pipes were supported by fixed to 40 mm by 20 mm by 3 mm thick steel L-angles, located at 120 mm from the concrete wall on both sides. The steel angles were supported by 2 nos. of M10 steel rods to the concrete lining.
2	**Rockwool**		
	Brand	:	ROCKWOOL.#
	Thickness	:	50 mm.*
	Density	:	160 kg/m^3.*
	Applied location	:	Covered the opening.#
3	**Insulation**		
	Brand & Model	:	Armacell Classo Armaflex.
	Sizes	:	25 mm thick by 750 mm long.*
	Applied location	:	Wrapped outside the pipes individually.#
4	**Bandage**		
	Brand & Model	:	Hilti CFS-B.#
	Quantity	:	2 layers in the middle of wall.
	Applied location	:	Wrapped around insulated pipes. Three pairs of insulated copper pipes were wrapped together by the bandage and the insulated PVC pipe was wrapped individually.#
5	**Sealant**		
	Brand & Model	:	Hilti CP606.#
	Applied location	:	Filled the gaps between the pipe and concrete lining.

*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.)

Specimen '19'

Item	Description		
1	**Pipe**		
	Material	:	Galvanized steel.#
	Overall sizes	:	138 mm inner diameter by 1.5 mm thick by 1,200 mm long.*
	Fixing method	:	The pipe was supported by fixed to 40 mm by 20 mm by 3 mm thick steel L-angles, located at 120 mm from the concrete wall on both sides. The steel angles were supported by 2 nos. of M10 steel rods to the concrete lining.
2	**Rockwool**		
	Brand	:	ROCKWOOL.#
	Thickness	:	50 mm.*
	Density	:	160 kg/m^3.*
	Applied location	:	Covered the opening.#
3	**Filling Foam**		
	Brand & Model	:	Hilti CF-F 750.
	Applied location	:	Filled the gaps between the pipe and concrete lining.
4	**Sealant**		
	Brand & Model	:	Hilti CP606.#
	Applied location	:	Filled the gaps between the pipe and concrete lining at both opening ends with 10 mm depth CP606.

*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.)

Specimen '20'

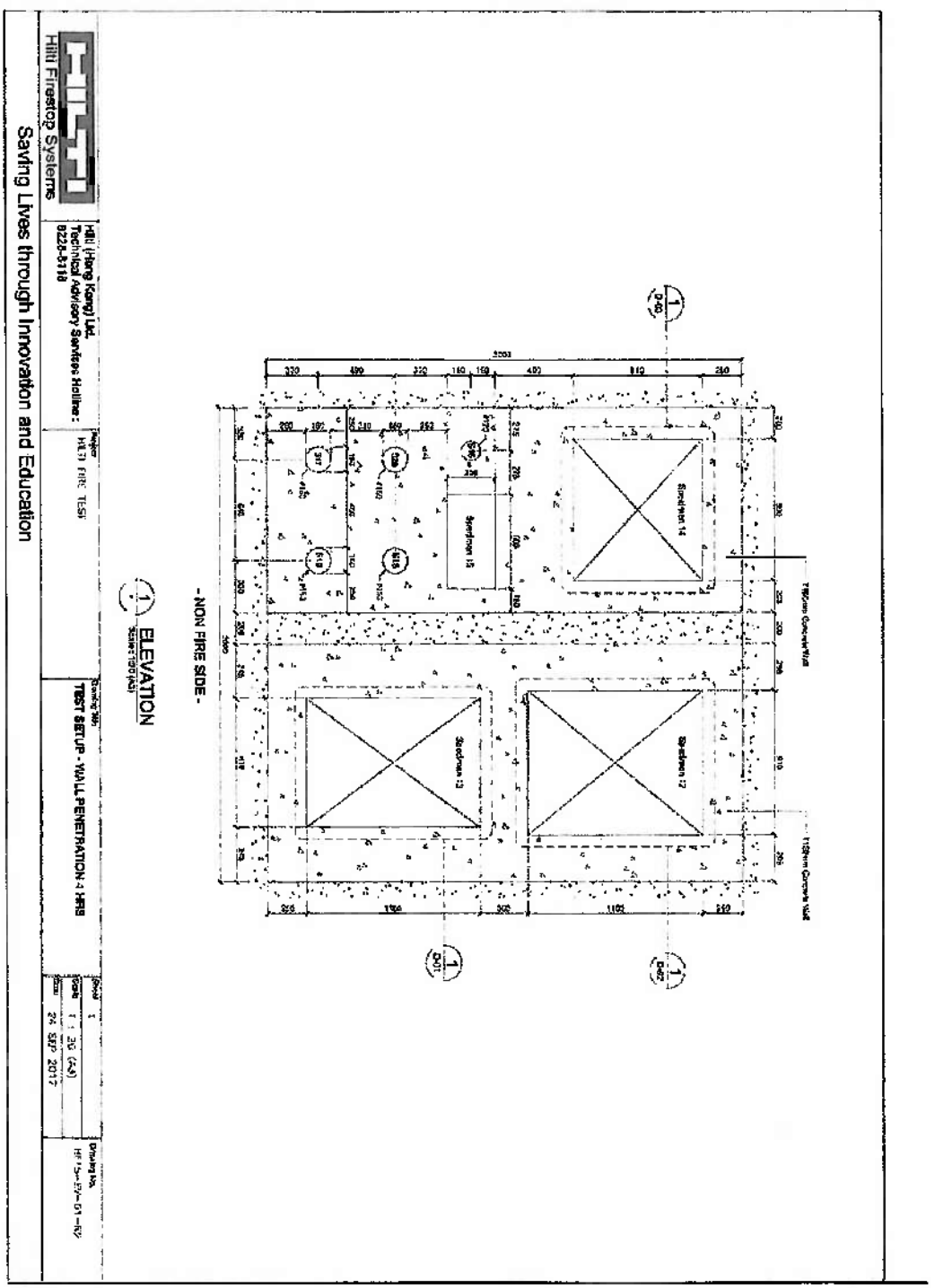
Item	Description		
1a	**PVC Pipe**		
	Material	:	PVC.#
	Overall sizes	:	1 no. of 25 mm outer diameter by 2 mm thick by 1,200 mm long.*
	Fixing method	:	The pipe was supported by fixed to 40 mm by 20 mm by 3 mm thick steel L-angles, located at 120 mm from the concrete wall on both sides. The steel angles were supported by 2 nos. of M10 steel rods to the concrete lining.
1b	**Copper Pipes**		
	Material	:	Copper.#
	Overall sizes	:	3 pairs of 12.7 mm outer diameter by 1 mm thick and 6.4 mm outer diameter by 1 mm thick 48 mm outer diameter by 4 mm thick by 1,200 mm long.*
	Fixing method	:	The pipes were supported by fixed to 40 mm by 20 mm by 3 mm thick steel L-angles, located at 120 mm from the concrete wall on both sides. The steel angles were supported by 2 nos. of M10 steel rods to the concrete lining.
2	**Rockwool**		
	Brand	:	ROCKWOOL.#
	Thickness	:	50 mm.*
	Density	:	160 kg/m^3.*
	Applied location	:	Covered the opening.#
3	**Insulation**		
	Brand & Model	:	Armacell Classo Armaflex.
	Sizes	:	25 mm thick by 750 mm long.*
	Applied location	:	Wrapped outside the pipes individually.#
4	**Bandage**		
	Brand & Model	:	Hilti CFS-B.#
	Quantity	:	2 layers in the middle of wall.
	Applied location	:	Wrapped around insulated pipes. All insulated pipes were wrapped together.#
5	**Sealant**		
	Brand & Model	:	Hilti CP606.#
	Applied location	:	Filled the gaps between the pipe and concrete lining.

*Notes: * Verified on site by RED.*

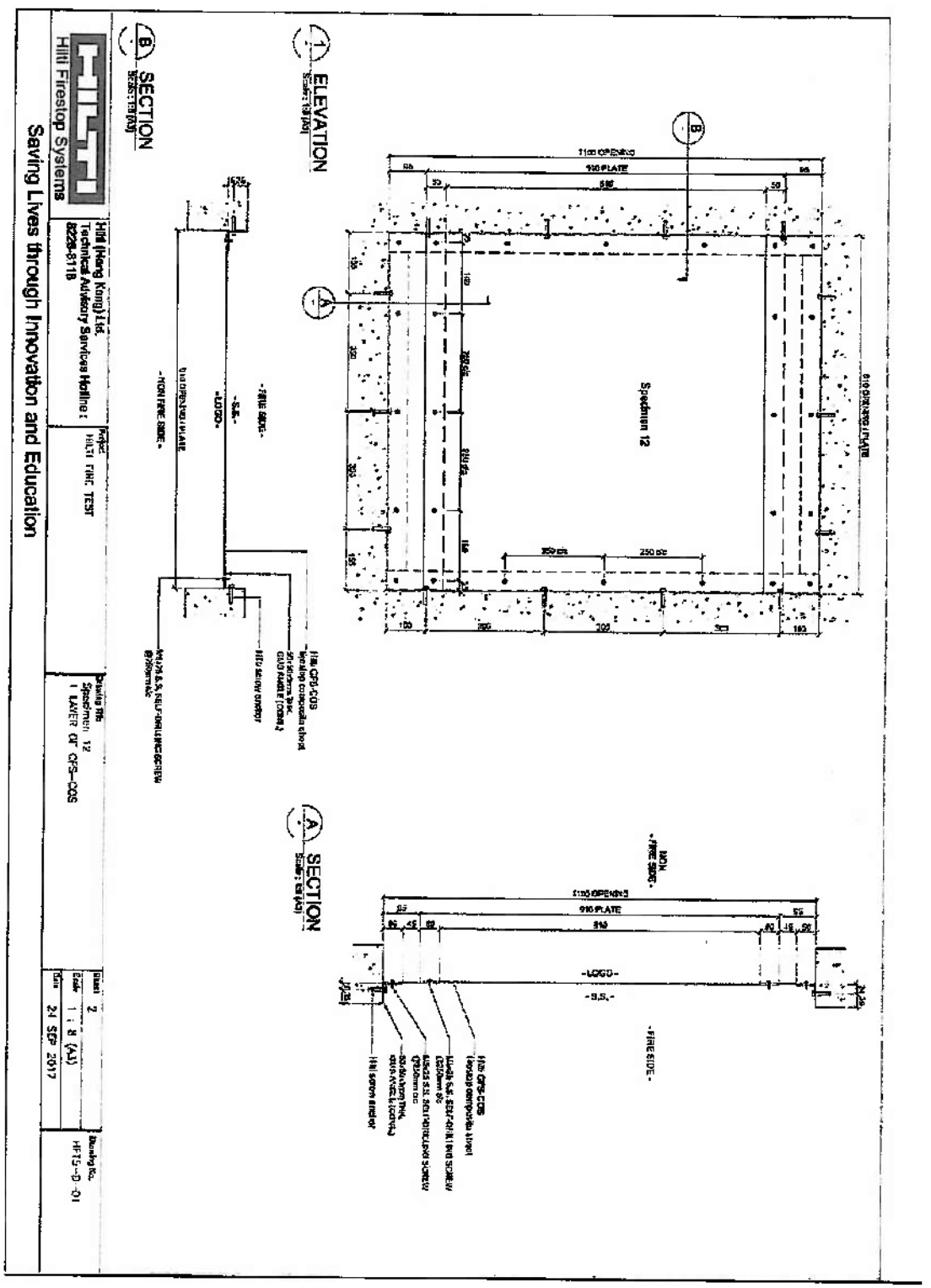
 # As shown on the test construction

Drawings from Test Sponsor

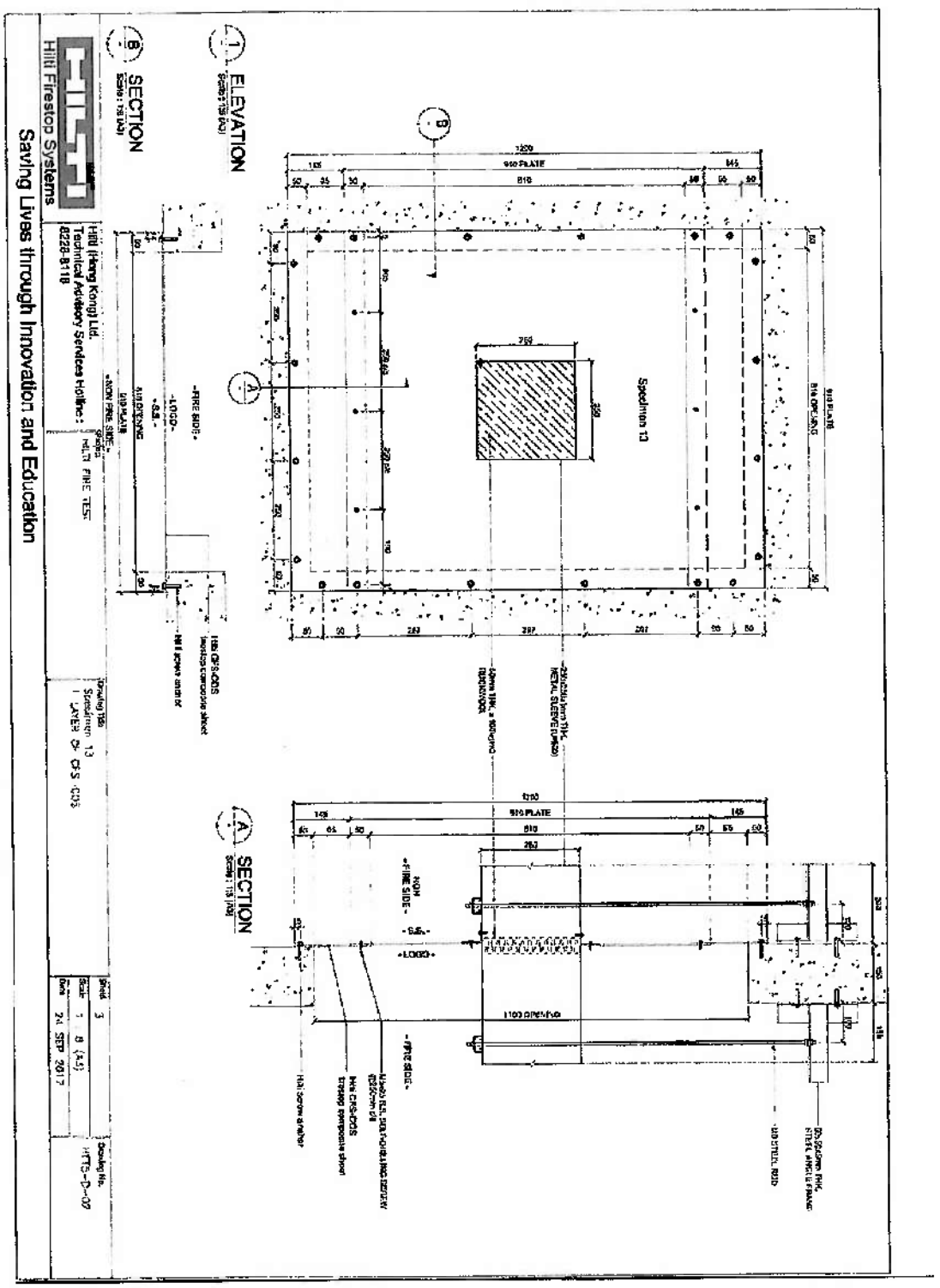
(The drawings provided by test sponsor, which was not verified by RED, except those specified and described in 'information from test sponsor'.)



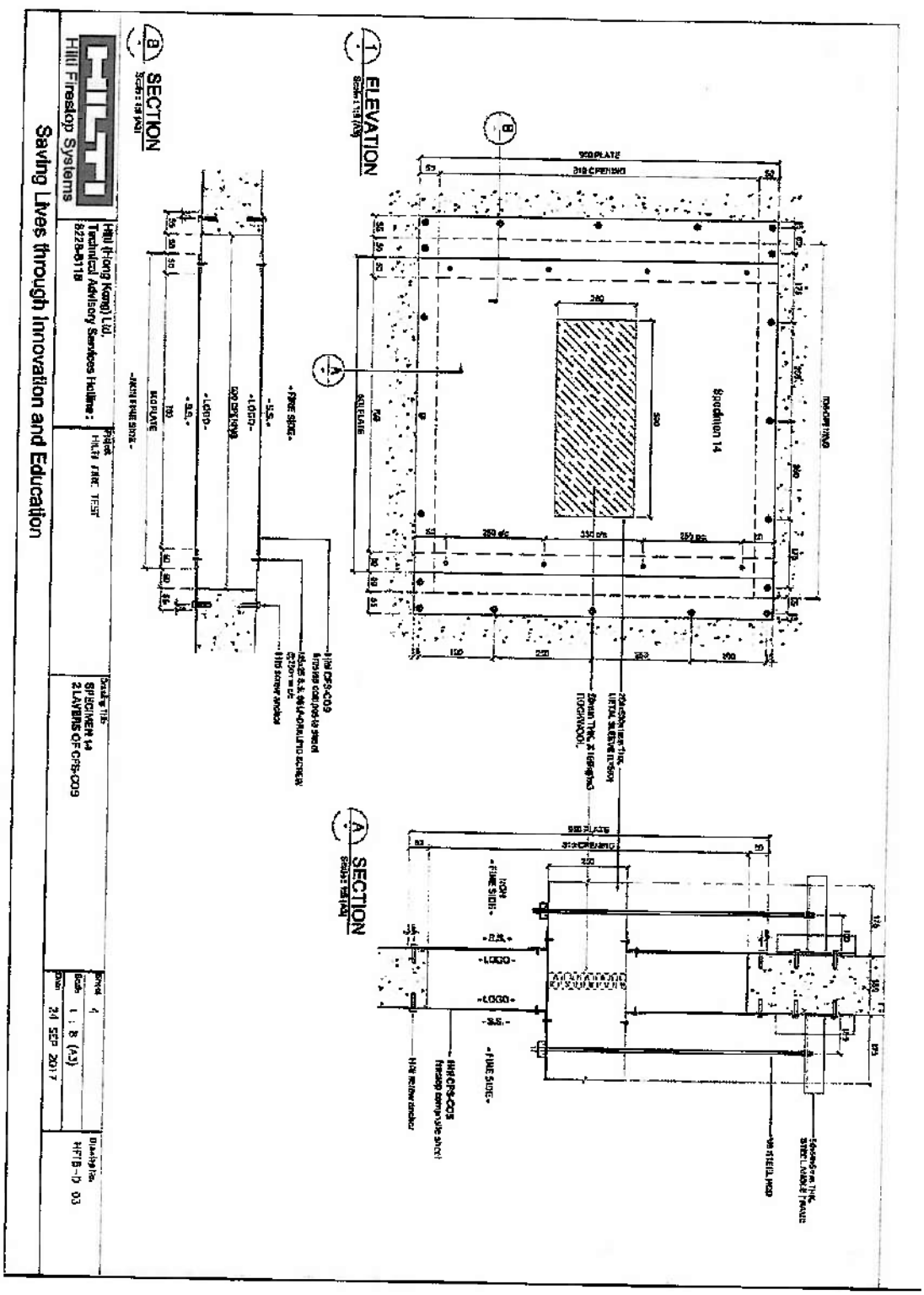
Specimen '12'


Hilti Firestop Systems
Saving Lives through Innovation and Education
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline :
2228-6118
MULTI FIRE TEST
Specimen 12
1 LAYER OF CFS-COS
2
1 : 8 (A3)
24 SEP 2017
HFTS-D-01
ELEVATION
SECTION
SECTION
Specimen 12
- FIRE SIDE -
- L.O.D.O. -
- S.S. -
- NON FIRE SIDE -
910 PLATE
910

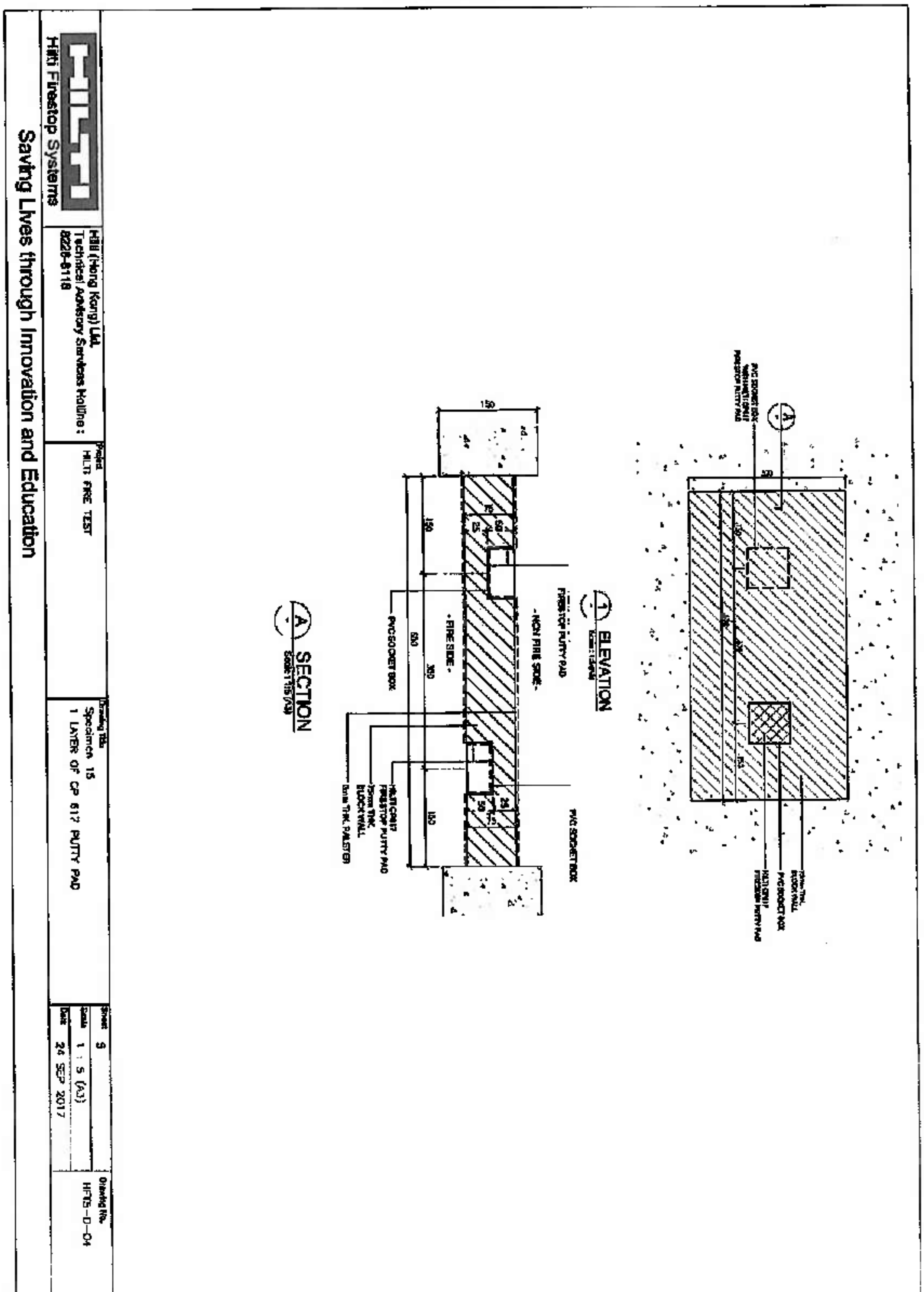
Specimen '13'


Hilti Firestop Systems
Saving Lives through Innovation and Education
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline :
2232 8118
SECTION
ELEVATION
SECTION
Specimen 13
950 PLATE
810 OPENING
FIRE SIDE
NON FIRE SIDE
LOAD
Date 24 SEP 2017
Sheet 3
Scale 1 : 8 (A4)

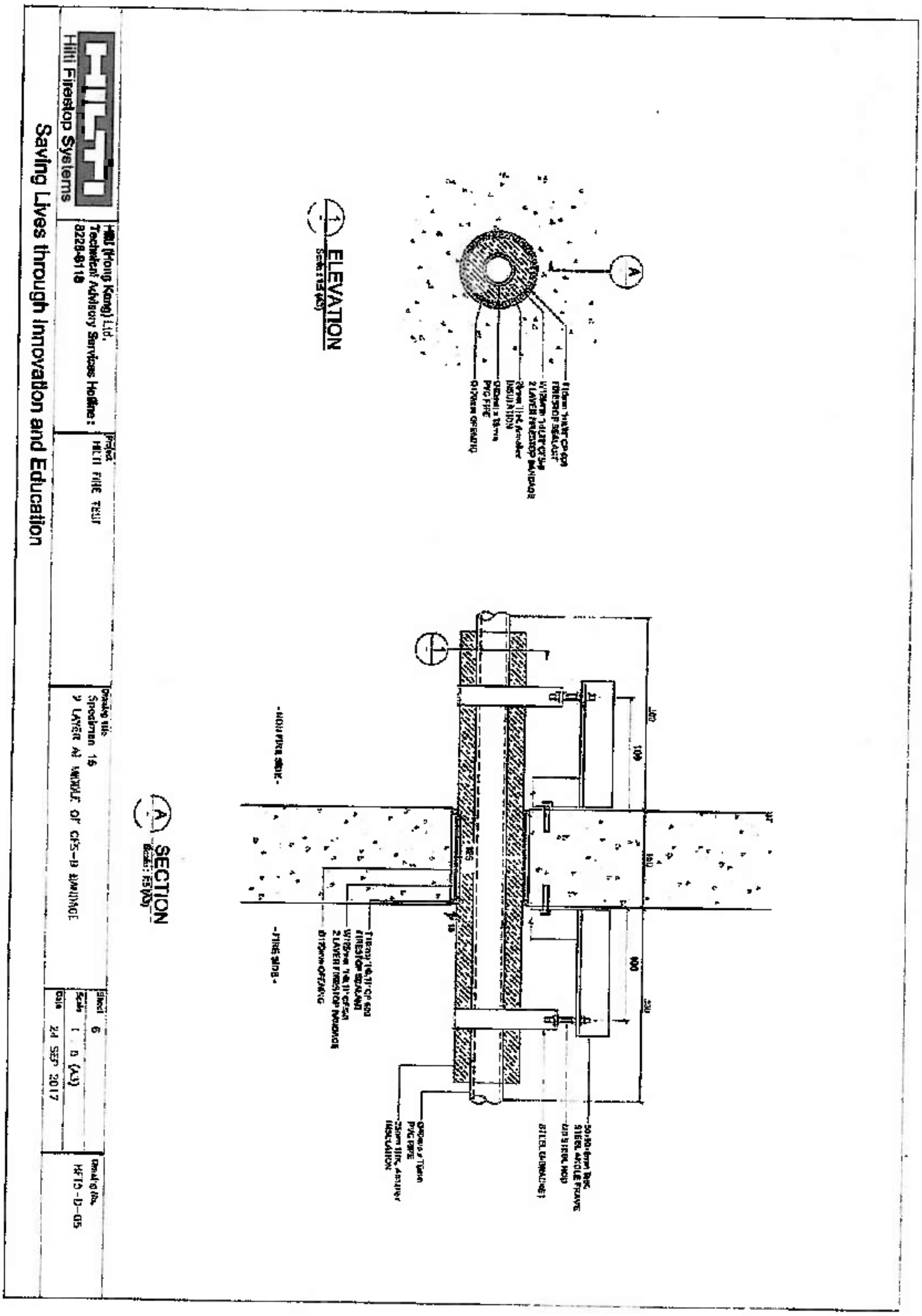
Specimen '14'


SECTION
ELEVATION
SECTION
Specimen 14
Hilti Firestop Systems
Saving Lives through Innovation and Education

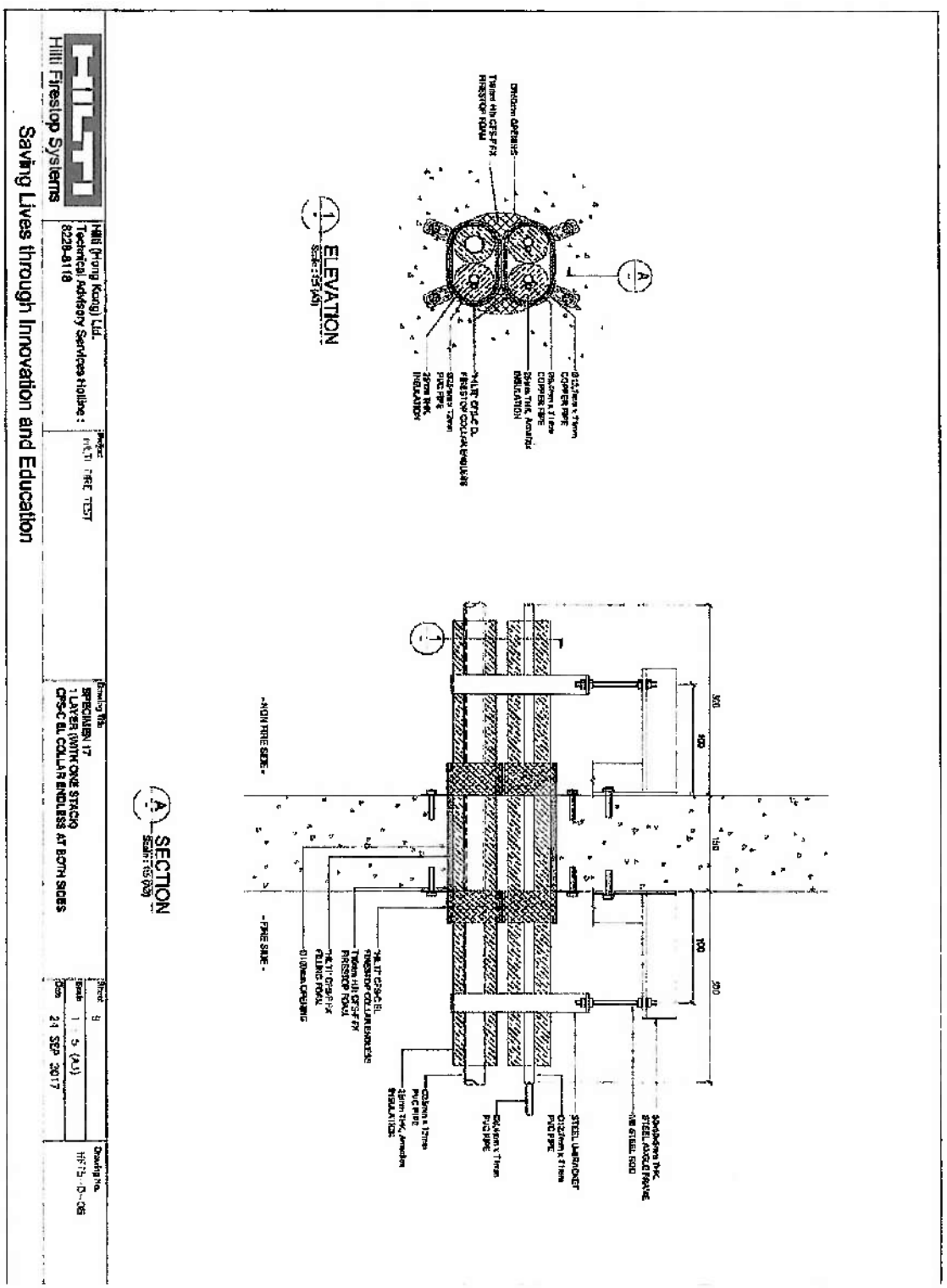
Specimen '15'


Hilti Firestop Systems
Saving Lives through Innovation and Education
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline: 8228-8118
Project
HILTI FIRE TEST
Drawing title
Specimen 15
1 LAYER OF CP 617 PUTTY PAD
Sheet 9
Scale 1 : 5 (A3)
Date 24 SEP 2017
Drawing No.
HFTS-D-04
ELEVATION
SECTION
- NON FIRE SIDE -
- FIRE SIDE -
PVC SOCKET BOX
FIRESTOP PUTTY PAD
BLOCK WALL
150
300
150

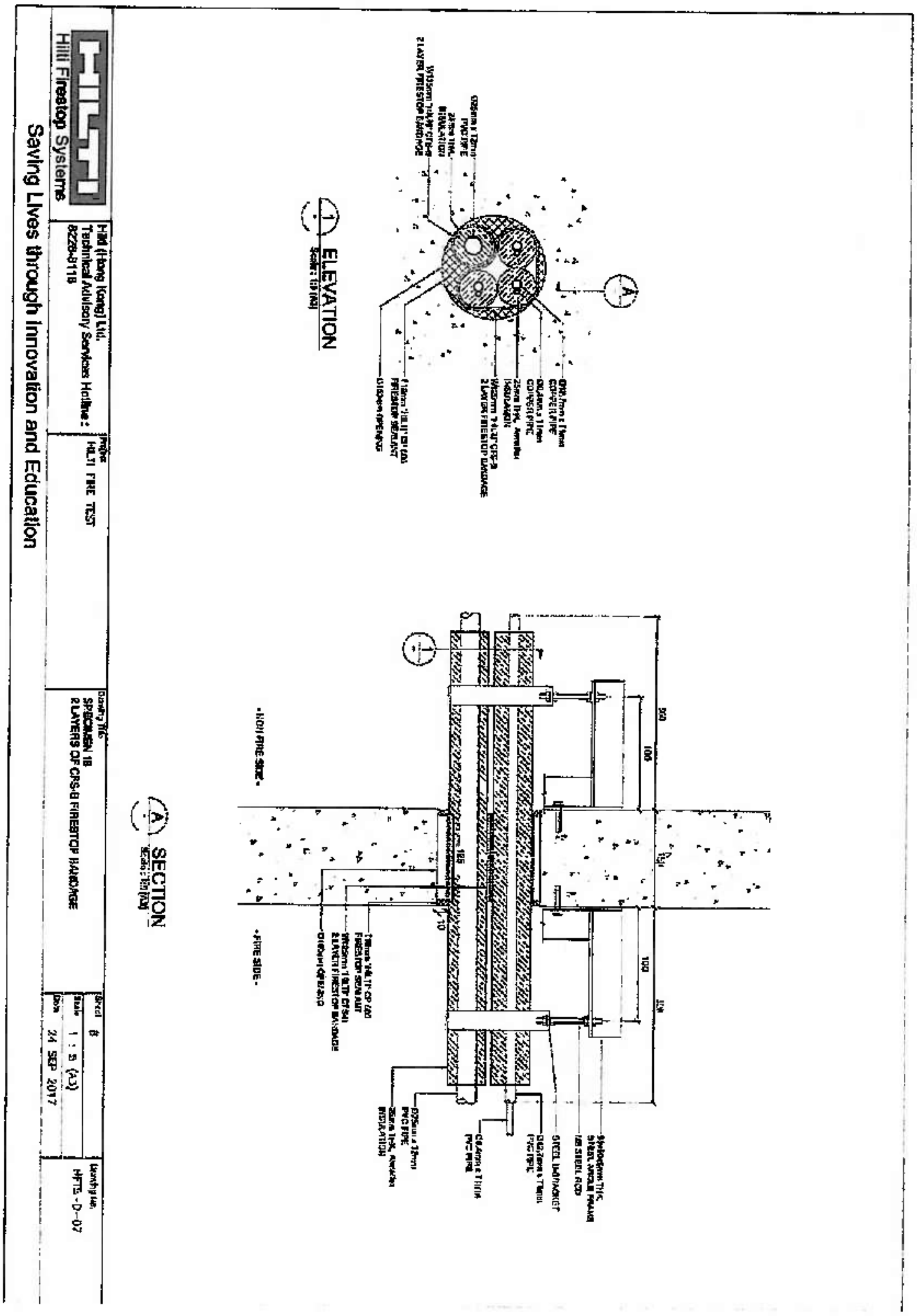
Specimen '16'


Hilti Firestop Systems
Saving Lives through Innovation and Education
ELEVATION
SECTION
HILTI FIRE TEST
Specimen 16
24 SEP 2017

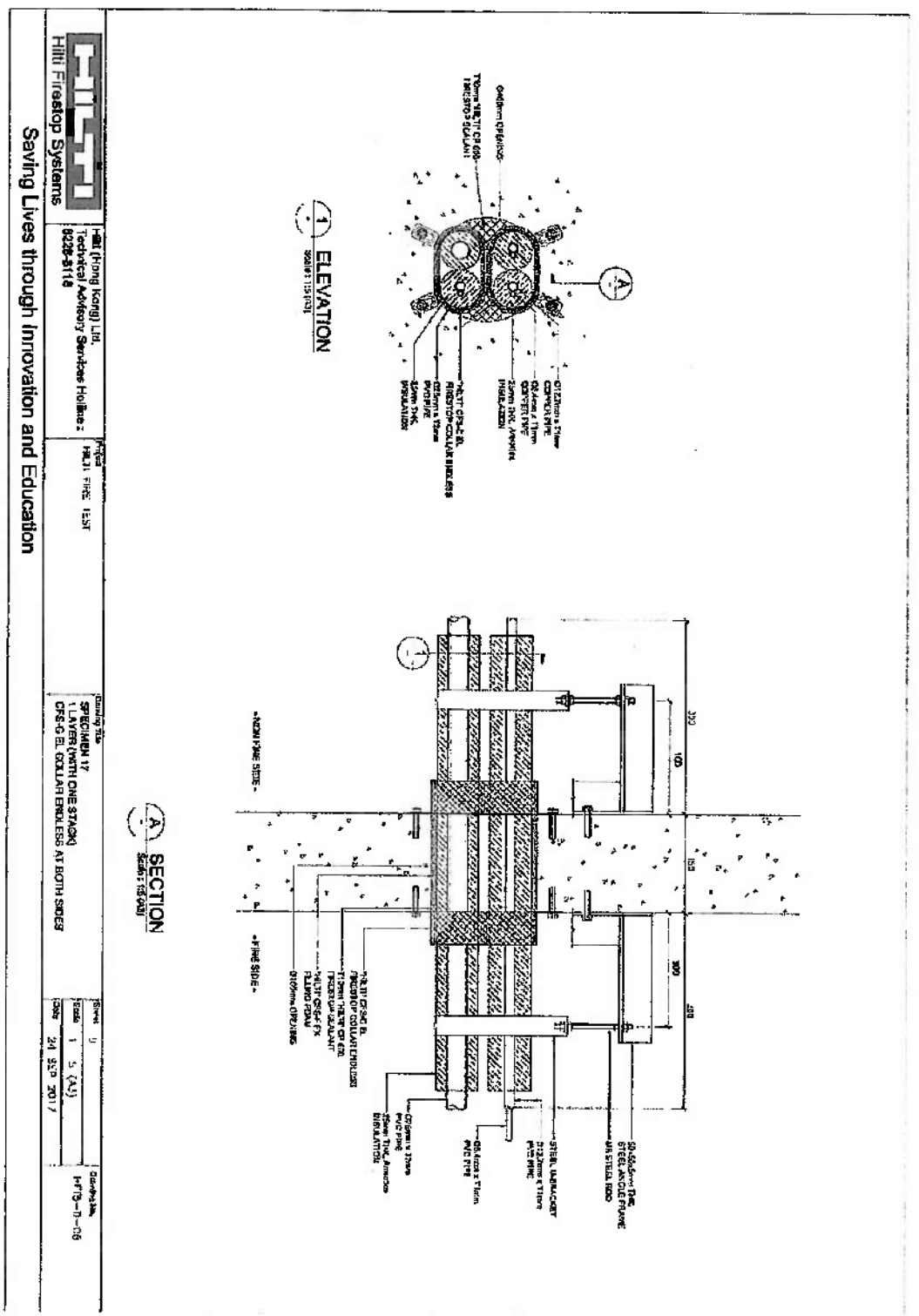
Specimen '17'


Hilti Firestop Systems
Saving Lives through Innovation and Education
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 2233-3113
Project
HILTI FIRE TEST
Drawing No.
SPECIMEN 17
1 LAYER (WITH ONE STACK)
CFS-C EL COLLAR ENDLESS AT BOTH SIDES
Sheet
9
Scale
1 : 5 (A1)
Date
21 SEP 2017
Drawing no.
HFTS-D-C05
ELEVATION
SECTION
- HIGH FIRE SIDE -
- FIRE SIDE -
STEEL ANGLE FRAME
STEEL LABORATORY FLOOR

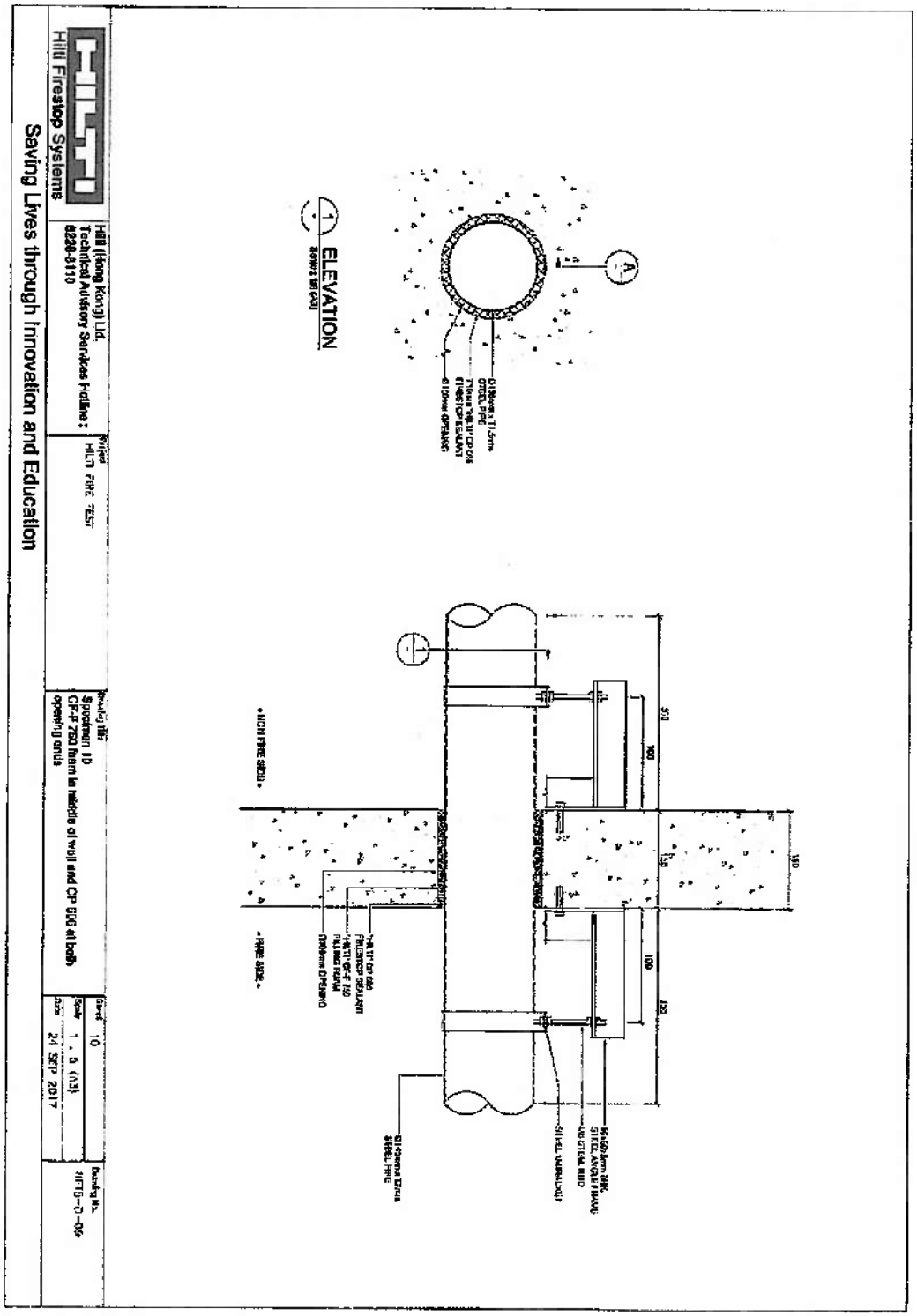
Specimen '18'


Hilti Firestop Systems
Saving Lives through Innovation and Education
ELEVATION
SECTION
NON FIRE SIDE
FIRE SIDE
HILTI FIRE TEST
SPECIMEN 18
2 LAYERS OF CFS-B FIRESTOP BANDAGE
1 : 5 (A3)
24 SEP 2017
HFTS-D-07

Specimen '19'


Hilti Firestop Systems
Saving Lives through Innovation and Education
SPECIMEN 17
1 LAYER (WITH ONE STACK)
CFS-C EL COLLAR ENDLESS AT BOTH SIDES
ELEVATION
SECTION
- NON-FIRE SIDE -
- FIRE SIDE -

Specimen '20'



- 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

June 28, 2013

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

Sample Description: Hilti Collar Endless CFS-C EL

Date Tested: May 17, 2013

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	**Collar Endless CFS-C EL**
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: 11 g/L of VOC**

Tom Barrett
Vice President/Strategic Analytical Services

Scott Creekmur
Chemist II

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

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

26 May 1994

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/rcy/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廣華道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 (24 小時 Hours)
圖文傳真 Fax: 852-3110066
852-3689744
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 : 1 April 2025
Ref. : 029/FP/RY/23

Subject : Country of Origin- Hilti CFS-C EL Firestop Collar Endless

Dear Sir / Madam,

Enclosed please find the information of Hilti CFS-C EL Firestop Collar Endless.

Brand Name : Hilti

Model Name : Hilti CFS-C EL Firestop Collar Endless

Manufacturer : Hilti Corporation

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

Manufacturer Contact Person : Spencer Cheung

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 : Spencer Cheung (+852 9732 1231)

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,

Spencer C.

HILTI (HONG KONG) LTD. MKT

Spencer Cheung
Head of Product Leadership Strategy

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

To whom it may concern

Date: 27th July 2017

Dear Sir / Madam,

Subject: Hilti Firestop Products non-CFC and Ozone Confirmation

Referring to your enquiry about the captioned subject, please be advised that:

Hilti firestop products, CFS-C EL Firestop Collar Endless is free of CFC, HCFC nor other ozone depletion elements.

CFC, HCFC and ozone depletion elements were not used during the product process neither.

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

Yours sincerely,

Dorothy Wai
Product Manger

Hilti (Hong Kong) Ltd.
701-704 & 708A&B | 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

Material Information Statement

Articles

According to Regulation (EC) 1907/2006, Article 32
Revision: 07.04.2020 Version: 18

1 Identification of the articles and of the company undertaking

1.1 Product identifier

Trade name:

- Firestop Bandage CFS-B / CP 646
- Firestop Back Pan Strip CFS-BPS
- Firestop Block CFS-BL / CFS-BL P
- Firestop Board CP 675
- Firestop Boot CFS-BO
- Firestop Box Insert
- Firestop Cable Collar CFS-CC / CFS-RCC / CFS-RCC EXT
- Firestop Cable Module CFS-T
- Firestop Cast-in device CP 680 / CP 681 / CFS-CID /
- CFS-CID MD P/M
- Firestop Coated Board CFS-CT B / CP670 / CP673 / CP676
- Firestop Collar CFS-C / CFS-C P
- Firestop Collar CP 643 / CP 644
- Firestop Composite Sheet CFS-COS
- Firestop Cord CFS-CO
- Firestop Cushion CP 651N
- Firestop Drop-In Device CFS-DID
- Firestop Edge of Slab QuickSeal CFS-EOS QS
- Firestop Endless Collar CFS-C EL
- Firestop Filler Module CFS-T FB
- Firestop Gangplate CFS-SL GP
- Firestop Module Box CFS-MB / CP 657
- Firestop Plug CFS-PL / CP 658
- Firestop Plug Seal CFS-T RR / CFS-T RRS
- Firestop Retrofit Sleeve CFS-SL RK
- Firestop Sleeve CP 645
- Firestop Sleeve Kit CFS-SL SK
- Firestop Speed Sleeve CFS-SL / CFS-SL GA / CP 653
- Firestop Top Track Seal CFS-TTS
- Firestop Top Track Seal CFS-TTS MD
- Firestop Top Track Cover CFS-TTS MD
- Firestop Top Track Plug CFS-TTS MD
- Firestop Top Track Seal CFS-TTS 212
- Firestop Top Track Seal CFS-TTS R
- Firestop Wedge Seal CFS-T WD120
- Firestop Wrap Strip CFS-W EL / SG / P / CP 648
- Foil Tapes CS-FT
- Intumescent façade cavity closer CP674
- Joint Sealing Tapes CS-JST
- Mineral Wool
- Mineral Wool Boards
- Multifunctional Tapes CS-MFT
- Pre-coated Mineral Wool Boards
- Smoke & Acoustic Track Seal CS-TTS SA
- Speed Plug CP 777
- Speed Strip CP 767

1.2 Application of the listed articles

Construction industry.

Refer to Hilti product literature, technical data sheets, 3rd party published listings and national approvals for specific application information. For more details, please contact your local Hilti organization through http://www.hilti.group

1.3 Manufacturer / Supplier

Hilti AG
Feldkircherstr. 100
FL-9494 Schaan
Liechtenstein

Customer Service
Phone +423 (0)844 84 84 85
Fax +423 (0)844 84 84 86

2 Other information

A Safety Data Sheet is not required due to the classification of these products as “articles” according to Regulation (EC) No. 1907/2006 of 18 December 2006 (EU) / 29CFR 1910.1200 (U.S.A.). Consequently, these products are exempted from CLP / OSHA Labeling and SDS requirements.

These data are based on our present knowledge. However, they shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Informing department:
chemicals.hse@hilti.com

Hilti CFS-C EL Firestop Collar Endless Job Reference

Year	Project Name	Customer Name	Project type
2020	20 SHEUNG YUET ROAD	PUI KAI DECORATION ENGINEERING	
2020	8-10 WAH SING STREET	CHEONG FUNG ENGINEERING COMPANY	
2020	397-399 CHATHAM ROAD NORTH	OPEN ENG. DESIGN LIMITED	
2021	8-10 WAH SING STREET	CHEONG FUNG ENGINEERING COMPANY	
2021	31-35 SHAN MEI STREET	CHILL INTERIOR DESIGN COMPANY	
2021	PAK TIN PAR ST	CHUN ENGINEERING LIMITED	
2021	22-40 FUK MAN ROAD	DREAM DESIGN LTD	
2021	16 ARGYLE ST	GREAT LEGEND CONTRACTING LIMITED	
2021	16 LOK KWAN STREET	TECTONIC ENG LTD	
2022	8-10 WAH SING STREET	CHEONG FUNG ENGINEERING COMPANY	