Hilti CFS-B Firestop Bandage

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 bandage CFS-B

APPLICATIONS

- Firestopping around insulated (hot/cold) non-flammable pipes
- Pipe materials: Insulated pipes including copper, steel and other metals with heat conductivity lower than that of copper (e.g.cast iron, stainless steel etc.)
- Various insulation materials
- Suitable for use in openings in concrete, masonry block or drywall

ADVANTAGES

- Highly versatile - one product for a variety of insulation materials, pipe materials and pipe diameters
- Quick and easy to install - no drilling or additional tools needed
- No need to interrupt the pipe insulation material within the wall/ floor penetration
- Minimal thickness for easy installation in narrow gaps
- Good elasticity for optimum flexibility
- Very good acoustic insulation properties

Smoke Siesmic Low VOC Mould & Mildew

Technical data	
Base materials	Concrete, Masonry, Drywall
Expansion temperature (approx.)	210 °C
Expansion ratio (unrestricted, up to)	1:14
Storage and transportation temperature range	-5 - 50 °C
Length	10 m
Colour	Grey
Thickness	2 mm
Width	125 mm

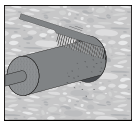
Application table

CFS-B (Firestop Bandage - 2 mm thick)

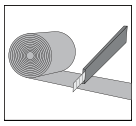
Pipe diameter (mm)	Insulation Thickness (mm)	No. Layers	Reference Wrap length (mm)	No. of penetrations with a 10m roll	Recommened drill hole X (mm)
25	40	2	720	14	121
32	40	2	770	13	128
40	40	2	820	12	136
50	40	2	880	11	146
65	50	2	1100	9	181
80	50	2	1190	8	196
100	50	2	1320	8	216
125	50	2	1480	7	241
150	50	2	1630	6	266
200	50	3	2920	3	319
250	50	3	3390	3	369
300	65	3	4150	2	449
400	65	3	5090	2	549
400	75	3	5280	1.9	569

* Please consult Hilti representatives for application detail of different type of piping units

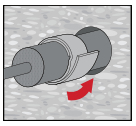
Application Procedure



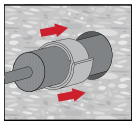
1. Clean the opening. The material around the opening must be dry, in sound condition and free from dust or grease.



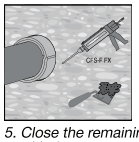
2. Cut Hilti Firestop Bandage CFS-B to fit the outside diameter of the insulation. Ensure 2 layers and an overlap.



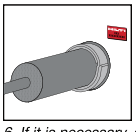
3. Wrap Hilti Firestop Bandage CFS-B around the insulation. Secure the bandage with steel bands or wire (≥ 0.7 mm).



4. Install Hilti Firestop Bandage CFS-B on both sides of the open-ing to a depth of 62.5 mm (see marking on bandage).



5. Close the remaining gap with the recommend gap filler. Refer to each base material for the correct filler.



6. If it is necessary, an additional insulation over the bandage has to be installed. Mount the installation identification plate beside the correctly sealed opening, if required.

Order Now Watch Video

Ordering designation	Sales pack quantity	Item number
CFS-B	1 pc	**429557**

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

2044968 A1-07.2012

bg
Много гъвкава, един продукт за различни типове изобирани метални тръби
- Бърз и лесен монтаж, малко необходимо пръстеновидно пространство

et
Väga painduv, üks toode eri tüüpi isoleeritud metalltorudele.
- Kiirelt ja lihtsalt paigaldatav, võtab vähe ruumi.

lt
Ypač lankstus vienas gaminys, skirtas izoliuoti įvairių tipų metalinius vamzdžius
- Spartu ir paprasta montuoti, pakanka nedidelio žiedinio tarpo

sl
Visoko prilagodljiv, en izdelek za različne tipe izoliranih kovinskih cevi
- Hitra in enostavna montaža, zahtevan majhen okrogel prostor

vi
Rất linh hoạt trong sử dụng, một sản phẩm chung cho các ống kim loại có lớp phủ cách nhiệt
- Lắp ráp nhanh chóng, dễ dàng, chỉ cần một không gian nhỏ quanh ống

cs
Velmi flexibilní, jeden produkt pro různé druhy izolovaných kovových trubek
- Rychlá a snadná instalace, vyžaduje malý kruhový prostor

hr
Vrlo elastičan, jedan proizvod za različite vrste izoliranih metalnih cijevi
- Brz i jednostavan za postavljanje, zahtijeva samo mali kružni proctor

lv
Ļoti elastīga, viens produkts der dažādiem izolētu metāla cauruļu tipiem.
- Ātri un viegli uzstādāma, nepieciešama neliela gredzenveida telpa.

sk
Vysokoflexibilný, jeden výrobok na rôzne typy izolovaných kovových trubiek
- Rýchla a jednoduchá inštalácia, potrebný malý kruhový priestor

zh
高度灵活，一种产品可以应用于不同型号的保温金属管道
- 安装工作简易，只需很小的环状空间

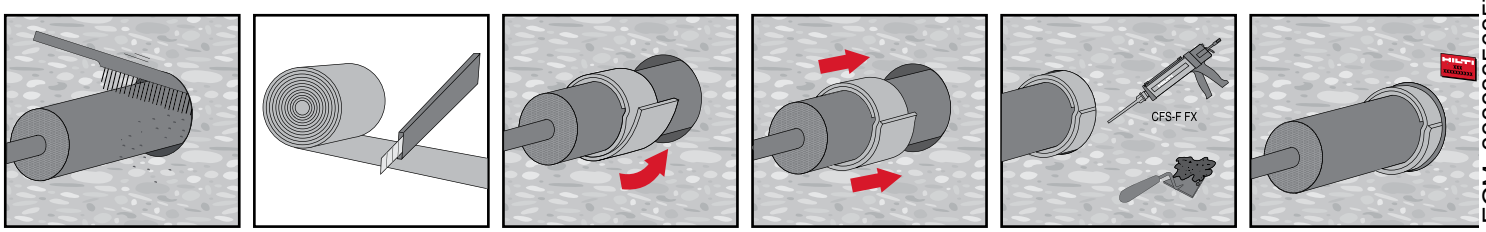
el
Ιδιαίτερα εύφλεκτο, ένα προϊόν για διαφορετικούς τύπους μονομένων μεταλλικών σωλήνων
- Γρήγορο και εύκολο ως προς την εγκατάσταση, απαιτείται μικρός δακτυλιώδης χώρος

hu
Nagy rugalmasságú; egy termék megfelel több fajta szigetelt fémcsőhöz.
- Kis helyen is gyorsan és egyszerűen felszerelhető

ru
Высокая гибкость, один продукта для разных типов изолированных металлических труб
- Быстрая и простая установка, малая потребность в месте для хранения

tr
Farklı türden yalıtılmış madeni borular için son derece esnek bir ürün.
- Çabuk ve kolay takılır, çepeçevre küçük bir boşluk gerekir.

ro
Flexibilitate ridicată, un singur produs pentru diferite conducte metalice izolate.
- Uşor şi rapid de montat, necesită spaţiu mic de instalare.



bg
1. Почистете отвора
2. Отрежете Hilti Противопожарният бандаж до външния диаметър на изолацията. Имайте предвид двата слоя.
3. Увийте Противопожарният бандаж около изолацията. Фиксирайте бандажа със стоманени ленти или тел (≧0,7 мм).
4. Монтирайте FS Бандажът от двете странив отвора на дълбочина от 62,5 мм.
5. Затворете оставащата фуга с гипс или Противопожарна пяна Hilti.
6. Ако е необходимо, върху бандажа трябва да бъде монтирана допълнителна изолация.

et
1. Puhastage ava.
2. Lõigake Hilti tuletõkkeside isolatsiooni välisläbimõõdu järgi. Arvestage kahe kihiga.
3. Mähkige tuletõkkeside isolatsiooni ümber. Kinnitage side terasest kinnitusklambrite või Traadiga (≧0,7 mm).
4. Paigaldage tuletõkkeside ava mõlemale küljele 62,5 mm paksuselt.
5. Tihendage vahe kipsi või Hilti tuletõkkevahuga.
6. Vajaduse korral tuleb sideme peale paigaldada lisaisolatsioonikiht.

lt
1. Išvalykite ertmę
2. Atpjaukite „Hilti“ juostos „Firestop“ gabalą, atitinkantį išorinį izoliacijos skersmenį. Atsižvelkite į tai, kad prireiks dviejų sluoksnių.
3. Apvyniokite izoliaciją juosta „Firestop“. Pritvirtinkite juostą viela (≧ 0,7 mm).
4. Juostą „Firestop“ įtaisykite 62,5 mm gylyje abiejose ertmės pusėse.
5. Užtaisykite likusį tarpą gipsu arba „Hilti“ putomis „Firestop“.
6. Jei būtina, juostą reikia padengti papildomu izoliacijos sluoksniu.

sl
1. Očistite odprtino
2. Hilti protipožarni trak izrežite na zunanji Premer izolacije. Upoštevajte število 2 plasti.
3. Protipožarni trak ovijte okoli izolacije. Trak Zavarujte z jeklenimi trakovi ali žico (≧0,7 mm).
4. Namestite protipožarni trak na obeh straneh Znotraj odprtine v globini 62,5 mm.
5. Zaprite preostalo odprtino z gipsom ali Hilti protipožarno peno.
6. Če je potrebno, je potrebno čez trak namestiti dodatno izolacijo.

vi
1. Làm sạch lỗ ở tường
2. Cắt băng chống cháy Hilti theo đường kính ngoài của lớp cách nhiệt. Chú ý chiều dày của hai lớp
3. Quấn băng chống cháy xung quanh lớp cách nhiệt.
4. Cố định lớp băng đã quấn bằng các dải thép hoặc bằng dây (≧0.7 mm)
5. Quấn băng chống cháy từ cả hai phía của lỗ tường sâu vào trong đến 62,5 mm
6. Bít kín các khe hở còn lại bằng thạch cao hoặc bọt chống cháy Hilti. Nếu thấy cần thiết có thể bọc thêm một lớp phủ cách nhiệt lên trên băng chống cháy

cs
1. Vyčistěte otvor
2. Vyřízněte protipožární bandáž Hilti podle vnějšího průměru izolace. Zohledněte dvěvrstvy.
3. Protipožární bandáž omotejte kolem izolace. Upevněte ji pomocí ocelových pásků nebo Drátem (≧ 0,7 mm).
4. Protipožární bandáž na obou stranách instalujte v otvoru v hloubce 62,5 mm.
5. Zbývající prostor uzavřete sádrou nebo protipožární pěnou Hilti.
6. V případě potřeby musí být přes bandáž položena další izolace.

hr
1. Očistite otvor
2. Izrežite Hilti vatrootpornu oblogu prema Vanjskom promjeru izolacije. Uzmite u obzir broj od 2 sloja.
3. Zamotajte Vatrootpornu oblogu oko izolacije. Osigurajte povez čeličnim vrpcama ili žicom (≧0,7 mm).
4. Postavite Vatrootpornu oblogu na obje strane unutar otvora u dubini od 62,5 mm.
5. Zatvorite preostali otvor gipsom ili Hilti vatrootpornom pjenom.
6. Ako je potrebno, preko zavoja treba postaviti dodatnu izolaciju.

lv
1. Notīriet atveri.
2. Nogrieziet Hilti pretaizdegšanās lentu atbilstoši izolācijas ārējam diametram. Ņemiet vērā, ka būs vajadzīgas divas kārtas.
3. Aptiniet pretaizdegšanās lentu ap izolāciju. Nostipriniet tinumu ar metāla lentu vai stiepli (≧0,7 mm).
4. Uzstādiet pretaizdegšanās lentu atveres abās pusēs 62,5 mm dziļumā.
5. Atlikušo vietu aizpildiet ar ģipsi vai Hilti pretaizdegšanās putām.
6.Ja vajadzīgs, virs tinuma jāuzstāda papildu izolācija

sk
1. Vyčistite otvor
2. Odrežte protipožiarnu bandáž Hilti podľa Vonkajšieho priemeru izolácie. Počítajte s 2 vrstvami.
3. Protipožiarnu bandáž obmotajte okolo izolácie. Bandáž zabezpečte oceľovou páskou alebo drôtom (≧ 0,7 mm).
4. Protipožiarnu bandáž nainštalujte na obidve strany s otvorom s hĺbkou 62,5 mm.
5. Zostávajúci medzeru uzatvorte sadrou alebo protipožiarnou penou Hilti.
6. Ak je to potrebné, nainštalujte cez bandáž doplňujúcu izoláciu.

zh
1. 清洁开口
2. 根据封堵的外径裁切喜利得防火带。注意使用2层。
3. 沿着保温层包绕防火带。用钢丝固定防火带（≧0.7mm）。
4. 在两侧的开口中安装防火带，安装深度为 62.5 mm。
5. 用石膏或者喜利得防火泡沫封闭残余间隙。
6. 在必要时，在防火带上面另外加装保温层。

el
1. Καθαρίστε το άνοιγμα
2. Κόψτε την Ταινία Πυρόσβεσης Hilti βάσει της Εξωτερικής διαμέτρου της μόνωσης. Λάβετε υπόψη σας τον αριθμό των 2 στρώσεων.
3. Τυλίξτε την Ταινία Πυρόσβεσης Hilti γύρω από την μόνωση. Ασφαλίστε την ταινία με ατσάλινες λωρίδες ή σύρμα (≧0,7 mm)
4. Τοποθετήστε την Ταινία FS και στις δύο πλευρές εντός του ανοίγματος σε βάθος 62,5 mm.
5. Κλείστε το κενό που υπάρχει με γύψο ή με Αφρό Πυρόσβεσης Hilti.
6. Εάν είναι απαραίτητο, πρέπει να τοποθετηθεί μια επιπρόσθετη μόνωση στην ταινία.

hu
1. Tisztítsa ki a nyílást
2. Vágja a Hilti Tűzvédelmi kötést a szigetelés Külső átmérőjének megfelelő méretűre. Két réteggel számoljon.
3. Tekerje körbe a Tűzvédelmi kötést a szigetelésen. Biztosítsa a kötést acélszalaggal vagy dróttal (≧0,7 mm).
4. Helyezzen fel Tűzvédelmi kötést a nyílás mindkét oldalára 62,5 mm-es mélységben.
5. Hilti Tűzvédelmi hab vagy gipsz használatával zárja le a fennmaradó nyílást.
6. Szükség esetén helyezzen további szigetelést a kötés felé.

ru
1. Прочистить отверстие.
2. Отрезать противопожарную ленту Hilti по размеру наружного диаметра изоляции с расчетом укладки ленты в 2 слоя.
3. Обмотать противопожарную ленту вокруг изоляции. Закрепить ленту стальными полосами или проволокой (≧0,7 мм).
4. Установить противопожарную ленту на обеих сторонах отверстия на глубину 62,5 мм.
5. Заделать стык гипсом или противопожарной пеной Hilti.
6. При необходимости установить поверх ленты дополнительный слой изоляции.

tr
1. Açıklığı temizleyiniz
2. Hilti Yangın Durdurucu Bandajı yalıtımın dış çapına göre kesiniz.2 tabaka bulunduğunu dikkate alınız.
3. Yangın Durdurucu Bandajı yalıtımın etrafına sarınız. Bandajı çelik tel şeritlerle (≧0,7 mm) sağlama alınız.
4. Yangın Durdurucu Bandajı açıklığın içinde her iki tarafta 62,3 mm derinliğe kadar takınız.
5. Kalan boşluğu alçıyla veya Hilti Yangın Durdurucu Köpükle kapatınız.
6. Gerekirse bandajın üzerine ilaveten yalıtıcı konulabilir.

da
1. Rengør åbningen
2. Skær Hilti Brandstop Båndet til den udvendige diameter af isoleringen så der er til 2 lag.
3. Fastgør Brandstop Båndet rundt om isoleringen med ståltråd (≧0.7 mm).
4. Påsæt Brandstop Bånd på begge sider i åbningen, i en dybde på 62,5 mm.
5. Forsegl det resterende hulrum med gips eller Hilti CFS-F FX
6. Hvis nødvendigt, kan et ekstra lag isolering sættes over båndet.

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

VOC Content Test Certificate

October 23, 2009

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

Sample Description: Hilti CP 646

Date tested: July 20, 2009

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: Legend Project Number 0903311

Specification	Product
LEED 2009 (LEED 3.0) **LEED 2.2** IEQ-4.1: Low-Emitting Materials – Firestop Materials	**Hilti** **CP 646**
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	
Multipurpose Construction Materials; VOC Limit: 70 g/L	**Product contains: 9.2 g/L of VOC**

William Welbes
Vice President of Laboratory Operations

Allen Noreen, Ph.D.
Technical Director

Ref. no : 199/FP/DY/23
Date : 08 Dec 2023

Subject : **Naming of Hilti CFS-B Firestop Bandage**

To whom it may concern,

I am writing to confirm that ‘’CP646’’ which shown in VOC Content Test Certificate is equivalent to ‘’Firestop bandage CFS-B’’ which shown in product catalogue.

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

Yours faithfully,

Dennis Yeung
Head of Product Leadership Strategy, F&P
Hilti (Hong Kong) Ltd.

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Member of
www.eota.eu

European Technical Assessment

ETA 10/0212
of 06/05/14

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011:	
Trade name of the construction product	**Hilti Firestop Bandage CFS-B**
Product family to which the construction product belongs	Fire Stopping and Sealing Product Penetration Seals
Manufacturer	**Hilt Corporation** Feldkircherstrasse 100 9494 Schaan Liechtenstein
Manufacturing plant(s)	Werk 5a
This European Technical Assessment contains	44 pages including 4 Annex(es) which form an integral part of this assessment.
	Annex(es) A - D Contain(s) confidential information and is/are not included in the European Technical Assessment when that assessment is publicly available.
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	ETAG 026, edition 2011, used as European Assessment Document (EAD)

General Comments

1. This European Technical Assessment is issued by Warrington Certification Limited on the basis of ETAG 026 Fire Protective Products Part 1: General June 2013, and Part 2: Fire Stopping and Fire Sealing Products Aug 2011, Used as European Assessment Document.

2. This European Technical Assessment is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1.

1 SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL ASSESSMENT

1 Technical Description of the Product

(Detailed information and data are given in Annexes)

1) Hilti Firestop Bandage CFS-B is a graphite based pipe wrap used to reinstate the fire resistance performance of wall or floor constructions where they have been provided with apertures for the penetration of single or multiple services.

2) The Hilti Firestop Bandage CFS-B is supplied in roll form, with binding wire used to wrap around pipes and pipe insulation to form a penetration seal. The bandage is cut to a length which suits the overall diameter of pipe or pipe and insulation and wrapped around the penetration twice.

3) Hilti Firestop Bandage CFS-B is supplied in 125 mm width, 2 mm thick and 10 m length.

4) Hilti Firestop Bandage CFS-B is used in conjunction with Hilti Firestop Acrylic CFS-S ACR to seal annular spaces up to 15 mm. Hilti Firestop Acrylic CFS-S ACR is subject to a separate ETA referenced 10/0292 & 10/0389.

5) Hilti Firestop Bandage CFS-B is used in conjunction with mortar and gypsum to seal annular spaces up to 50 mm. The mortar should be EN998-2 – class M10.

Internal use- ETAG 026-2 (used as European Assessment Document EAD) Type Z_2.

2 Specification Of The Intended Use In Accordance With The Relevant EAD

2.1 Intended Use

The intended use of Hilti Firestop Bandage CFS-B is to reinstate the fire resistance performance of rigid and flexible wall constructions where they are penetrated by various insulated plastic, aluminium composite and metallic pipes.

1) The specific elements of construction that the system Hilti Firestop Bandage CFS-B may be used to provide a penetration seal in, are as follows:

Rigid walls:	The wall must have a minimum thickness 100 mm and comprise concrete, aerated concrete or masonry, with a minimum density of 550 kg/m^3.
Rigid Floors	The floors must have a minimum thickness of 150 mm and comprise concrete, aerated concrete or masonry, with a minimum density of 550 kg/m^3.
Flexible walls	The wall must have a minimum thickness of 100 mm and comprise timber or steel studs lined on both faces with minimum 2 layers of 12.5 mm thick, 'Type F' Gypsum boards according to EN 520. In timber stud walls, no part of the penetration shall be closer than 100 mm to a stud, the cavity must be closed between the penetration seal and the stud and minimum 100 mm of insulation of class A1 or A2 according to EN 13501-1, is provided within the cavity between the penetration seal and the stud.

The supporting construction must be classified in accordance with EN 13501-2 for the required fire resistance period.

2) The System Hilti Firestop Bandage CFS-B may be used to provide a penetration seal with insulated plastic, aluminium composite and metallic pipes

3) There is no minimum separation between adjacent seals

4) Services in walls shall be supported at maximum 450mm from the face of the separating element for walls, and 330mm above the surface of the floor.

5) The provisions made in this European technical approval are based on an assumed working life of the firestop product of 10 years, provided the conditions laid down in clauses 4 and 5 relating to manufacturing, installation, use and repair, are met.
The indications given on the intended working life cannot be interpreted as a guarantee given by the producer or the approval body, but are to be used as a means for selecting the appropriate product in relation to the expected economically reasonable working life of the works. The real working life might be, in normal use conditions, considerably longer without major degradation affecting the essential requirements.

2.2 Use Category

Type Z_2: Intended for use at internal conditions with humidity classes other than Z_1, excluding temperatures below 0°C.

3 Performance Of The Product And References To The Methods Used For Its Assessment

The assessment of fitness for use has been made in accordance with EOTA ETAG 026 Part 2: 2011-08-08 (used as European Assessment Document, EAD)

ETAG Clause No.	ETA Clause No.	Characteristic	Assessment of characteristic
		Mechanical resistance and stability	Not relevant
		Safety in case of fire	**See Clause 2.1**
2.4.1	3.1	Reaction to fire	**Class E according to EN 13501-1**
2.4.2	3.2	Resistance to fire	**See clause 2.2 & Annex C**
		Hygiene, Health and the Environment	
2.4.3	3.3	Air permeability	No performance determined
2.4.4	3.4	Water permeability	No performance determined
2.4.5	3.5	Dangerous substances	**See clause 2.5**
		Safety in use	
2.4.6	3.6	Mechanical resistance and stability	No performance determined
2.4.7	3.7	Resistance to impact/movement	No performance determined
2.4.8	3.8	Adhesion	No performance determined
		Protection against noise	No performance determined
2.4.9	3.9	Airborne sound insulation	No performance determined
		Energy, Economy and Heat Retention	
2.4.10	3.10	Thermal properties	No performance determined
2.4.11	3.11	Water vapour permeability	No performance determined
		General aspects relating to fitness for use	
2.4.12	3.12	Durability and serviceability	Z_2

3.1 Reaction to fire

System Hilti Firestop Bandage CFS-B is classified '**E**' in accordance with EN 13501-1.

3.2 Resistance to fire

System Hilti Firestop Bandage CFS-B has been tested in accordance with EN 1366-3: 2009 based upon the test results and the field of direct application specified within EN 1366-3: 2009, the system Hilti Firestop Bandage CFS-B has been classified in accordance with EN 13501-2, as given in Annex C:

The seals may only be penetrated by the services described in Annex C; other parts or support constructions must not penetrate the seal.

The service support construction must be fixed to the building element containing the penetration seal or a suitable adjacent building element, in such a manner that in the case of fire, no additional load is imposed on the seal. Furthermore it is assumed that the unexposed face support is maintained for the required period of fire resistance.

Pipes must be perpendicular to the seal surface.

It is assumed that compressed air systems are switched off by other means in the case of fire.

The function of the pipe seal in case of pneumatic dispatch systems, pressurised air systems etc. is guaranteed only when the systems are shut off in case of fire.

The assessment does not cover the avoidance of destruction of the seal or of the abutting building element(s) by forces caused by temperature changes in case of fire. This has to be considered when designing the piping system.

The approval does not address any risks associated with leakage of dangerous liquids or gases caused by failure of the pipe(s) in case of fire.

The classifications relate to C/U (capped inside the furnace/uncapped outside) for metal pipes and U/C (capped outside/uncapped inside the furnace) for plastic and composite pipes. For further information refer to national regulations.

The durability assessment does not take account of the possible effect of substances permeating through the pipe on the penetration seal.

3.3 Air permeability

No performance determined

3.4 Water permeability

No performance determined

3.5 Dangerous substances

The applicant is required to submit a written declaration stating whether or not the fire stopping and fire sealing product contains dangerous substances according to European and national regulations, when and where relevant in the Member States of destination, and shall list these substances.

Hilti Corporation declare that product Hilti Firestop Bandage CFS-B is in compliance with Council Directive 76/769/EEC of 27th July 1976 on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (incl. all amendments and adaptations).

Confirmation has further been declared that all dangerous chemical substances ≥ 1.0 % w/w as well as all toxic, carcinogenic, toxic for reproduction and mutagenic chemical substances ≥ 0.1 % w/w (Status: 29. adaption –2004/73/EG – of the EU directive 67/548/EEC - classification, packaging and labelling of dangerous substances) are stated in the Hilti Firestop Bandage CFS-B material safety data sheets (according to 91/155/EEC including amendments) and have been considered for the classification of the products according to the directive1999/45/EG (classification of preparations, including amendments).

All dangerous chemical substances are below the classification limits of 67/548/EEC.

3.6 Mechanical resistance and stability

No performance determined.

3.7 Resistance to impact/movement

No performance determined.

3.8 Adhesion

Not relevant.

3.9 Airborne sound insulation

No performance determined

3.10 Thermal Properties

No performance determined.

3.11 Water vapour permeability

No performance determined.

3.12 Durability and serviceability

Hilti Firestop Bandage CFS-B has been tested in accordance with EOTA Technical Report - TR024 – Edition November 2006, for the type Z_2 use category specified in ETAG 026-2 (used as European Assessment Document, EAD), and the results of the tests have demonstrated suitability for penetration seals intended for use in internal conditions with humidity lower than 85% RH excluding temperatures below 0°C, without exposure to rain or UV.

4 Assessment And Verification Of Constancy Of Performance (Hereinafter AVCP) System Applied, With References To Its Legal base

According to the decision 1999/454/EC of the European Commission the system of assessment and verification of constancy of performance (see Annex V to the Regulation (EU) No 305/2011) given in the following table apply:

Products	Intended uses	Level or Class	System
Fire stopping and fire sealing products	For fire compartmentation and / or fire protection or fire performance	Any	System 1

5. Technical Details Necessary For The Implementation Of The AVCP System, As Provided For In The Applicable EAD.

Tasks for the Manufacturer

Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall ensure that the product is in conformity with this European Technical Assessment.

The manufacturer may only use constituent materials stated in the technical documentation of this European Technical Assessment.

The factory production control shall be in accordance with the Control Plan of 17/3/10 relating to the European technical assessment ETA 10/0212 which is part of the technical documentation of this European technical assessment. The "Control Plan" is laid down in the context of the factory production control system operated by the manufacturer and deposited at Warrington Certification Limited.

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the Control Plan.

Other tasks of manufacturer

Additional information

The manufacturer shall provide a technical data sheet and an installation instruction with the following minimum information:

(a) Technical data sheet:

- Field of application:
- Building elements for which the penetration seal is suitable, type and properties of the building elements like minimum thickness, density, and - in case of lightweight constructions – the construction requirements.
- Services for which the penetration seal is suitable, type and properties of the services like material, diameter, thickness etc. in case of pipes including insulation materials; necessary/allowed supports/fixings (e.g. cable trays)
- Limits in size, minimum thickness etc. of the penetration seal
- Construction of the penetration seal including the necessary components and additional products (e.g. backfilling material) with clear indication whether they are generic or specific.

(b) Installation instruction:

- Steps to be followed
- Procedure in case of retrofitting.

Tasks of approved bodies

The approved body shall perform the

— initial type-testing of the product,

— initial inspection of factory and of factory production control,

— continuous surveillance, assessment and approval of factory production control,

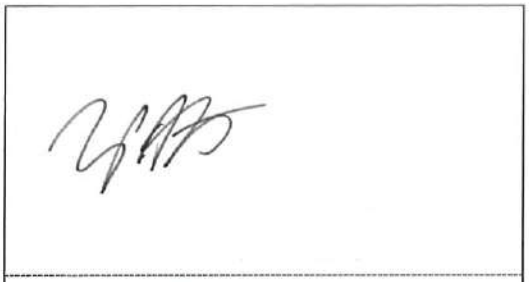
In accordance with the provisions laid down in the " Control Plan" of 17/3/10 relating to the European Technical Assessment 10/0212.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European technical assessment.

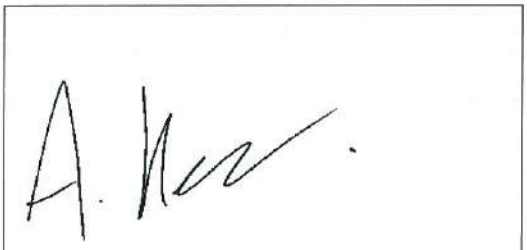
In cases where the provisions of the European technical assessment and its "Control Plan" are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform the Warrington Certification Limited without delay.

Signatories



Responsible Officer

C. Abbott* - Principal Certification Engineer



Approved

A. Kearns* - Technical Manager

* For and on behalf of Warrington Certification Limited.

Annex A

Reference Documents and LIST OF ABBREVIATIONS

References to standards mentioned in the ETA:

EN 13501-1	Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests
EN 13501-2	Fire classification of construction products and building elements – Part 2: Classification using test data from fire resistance tests
EN 1366-3	Fire resistance tests for service installations - Part 3: Penetration seals

Other reference documents:

EOTA TR 024	Characterisation, Aspects of Durability and Factory Production Control for Reactive Materials, Components and Products
ETAG No. 026: Part 2	Guideline For European Technical Approval of Fire Stopping and Fire Sealing Products, Part 3: Penetration Seals(used as European Assessment Document, EAD)

Annex B

Description of Product and Product Literature

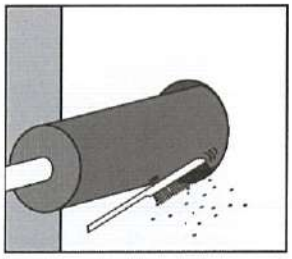
Hilti Firestop Bandage CFS-B

A detailed specification of the product is contained in document "Evaluation Report" relating to the European Technical Approval ETA – 10/0212 issued on 07/04/14, of Hilti Firestop Bandage CFS-B which is a non-public part of this ETA.

1 Installation

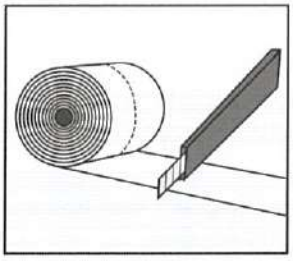
Installation of system Firestop Bandage CFS-B shall be conducted as follows:

1



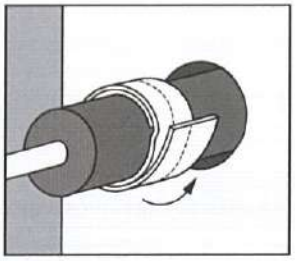
Clean opening.

2



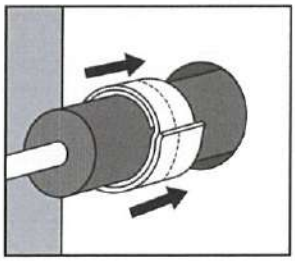
Cut Hilti Firestop Bandage CFS-B to fit the outside diameter of the insulation. Consider the number of 2 layers.

3



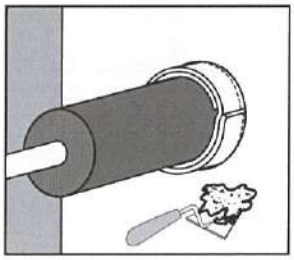
Wrap Hilti Firestop Bandage CFS-B around the insulation. Secure the bandage with steel bands or wire (≥ 0.7mm)

4



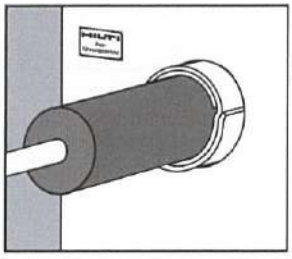
Install Hilti Firestop Bandage CFS-B on both sides within the opening in a depth of 62.5 mm.

5



Close the remaining gap with mortar or gypsum.

6



If it is necessary, an additional insulation over the bandage has to be installed.

Two layers of bandage are required around the pipe/insulation.

2 Indications to the manufacturer

2.1 Packaging, transport and storage

The following measures should be adopted with regard to handling and storage of the Hilti Firestop Bandage CFS-B:

- Handling
  - — Information for safe handling: No special measures required.
  - — Information about protection against explosions and fires: No special measures required.
- Storage
  - — Don't store the product under 0 °C and not over +60 °C

2.2 Use, maintenance, repair

The system Hilti Firestop Bandage CFS-B should be installed and used as described earlier in this document.

System Hilti Firestop Bandages CFS-B seals which are damaged should not be used or if damaged after installation, should be removed and replaced with undamaged bandages.

In the area covered by the ETA when the set up recommendation have been followed there is no maintenance protocol to be followed. The product does not need any maintenance in the life time indicated in the ETA.

Annex C

RESISTANCE TO FIRE CLASSIFICATION OF PENETRATION SEALS MADE OF HILTI FIRESTOP BANDAGE CFS-B

Intended use of pipes and reference to relevant section.

Typical Application	Pipe Material	Pipe standard	Flexible and rigid wall ≥ 100 mm	Rigid wall ≥ 200 mm	Floor ≥ 150mm
Heating	Copper		see 2.1.2	see 2.2.2	see 2.3.2
	Steel		see 2.1.3	see 2.2.3	see 2.3.3
	Alu Composite Pipes	EN ISO 21003	see 2.1.4	see 2.2.4	see 2.3.4
	PE-Xa	EN ISO 15875	see 2.1.5	-	see 2.3.5
Potable Water	Stainless Steel		see 2.1.3	see 2.2.3	see 2.3.3
	Alu Composite Pipes	EN ISO 21003	see 2.1.4	see 2.2.4	see 2.3.4
	PE-Xa	EN ISO 15875	see 2.1.5	-	see 2.3.5
Cooling	Copper		see 2.1.2	see 2.2.2	see 2.3.2
	Steel / Stainless Steel		see 2.1.3	see 2.2.3	see 2.3.3
	Alu Composite Pipes	EN ISO 21003	see 2.1.4	see 2.2.4	see 2.3.4
	PE-HD	EN 12201-2	see 2.1.5		see 2.3.5
Various	Copper		see 2.1.2	see 2.2.2	see 2.3.2
	Steel		see 2.1.3	see 2.2.3	see 2.3.3
	Alu Composite Pipes	EN ISO 21003	see 2.1.4	see 2.2.4	see 2.3.4

1 General Information Hilti Firestop Bandage CFS-B

1.1 Penetration seal and bandage installation

Pipes insulated with elastomeric combustible insulation (see Annex D) fire-stopped by wrapping the Hilti Firestop Bandage CFS-B twice around the insulation material.

Steel wire is utilised to hold the Hilti Firestop Bandage CFS-B together, positioned approximately in the first quarter measured from the flank.

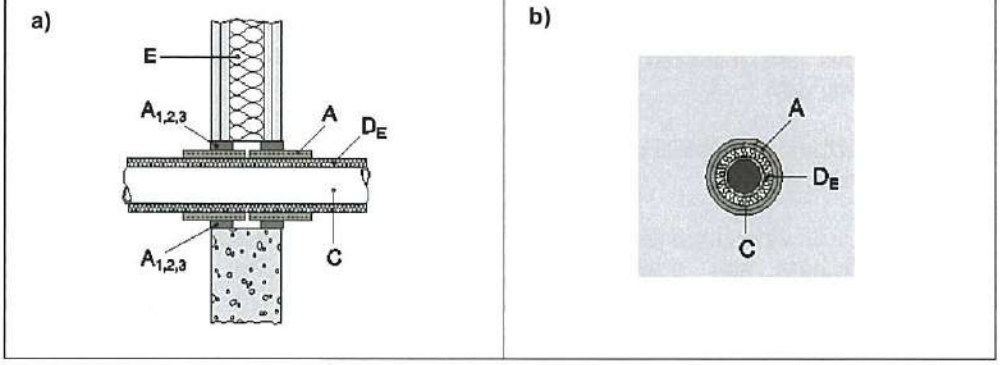
The Hilti Firestop Bandage CFS-B is mounted on both side of the penetration.

The Hilti Firestop Bandage CFS-B is then pushed into the penetration in line with the designated marking shown on midsize of the Hilti Firestop Bandage CFS-B or at 100 mm thick walls the Hilti Firestop Bandage CFS-B was placed with a distance of approximately 5 mm from each other.

1.1.1 Single penetration seal

Single insulated pipes running through the penetration are sealed utilising two layers of Hilti Firestop Bandage CFS-B.

Installation scheme of bandage
a) side view b) front view



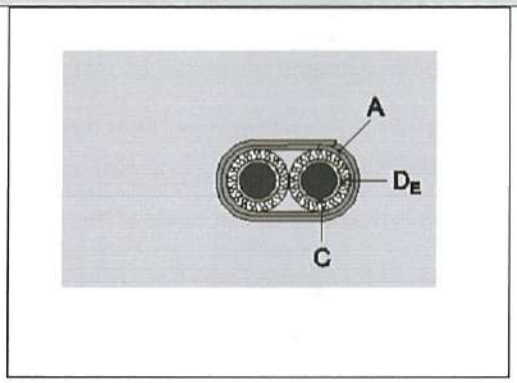
1.1.2 Bundled penetration

Small aluminium composite pipes (≤Ø 16mm) can be wrapped together in a double penetration with the Hilti Firestop Bandage CFS-B.

Hilti Firestop Bandage CFS-B is wrapped over both insulated pipes. Fixing and positioning of the bandage is installed as described above.

Installation and Hilti Firestop Bandage CFS-B is as described above

Installation sceme of bandage
Front view of two pipes wrapped together with bandage



1.2 Pipe insulation with combustible and mineral wool insulation

Specific insulation thickness with corresponding classification class is shown at each section below.

1.2.1 Elastomeric combustible insulation

Pipes are insulated with elastomeric combustible insulation material of varying thickness'.

Elastomeric material ranges from 7,7 mm up to 45 mm in configuration (CS) Continued Sustained.

Results were displayed considering E.2.7.5.2 and E.2.7.8.2 allowing interpolation of wall thickness and diameter between tested specimens and insulation thickness, respectively.

Metallic pipes from diameter 323.9mm on were insulated by a fixed thickness of 25mm elastomeric combustible insulation.

Metallic pipes were tested in C/U configuration, plastic and aluminum composite pipes in U/C configuration

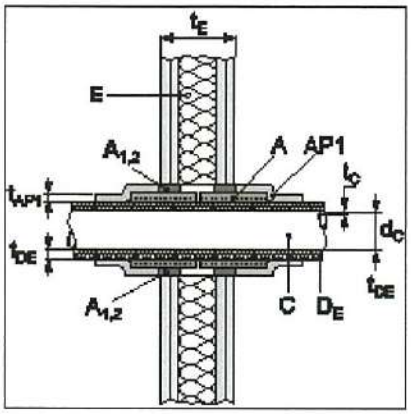
1.2.2 Mineral wool insulation

For mineral wool insulation Rockwool conlit shells /Rockwool 800 or Rockwool KlimaRock / Rockwool RS 800 (40mm, approx. 40kg/m³; (LI) Local Interrupted was utilised.

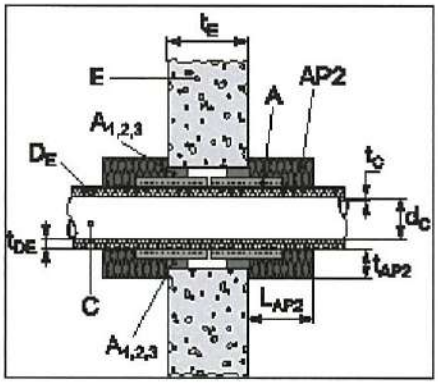
1.3 Additional Protection

Additional insulation material (AP) is utilised for some applications and comprises of the following:

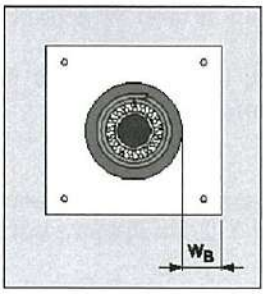
AP1: Armaflex AF elastomeric material for thermal insulation, 19 mm thick and 250 mm in length (LI) Local Interrupted



AP2: Mineral wool, Rockwool Klimarock, 40mm thick, 250 mm in length; density approximately40kg/m³ (LI) Local Interrupted

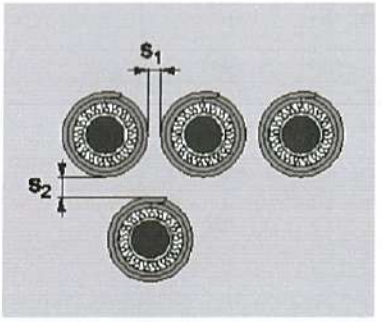


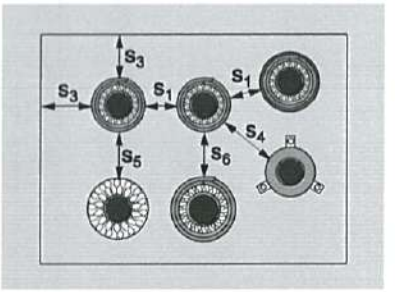
AP3: Beading / Outside Framing
Beading for flexible wall (100 mm) is applied by adding boards on both sides in two layers (2x12,5 mm Type F board) fixed with drywall screws. The resulting strips around the pipe whole are at least 50 mm in width. Final penetration seal thickness is 150 mm.



1.4 Clearance to insulated pipes and other fire-stopped services

Clearance of services to each other – references see below 1.4.1 to 1.4.5
These clearance are valid for flexible, rigid wall and floor.





1.4.1 Clearance to pipes firestopped by bandage in linear configuraton - S_1

Clearance is ≥ 0 mm to each other for insulated pipes wrapped by bandage CFS-B and in some cases to additional protection according classification.

1.4.2 Clearance to pipes firestopped by bandage in cluster configuraton – S_2

Clearance is ≥ 0 mm to each other for insulated pipes wrapped by bandage CFS-B and in some cases to additional protection according classification.

1.4.3 Distances to seal edge - S_3

In round openings distance to seal edge are up to 50mm. In case where no gap is left between construction and bandage, smoke tightness has been secured.

1.4.4 Clearance to Hilti Firestop Collar CFS-C EL - S_4

Clearance to Hilti Firestop Collar is shown to be zero. Please refer for detailed results the corresponding ETA 14/0085.

1.4.5 Clearance to Conlit shell and Klimarock - S_5

Insulated pipes fire-stopped with Hilti Firestop Bandage CFS-B are tested to have a clearance to bandage or respectively to additional protection of zero.

1.4.6 Distance to PE-HD / PE-Xa pipes- S_6

Minimum distance to plastic pipes (PE-HD / PE-Xa) is in Wall ≥65 mm, in floor ≥0 mm.

1.5 Annular Gap

In flexible and rigid wall Hilti Acrylic Firestop CFS-S ACR and gypsum is used to fill annular space. Mortar and gypsum is used in rigid walls and floors.
Hilti Acrylic Firestop CFS-S ACR is used for gaps of 0 mm -15 mm

Mortar and gypsum is used in rigid walls and floors, annular space is allowed from approximately 3 up to 50 mm.

1.6 Pipe Support

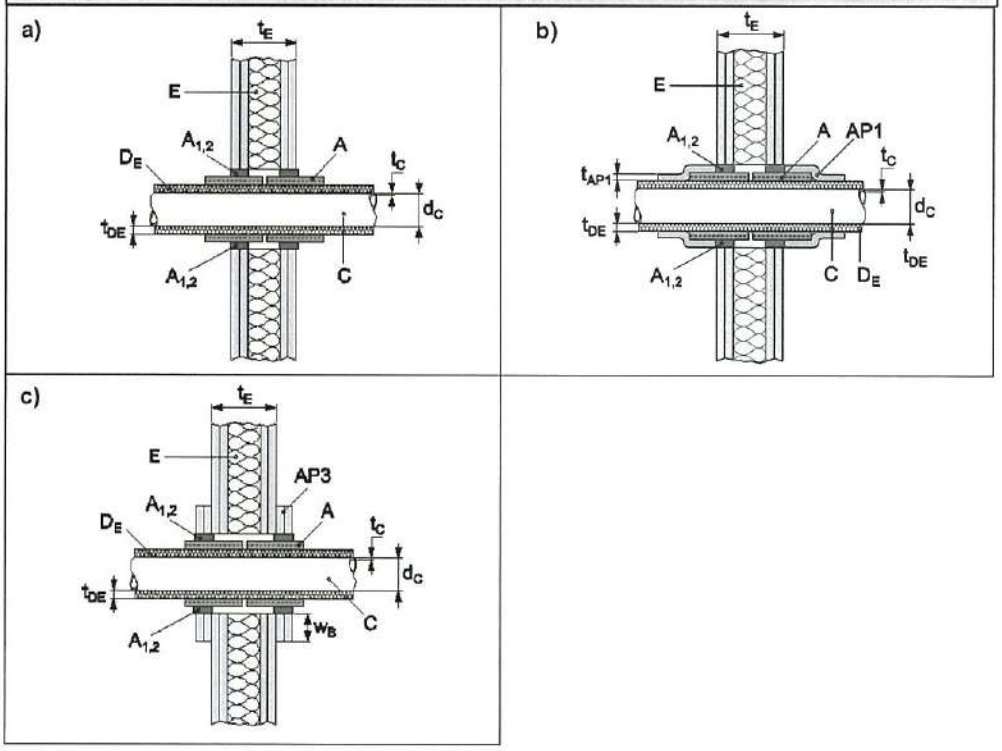
Pipes are supported in wall application at a distance of 450 mm.
In floors first support was in 330 mm distance installed from surface.

2 Testing of fire resistance in different constructions

2.1 Flexible wall (≥100 mm)

2.1.1 Installation variations of insulated pipes protected by Hilti Firestop Bandage CFS-B

Installation examples:
a) Standard installation
b) Installation with additional protection AP1
c) Installation with additional protection beading/outside framing (AP3)

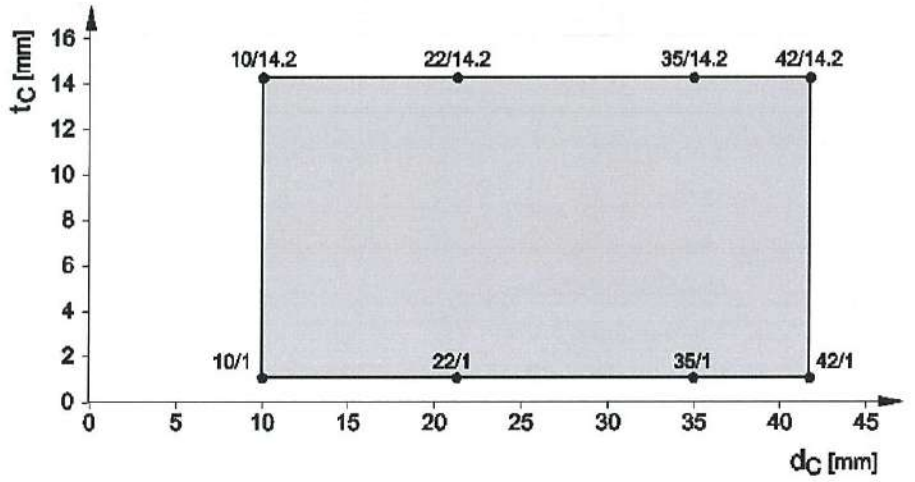


2.1.2 Copper pipes

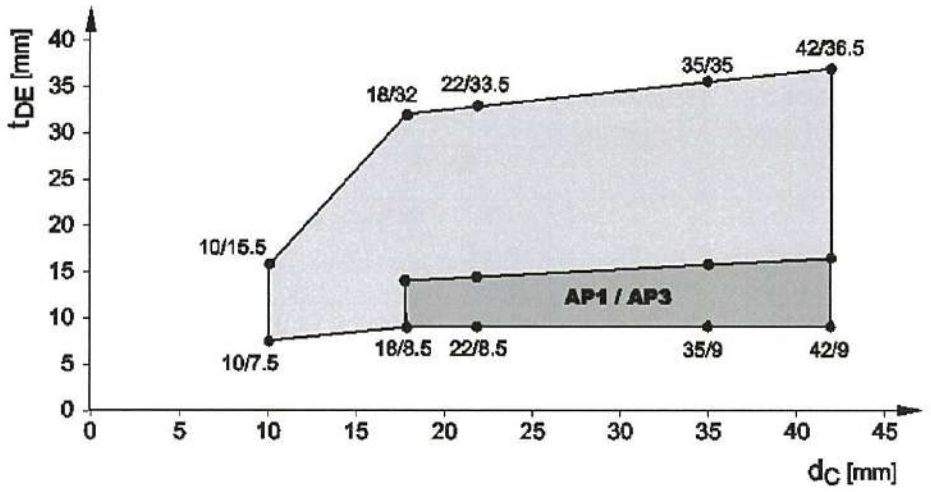
Copper pipes are insulated with elastomeric combustible insulation ranging in thickness [mm] from 7,5mm till up to 36,5mm.

Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification		
			from		to			addition. protection	
			Ø small	Ø big	Ø small	Ø big	-	AP 1	AP 3
Copper	10 to 18	1 - 14,2	7,5	8,0	15,4	32,0	EI 90	-	-
Copper	18 to 42	1 - 14,2	8,0	9,0	33,5	36,5	EI 60	EI 90	-
Copper	18 to 42	1 - 14,2	14,5	16,5	33,5	36,5	EI 90		-
Copper	18 to 42	1 - 14,2	8,0	9,0	33,5	36,5			EI 90
Copper	10 to 35	1 - 14,2	7,5	9,0	15,4	35,0			EI 120

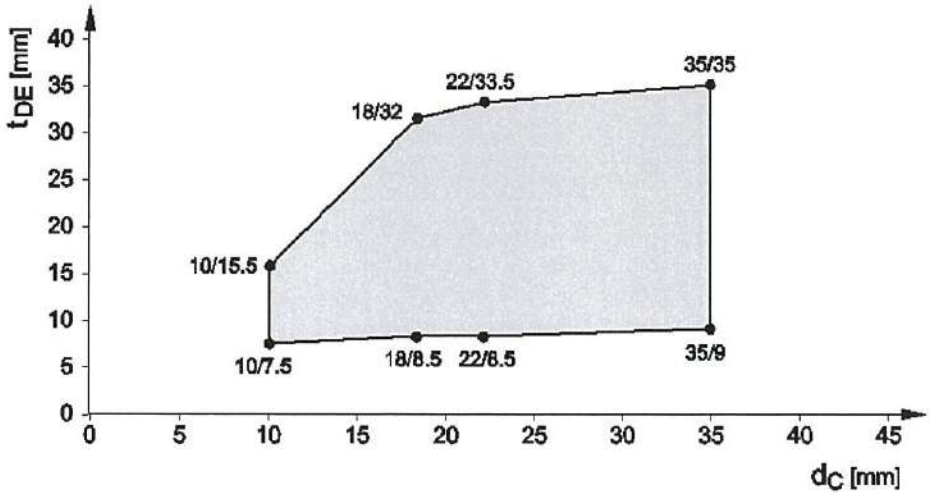
Copper pipe – relation wall thickness towards pipe diameter
Graph shows pipe wall thickness (II) towards pipe diameter (Ø dC)



Copper pipes, C/U, flexible wall ≥100 mm – EI 90
Thin insulation thickness aquires at higher pipe diameter additional protection (AP1 or AP3; dark area)
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø dC)



Copper pipes, C/U, flexible wall ≥100 mm – EI 120
Additional protection AP3 – penetration seal thickness 150 mm
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø dC)

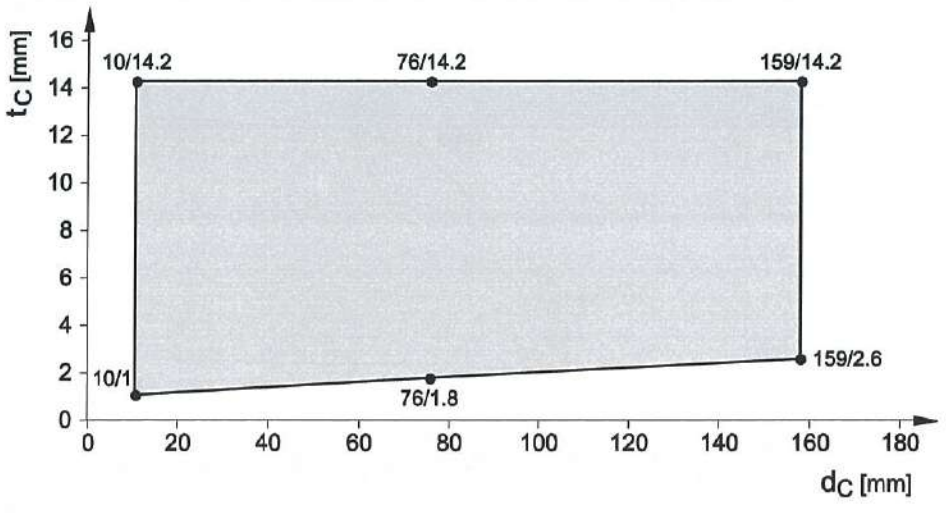


2.1.3 Steel Pipes

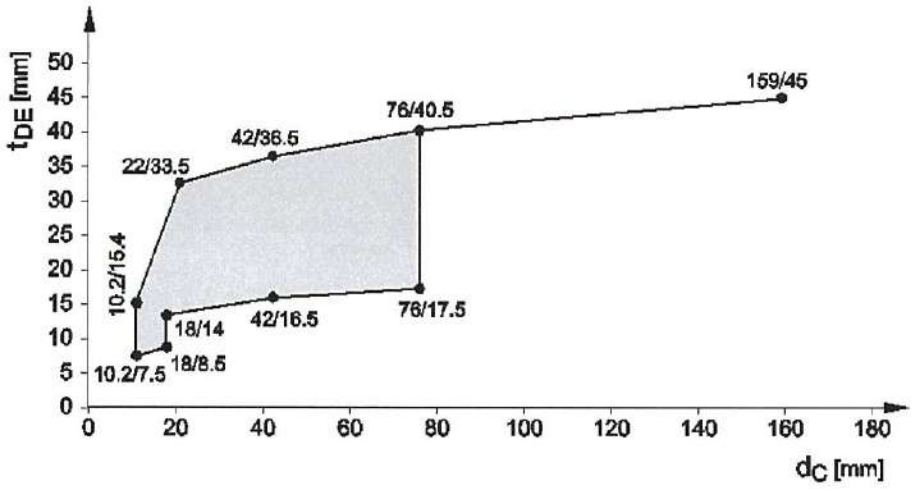
Applying Annex E1.3.2 of DIN EN 1366-3:2009 the field of application given above for copper pipes is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1050°C, e.g. unalloyed steel, low alloyed steel, cast iron, stainless steel, Ni alloys (NiCu, NiCr, NiMo alloys) and Ni.

Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification		
			from		to			addition. protection	
			Ø small	Ø big	Ø small	Ø big	-	AP 1	AP 3
Steel	10,2 to 18	1 - 14,2	7,5	8,5	15,4	33,5	EI 90		
Steel	18 to 42	1 - 14,2	8,5	9,0	32,0	36,5	EI 60	EI 90	
Steel	18 to 42	1 - 14,2	14,0	16,5	32,0	36,5	EI 90		
Steel	42,4 to 76	1,4 - 14,2	16,5	17,5	36,5	40,5	EI 90		
Steel	10,2 to 76	1 - 14,2	7,5	9,5	15,4	40,5		EI 90	
Steel	76 to 159	1,8 - 14,2	40,5	45	40,5	45	EI 90		
Steel	10,2 - 60	1 - 14,2	7,5	9,0	15,4	39			EI 120

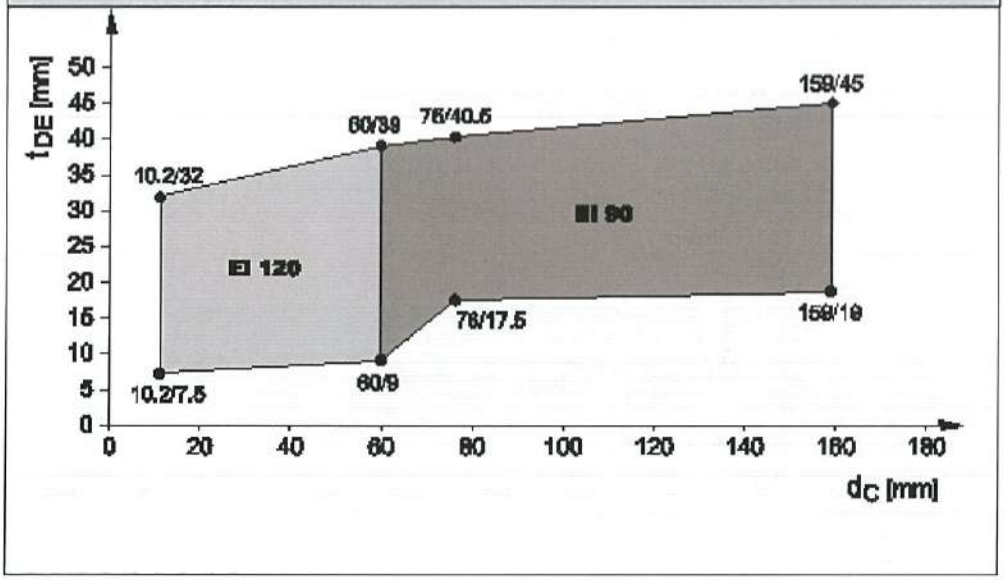
Steel pipe, flexible wall ≥100 mm – relation wall thickness towards pipe diameter
Graph shows pipe wall thickness (tc) towards pipe diameter (Ø dC)



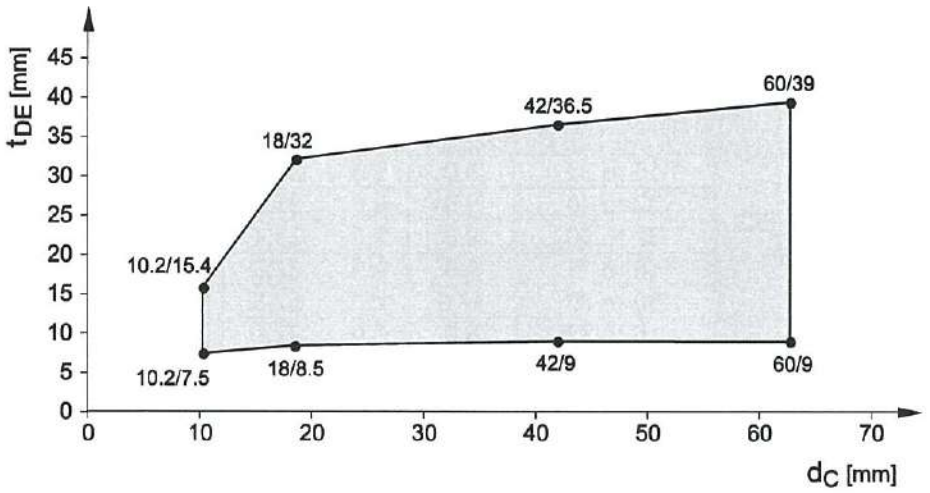
Steel pipes, C/U, flexible wall ≥100 mm – EI 90
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø dC)



Steel pipes, C/U, flexible wall ≥100 mm – EI 60 or EI 90 + AP1
Additional protection AP1 is required to reach EI 90
From pipe Ø 76 to Ø 159 mm classification is EI 120 at high insulation thickness (40.5/45 mm; see dotted line in graph below)
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



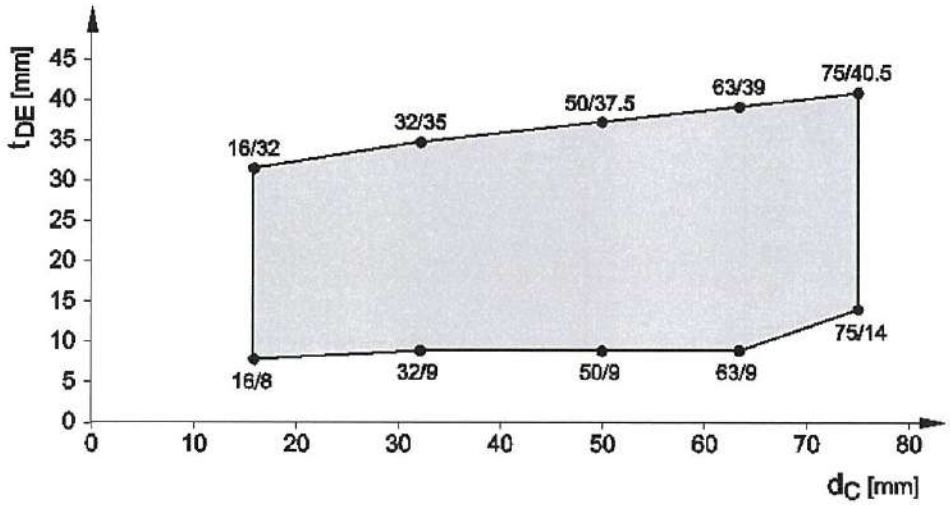
Steel pipes, C/U, flexible wall ≥100 mm – EI 120 with beading (AP3)
Additional protection AP3, thickness of penetration seal 150 mm
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



2.1.4 Aluminium Composite Pipes

Manu-facturer	Product name	Pipe diameter dc (mm)	Insulation thickness (mm)				Classification	
			from		to			Additional Protection
			Ø small	Ø big	Ø small	Ø big		AP3
Fränkische Rohrwerke	Alpex F50 Profi	16 to 32	8,0	9,0	32,0	35,0	EI 90	
		32 to 40	9,0	9,0	35,0	36,5	EI 60	
		32 to 50	9,0	9,0	35,1	37,5		EI 120
		50 to 75	9,0	9,0	37,5	40,5	EI 60	
		50 to 75	37,5	40,5	37,5	40,5	EI 120	
Geberit	Mepla	16 to 32	8,0	9,0	32,0	35,0	EI 90	
		32 to 40	9,0	9,0	35,0	36,5	EI 60	
		32 to 50	9,0	9,0	35,1	37,5		EI 120
		50 to 75	9,0	9,0	37,5	40,5	EI 60	
		50 to 75	37,5	40,5	37,5	40,5	EI 120	
Georg Fischer	Sanipex	16 to 32	8,0	9,0	32,0	35,0	EI 90	
		32 to 40	9,0	9,0	35,0	36,5	EI 60	
		32 to 50	9,0	9,0	35,1	37,5		EI 120
		50 to 63	9,0	9,0	37,5	39	EI 60	
		40 to 63	9,0	9,0	36,5	39	EI 120	
IVT	PRINETO Stabilrohr	17 to 52	8,0	9,0	32,0	37,5	EI 90	
		52 to 63	9,0	9,0	37,5	39	EI 60	
		17 to 63	32	39	32	39	EI 120	
KeKelit	KELOX KM 110	16 to 75	8,0	14,0	32,0	40,5	EI 90	
		16 to 73	32	40,5	32	40,5	EI 120	
Rehau	Rautitan stabil	16 to 40	8,0	9,0	32,0	38,5	EI 90	
		16 to 40	32,0	38,5	32,0	38,5	EI 120	
TECE	TECEflex Verbundrohr	16 to 50	8,0	9,0	32,0	37,5	EI 90	
		63	9,0	9,0	29	29	EI 60	
		16 to 63	32	40,5	32	40,5	EI 120	
Uponor	Unipipe MLC	16 to 32	8,0	9,0	32,0	35,0	EI 120	
Viega	SANIFIX Fosta-Rohr	16 to 32	8,0	9,0	32,0	35,0	EI 120	
		32 to 63	9,0	9,0	36,5	39	EI 60	
		32 to 50	9,0	9,0	35,1	37,5		EI 120
		16 to 63	32	39	32	39	EI 120	

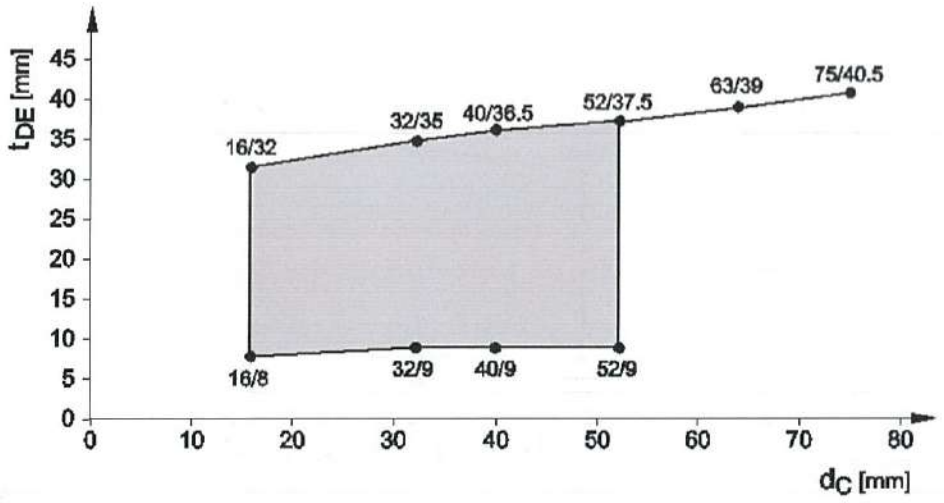
Aluminium Composite Pipes, U/C, flexible wall ≥ 100 mm - EI 60
All specimens listed
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



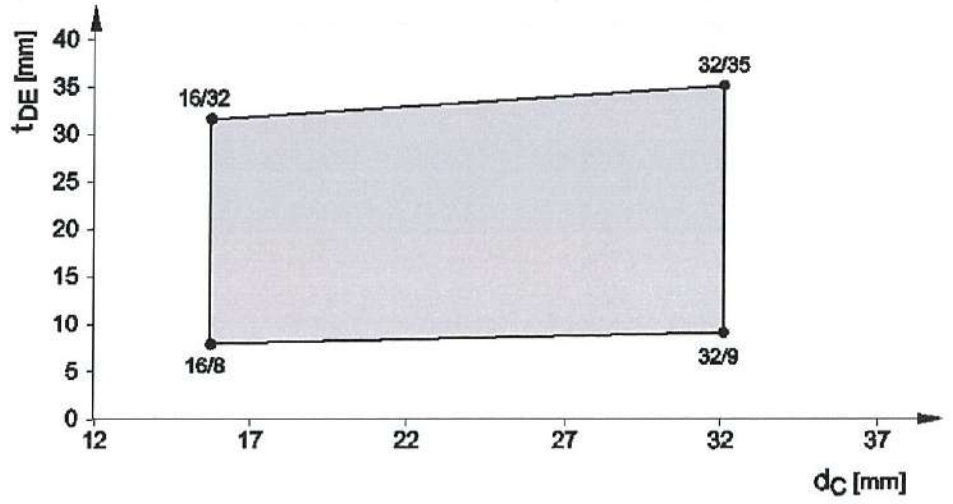
list_1 of composite pipes – Brand (Type):
Kekelit (Kelox), IVT (Prineto Stabil Rohr), Rehau (Rautitan stabil), TECEflex (Verbundrohr)

list_2 of composite pipes - Brand (Type):
Fränkische Rohrwerke (Alpex System), Geberit (Mepla), Georg Fischer (Sanipex) Viega (Sanifix Fosta), Uponor (Unipipe MLC – pipe Ø range from 16 to 32 mm, only)

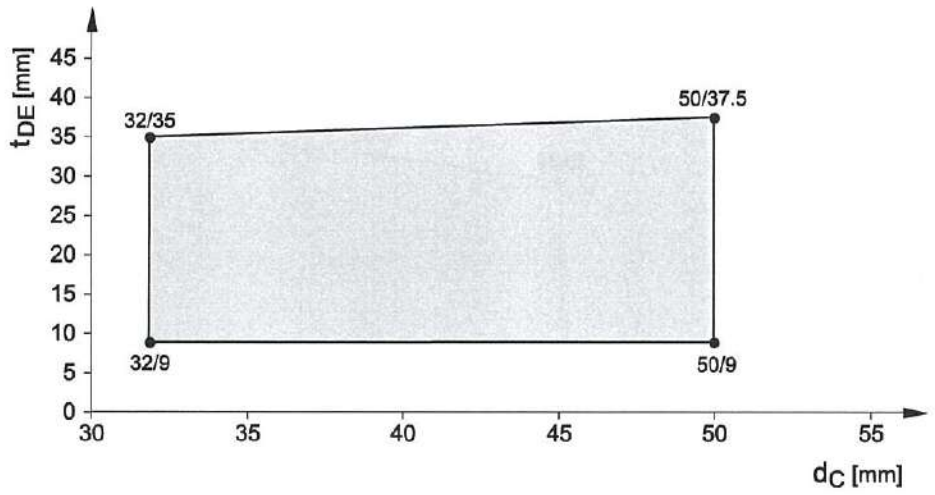
Aluminium Composite Pipes, U/C, flexible wall ≥ 100 mm - EI 90
All specimens list_1
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



Aluminium Composite Pipes, U/C, flexible wall ≥ 100 mm - EI 90
All specimens list_2
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



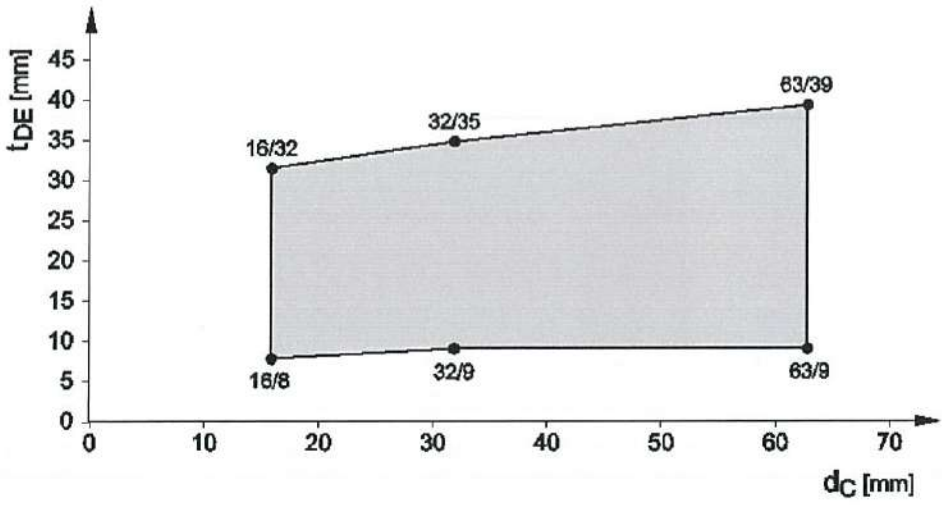
Aluminium Composite Pipes, U/C, flexible wall ≥ 100 mm - EI 120 with beading
All specimens list_2 but without Uponor
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



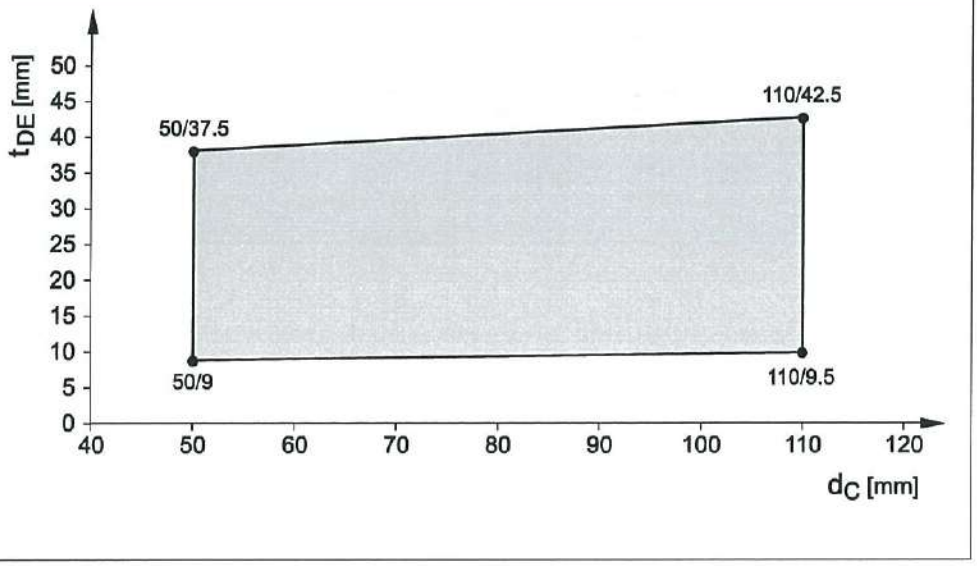
2.1.5 Plastic pipes made of PE-Xa (EN ISO 15875) and PE HD (EN 12201-2)

Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification
			from		to		
			Ø small	Ø big	Ø small	Ø big	-
PE-Xa	16 to 63	2,2 to 8,6	8	9,0	32	39	EI 120
PE HD 100	50 to 110	4,6 to 10	9	9,5	37,5	42,5	EI 120

Plastic pipes PE-X according EN ISO 15875, U/C, flexible wall ≥ 100 mm - EI 120
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



Plastic pipes PE-HD according EN 12201-2, U/C, flexible wall ≥ 100 mm - EI 120
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



120

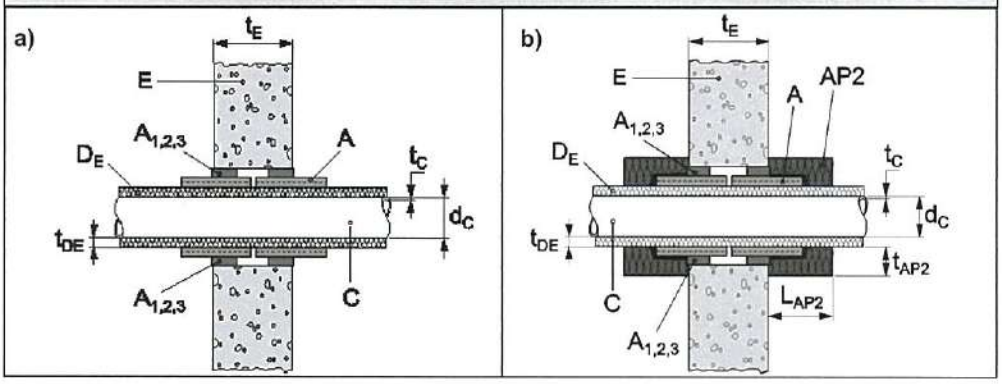
2.2 Rigid Wall

2.2.1 Set-up of rigid wall (200 mm)

The wall must have a minimum thickness of 200 mm and comprise of concrete, aerated concrete or masonry, with a minimum density of 550 kg/m^3

Installation variants of insulated pipes protected by Hilti Firestop Bandage CFS-B

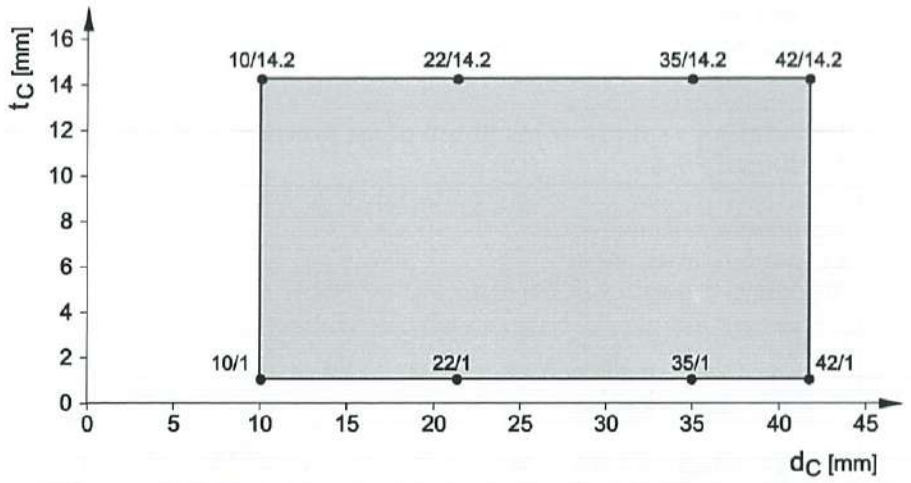
Installation examples:
a) Standard installation
b) Installation with additional protection AP2



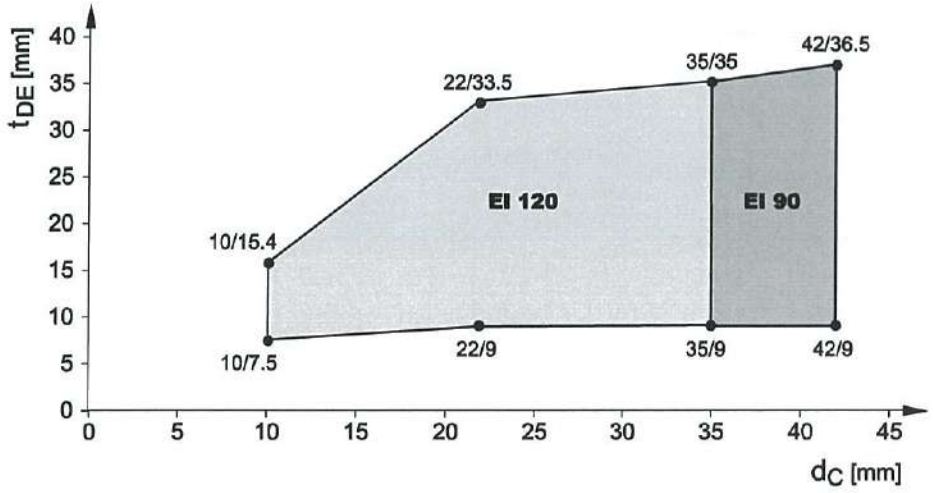
2.2.2 Copper Pipes

Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification
			from		to		
			Ø small	Ø big	Ø small	Ø big	-
Copper	10 to 42	1 - 14,2	7,5	9,0	15,4	36,5	EI 90
Copper	10 to 35	1 - 14,2	7,5	9,0	15,4	35,0	EI 120

Copper pipe, rigid wall ≥200 mm – relation wall thickness towards pipe diameter
Graph shows pipe wall thickness (tc) towards pipe diameter (Ø d_C)



Copper pipes, C/U, rigid wall ≥200 mm – EI 120 / EI 90
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



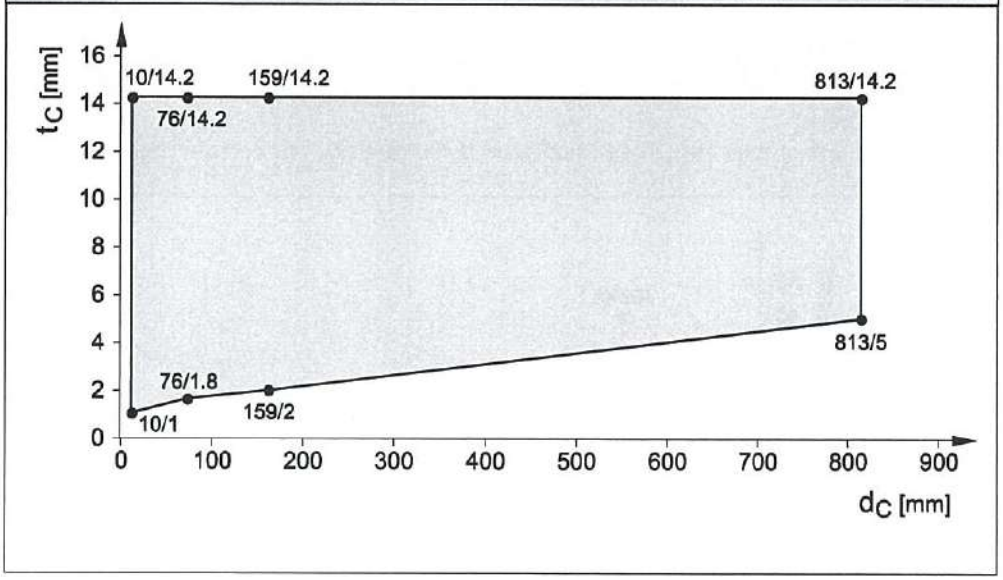
2.2.3 Steel Pipes

Applying Annex E1.3.2 of DIN EN 1366-3:2009 the field of application given in 2.2.2 for copper pipes is also valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1050°C, e.g. unalloyed steel, low alloyed steel, cast iron, stainless steel, Ni alloys (NiCu, NiCr, NiMo alloys) and Ni.

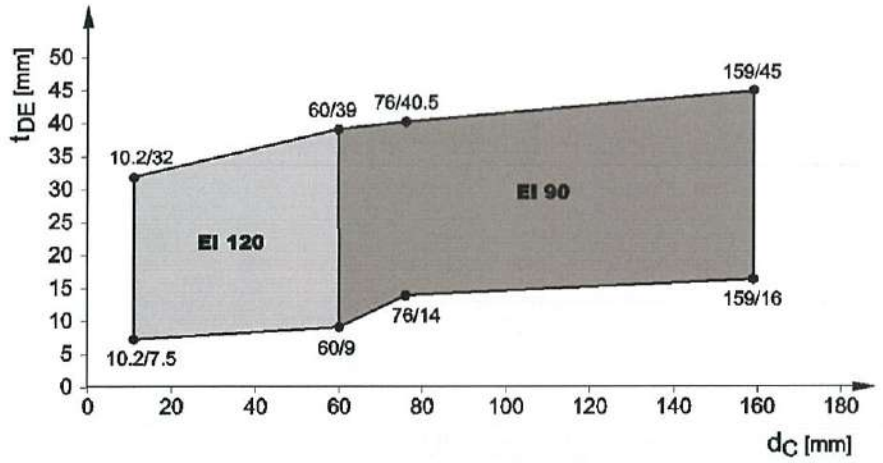
Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification	
			from		to			
			Ø small	Ø big	Ø small	Ø big	-	AP 2
Steel	10,2 to 60	1 to 14,2	7,5	9	32,0	39	EI120	
Steel	76 to 159	1,8 to 14,2	17,5	19	40,5	45	EI 90	
Steel	159	2 to 14,2	45	45	45	45	EI 120	
Steel	159 to 813	2 to 14,2	16	25	45	25		EI 120

AP 2 insulation was applied in a length of 500 mm for pipe Ø813. Therefore this is valid for pipe range from Ø159 to Ø813 mm.

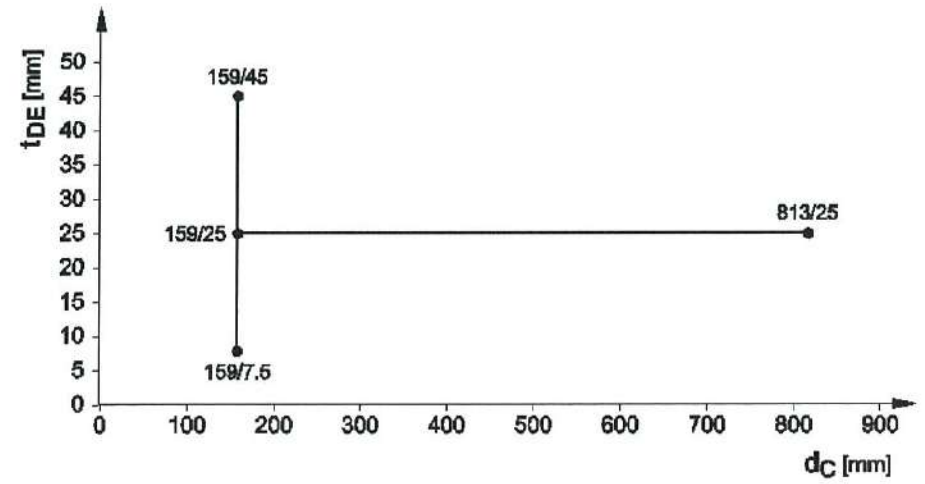
Steel pipe, rigid wall ≥200 mm – relation wall thickness towards pipe diameter
Graph shows pipe wall thickness (tc) towards pipe diameter (Ø d_C)



Steel pipes, C/U, rigid wall ≥200 mm – EI 120 /90
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



Steel pipes, C/U, rigid wall ≥200 mm – EI 120
Insulated large pipes from Ø 159 up to 813 mm
Elastomeric insulation plus additional protection mineralwool (AP2, Klimarock 40mm)
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)

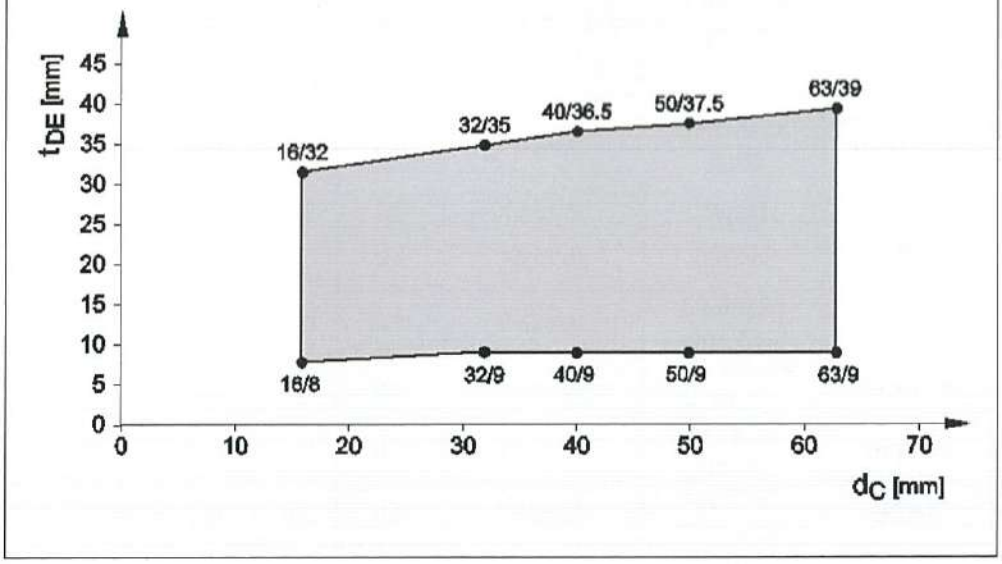


2.2.4 Aluminium Composite Pipes

Manu-facturer	Product name	Pipe diameter dc (mm)	Insulation thickness (mm)				Classification
			from		to		
			Ø small	Ø big	Ø small	Ø big	
Fränkische Rohrwerke	Alpex F50 Profi	16 to 63	8,0	9,0	32,0	39,0	EI 120
Geberit	Mepla	16 to 63	8,0	9,0	32,0	39,0	EI 120
Georg Fischer	Sanipex	16 to 63	8,0	9,0	32,0	39,0	EI 120
IVT	PRINETO Stabilrohr	16 to 63	8,0	9,0	32,0	39,0	EI 120
KeKelit	KELOX KM 110	16 to 63	8,0	9,0	32,0	39,0	EI 120
Rehau	Rautitan stabil	16 to 63	8,0	9,0	32,0	39,0	EI 120
TECE	TECEflex Verbundrohr	16 to 63	8,0	9,0	32,0	39,0	EI 120
Viega	SANIFIX Fosta-Rohr	16 to 63	8,0	9,0	32,0	39,0	EI 120

Result is valid for composite pipes list_1 and List_2 with exception Uponor (see 2.4; note[2,3])

Aluminium Composite Pipes, U/C, rigid wall ≥ 200 mm - EI 90
All specimens list_1 and list_2 (not proven for Uponor)
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



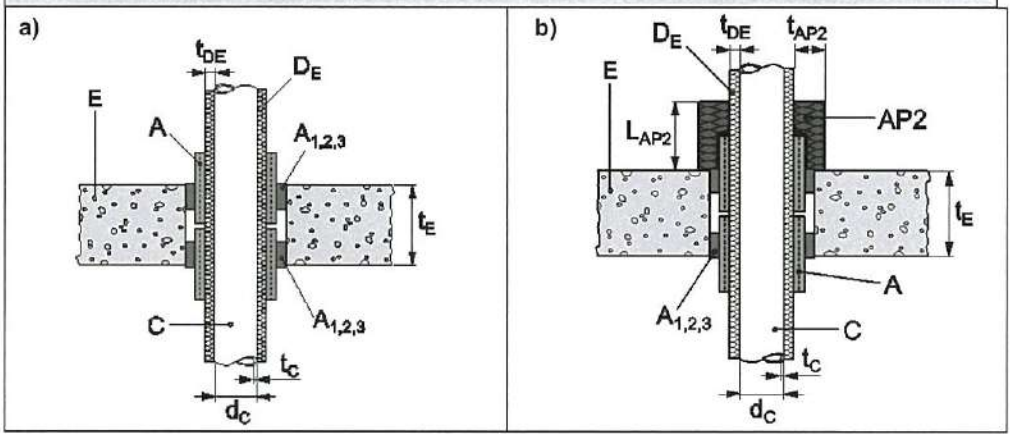
2.3 Floor

2.3.1 Set-up of floor

The supporting construction is build according EN 1355-3:2009 of at least lightweight concrete slabs of a thickness of 150 mm and a density of 550 kg/m³.

Installation variants of insulated pipes protected by Hilti Firestop Bandage CFS-B

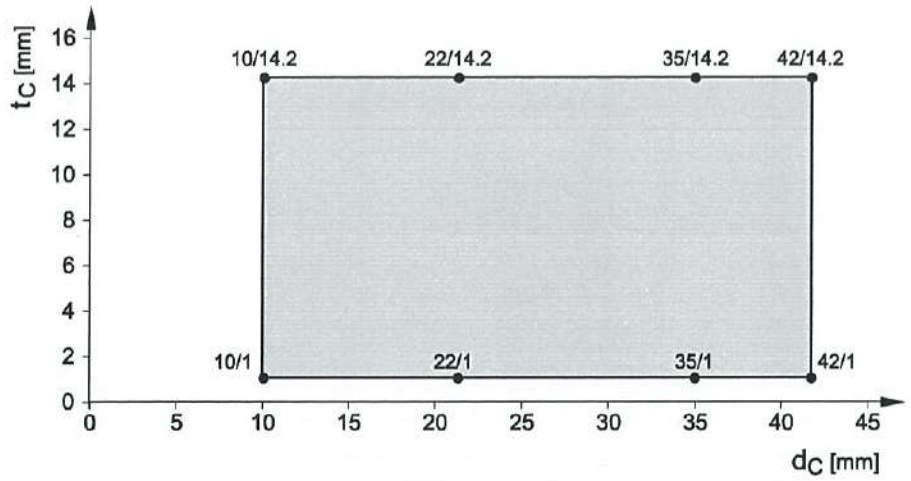
Installation examples:
a) Standard installation
b) Installation with additional protection AP2



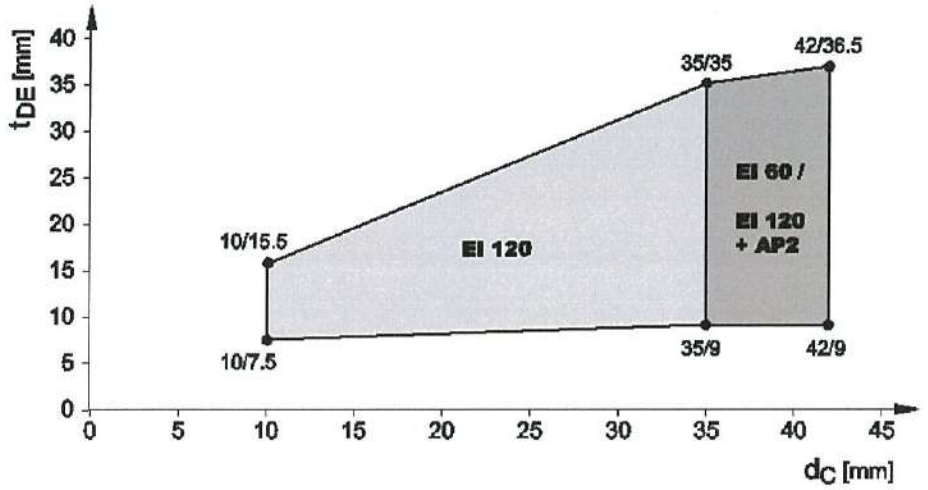
2.3.2 Copper Pipes

Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification		
			from		to				
			Ø small	Ø big	Ø small	Ø big	-	AP 1	AP 2
Copper	10 to 35	1 - 14,2	7,5	9,0	15,5	35,0	EI 120	-	-
Copper	35 to 42	1 - 14,2	9,0	9,0	35,0	36,5	EI 60		EI 120

Copper pipe, rigid wall ≥200 mm – relation wall thickness towards pipe diameter
Graph shows pipe wall thickness (tc) towards pipe diameter (Ø d_C)



Copper pipes, C/U, floor ≥150 mm – EI 120 / EI 60 / EI 120 plus AP2
Additional protection AP2 (mineral wool) is required from Ø 35 to 42 mm to reach
EI 120
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)

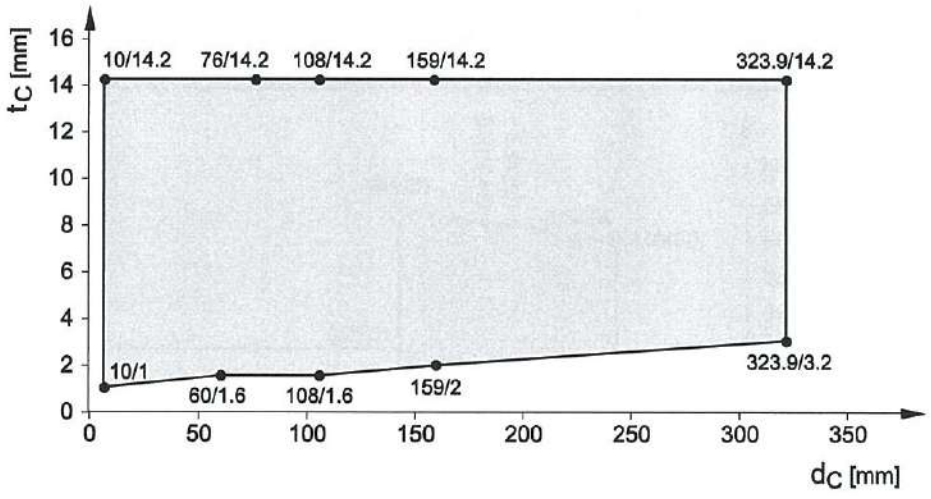


2.3.3 Steel Pipes

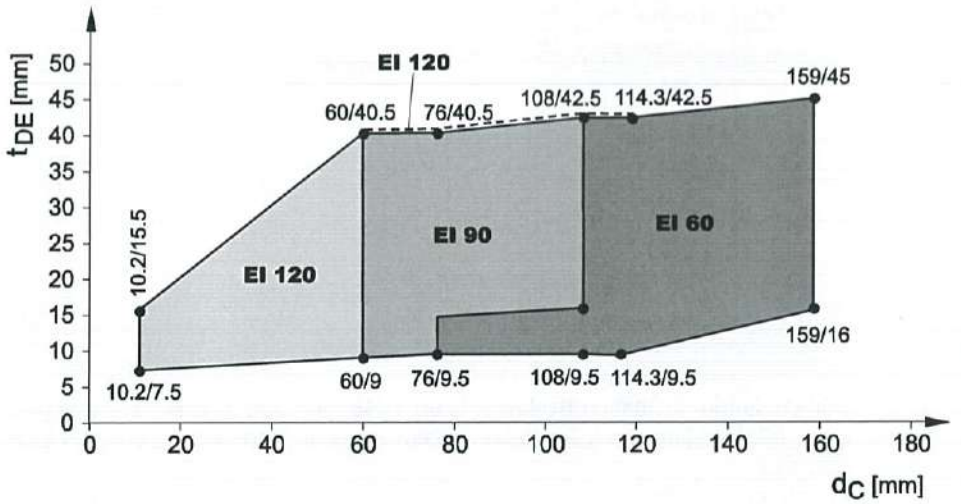
Service	Pipe diameter d_c [mm]	Pipe wall thickness t_c [mm]	Insulation thickness t_{DE} [mm]				Classification	
			from		to			
			Ø small	Ø big	Ø small	Ø big	-	AP 2
Steel	10,2 to 60	1 to 14,2	7,5	9,0	15,5	39,0	EI120	
Steel	60 to 76	1 to 14,2	9,0	9,5	39,0	40,5	EI 90	EI 120
Steel	76 to 108	1,8 to 14,2	14,0	14,5	39,0	42,5	EI 90	
Steel	10,2 to 114,3	1 to 14,2	15,5	42,5	15,5	42,5	EI 120	
Steel	76 to 323,9	1,8 to 14,2	9,5	25	39,0	25		EI 120
Steel	76 to 159	1,6 to 14,2	9,0	16,0[2]	39,0	45	EI 60	

[1] till Ø159 mm insulation thickness is up to 45mm; pipe diameters above insulation is 25 mm. AP 2 – Klima Rock Insulation 40mm - was applied on pipe Ø 323,9 at a length of 500 mm.
[2] minimal insulation thickness above Ø114,3 mm is increased to 16 mm

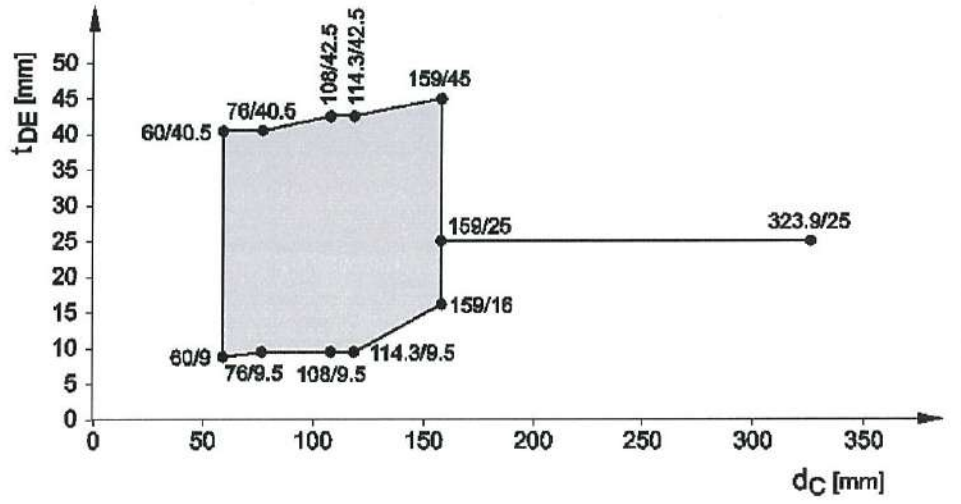
Steel pipe, floor ≥150 mm – relation wall thickness towards pipe diameter
Graph shows pipe wall thickness (tc) towards pipe diameter (Ø d_c)



Steel pipes, C/U, floor ≥150 mm – EI 120 / EI 90 / EI 60
Different insulation thickness results in distinct classifications
EI 120 classification is valid for highest insulation thickness up to Ø 114 mm (dotted line)
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



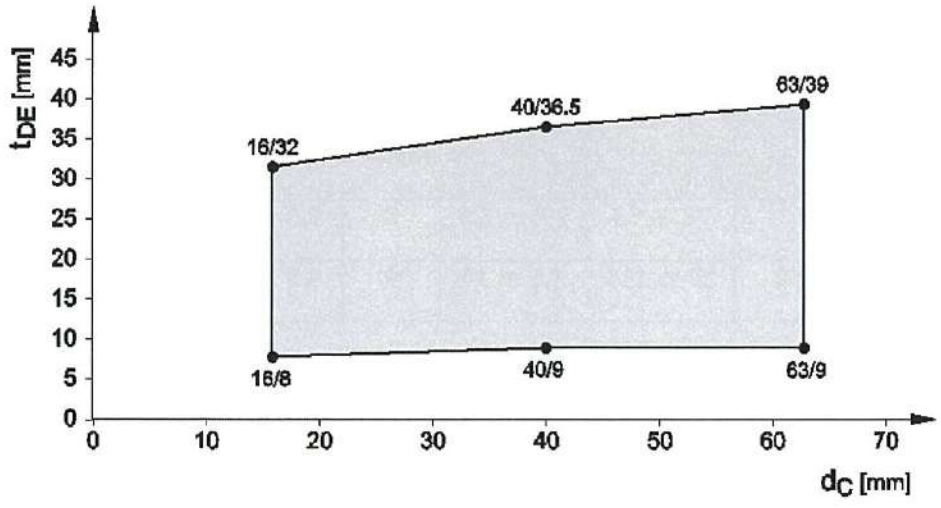
Steel pipes, C/U, floor ≥150 mm – EI 180 plus AP2
Pipes insulated with elastic combustible insulation are additional protected by AP2 (Klimarock 40 mm)
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



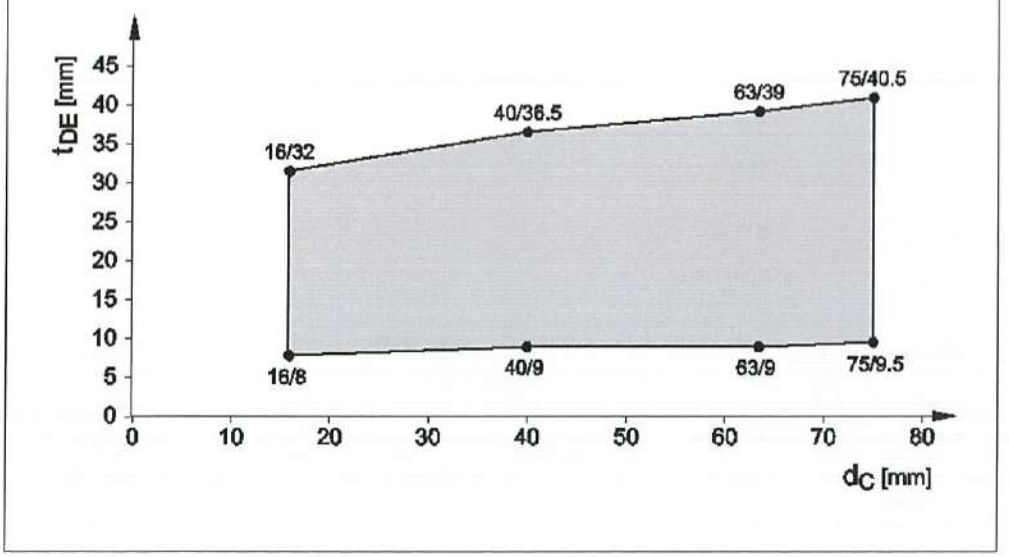
2.3.4 Aluminium Composite Pipes

Manu-facturer	Product name	Pipe diameter dc (mm)	Insulation thickness (mm)				Classification
			from		to		
			Ø small	Ø big	Ø small	Ø big	
Fränkische Rohrwerke	Alpex F50 Profi	16 to 40	8,0	9,0	32,0	36,5	EI 120
		40 to 75	9,0	9,0	36,5	40,5	EI 90
		75	40,5		40,5		EI 180
Geberit	Mepla	16 to 75	8,0	9,0	32,0	39,0	EI 120
		75	40,5		40,5		EI 180
Georg Fischer	Sanipex	16 to 63	8,0	9,0	32,0	39,0	EI 120
IVT	PRINETO Stabilrohr	17 to 63	8,0	9,0	32,0	39,0	EI 120
KeKelit	KELOX KM 110	16 to 63	8,0	9,0	32,0	39,0	EI 120
		75	9,5		40,5		EI 180
Rehau	Rautitan stabil	16 to 63	8,0	9,0	32,0	39,0	EI 120
TECE	TECEflex Verbundrohr	16 to 63	8,0	9,0	32,0	39,0	EI 120
Uponor	Unipipe MLC	16 to 32	8,0	9,0	32,0	35,0	EI 180
Viega	SANIFIX Fosta-Rohr	16 to 63	8,0	9,0	32,0	39,0	EI 120

Aluminium Composite Pipes, U/C, floor ≥ 150 mm - EI 120
All specimens listed
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



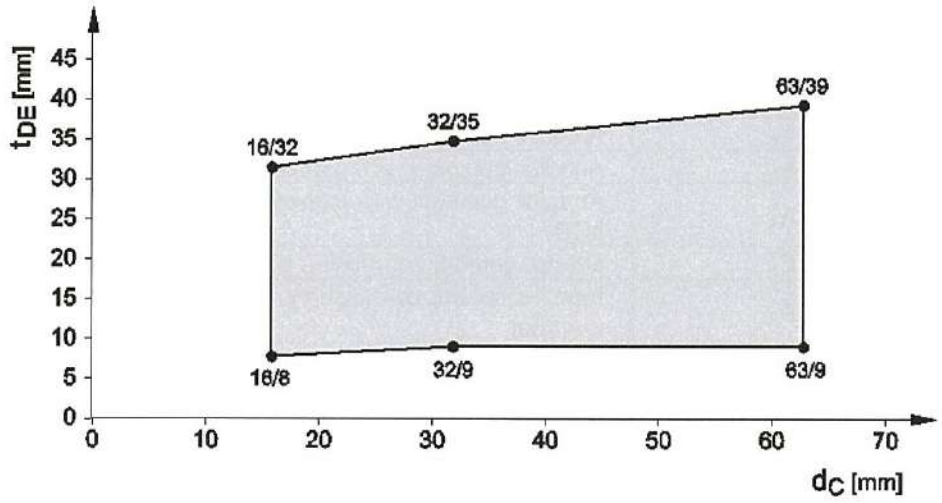
Aluminium Composite Pipes, "Fränkische Rohrwerke", U/C, floor ≥ 150 mm- EI 90
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



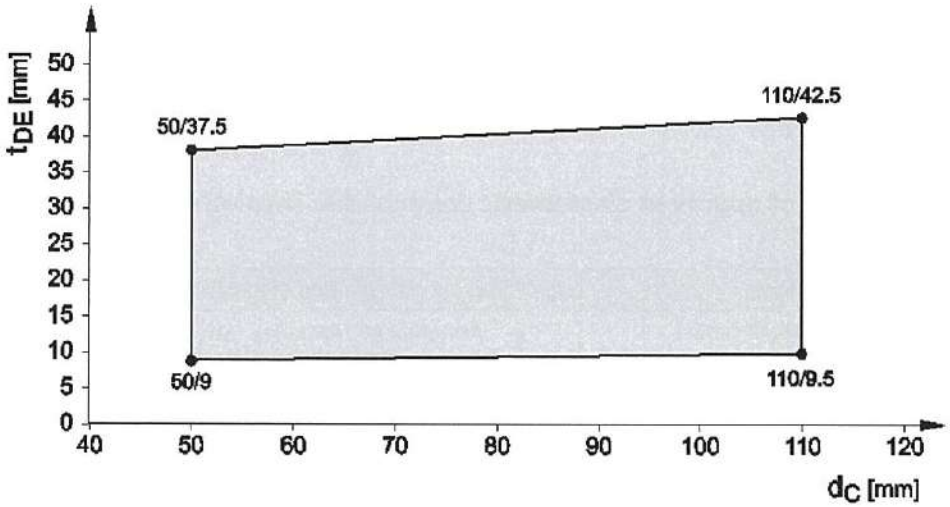
2.3.5 Plastic pipes made of PE-Xa (EN ISO 15875) and PE HD (EN 12201-2)

Service	Pipe diameter d_C [mm]	Pipe wall thickness t_C [mm]	Insulation thickness t_{DE} [mm]				Classification
			from		to		
			Ø small	Ø big	Ø small	Ø big	-
PE-Xa	16 to 63	2,2 to 8,6	8	9,0	32	39	EI 180
PE HD 100	50 to 110	4,6 to 10	9	9,5	37,5	42,5	EI 180

Plastic pipes PE-X according EN ISO 15875, U/C, floor ≥ 150 mm - EI 180
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



Plastic pipes PE-HD according EN 12201-2, U/C, floor ≥ 150 mm - EI 180
Graph shows approved insulation thickness (t_{DE}) at certain pipe diameter (Ø d_C)



Annex D

Abbreviations used in drawings

Abbreviation	Description
A	Hilti Firestop Bandage CFS-B
A_1	Annular gap seal with Hilti Firestop Acrylic Sealant CFS-S ACR
A_2	Annular gap seal with gypsum plaster
A_3	Annular gap seal with cementious mortar acc. EN 998-2, group M10
C	Service (metal, composite, plastic pipes)
D_E	Pipe insulation, combustible, butyl based elastomeric foamed material
d_C	Pipe diameter (nominal outside diameter)
E	Building element (wall, floor)
s_1	Minimum distance between single insulated pipes
s_2	Minimum distance between clustered pipes
s_3	Minimum distance between penetrating pipe and building element
S_4	Minimum distance between single insulated pipes and Collar CFS-C SL
S_5	Minimum distance between single insulated pipes and Conlit shell or Klimarock
t_C	Pipe wall thickness
t_{DE}	Insulation thickness
t_E	Thickness of the building element
L_D	Length of Insulation
AP1	Additional protection by elastomeric, combastible insulation
AP2	Additional protection by mineralwool (Klimarock)
AP3	Additional protection by beading / outside framing

List of approved elastomeric combustible Insulations:

Producer	Approved Type of foamed elastomeric thermal isolation
Armacell GmbH	• Armaflex AF, Armaflex SH, Armaflex Ultima, Armaflex HT
NMC Group	• Insul-Tube (nmc), Insul-Tube H-Plus (nmc),
Kaimann GmbH	• Kaiflex KK plus, Kaiflex KK,
L'Isolante K-Flex	• l'Isolante K-Flex HT, l'Isolante K-Flex ECO, l'Isolante K-Flex ST, l'Isolante K-Flex H, l'Isolante K-Flex ST Plus

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

On 6 nos. of Pipe Systems (Specimens '11', '12', '13', '14', '15' and '16')

Test Report No.: R16L28-1A

Identification No.: Q16L45-1

Issue Date: 27 April 2017

Testing Location:

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

Test Sponsor

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

APPROVED SIGNATORY: _____ **DATE:** 27 APR 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 pipe systems (specimens '11', '12', '13', '14', '15' and '16')

Twenty-seven specimens of penetration systems, namely specimens '1a' to '27', 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 pipe systems, namely specimens '11', '12', '13', '14', '15' and '16' (refer to photo 1), were considered. As requested by the test sponsor, the specimens were mounted within concrete line specimen holder as shown in the test sponsor's drawings (see the appendix). The specimens were symmetrical and only one side of specimen was tested, which was determined by test sponsor.

Specimen '11' was comprised of an opening with sizes of 220 mm wide by 130 mm high incorporated with 2 nos. of pipes. The left and right pipe consisted of a copper pipe with sizes of 19 mm diameter and 6.4 mm diameter respectively by 4 mm thick by 1,400 mm long. Both copper pipes were wrapped with a layer of nominal 40 mm thick by 1,200 mm long insulation 'Armaflex' with density of 40 kg/m^3. The opening was filled by a layer of nominal 100 mm thick 'CFS-F FX' foam.

Specimen '12' had overall dimensions of 135 mm diameter by 1,400 mm long. It was comprised of a G.I. pipe with sizes of 25 mm internal diameter by 4 mm thick, wrapped with a layer of nominal 50 mm thick by 1,200 mm long insulation 'Armaflex' with density of 40 kg/m^3.

Specimen '13' had overall dimensions of 190 mm diameter by 1,400 mm long. It was comprised of a G.I. pipe with sizes of 50 mm internal diameter by 5 mm thick, wrapped with a layer of nominal 65 mm thick by 1,200 mm long insulation 'Armaflex' with density of 40 kg/m^3.

Specimen '14' had overall dimensions of 135 mm diameter by 1,400 mm long. It was comprised of a G.I. pipe with sizes of 25 mm internal diameter by 4 mm thick, wrapped with a layer of nominal 50 mm thick by 1,200 mm long insulation 'Phenolic Foam' with density of 40 kg/m^3.

Specimen '15' had overall dimensions of 190 mm diameter by 1,400 mm long. It was comprised of a G.I. pipe with sizes of 50 mm internal diameter by 5 mm thick, wrapped with 2 layers of nominal 32 mm thick (total 64 mm thick) by 1,200 mm long insulation 'Phenolic Foam' with density of 40 kg/m^3.

Specimen '16' had overall dimensions of 390 mm diameter by 1,400 mm long. It was comprised of a G.I. pipe with sizes of 250 mm internal diameter by 5 mm thick, wrapped with a layer of nominal 40 mm thick and a layer of nominal 25 mm thick (total 65 mm thick) by 1,200 mm long insulation 'Phenolic Foam' with density of 40 kg/m^3.

All specimens were penetrated through a nominal 200 mm thick concrete wall. The gaps between specimen '11' and concrete wall were applied with a layer of 'CFS-B' bandage. The gaps between specimens '12', '13', '14', '15' and concrete wall were applied with a layer of 'CFS-B' bandage, mineral wool with density of 100 kg/m^3 and 'CP606' sealant, while the gap between specimen '16' and concrete wall was applied with 2 layers of 'CFS-B' bandage, mineral wool with density of 100 kg/m^3 and 'CP606' sealant (refer to the drawings from test sponsor). Each end of the G.I. pipes of specimens '12', '13', '14', '15' and '16' at the exposed side was covered by a nominal 3 mm thick steel plate.

The copper pipes of specimen '11' and the G.I. pipes of specimens '12', '13', '14', '15' and '16' was 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 pipe 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 '11'	**121** Minutes (No failure)	N/A
Specimen '12'	**121** Minutes (No failure)	N/A
Specimen '13'	**121** Minutes (No failure)	N/A
Specimen '14'	**121** Minutes (No failure)	N/A
Specimen '15'	**121** Minutes (No failure)	N/A
Specimen '16'	**121** Minutes (No failure)	N/A

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 pipe systems when tested in accordance with BS 476: Part 20: 1987, 'Methods for determination of the fire resistance of elements of construction (general principles)'.

3 TEST INFORMATION

3.1 Test Sponsor

Hilti (Hong Kong) Limited

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

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

3.2 Testing Location

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

3.3 Date of Test

20th January 2017

3.4 Witness of the test

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

4 EQUIPMENT

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

Eight (8) 'type K' thermocouples to monitor the temperature of the unexposed face of 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 eight (8) thermocouples fixed to the unexposed surface (see Figure 2 for the locations and reference numbers of the thermocouples).

Thermocouples S4 - S6 were fixed at 100 mm away from the concrete wall on the foam and thermocouples S1 - S3 were fixed at 50 mm away from the concrete wall on the bandage of specimen '16' for additional information only. Thermocouples S16 and S17 were fixed on specimen '11' 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 temperature of the unexposed surface of specimen '11' were shown graphically in Figure 4.

The mean and maximum temperatures of the unexposed surface of specimen '16' were shown graphically in Figure 5.

The furnace pressure was shown graphically in Figure 6.

The radiation was shown graphically in Figure 7.

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 '11'	**121** Minutes (No failure)	N/A
Specimen '12'	**121** Minutes (No failure)	N/A
Specimen '13'	**121** Minutes (No failure)	N/A
Specimen '14'	**121** Minutes (No failure)	N/A
Specimen '15'	**121** Minutes (No failure)	N/A
Specimen '16'	**121** Minutes (No failure)	N/A

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 '11'

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

Specimen '12'

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

Specimen '13'

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

Specimen '14'

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

Specimen '15'

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

Specimen '16'

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

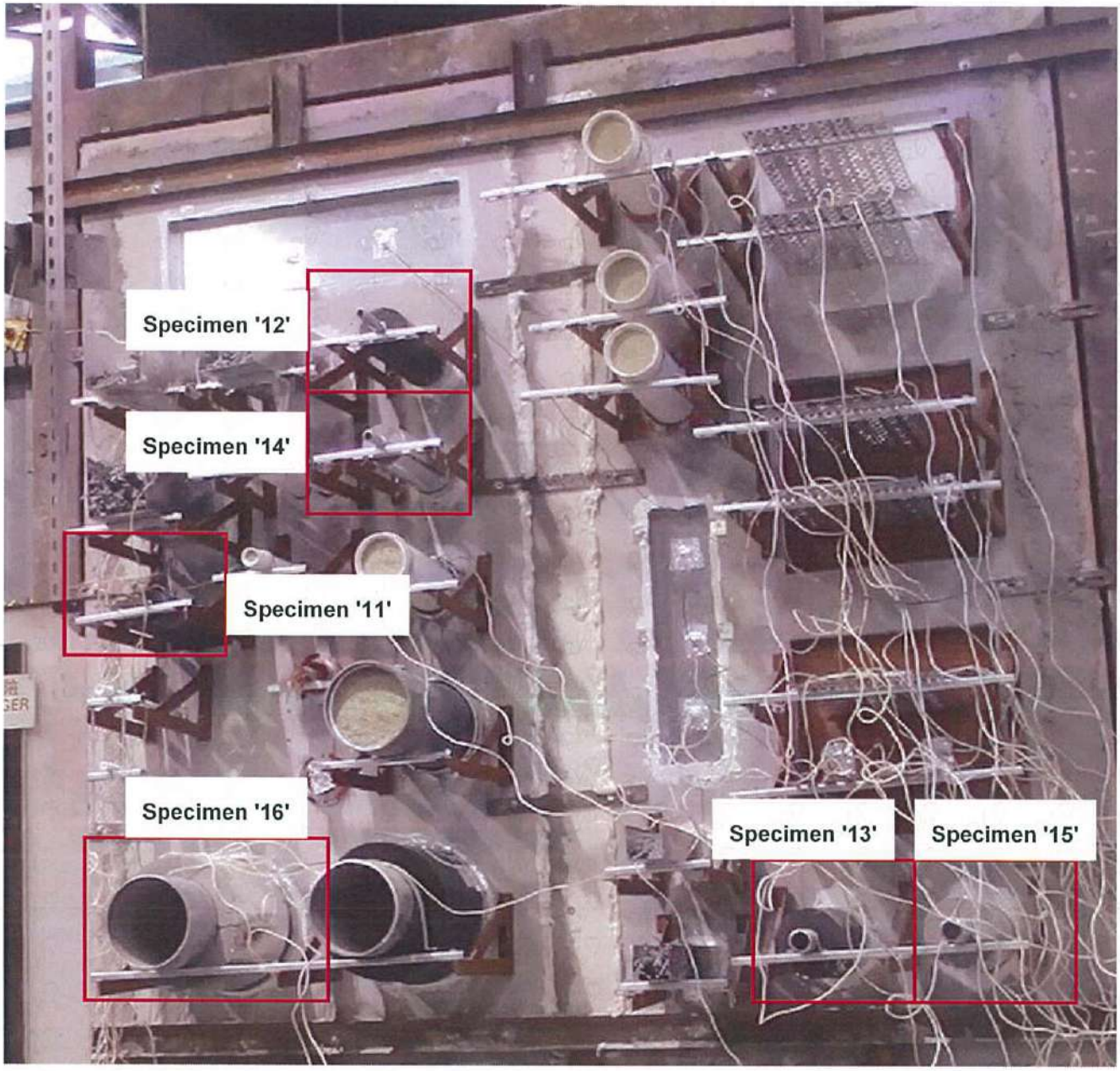


Photo 1: The unexposed face of the specimens before the test.

Note: In this test report, only specimens '11', '12', '13', '14', '15' and '16' were considered.

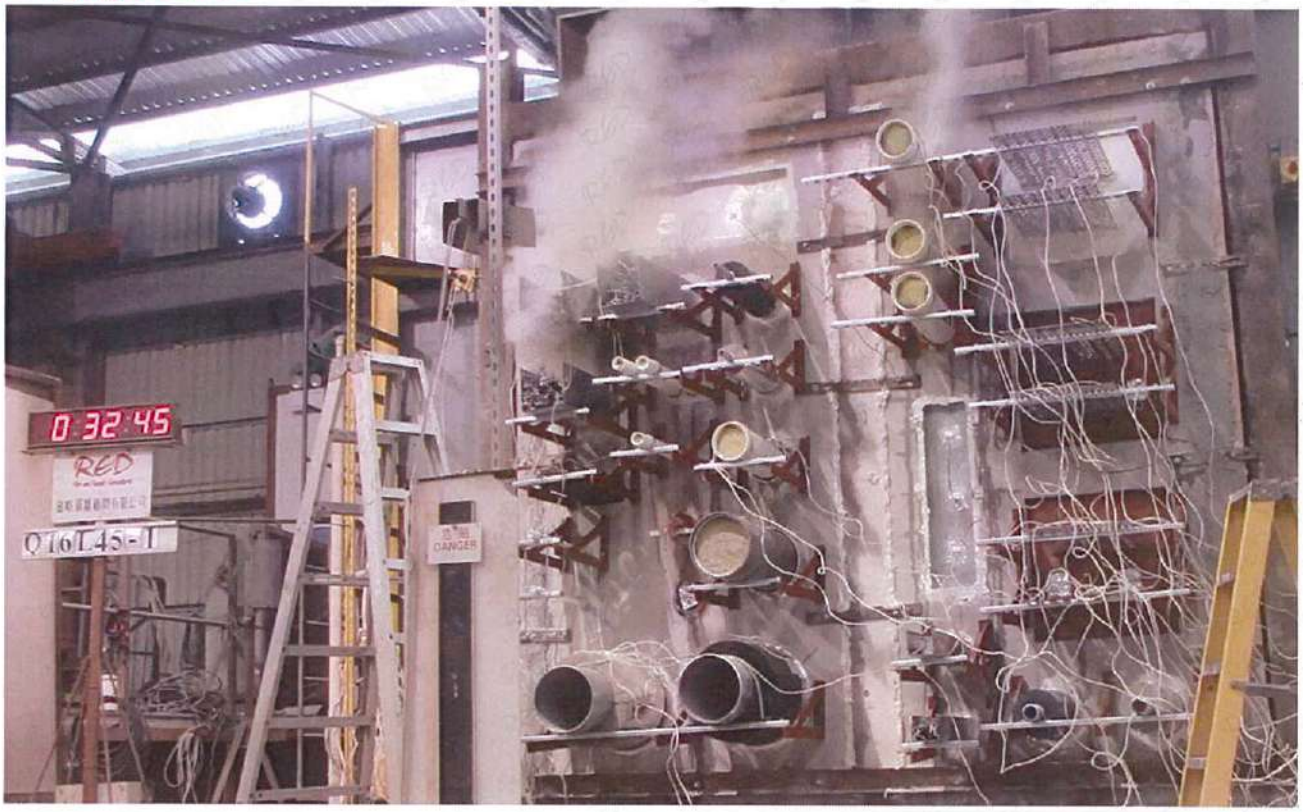


Photo 2: The unexposed face of the specimens after a heating period of 32 minutes.

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

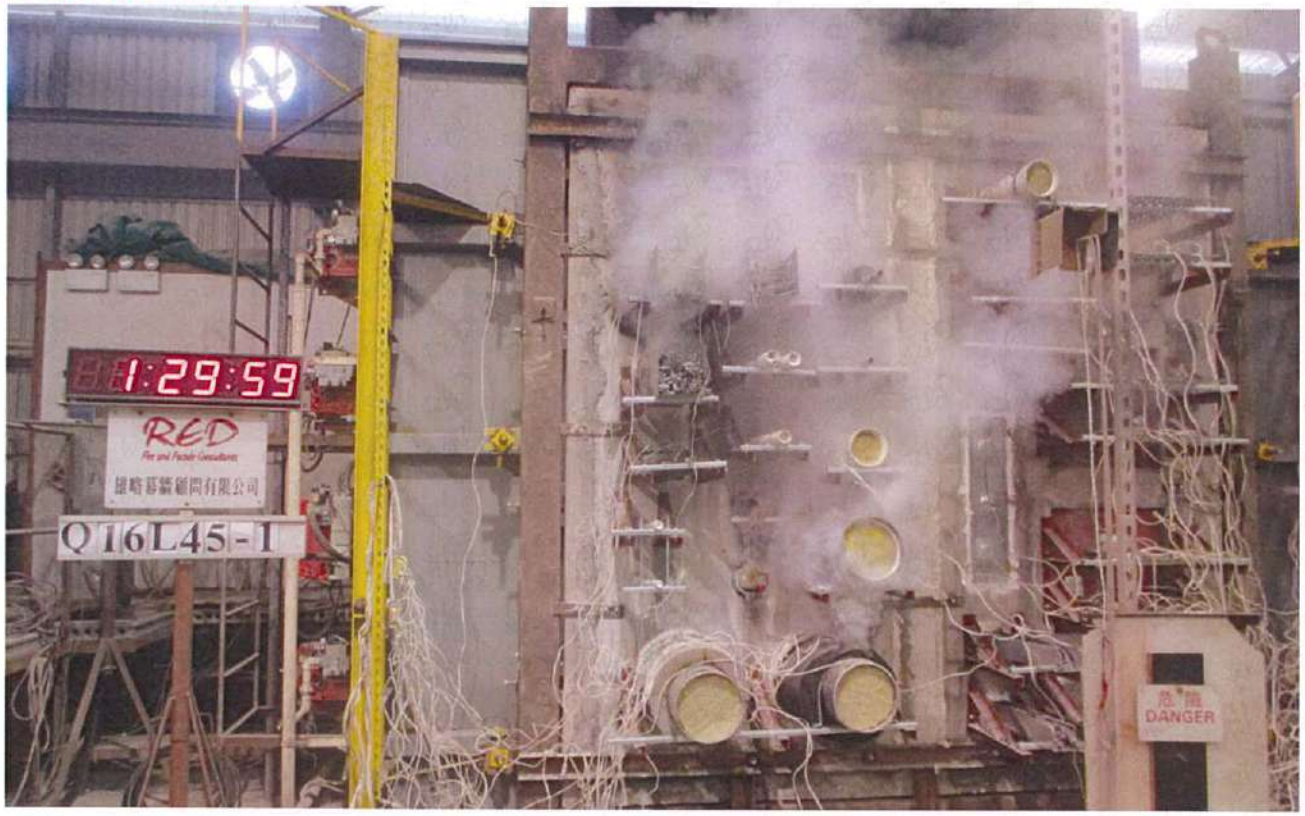


Photo 4: The unexposed face of the specimens after a heating period of 89 minutes.

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

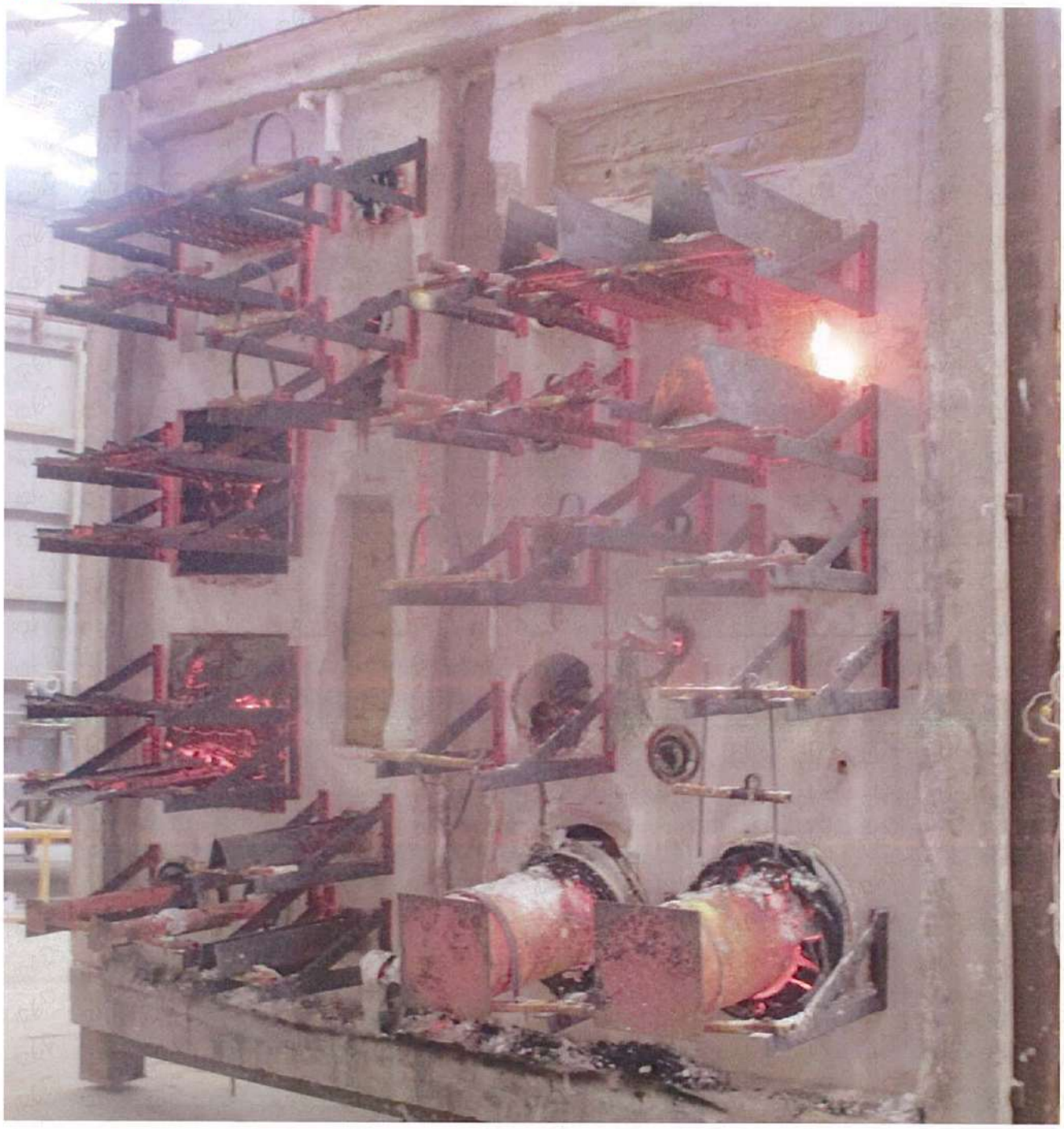


Photo 6: The exposed face of the specimens after the test.

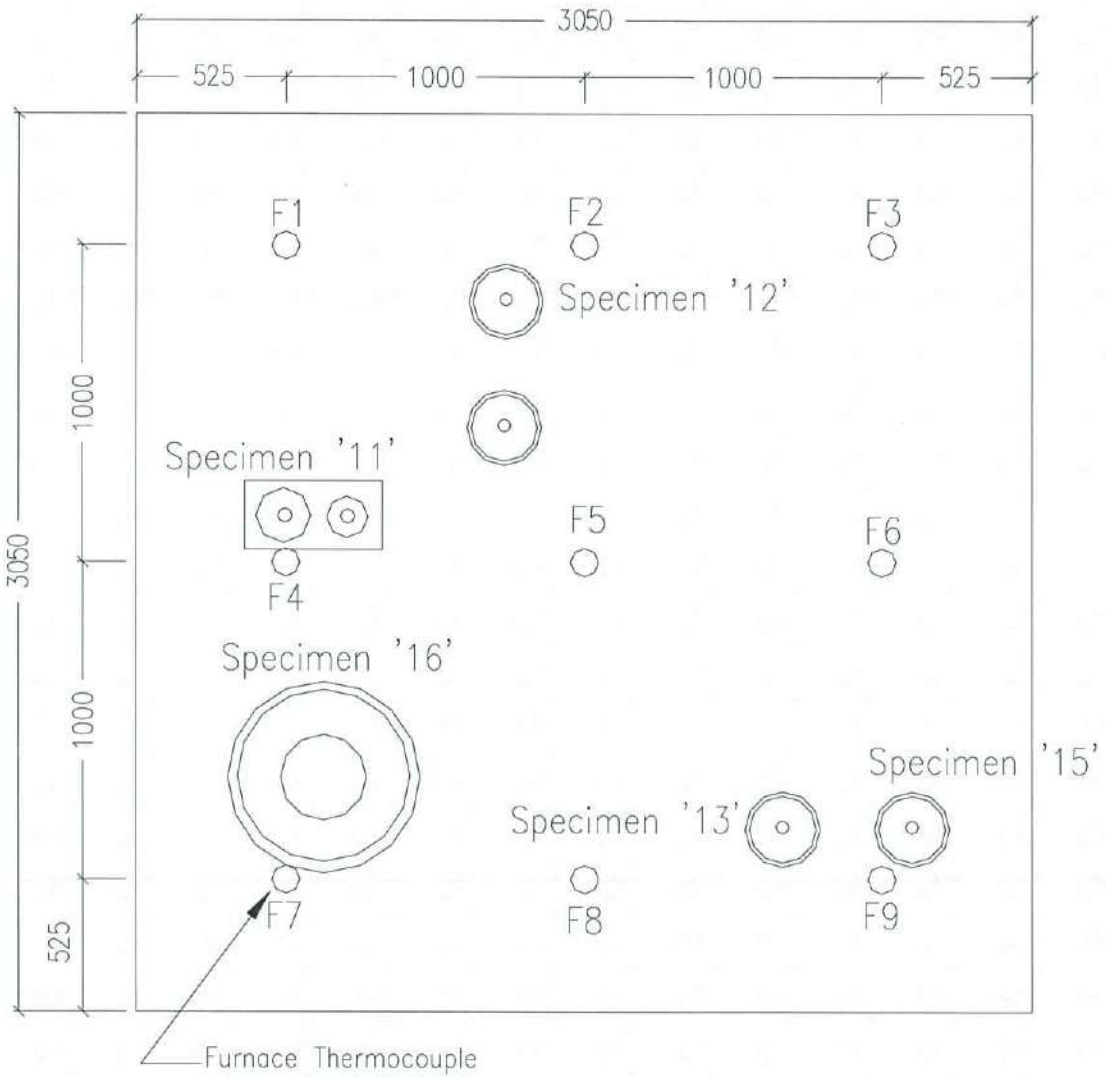


Figure 1 – Locations and reference numbers of furnace thermocouples.
(This figure is not to scale and all dimensions are in millimetres.)

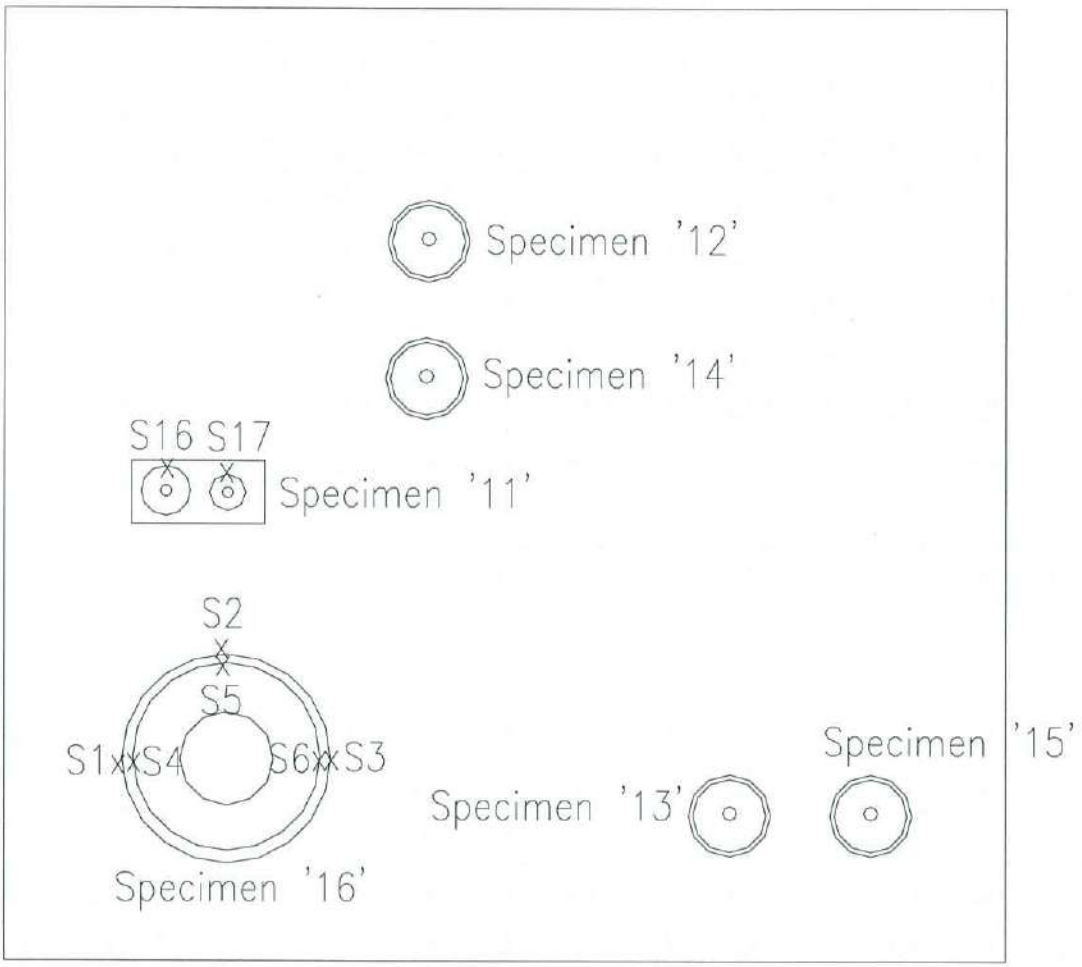


Figure 2 – Locations and reference number of thermocouples to monitor the temperature of unexposed surface of the specimens.
(This figure is not to scale.)

Notes: Thermocouples S1 - S3 were fixed at 50 mm away from the concrete wall on the bandage for additional information only.

Thermocouples S4 - S6 were fixed at 100 mm away from the concrete wall on the foam for additional information only.

Thermocouples S16 and S17 were fixed for additional information only.

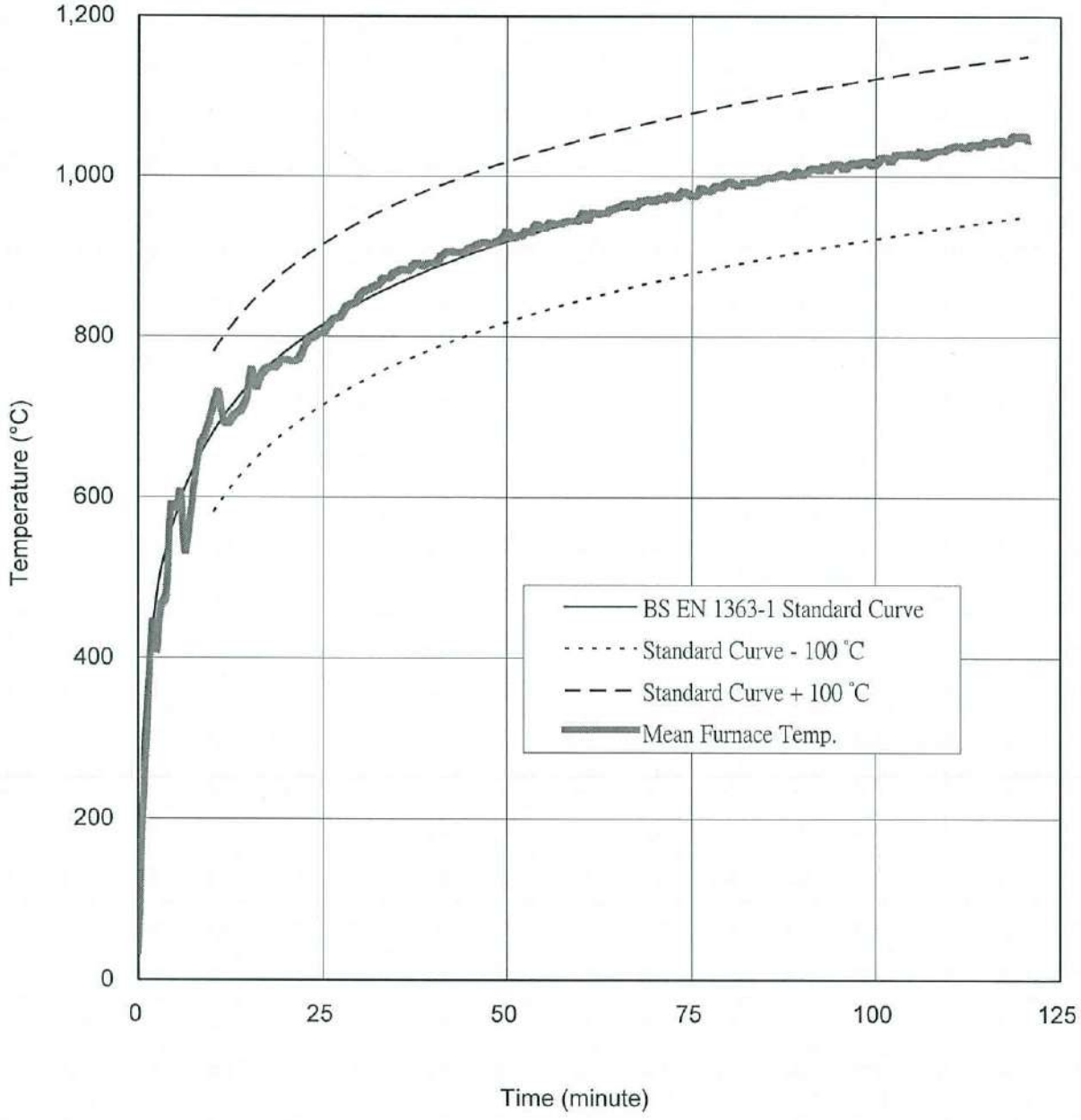


Figure 3 – Mean furnace temperature.

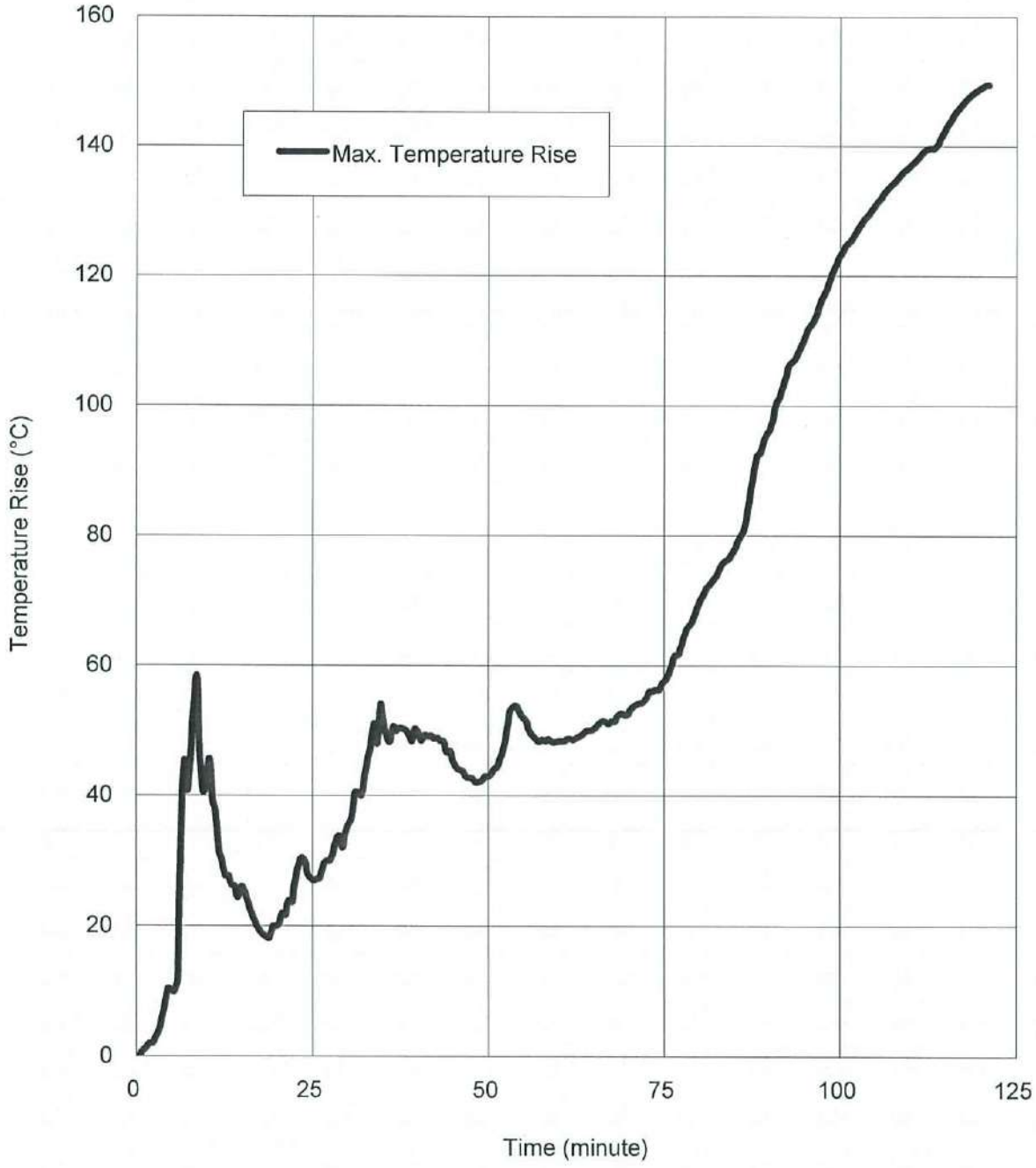


Figure 4 – Temperature rises of unexposed surface of specimen '11'.

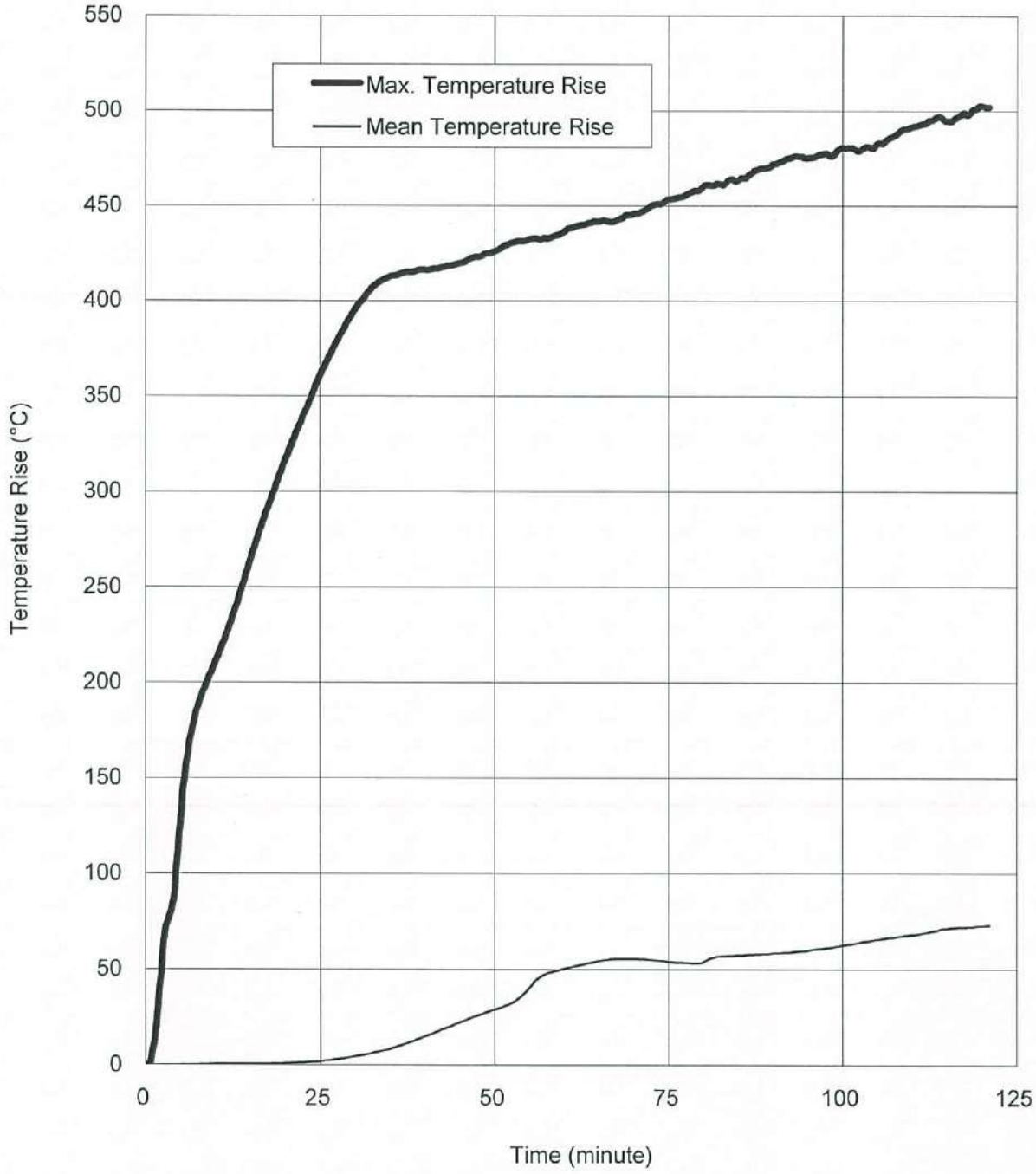


Figure 5 – Temperature rises of unexposed surface of specimen '16'.

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.

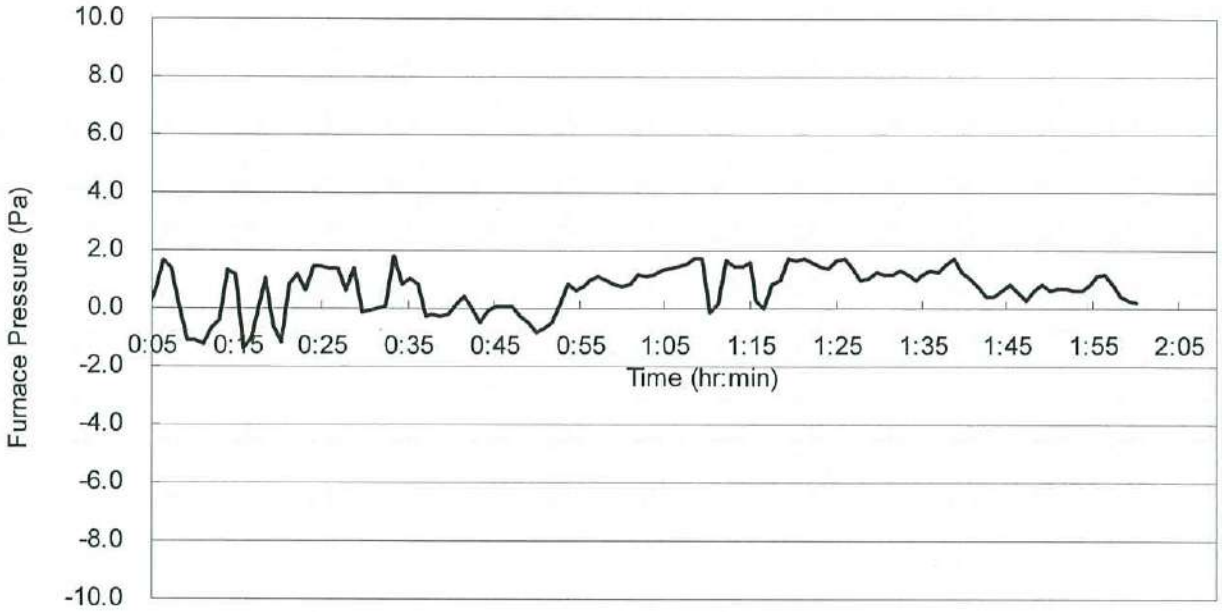


Figure 6 – Furnace pressure.

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

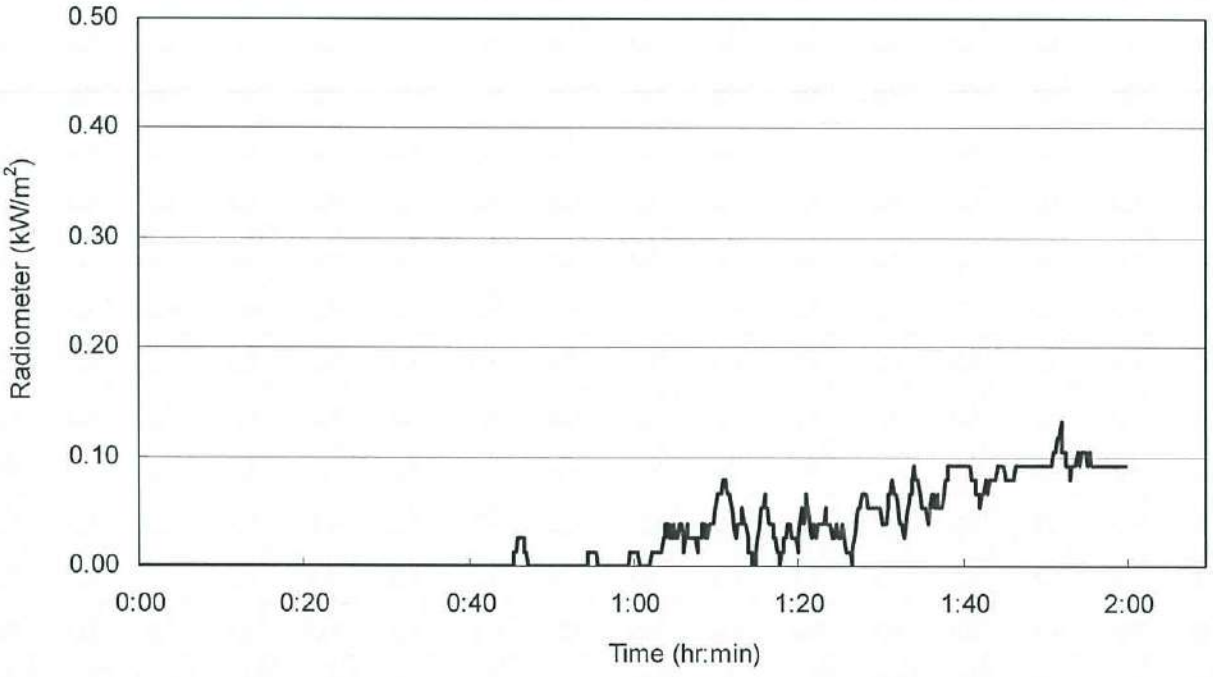


Figure 7 – Radiation.

APPENDIX B – Observation

Time (min.sec)	Exposed (E) or Unexposed (U)	Observation
00.00	-	Test started.
04.00	U	Smoke started releasing from the perimeter of specimen '11'.
08.00	U	Smoke started releasing from the perimeter of specimens '12', '14' and '16'.
14.30	U	Pop sound was heard from the specimens.
30.00	U	Specimens '11', '12', '13', '14', '15' and '16' satisfied the integrity requirements performance.
60.00	U	Specimens '11', '12', '13', '14', '15' and '16' satisfied the integrity requirements performance.
90.00	U	Specimens '11', '12', '13', '14', '15' and '16' satisfied the integrity requirements performance.
120.00	U	Specimens '11', '12', '13', '14', '15' and '16' 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 S1 - S6, S16 and S17

Time (min)	S1	S2	S3	S4	S5	S6	S16	S17
0	0	0	0	0	0	0	0	0
5	146	0	0	0	0	1	10	1
10	210	1	0	1	0	1	42	2
15	268	0	0	1	1	1	26	3
20	319	0	1	1	1	2	20	4
25	363	1	1	1	2	4	27	6
30	397	2	3	2	4	8	36	8
35	413	5	5	3	9	13	51	10
40	416	12	9	6	19	20	50	12
45	420	19	15	10	28	28	45	15
50	427	27	26	16	37	36	43	17
55	433	38	45	21	42	63	51	19
60	437	44	64	27	48	77	48	21
65	442	46	67	33	54	77	51	23
70	446	45	68	37	56	73	53	25
75	454	43	67	41	56	65	58	29
80	461	42	66	43	55	64	70	30
85	464	41	67	45	56	72	78	33
90	472	42	71	47	58	70	96	35
95	475	43	74	50	61	70	112	37
100	480	46	76	53	64	72	124	38
105	483	49	76	57	67	73	131	39
110	492	52	76	61	70	74	137	41
115	495	54	74	68	72	75	143	45
120	503	56	75	70	73	76	149	48
121	502	57	76	70	73	76	150	48

Notes: Locations of thermocouples S1 - S6, S16 and S17 are shown in Figure 2.

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

APPENDIX D – Information from Test Sponsor

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

For Specimen '11'

Item	Description	
1	**Pipe System**	
	Overall dimensions of insulated pipe including CFS-B	: Left pipe- 110 mm diameter x 1,400 mm long.* Right pipe- 95 mm diameter x 1,400 mm long.*
	Copper pipe dimensions	: Left pipe- 19 mm diameter x 4 mm thick.* Right pipe- 6.4 mm diameter x 4 mm thick.*
	Fixing details of copper pipes	: The copper pipes was 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 pipe rings with 2 nos. of M5 bolts and nuts on both sides. The steel channels were supported by an external steel framework constructed by 50 mm x 50 mm x 3 mm steel L-angles which in turn fixed to the concrete lining of test rig by 2 nos. of M10 anchor bolts.*
2	**Insulation (Armaflex)**	
	Brand & Model	: Armaflex.
	Generic type	: Type "D" - Flexible Closed Cell Elastomeric Insulation - Armaflex.
	Density	: 40 kg/m^3.
	Overall sizes	: 40 mm thick by 1,200 mm long.
	Fixing method	: Adhere at the surface and mechanically attached with metal wire.
	Applied location	: Wrapped around the copper pipes.
3	**Firestop Foam**	
	Brand & Model	: Hilti firestop foam CFS-F FX.
	Thickness	: 100 mm thick.
	Fixing details	: Filled up the opening of 220 mm wide x 130 mm high.
4	**CFS-B Bandage**	
	Brand & Model	: Hilti Firestop Bandage CFS-B.
	Material	: Polymer-bonded intumescent material
	Number of layer	: 1 layer.
	Applied locations	: At the gaps between pipes and concrete wall & located in the middle of wall.

*Notes: * Verified on site by RED.*

 # As shown on the test construction.

Appendix D – Information from Test Sponsor

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

For Specimens '12', '13', '14', '15' and '16'

Item	Description	
1	**Pipe Systems**	
	Overall pipe dimensions	: Specimen '12'- 135 mm diameter x 1,400 mm long.*
		Specimen '13'- 190 mm diameter x 1,400 mm long.*
		Specimen '14'- 135 mm diameter x 1,400 mm long.*
		Specimen '15'- 190 mm diameter x 1,400 mm long.*
		Specimen '16'- 390 mm diameter x 1,400 mm long.*
	G.I. pipe dimensions	: Specimen '12'- 25 mm internal diameter x 4 mm thick.*
		Specimen '13'- 50 mm internal diameter x 5 mm thick.*
		Specimen '14'- 25 mm internal diameter x 4 mm thick.*
		Specimen '15'- 50 mm internal diameter x 5 mm thick.*
		Specimen '16'- 250 mm internal diameter x 5 mm thick.*
	Fixing details of G.I. pipes	The G.I. pipes of all specimens was 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 pipe rings with 2 nos. of M5 bolts and nuts on both sides. The steel channels were supported by an external steel framework constructed by 50 mm x 50 mm x 3 mm steel L-angles which in turn fixed to the concrete lining of test rig by 2 nos. of M10 anchor bolts. Each end of the G.I. pipes at the exposed side was covered by a nominal 3 mm thick steel plate.*
2	**Insulation (Armaflex) - Specimen '12' and '13'**	
	Brand & Model	: Armaflex.
	Generic type	: Type "D" - Flexible Closed Cell Elastomeric Insulation - Armaflex.
	Density	: 40 kg/m^3.
	Overall sizes	: Specimen '12'- 50 mm thick by 1,200 mm long.
		Specimen '13'- 65 mm thick by 1,200 mm long.
	Fixing method	: Adhere at the surface and mechanically attached with metal wire.

** and # see notes on page 22*

Appendix D – Information from Test Sponsor

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

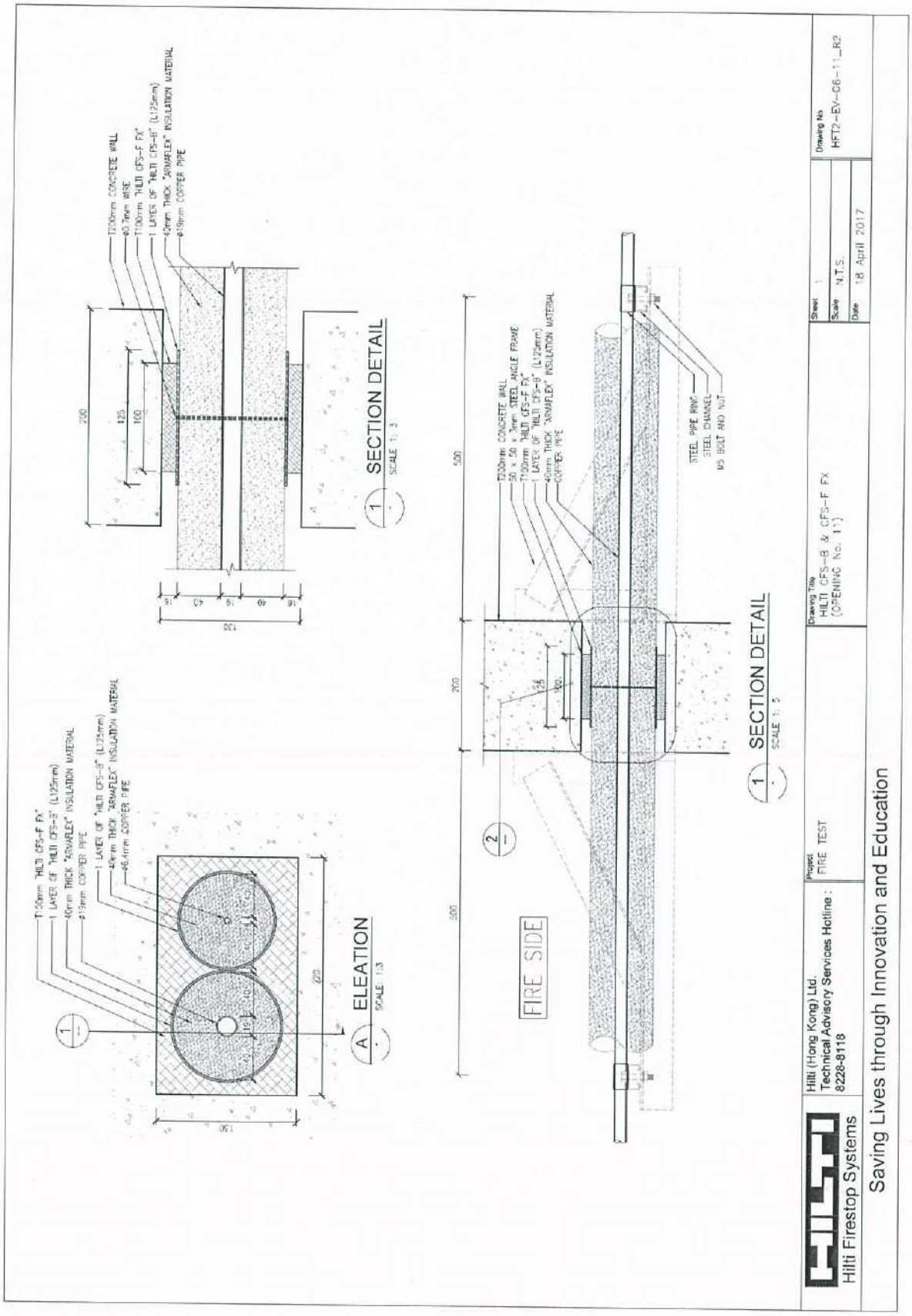
For Specimens '12', '13', '14', '15' and '16'

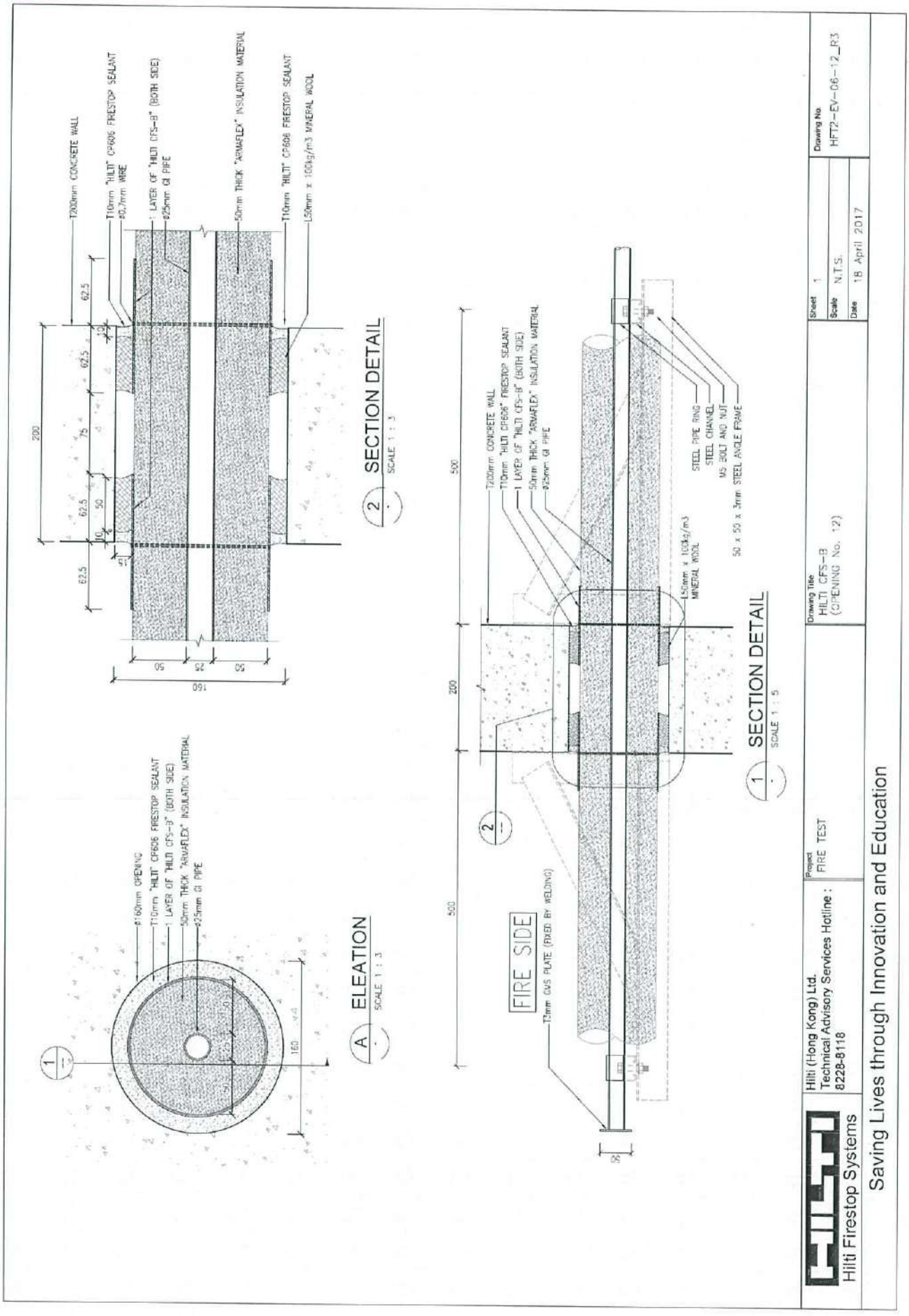
Item	Description	
3	**Insulation (Phenolic foam) - Specimen '14', '15' and '16'**	
	Brand & Model	: Phenolic.
	Generic type	: Type "A" - CFC & HCFC Free Phenolic Foam Insulation - Phenolic foam.
	Density	: 40 kg/m^3.
	Overall sizes	: Specimen '14'- 50 mm thick by 1,200 mm long. Specimen '15'- 2 x 32 mm thick (total 64 mm thick) by 1,200 mm long. Specimen '16'- 40 mm + 25 mm thick (total 65 mm thick) by 1,200 mm long.
	Fixing details	: Adhere at the surface and mechanically attached with metal wire.
4	**CFS-B Bandage**	
	Brand & Model	: Hilti Firestop Bandage CFS-B.
	Material	: Polymer-bonded intumescent material.
	Number of layer	: Specimens'12', '13', '14' and '15' - 1 layer. Specimens '16' - 2 layers.
	Applied locations	: At the gaps between pipes and concrete wall & located in the middle of wall.
5	**Mineral Wool**	
	Brand	: ROCKWOOL.#
	Length	: 50 mm.*
	Density	: 100 kg/m^3.#
	Applied locations	: At the gaps between all the entire pipes and concrete wall.
6	**Fire Sealant**	
	Brand & Model	: Hilti CP 606 flexible firestop sealant.#
	Material	: Acrylic based.
	Thickness	: 10 mm.
	Applied locations	: At the gaps between all the entire pipes and concrete wall.

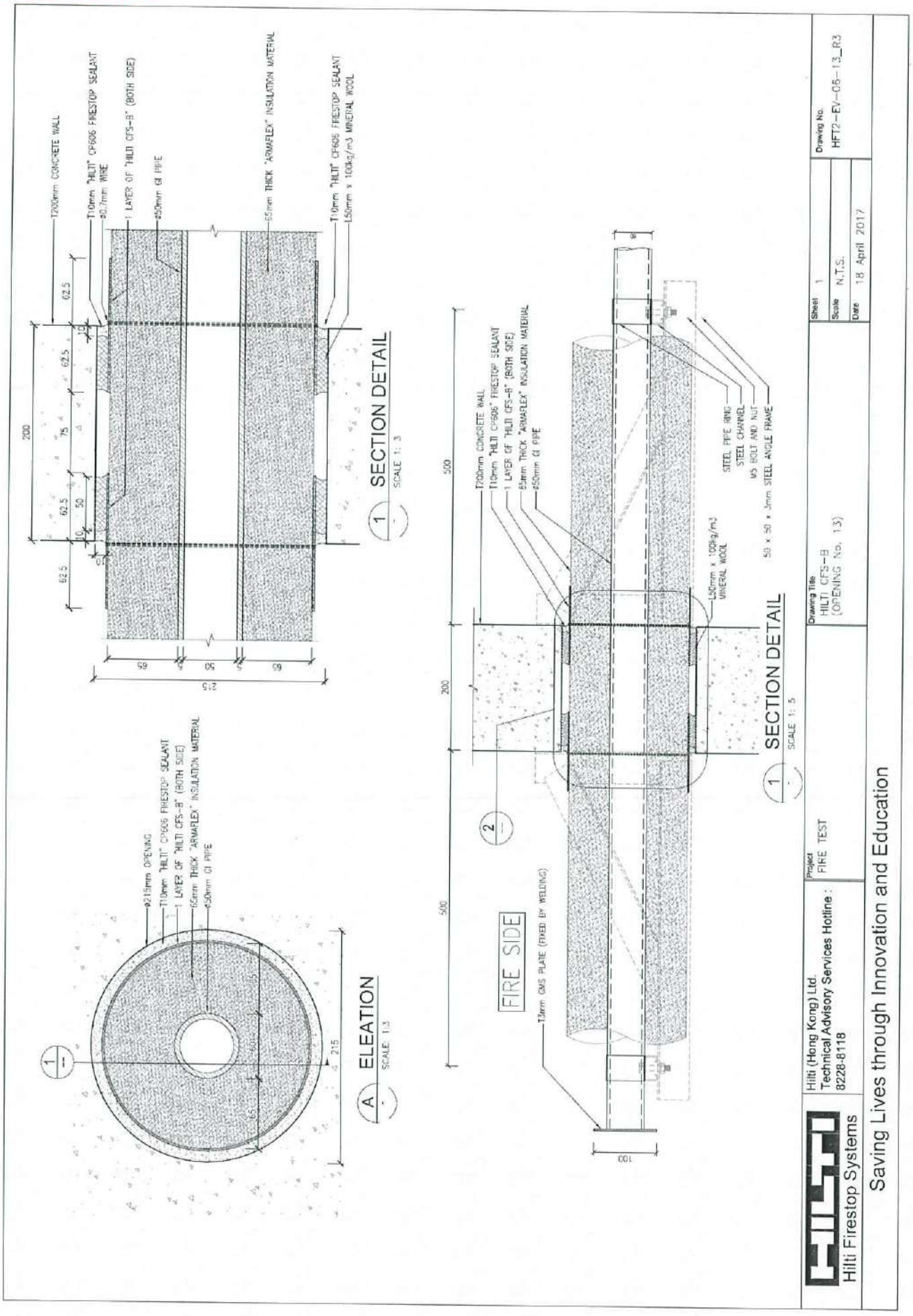
** and # see notes on page 22*

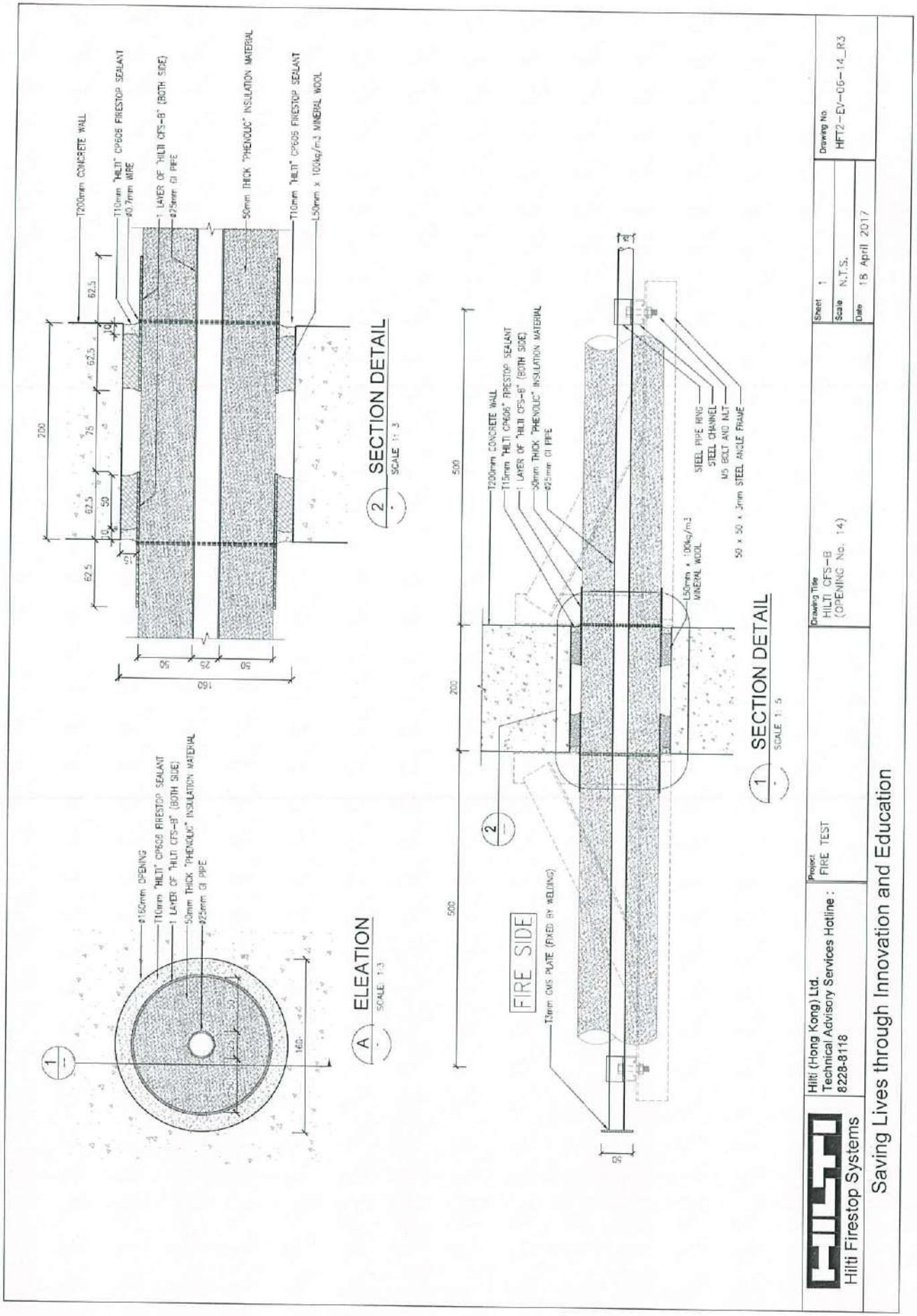
Drawings from Test Sponsor

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




T200mm CONCRETE WALL
T10mm "HILTI" CP606 FIRESTOP SEALANT
1 LAYER OF "HILTI CFS-B" (BOTH SIDE)
ø25mm GI PIPE
50mm THICK "ARMAFLEX" INSULATION MATERIAL
L50mm x 100kg/m3 MINERAL WOOL
2 SECTION DETAIL
SCALE 1 : 3
ø160mm OPENING
A ELEATION
SCALE 1 : 3
FIRE SIDE
T2mm GWS PLATE (FIXED BY WELDING)
STEEL PIPE RING
STEEL CHANNEL
M5 BOLT AND NUT
50 x 50 x 3mm STEEL ANGLE FRAME
1 SECTION DETAIL
SCALE 1 : 5
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-8118
Project FIRE TEST
Drawing Title HILTI CFS-B (OPENING No. 12)
Sheet 1
Scale N.T.S.
Date 18 April 2017
Drawing No. HFT2-EV-06-12_R3
Hilti Firestop Systems
Saving Lives through Innovation and Education


T200mm CONCRETE WALL
T10mm "HILTI" CP606 FIRESTOP SEALANT
Ø0.7mm WIRE
1 LAYER OF "HILTI CFS-B" (BOTH SIDE)
Ø50mm GI PIPE
65mm THICK "ARMAFLEX" INSULATION MATERIAL
T10mm "HILTI" CP606 FIRESTOP SEALANT
L50mm x 100kg/m3 MINERAL WOOL
1 SECTION DETAIL
SCALE 1: 3
Ø215mm OPENING
T10mm "HILTI" CP606 FIRESTOP SEALANT
1 LAYER OF "HILTI CFS-B" (BOTH SIDE)
65mm THICK "ARMAFLEX" INSULATION MATERIAL
Ø50mm GI PIPE
A ELEATION
SCALE 1:3
T200mm CONCRETE WALL
T10mm "HILTI CP606" FIRESTOP SEALANT
1 LAYER OF "HILTI CFS-B" (BOTH SIDE)
65mm THICK "ARMAFLEX" INSULATION MATERIAL
Ø50mm GI PIPE
STEEL PIPE RING
STEEL CHANNEL
M5 BOLT AND NUT
50 x 50 x 3mm STEEL ANGLE FRAME
L50mm x 100kg/m3 MINERAL WOOL
FIRE SIDE
T3mm CMS PLATE (FIXED BY WELDING)
1 SECTION DETAIL
SCALE 1: 5
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-8118
Project FIRE TEST
Drawing Title HILTI CFS-B (OPENING No. 13)
Sheet 1
Scale N.T.S.
Date 18 April 2017
Drawing No. HFT2-EV-05-13_R3
Hilti Firestop Systems
Saving Lives through Innovation and Education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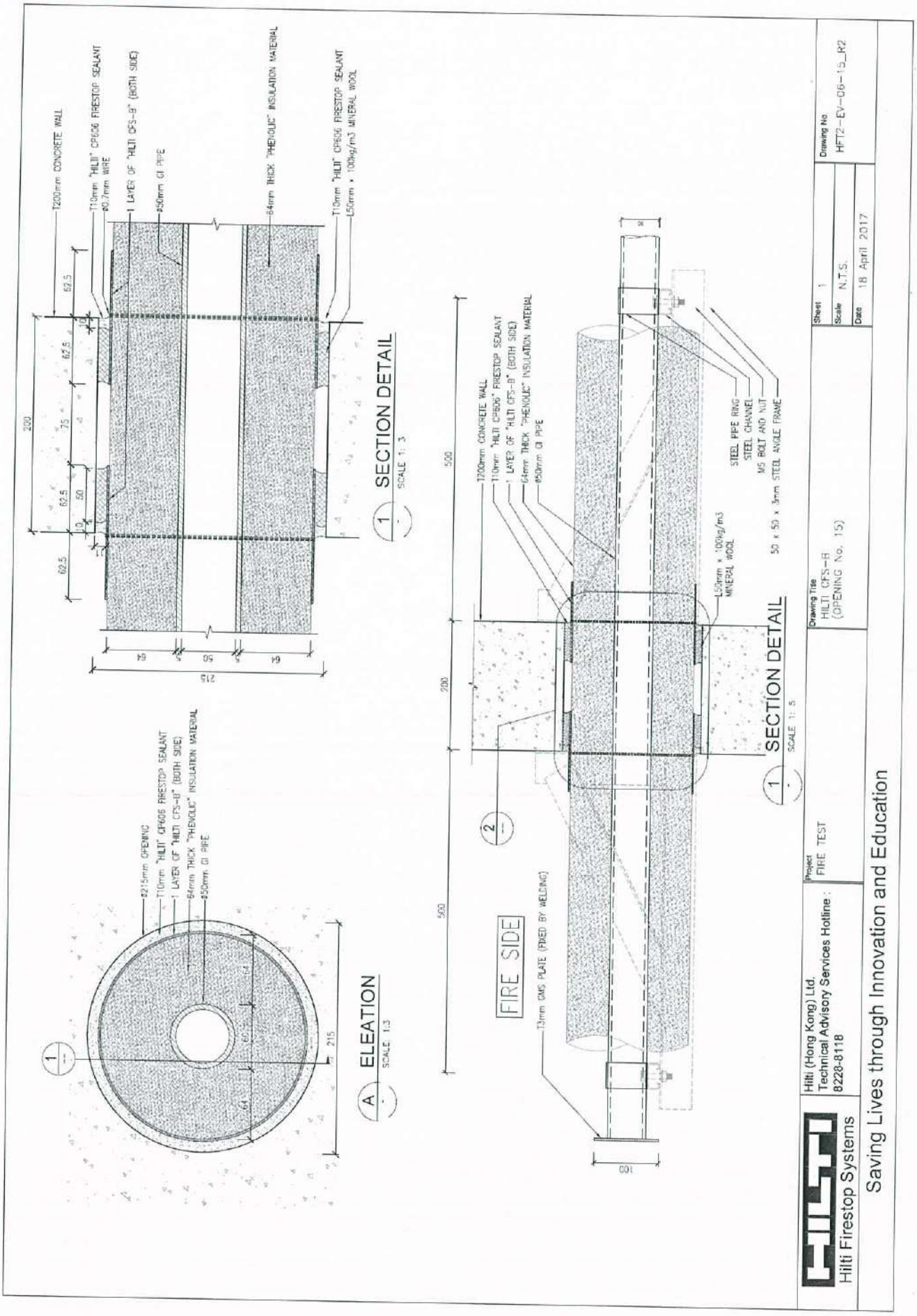
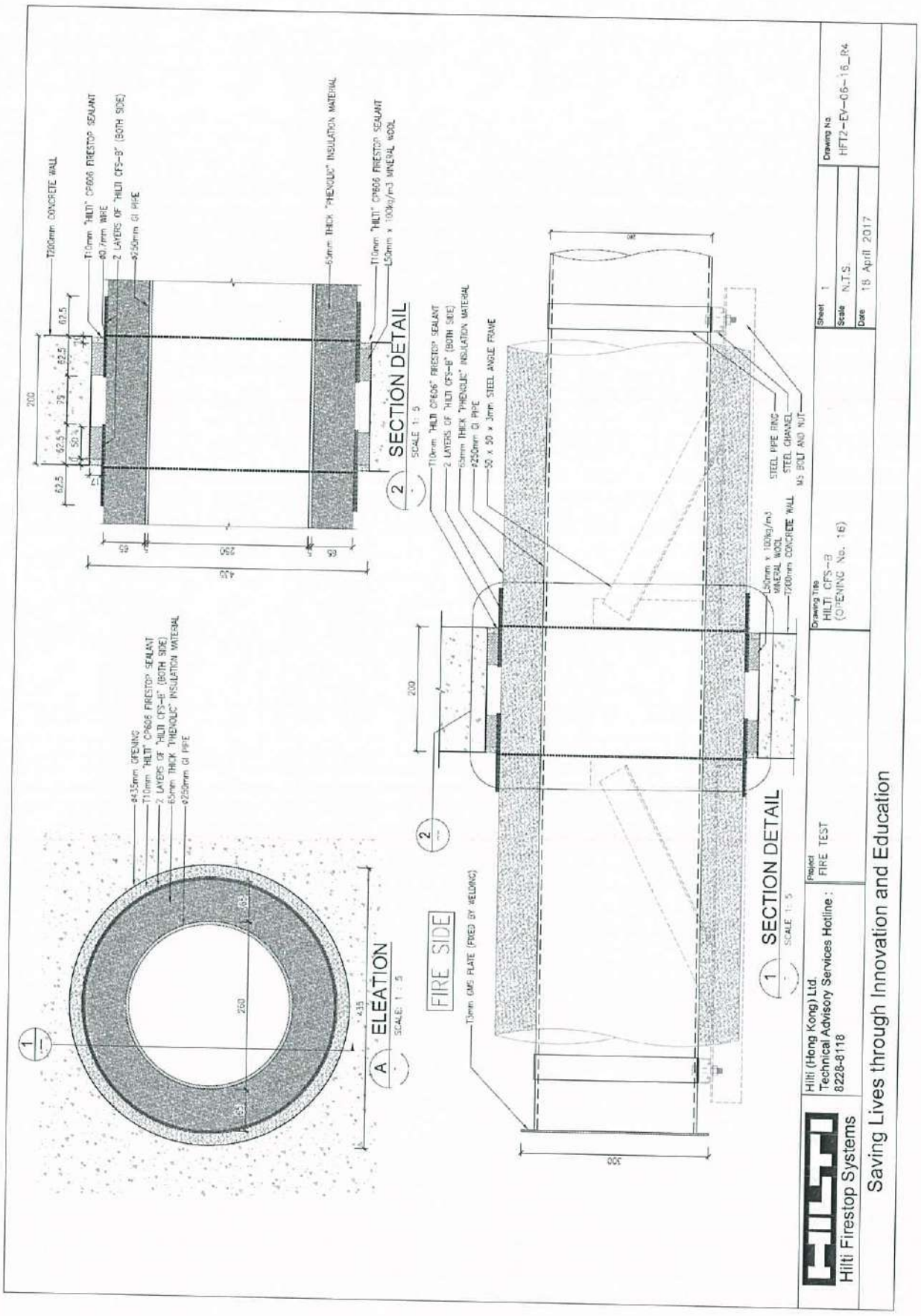
T10mm "HILTI" CP606 FIRESTOP SEALANT
40.7mm MIRE
1 LAYER OF "HILTI CFS-B" (BOTH SIDE)
ø25mm GI PIPE
50mm THICK "PHENOLIC" INSULATION MATERIAL
T10mm "HILTI" CP606 FIRESTOP SEALANT
L50mm x 100Kg/m3 MINERAL WOOL
2 SECTION DETAIL
SCALE 1: 3
ø150mm OPENING
T10mm "HILTI" CP606 FIRESTOP SEALANT
1 LAYER OF "HILTI CFS-B" (BOTH SIDE)
50mm THICK "PHENOLIC" INSULATION MATERIAL
ø25mm GI PIPE
A ELEATION
SCALE 1:3
T200mm CONCRETE WALL
T15mm "HILTI CP606" FIRESTOP SEALANT
1 LAYER OF "HILTI CFS-B" (BOTH SIDE)
50mm THICK "PHENOLIC" INSULATION MATERIAL
ø25mm GI PIPE
STEEL PIPE RING
STEEL CHANNEL
M5 BOLT AND NUT
50 x 50 x 3mm STEEL ANGLE FRAME
L50mm x 100Kg/m3 MINERAL WOOL
FIRE SIDE
T3mm GMS PLATE (FIXED BY WELDING)
1 SECTION DETAIL
SCALE 1: 5
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-8118
Project: FIRE TEST
Drawing Title: HILTI CFS-B (OPENING No. 14)
Sheet 1
Scale N.T.S.
Date 18 April 2017
Drawing No. HFT2-EV-06-14_R3
Hilti Firestop Systems
Saving Lives through Innovation and Education


T200mm CONCRETE WALL
T10mm "HILTI" CP606 FIRESTOP SEALANT
Ø0.7mm WIRE
1 LAYER OF "HILTI CFS-B" (BOTH SIDE)
Ø50mm GI PIPE
64mm THICK "PHENOLIC" INSULATION MATERIAL
T10mm "HILTI" CP606 FIRESTOP SEALANT
L50mm x 100kg/m3 MINERAL WOOL
1 SECTION DETAIL
SCALE 1: 3
Ø215mm OPENING
A ELEATION
SCALE 1:3
FIRE SIDE
T3mm GMS PLATE (FIXED BY WELDING)
STEEL PIPE RING
STEEL CHANNEL
M5 BOLT AND NUT
50 x 50 x 3mm STEEL ANGLE FRAME
1 SECTION DETAIL
SCALE 1: 5
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-8118
Hilti Firestop Systems
Saving Lives through Innovation and Education
Project
FIRE TEST
Drawing Title
HILTI CFS-B
(OPENING No. 15)
Sheet 1
Scale N.T.S.
Date 18 April 2017
Drawing No
HFT2-EV-06-15_R2



- End of report -

Research Engineering Development Façade Consultants Limited
雄略幕牆顧問有限公司
DD134, Lung Kwu Tan, Tuen Mun, N.T., Hong Kong

Hilti (Hong Kong) Limited

701-704 and 708A&B, Tower A Manulife Financial Centre,

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

Date: 10th July, 2024 Our Ref: R24F40-1A

TO WHOM IT MAY CONCERN

Re: Assessment Report no. R17E27-1A – Fire Resistance Performance of Hilti 'CFS-B' Firestop Bandage for Insulated Metal Pipes Penetration Sealing for up to 120 Minutes Integrity with Respect to BS 476: Part 20: 1987

The RED assessment report no. R17E27-1A was issued on 19th June, 2017 and expired on 18th June, 2019. The specification and interpretation of test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. Whilst RED has conducted a review of the procedures adopted for the supporting data to ensure they are consistent with current practices, the assessment report no. R17E27-1A has been reviewed and found satisfactory.

Therefore, it is recommended that the assessment report no. R17E27-1A is valid until 9th July, 2026 and another review shall be undertaken by 8th July, 2026.

Declaration by the Applicant:

By distributing this copy of technical review, we, Hilti (Hong Kong) Limited, confirmed that there have been no changes to the material specifications, nor the methods of construction of the test specimen considered in the original appraisal of assessment report no. R17E27-1A.

Yours Sincerely,

Assessment by:

Dr. SZE Lip-kit
Authorized Signature
Research Engineering Development
Façade Consultants Limited

Reviewed by:

Ir Dr. YUEN Sai-wing, MHKIE (Fire)
Authorized Signature
Research Engineering Development
Façade Consultants Limited

ASSESSMENT REPORT

The use of Hilti "CFS-B" Firestop Bandage for insulated metal pipes penetration sealing

Report No.: R17E27-1A

Issue Date: 19 June 2017

Date of Review: 18 June 2019

Report Sponsor

Hilti (Hong Kong) Limited
701-704 & 708B, Tower A Manualife Finance Centre,
223 Wai Yip Street, Kwun Tong, Kowloon, HK

For the Project:
"Oil Street"

CONTENT

REVISION HISTORY

Issue date (DD/MM/YYYY)	Issue number	Remark
19/06/2017	0	Initial version

THE USE OF HILTI 'CFS-B' FIRESTOP BANDAGE FOR THE INSULATED METAL PIPES PENETRATION SEALING

1 INTRODUCTION

This assessment report presents an appraisal for the use of the Hilti 'CFS-B' Firestop Bandage for the metal pipes penetration sealing through masonry wall. The appraisal will be based on the primary test evidence of R16L28-1A issued by Research Engineering Development Façade Consultants Limited (RED) and Test Report No. 15863A issued by WFRGENT nv. It is prepared for Hilti (Hong Kong) Limited of 701-704 & 708B, Tower A, Manualife Finance Centre, 223 Wai Yip Street, Kwun Tong, Kowloon, HK.

The proposed pipes penetration sealing systems used for the metal pipe though masonry wall construction are required to provide a fire resistance performance of up to 120 minutes integrity with respect to BS 476: Part 20: 1987.

2 ASSUMPTIONS

The proposed systems are assumed to be installed in a similar manner to that of the previously tested system by competent installers. It is assumed that the modified systems will be constructed in a similar manner from materials and components of the same manufacture and equivalent quality as tested with supporting test evidence or otherwise appraised by RED. Further assumptions related to the specific modifications will be stated in the report.

It is also assumed that the supporting structures to which the perimeter of the systems will be fixed are capable of supporting the proposed structure effectively.

Assuming that the issue of the original test report is valid, the current testing standard or testing experience has not been changed and the procedures adopted for the original report have been re-examined and reviewed that there have been no changes to the specification of the construction considered in the original report. If contradictory data or any related evidence becomes available to RED, the assessment will be unconditionally withdrawn and the sponsor will be notified. This report is based on the given information, in which is declared by report sponsor that no contradictory data has become available.

3 SUPPORTING DATA

3.1 Summary of Supporting Test Evidences

Report no.	Sections	Description
Primary Test Evidence		
R16L28-1A	4.1	Supporting test evidence for the use of the Hilti 'CFS-B' pipe penetration sealing for insulated metal piping through masonry wall that requires 120 minutes integrity.
Test report no. 15863A	4.1	Supporting test evidence for the use of the Hilt 'CFS-B' pipe penetration sealing for insulated metal piping through masonry wall that requires 120 minutes integrity.

3.2 Primary Test Evidence

3.2.1 RED Test Report No. R16L28-1A

A fire resistance test stated to be in accordance with BS 476: Part 20: on twenty seven (27) specimens of penetrating sealing systems was performed at the RED HK Laboratory on 20 January 2017. The test sponsor Hilti (Hong Kong) Limited.

In this test report, only pipe systems, namely specimens '11', '12', '13', '14', '15' and '16', were considered. As requested by the test sponsor, the specimens were mounted within concrete line specimen holder as. The specimens were symmetrical and only one side of specimen was tested, which was determined by test sponsor.

Specimen '11' was comprised of an opening with sizes of 220 mm wide by 130 mm high incorporated with 2 nos. of pipes. The left and right pipe consisted of a copper pipe with sizes of 19 mm diameter and 6.4 mm diameter respectively by 4 mm thick by 1,400 mm long. Both copper pipes were wrapped with a layer of nominal 40 mm thick by 1,200 mm long insulation 'Armaflex' with density of 40 kg/m^3. The opening was filled by a layer of nominal 100 mm thick 'CFS-F FX' foam.

Specimen '12' had overall dimensions of 135 mm diameter by 1,400 mm long. It was comprised of a G.I. pipe with sizes of 25 mm internal diameter by 4 mm thick, wrapped with a layer of nominal 50 mm thick by 1,200 mm long insulation 'Armaflex' with density of 40 kg/m^3.

Specimen '13' had overall dimensions of 190 mm diameter by 1,400 mm long. It was comprised of a G.I. pipe with sizes of 50 mm internal diameter by 5 mm thick, wrapped with a layer of nominal 65 mm thick by 1,200 mm long insulation 'Armaflex' with density of 40 kg/m^3.

Specimen '14' had overall dimensions of 135 mm diameter by 1,400 mm long. It was comprised of a G.I. pipe with sizes of 25 mm internal diameter by 4 mm thick, wrapped with a layer of nominal 50 mm thick by 1,200 mm long insulation 'Phenolic Foam' with density of 40 kg/m^3.

Specimen '15' had overall dimensions of 190 mm diameter by 1,400 mm long. It was comprised of a G.I. pipe with sizes of 50 mm internal diameter by 5 mm thick, wrapped with 2 layers of nominal 32 mm thick (total 64 mm thick) by 1,200 mm long insulation 'Phenolic Foam' with density of 40 kg/m^3.

Specimen '16' had overall dimensions of 390 mm diameter by 1,400 mm long. It was comprised of a G.I. pipe with sizes of 250 mm internal diameter by 5 mm thick, wrapped with a layer of nominal 40 mm thick and a layer of nominal 25 mm thick (total 65 mm thick) by 1,200 mm long insulation 'Phenolic Foam' with density of 40 kg/m^3.

All specimens were penetrated through a nominal 200 mm thick concrete wall. The gaps between specimen '11' and concrete wall were applied with a layer of 'CFS-B' bandage. The gaps between specimens '12', '13', '14', '15' and concrete wall were applied with a layer of 'CFS-B' bandage, mineral wool with density of 100 kg/m^3 and 'CP606' sealant, while the gap between specimen '16' and concrete wall was applied with 2 layers of 'CFS-B' bandage, mineral wool with density of 100 kg/m^3 and 'CP606' sealant. Each end of the G.I. pipes of specimens '12', '13', '14', '15' and '16' at the exposed side was covered by a nominal 3 mm thick steel plate.

The copper pipes of specimen '11' and the G.I. pipes of specimens '12', '13', '14', '15' and '16' was 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 pipe 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 '11'	**121** Minutes (No failure)	N/A
Specimen '12'	**121** Minutes (No failure)	N/A
Specimen '13'	**121** Minutes (No failure)	N/A
Specimen '14'	**121** Minutes (No failure)	N/A
Specimen '15'	**121** Minutes (No failure)	N/A
Specimen '16'	**121** Minutes (No failure)	N/A

The test was discontinued after a heating period of 121 minutes (See R16L28-1A for full details).

3.2.2 *WFRGETNT Test Report No. 15863A**

A fire resistance test stated to be in accordance with BS EN 1366-3: 2009 utilising the general principles of BS EN 1363-1: 1999 on seven (17) pipes fitted with the Hilti 'CFS-B' pipe penetration systems though partition wall was performed at the WFRGENT NV on 29 November 2013. The test sponsor was Hilti AG, who had given permission to use this data.

The seventeen piping involves both metal pipes and plastics pipes wrapped with pipe insulation. Steel pipe diameters range from 10.2 mm to 159 mm with the pipe insulation (Armaflex) thickness from 14 mm to 45 mm. Copper pipe diameters range from 18 mm to 42 mm with the pipe insulation (Armaflex) thickness from 8.5 mm to 16.5 mm or Rockwool RS 800 with thickness from 30 mm to 40 mm. Plastic pipe diameters from 50 mm to 110 mm with insulation thickness (Armaflex) from 9 mm to 42.5 mm. All the piping were fitted with the Hilti 'CFS-B' Firestop Bandage with two continuous layers around the pipes with combustible Armaflex/AF insulation installed 50 mm covered by the supporting wall and 75 mm outside the flexible wall. A metal wire was used to provide fixing to the Hilti 'CFS-B' Firestop Bandage. The annual gaps in between the specimens and the supporting wall construction were filled with gypsum with at least 25 mm thick on each side.

Among the specimens, the specimen nos. 3a, 3b and 3c are the copper piping penetrations with the three pipes arranged next to each other without separation distance.

The specimens achieved the fire resistance performance with respect to BS EN 1366-3: 2009 as follow:

Pipe no.	Insulation (Max temp.)	Integrity (Cotton Pad)	Integrity (Sustained flaming)	Integrity (Gap Gauge)
1a	133	133	133	133
1b	133	133	133	133
1c	127	133	133	133
1d	76	133	133	133
1e	93	133	133	133
2b	95	133	133	133
2c	60	133	133	133
2d	116	133	133	133
3a	81	133	133	133
3b	133	133	133	133
3c	133	133	133	133
4a	133	133	133	133
4b	133	133	133	133
4c	133	133	133	133
4d	133	133	133	133
4e	133	133	133	133
4f	133	133	133	133

The test was discontinued after a period of 133 minutes (See WFRGENT Report no. 15863A for full details).

4 PROPOSAL & DISCUSSION

4.1 The use of Hilti 'CFS-B' firestop bandage for the purpose of penetration gap sealing for insulated metal piping though masonry wall construction

Proposal

It is proposed that Hilti 'CFS-B' firestop bandage may be used for the purpose of penetration gap sealing of insulated metal piping through the masonry wall construction for the project: "Oil Street". The usage of the Hilti 'CFS-B' firestop bandage is referenced to the test evidences R16L28-1A and WFRGENT Report no. 15863A. In this project, insulated pipes either wrapped by Armaflex or Mineral Wool are required to penetrating through masonry wall and the Hilti 'CFS-B' is used to provide the sealing in order to maintain the integrity performance.

The pipes are metal pipes that may be steel or copper with the outer diameters ranging from 6.4 mm to 60 mm and may wrapped with "Amarflex" insulation up to 40 mm thick or Mineral wool insulation up to 40 mm thick. All individual pipes will need to be wrapped with one layer of continuous Hilti 'CFS-B' Firestop bandage located at the mid-depth of the wall aperture with the aids of metal wires.

Regarding the clearance in between the piping and the wall aperture, when the clearances are less than 30 mm width, CP606 with the application depth of 15 mm backed with minimum 70 mm deep by 100 kg/m^3 mineral wool shall be used. Whilst the clearances are larger than 30 mm, the clearance shall be sealed up with the Hilti 'CFS-F FX' with the minimum depth of 100 mm located at the mid-depth of the wall aperture (see details in the attached drawing).

The systems are required to provide 120 minutes integrity performance only with respect to BS 476: Part 20: 1987. A typical application detail was as shown in the drawings in the appendix.

Discussion

The test evidence R16L28-1A described a test of total 27 nos. of penetration sealing systems with respect to BS 476: Part 20: 1987. And within the specimens, specimen '11', '12', '13', '14', '15' and '16' are the specimens that used 'Hilti CFS-B' for insulated metal piping system. While for specimen '11' the gap clearance between the aperture and the piping unit was sealed by 'Hilti CFS-F FX' while for the rest of the specimens the gap clearances were sealed by 'Hilti CP606'. Specimen '11' was a double piping unit but with each pipe unit consisted of a single copper pipe, 19 mm diameter and 6.4 mm diameter, respectively, and each wrapped with 40 mm thick 'Armaflex' insulation material. This double piping units are penetrating a rectangular aperture with sizes of 220 mm wide by 130 mm high on the wall. For the rest of the specimens, they are single piping unit, which are the G.I. pipe with various diameter (25 mm, 50 mm and 250 mm) wrapped with 50 - 65 mm 'Phenolic Foam' or 'Armaflex' insulation materials penetrating circular aperture. All the specimens as mentioned above achieved 121 minutes integrity performance with respect to BS 476: Part 20: 1987 without failure.

While the test report no. 15863A described the test evidence on a numbers of insulated metal pipes and

plastic pipes through partition wall which included a single pipe penetration as well as multiple pipes adjacent to each other without separation distance. In the tested situation, some of the metal pipe sizes were 10.1 mm diameter with 32 mm thick insulation, 42.4 mm diameter pipe with 36.5 mm thick insulation and even 159 mm diameter with 45 mm thick insulation. While the tested plastic pipe sizes were 50 mm diameter with 9 mm and 37.5 mm thick insulation, respectively, 110 mm diameter with 9.5 mm and 42.5 mm thick insulation respectively.

Appraisal against the BS 476: Part 20: 1987 integrity criteria

The test was conducted in accordance with BS EN 1366-3: 2009 which is considered adequate for the assessment against BS 476: Part 20: 1987.

The fire tests on penetration sealing systems as tested and described in test report no. 15863A was carried out in accordance with BS EN 1366-3: 2009. In reviewing the test, we have considered the designs and installation of the specimens, the surrounding construction, the initial furnace temperature, the pressure in the furnace, the changes in the integrity criteria and the behaviour of the fire test. We are satisfied that if this fire test had been conducted in BS 476: Part 20: 1987 and very similar results would have been achieved.

Fire test to BS EN 1366-3: 2009 and BS 476: Part 202: 1987 have the same furnace temperature-time curve, i.e., the standard ISO temperature time curve represented by $T = 345 \log_{10}(8t + 1) + 20$, where T is the furnace temperature rise and t is the time of heating conditions. However, a more severe overpressure requirement of 5 Pa required by BS EN 1366 - 3: 2004 was used, which was normally deemed to be more onerous. The passing criteria for the standards of BS EN 1366-3: 1999 and BS 476: Part 20: 1987 are summarised as follows:

Integrity. Monitor the unexposed face of the specimen for evaluation of integrity. A failure of the test construction to maintain integrity occurs when collapse or sustained flaming on the unexposed face occurs or impermeability is exceeded.

Insulation. Failure occurs when the temperature recorded at any position on the unexposed face is in excess of 180 °C above its initial value; or when integrity failure occurs.

Having stated these criteria, there is no difference between the tests to BS EN and British standards. Therefore, the insulated glazing assemblies, with the same construction as the prototypes tested and described in test report no. 15863A in accordance with BS EN 1366-3: 2009 as appropriate, may provide similar fire resistance performance if test to BS 476: Part 20: 1987.

Metal pipe wrapped with "Armaflex" insulation material

In the proposed setup, the diameter of the steel or copper pipes range from 6.4 mm up to 60 mm wrapped with maximum 65 mm thick pipe insulation. The proposed pipe sizes are all within the tested pipe sizes. In the test evidence, the smallest pipe sizes as tested in R16L28-1A was 6.4 mm copper pipe wrapped with 40 mm "Armaflex" insulation. This pipe was arranged next to a 19 mm copper pipe with 40 mm thick "Armaflex". The two pipes together were wrapped with 1 layer of Hilti 'CFS-B' at the mid-depth

of the wall aperture and the clearance between the piping and the wall aperture are filled with 100 mm deep Hilti 'CFS-F FX' foam. The function of the bandage is to ensure that incase the insulation material is burnt away under heating, the intumescent material inside the bandage will expand to seal up the potential gap formed. The test evidence had proven that with the maximum thickness of 40 mm insulation material, the bandage is effective in sealing the gap to maintain the integrity performance. The proposed setup is therefore considered acceptable. For this configuration, the double piping was penetrating through an aperture of 220 mm wide by 130 mm high aperture. In case the clearances are larger than 30 mm wide, the gap shall be sealed with Hilti 'CFS-FX X' foam fully filled within the 100 mm depth. Whilst the gap clearances are less than 30mm, Hilti "CP606" intumescent sealant with the application depth of 15 mm backed with minimum 70 mm deep by 100 kg/m^3 mineral wool on both sides of the wall can be used.

Metal pipe wrapped with "Mineral Wool" insulation material

In the test evidence WFR GENT Report no. 15863A, the metal pipes with sizes of 28 mm were wrapped with 30 mm and 40 mm Rockwool, respectively. In the test, the clearance between piping and the wall aperture was filled with plaster only, no intumescent material was used. Provided that the maximum thickness of the pipe insulation remain the same as that tested, the variation of the pipe diameter is in fact less critical compared to the insulation thickness. In addition, a similar proposal for pipe that insulated with 'Armaflex' had been tested, and compare to 'Armaflex' the 'Mineral Wool' is supposed to be a better material in terms of fire resistance. Therefore, it is reasonable to believed that for the pipe lined with 'Armaflex' if replaced by 'Mineral Wool' lining, the fire resistance performance of the system shall be maintained.

While in the proposal, 1 layer of the Hilti 'CFS-B' bandage at the mid-depth of the wall aperture is proposed. This sealing method had been tested for metal pipe with 'Armaflex' insulation, since mineral wool (with minimum density of 100 kg/m^3) are supposed to be non-combustible, therefore it is expected that using the same sealing method used for 'Mineral wool' lined metal piping is considered acceptable and the integrity performance shall be maintained as well. In case the clearances are larger than 30 mm wide, the gap shall be sealed with Hilti 'CFS-FX X' foam fully filled within the 100 mm depth. Whilst the gap clearances are less than or equal to 30mm, Hilti "CP606" intumescent sealant with the application depth of 15 mm backed with 70 mm deep by 100 kg/m^3 mineral wool on both sides of the wall can be used.

Based on the above justification, the use of 1 layer of the Hilti 'CFS-B' firestop bandage with adequate clearance sealing by either Hilti "CFS-FX X' foam for large clearance (>30 mm) or Hilti 'CP606' for small clearance (≤ 30mm) is considered to be an adequate sealing method to maintain the integrity performance for 120 minutes at the location of the pipe penetration.

5 CONCLUSION

The proposed use of Hilti 'CFS-B' Firestop Bandage and Hilti 'CFS-FX X' Foam for insulated metal pipes penetration through masonry wall is capable to maintain the fire resistance performance of up to 120 minutes integrity with respect to BS 476: Part 20: 1987

6 DECLARATION BY APPLICANT

We, Hilti (Hong Kong) Limited, confirm that the material, component or element of structure, which is the subject of the test report being reviewed, has not to our knowledge been subjected to another test to the standard against which the assessment is being made.

We agree to withdraw this assessment from circulation should the component or element of structure be the subject of another test to the standard against which the assessment is being made.

We are not aware of any information that could affect the conclusions of this assessment.

If we subsequently become aware of any such information we agree to ask the assessing authority to withdraw the assessment.

7 VALIDITY

This assessment is based on test data, experience and the information supplied. The assessment will be invalidated if the assessed construction is subsequently tested since actual test data is deemed to take precedence over an expressed opinion. Any changes in the specification of product will invalidate this assessment. This assessment relates only to the specimen assessed and does not by itself infer that the product is approved under any other endorsements, approval or certification scheme. Since the appraisal method is under development, the laboratory reserved the right to supersede this assessment in case the appraisal method had been changed.

This report only relates to the specimen(s) tested and may only be reproduced by the sponsor in full, without comment, abridgement and modifications.

8 SIGNATORIES

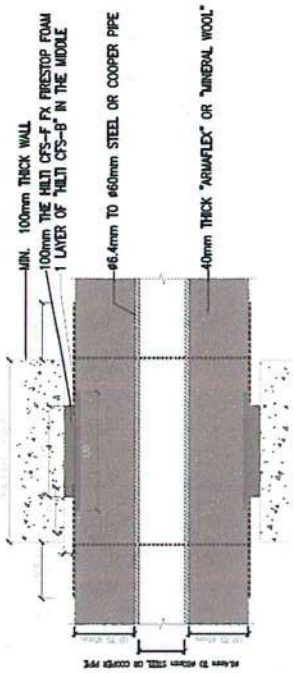
Assessment by:

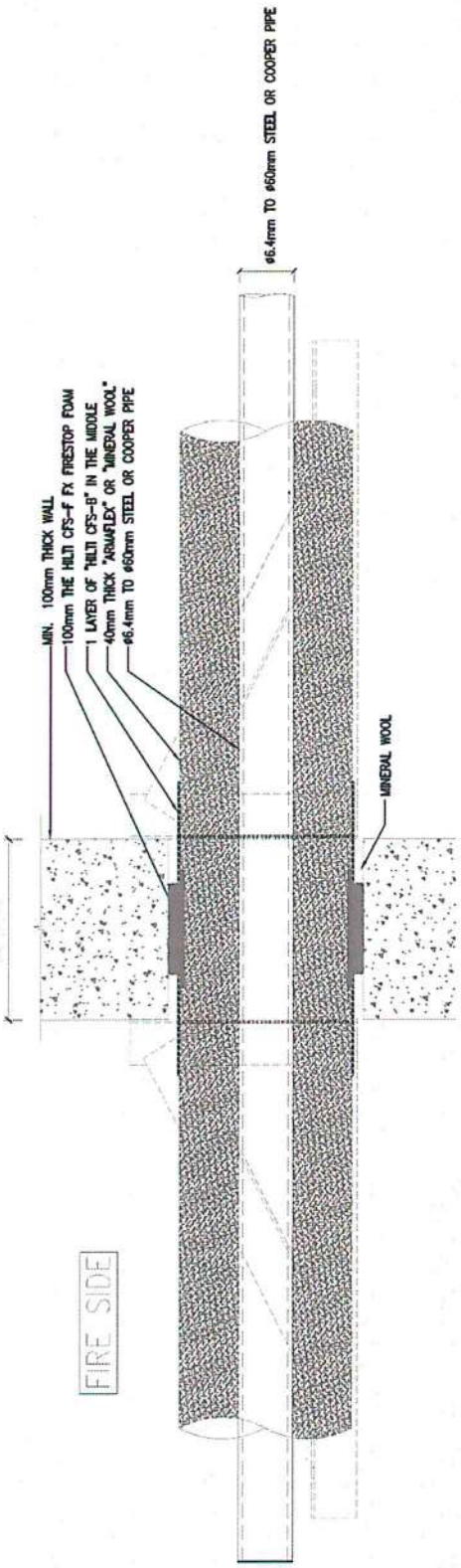
Dr. SZE Lip-kit
Test Consultant
Research Engineering Development
Façade Consultants Limited

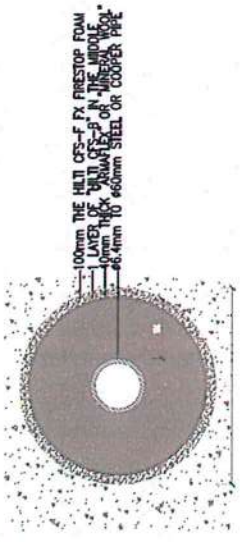
Reviewed by:

Ir Dr. YUEN Sai-wing, MHKIE (Fire)
Authorized Signature
Research Engineering Development
Façade Consultants Limited

APPENDIX - DRAWINGS FROM THE APPLICANT







- End of Report -

Research Engineering Development Façade Consultants Limited
雄略幕牆顧問有限公司
DD134, Lung Kwu Tan, Tuen Mun, N.T., Hong Kong

Hilti (Hong Kong) Limited

701-704 and 708A&B, Tower A Manulife Financial Centre,

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

Date: 15th July, 2022

Our Ref: R22G18-1A

TO WHOM IT MAY CONCERN

Re: Assessment Report no. R17E27-1A – Fire Resistance Performance of Hilti 'CFS-B' Firestop Bandage for insulated metal pipes penetration sealing for up to 120 Minutes Integrity with Respect to BS 476: Part 20: 1987

The RED assessment report no. R17E27-1A was issued on 19th June, 2017 and expired on 18th June, 2019. The specification and interpretation of test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. Whilst RED has conducted a review of the procedures adopted for the supporting data to ensure they are consistent with current practices, the assessment report no. R17E27-1A has been reviewed and found satisfactory.

Therefore, it is recommended that the assessment report no. R17E27-1A is valid until 15th July, 2024 and another review shall be undertaken by 14th July, 2024.

Declaration by the Applicant:

By distributing this copy of technical review, we, Hilti (Hong Kong) Limited, confirmed that there have been no changes to the material specifications, nor the methods of construction of the test specimen considered in the original appraisal of assessment report no. R17E27-1A.

Yours Sincerely,

Assessment by:

Dr. SZE Lip-kit
Authorized Signature
Research Engineering Development
Façade Consultants Limited

Reviewed by:

Ir Dr. YUEN Sai-wing, MHKIE (Fire)
Authorized Signature
Research Engineering Development
Façade Consultants Limited

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

HOKLAS 091 TEST

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

On 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

雄略

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.

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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 810 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 '15' 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

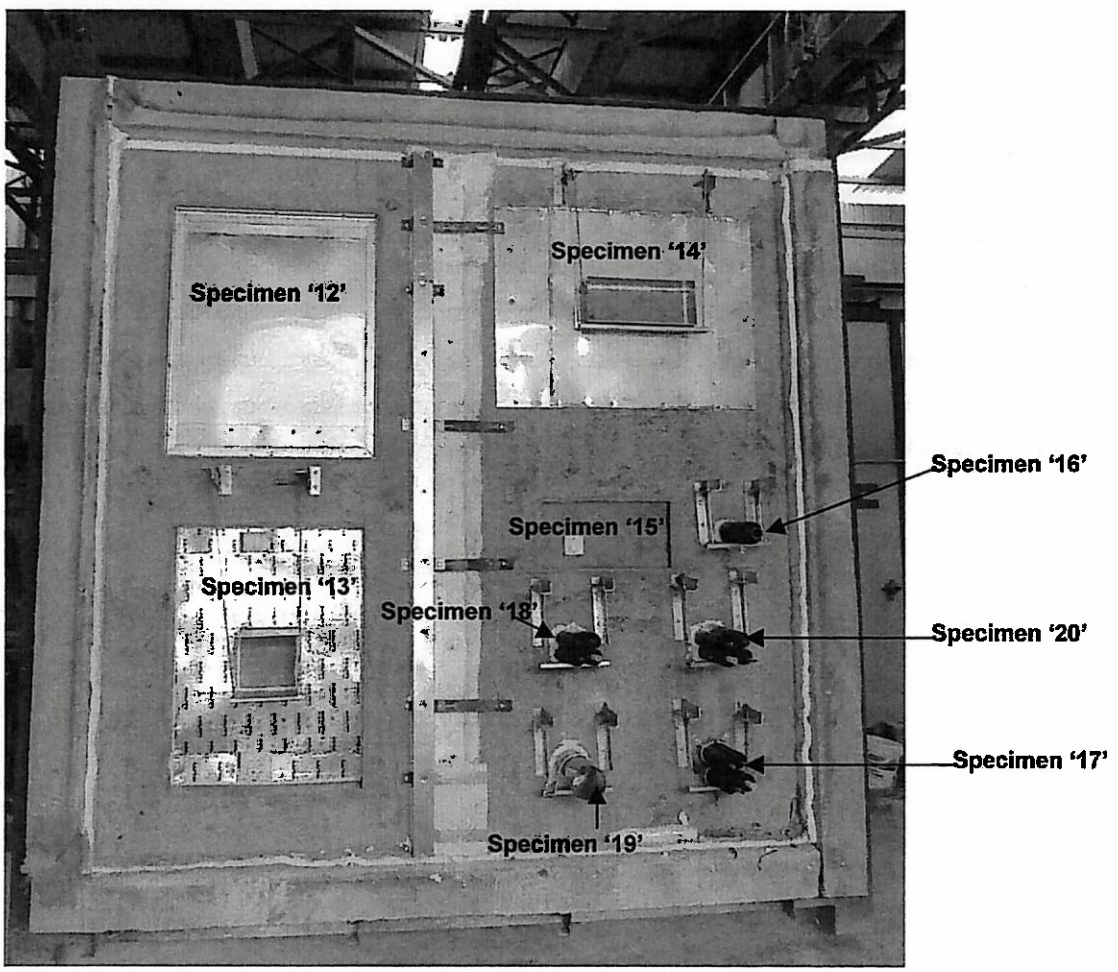


Photo 1: The exposed face of the specimens before the test.

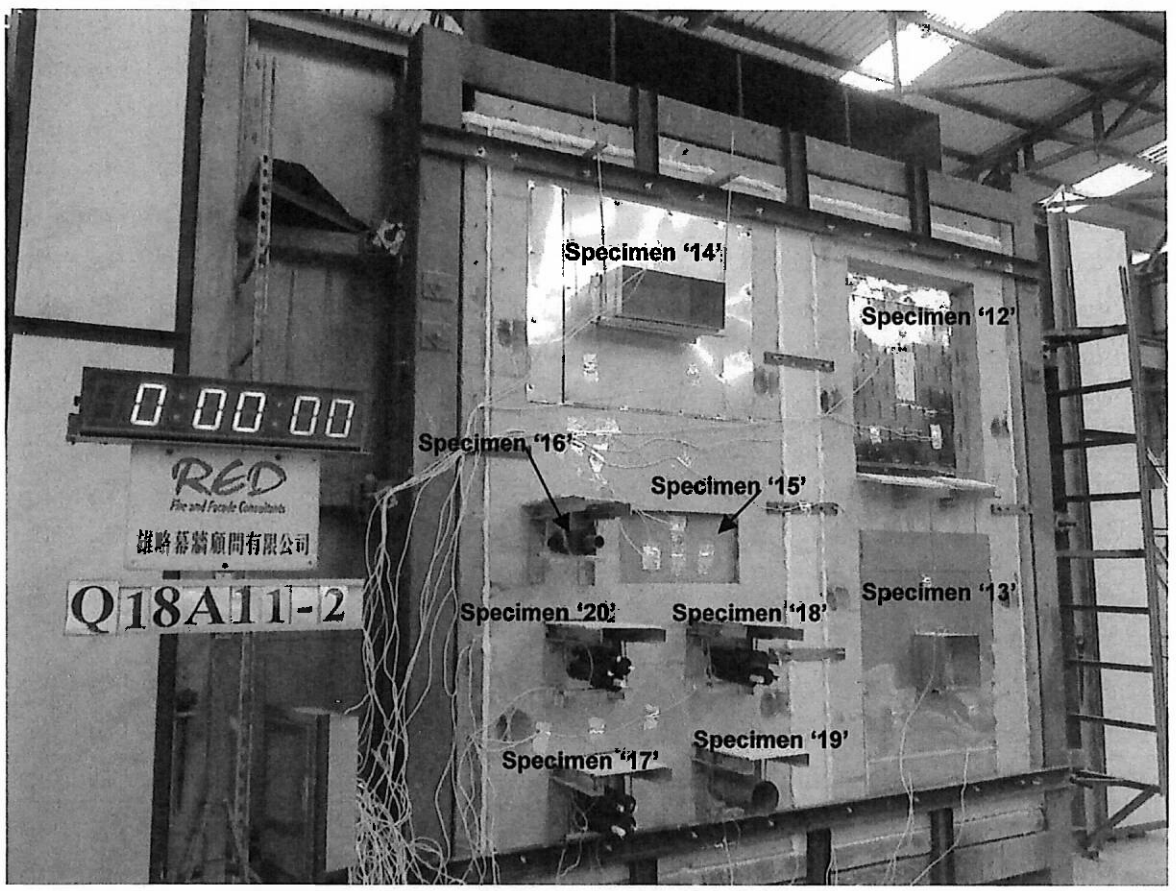


Photo 2: The unexposed face of the specimens before the test.

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

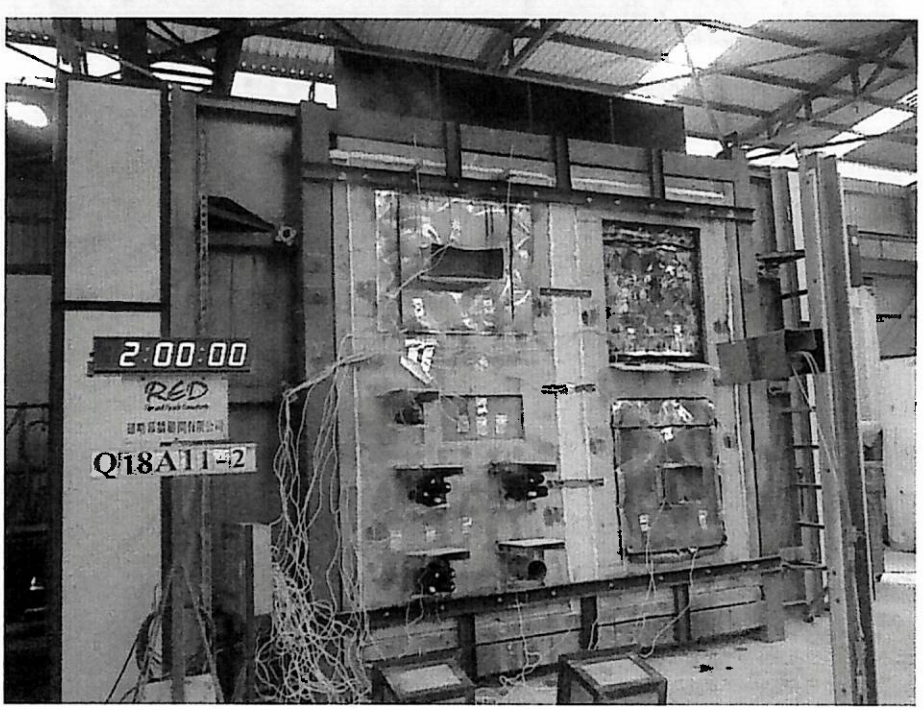


Photo 4: The unexposed face of the specimens after a heating period of 120 minutes.

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.

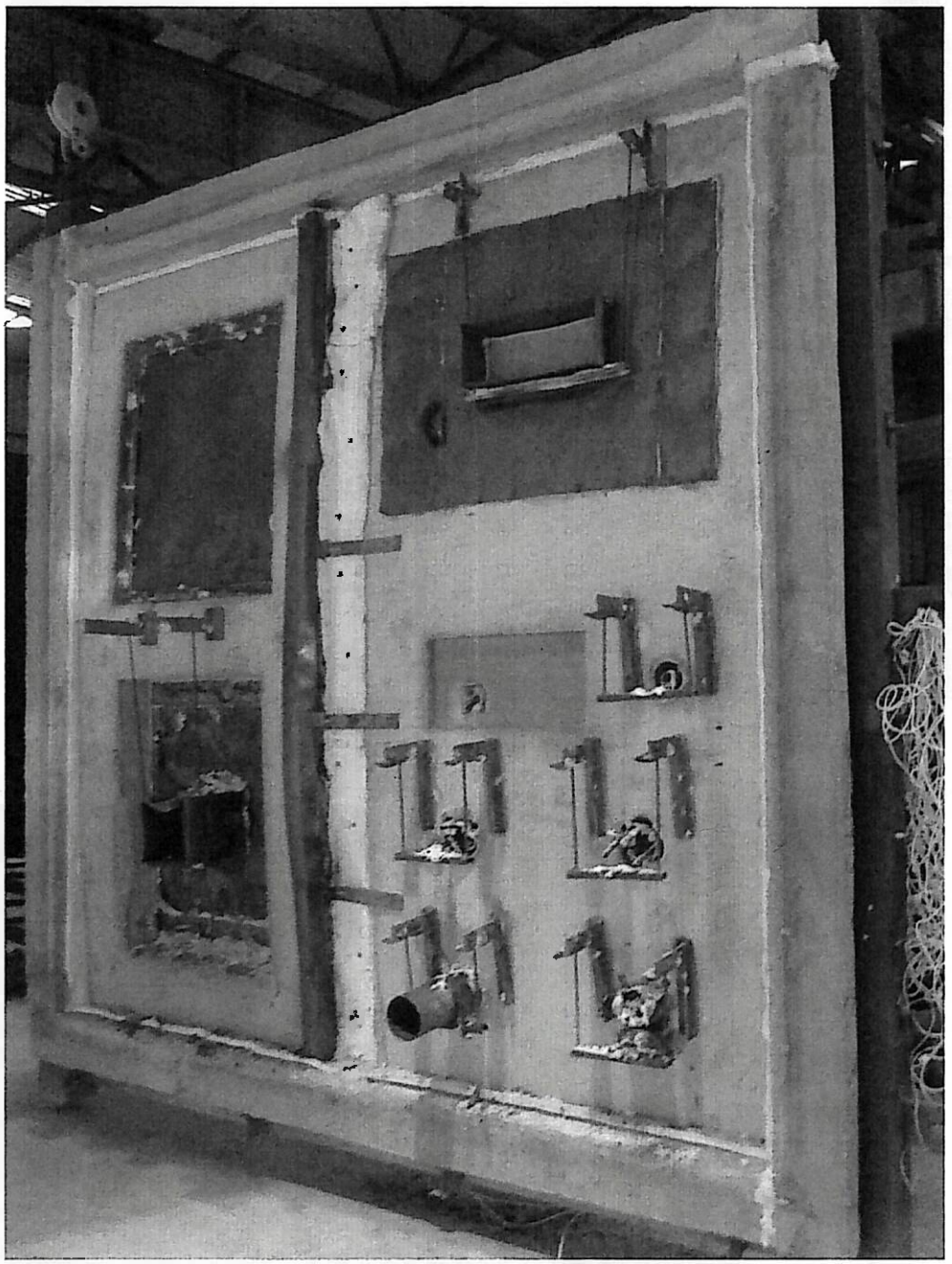


Photo 7: The exposed face of the specimens after the test.

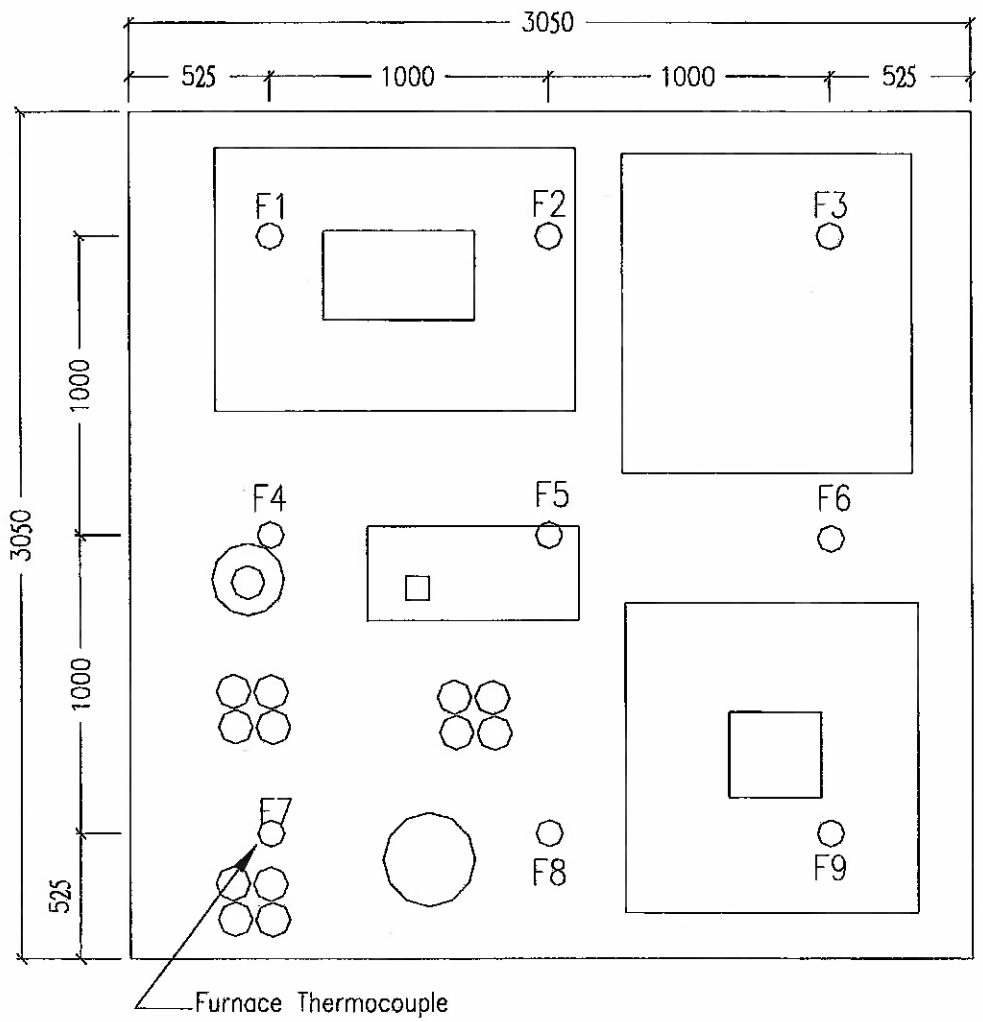


Figure 1 – Locations and reference numbers of furnace thermocouples.
(This figure is not to scale and all dimensions are in millimetres.)

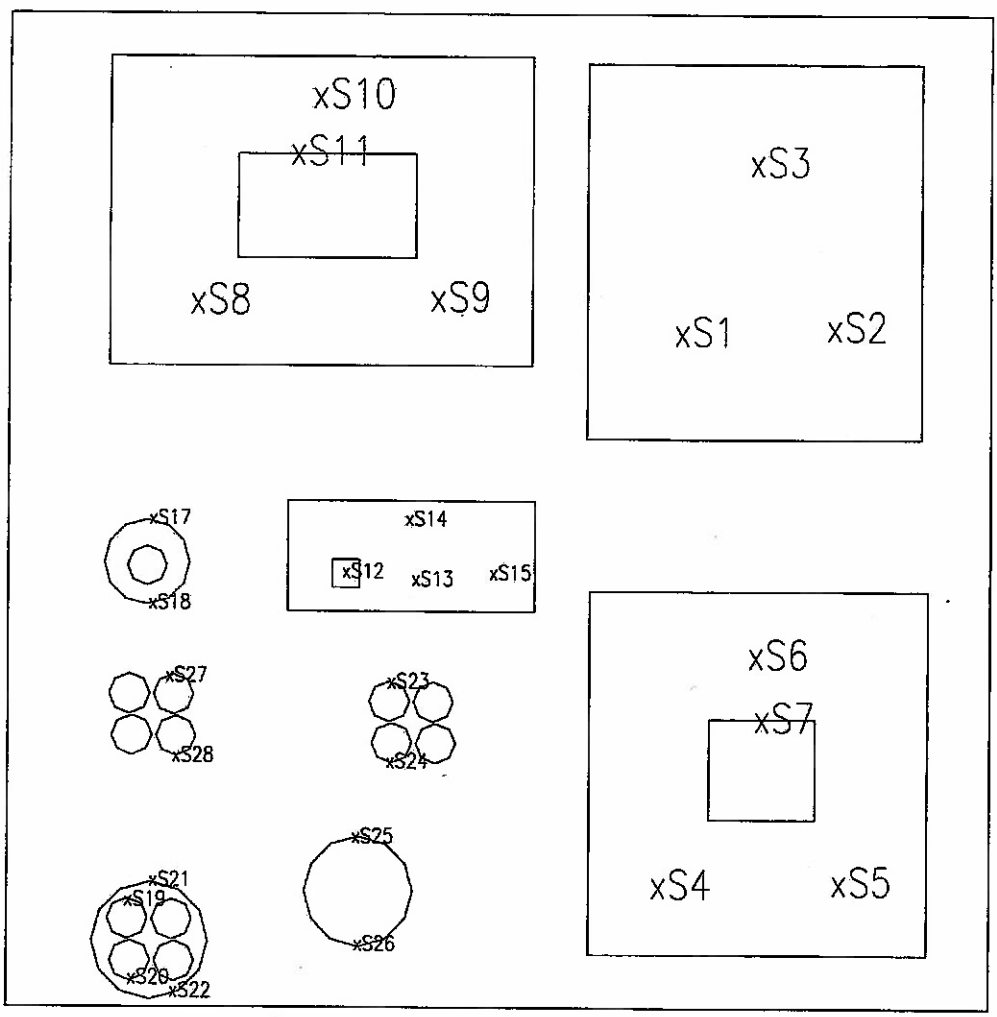


Figure 2 – Locations and reference number of thermocouples to monitor the temperature of unexposed surface of the specimens.
(This figure is not to scale.)

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

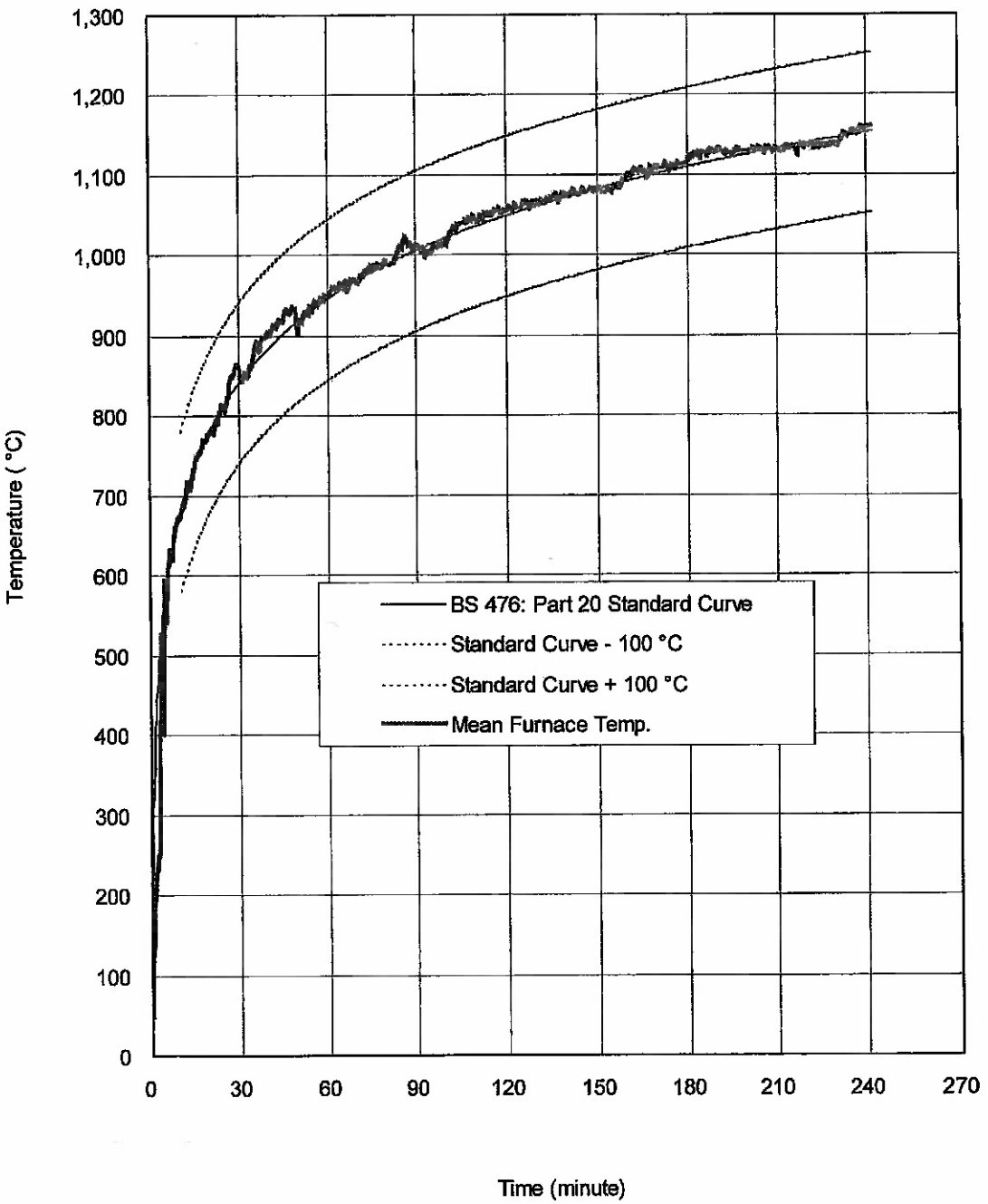


Figure 3 – Mean furnace temperature.

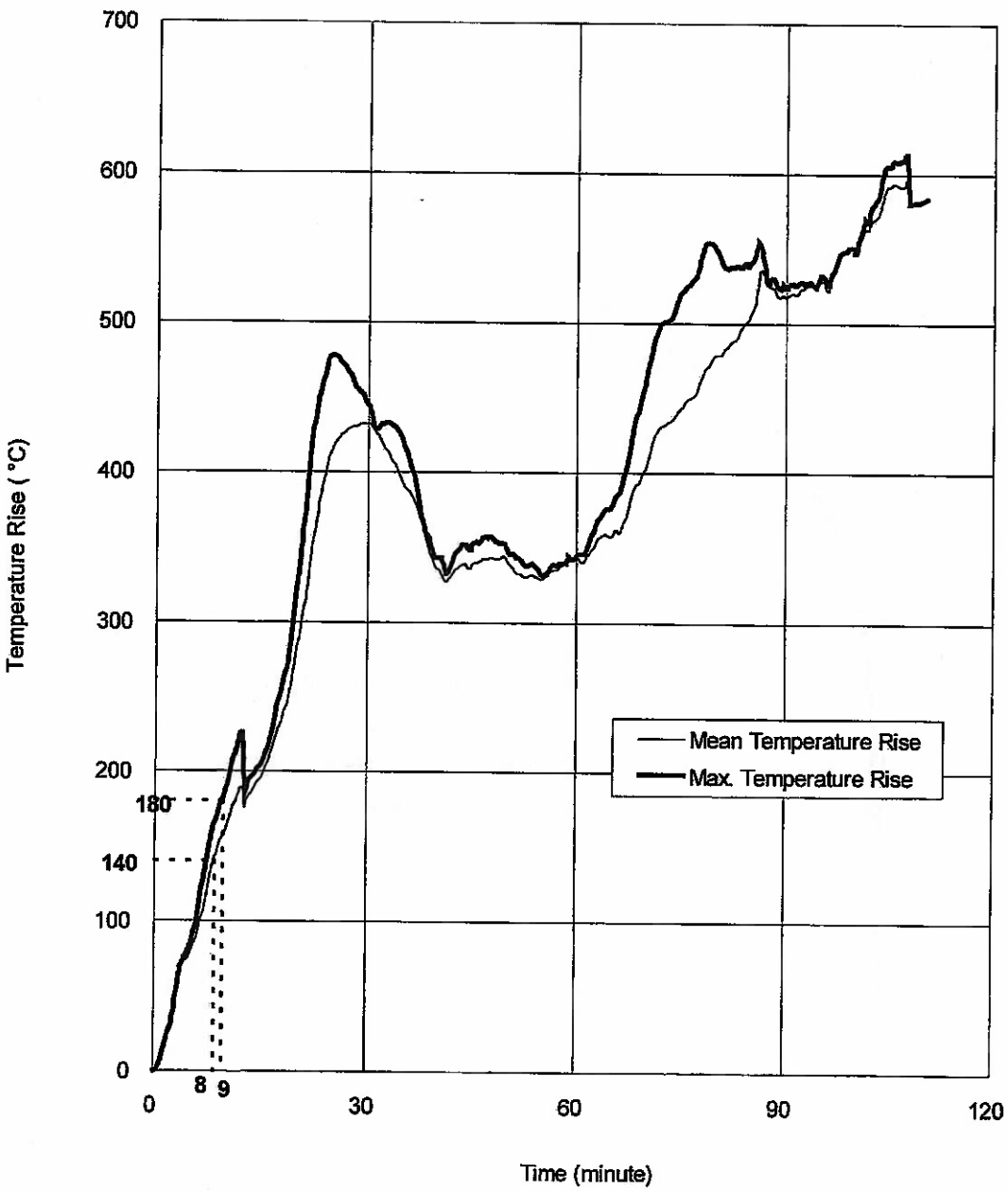


Figure 4 – Temperature rises of unexposed surface of specimen '12'.

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

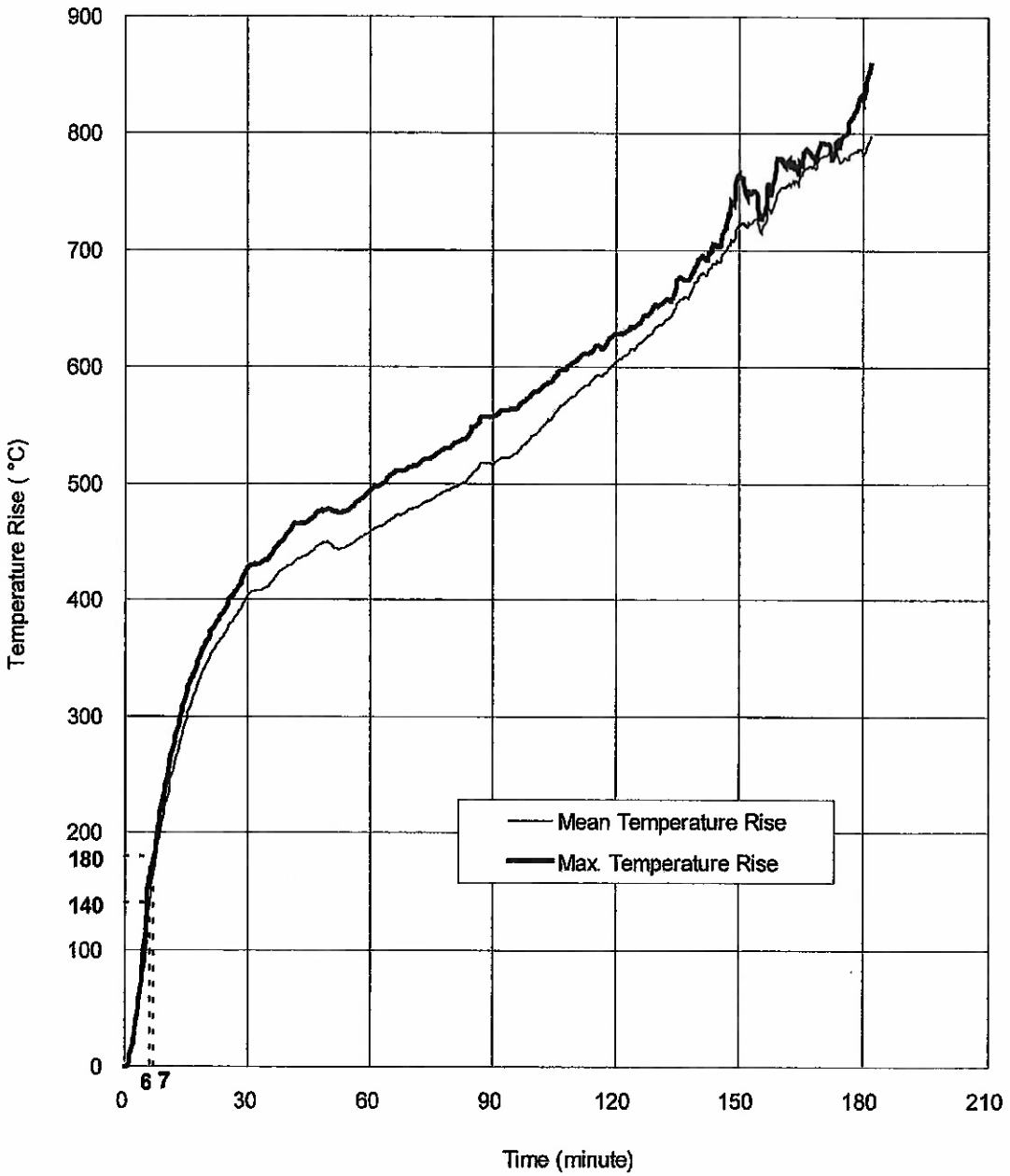


Figure 5 – Temperature rises of unexposed surface of specimen '13'.

Note: Thermocouples S4 - S7 malfunctioned after a heating period of 181 minutes.

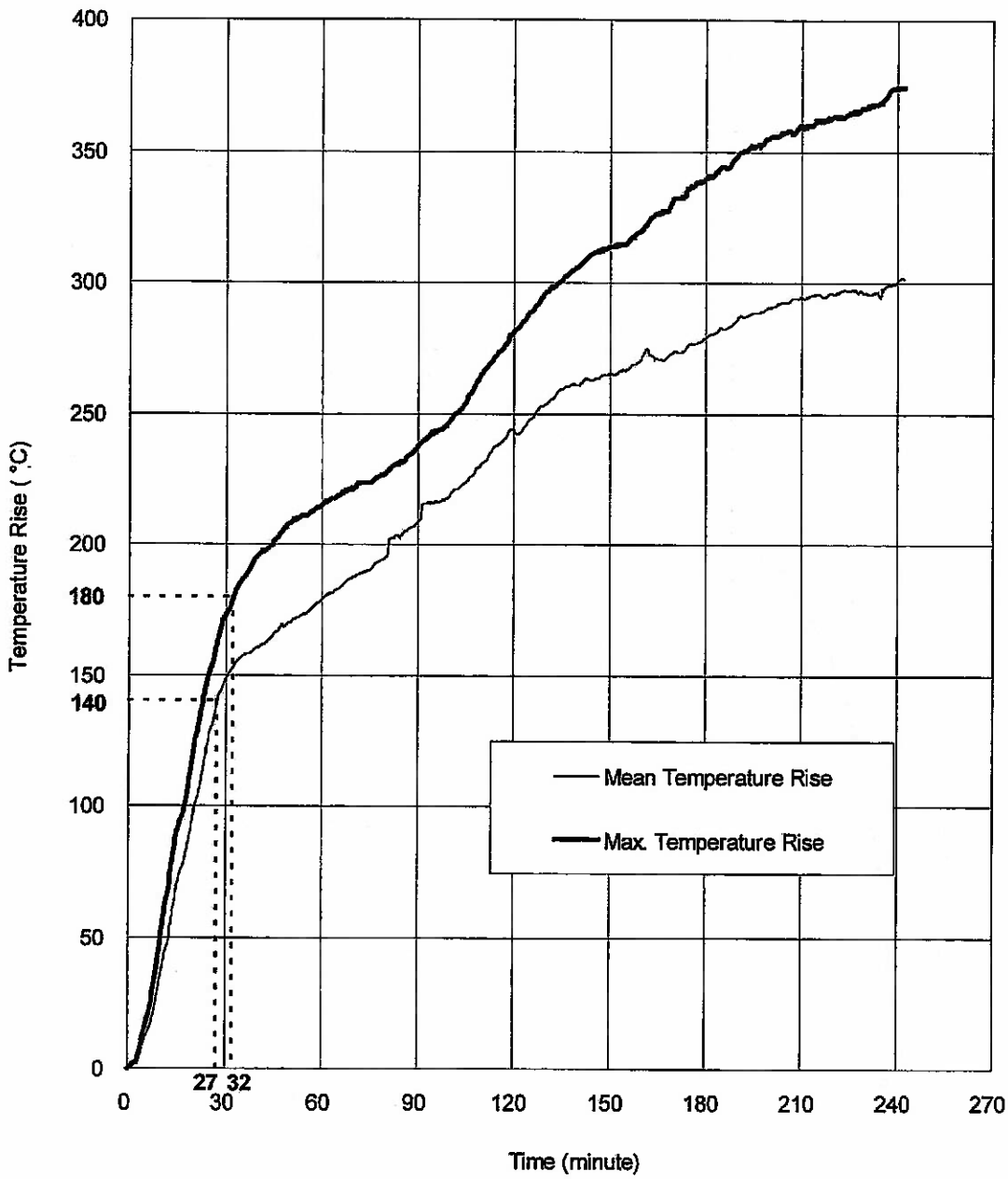


Figure 6 – Temperature rises of unexposed surface of specimen '14'.

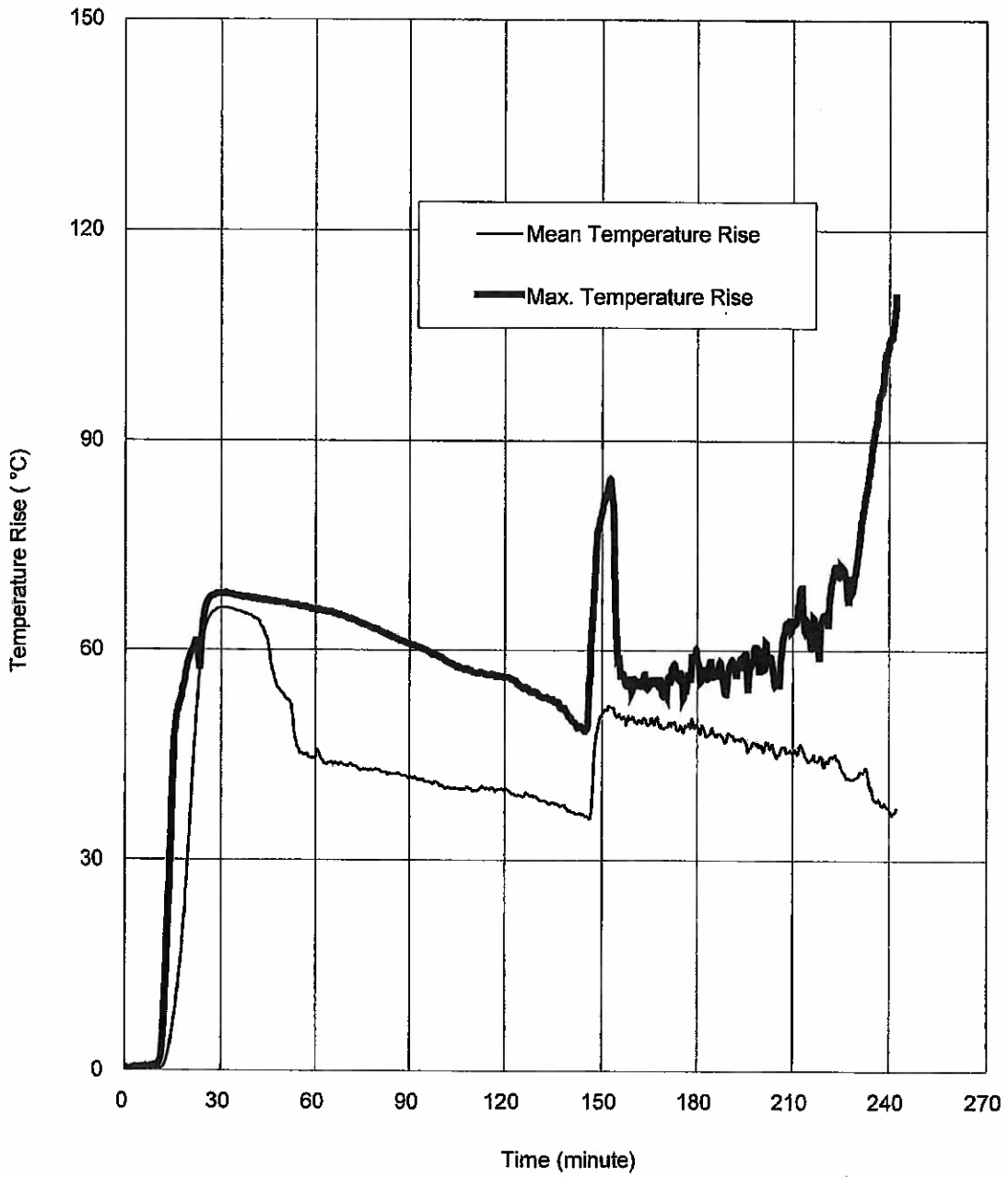


Figure 7 – Temperature rises of unexposed surface of specimen '15'.

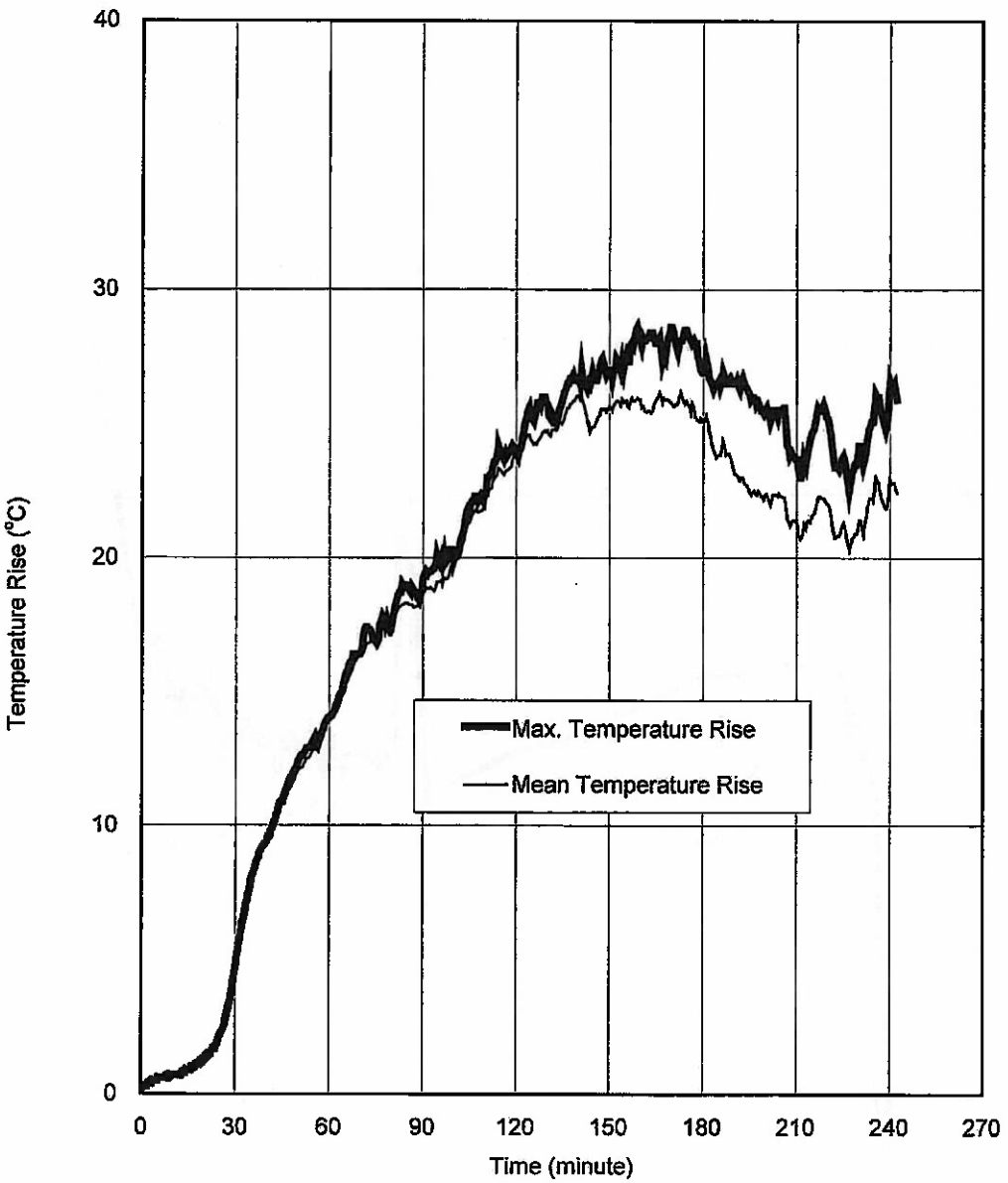


Figure 8 – Temperature rises of unexposed surface of specimen '16'.

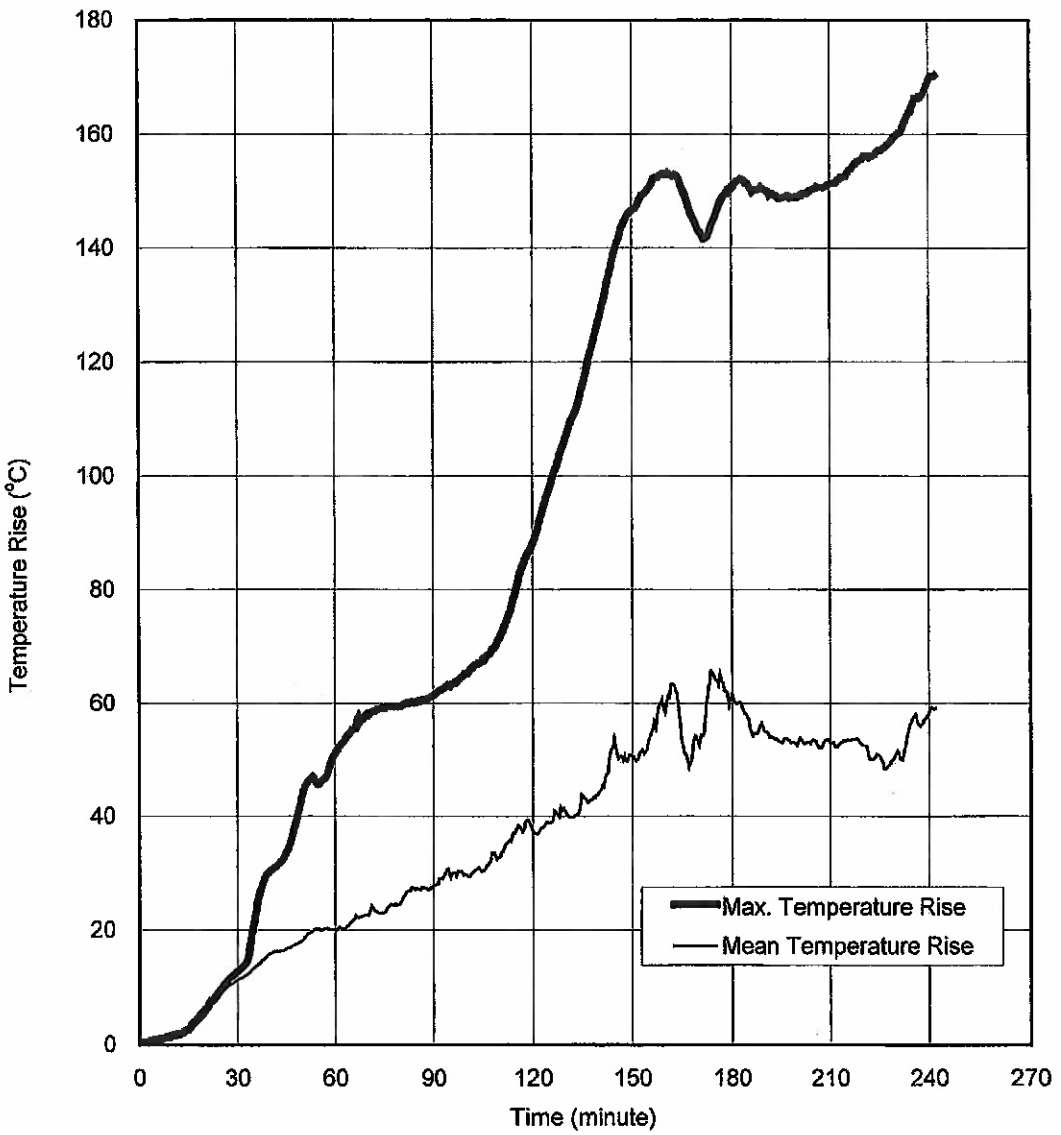


Figure 9 – Temperature rises of unexposed surface of specimen '17'.

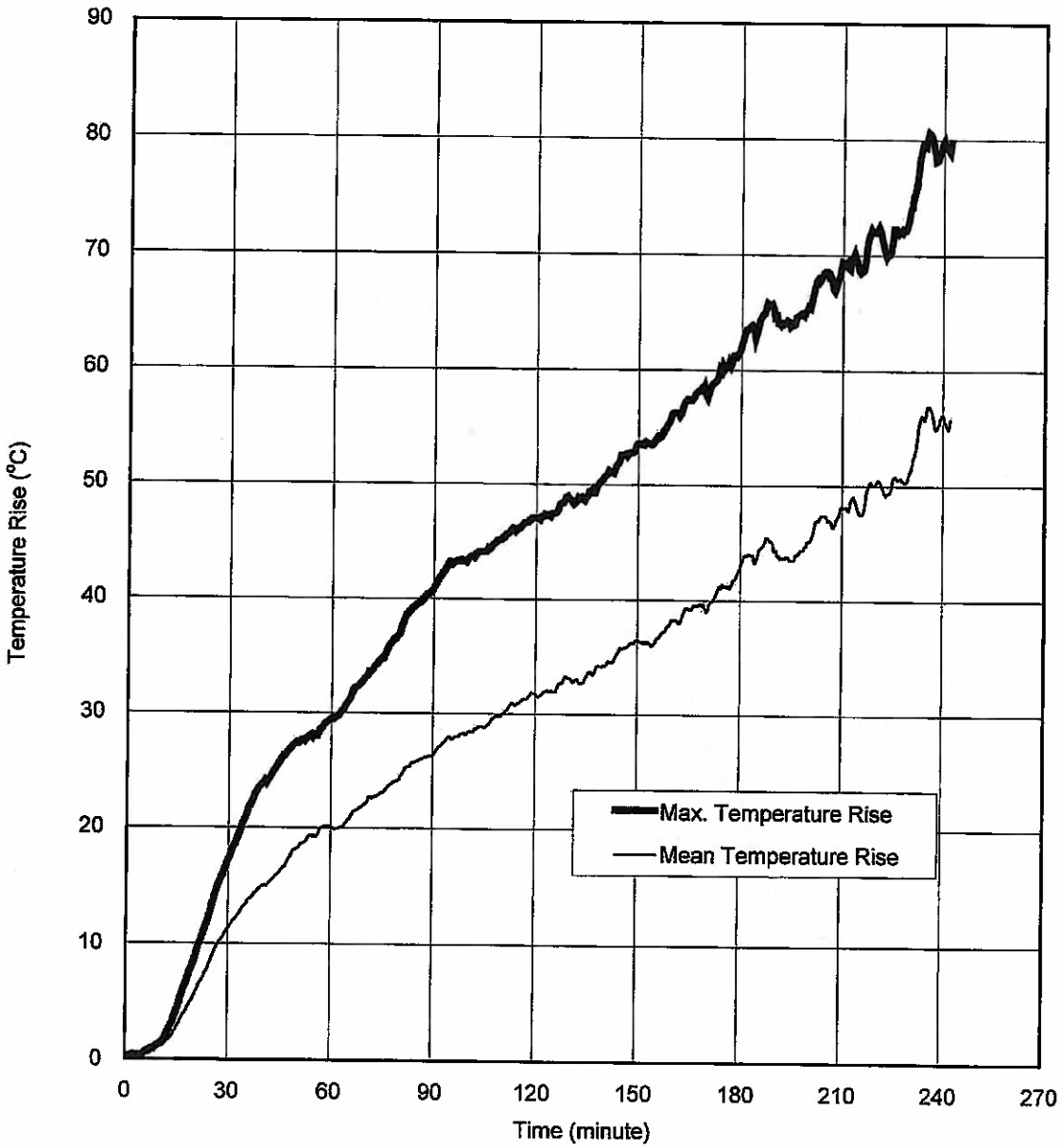


Figure 10 – Temperature rises of unexposed surface of specimen '18'.

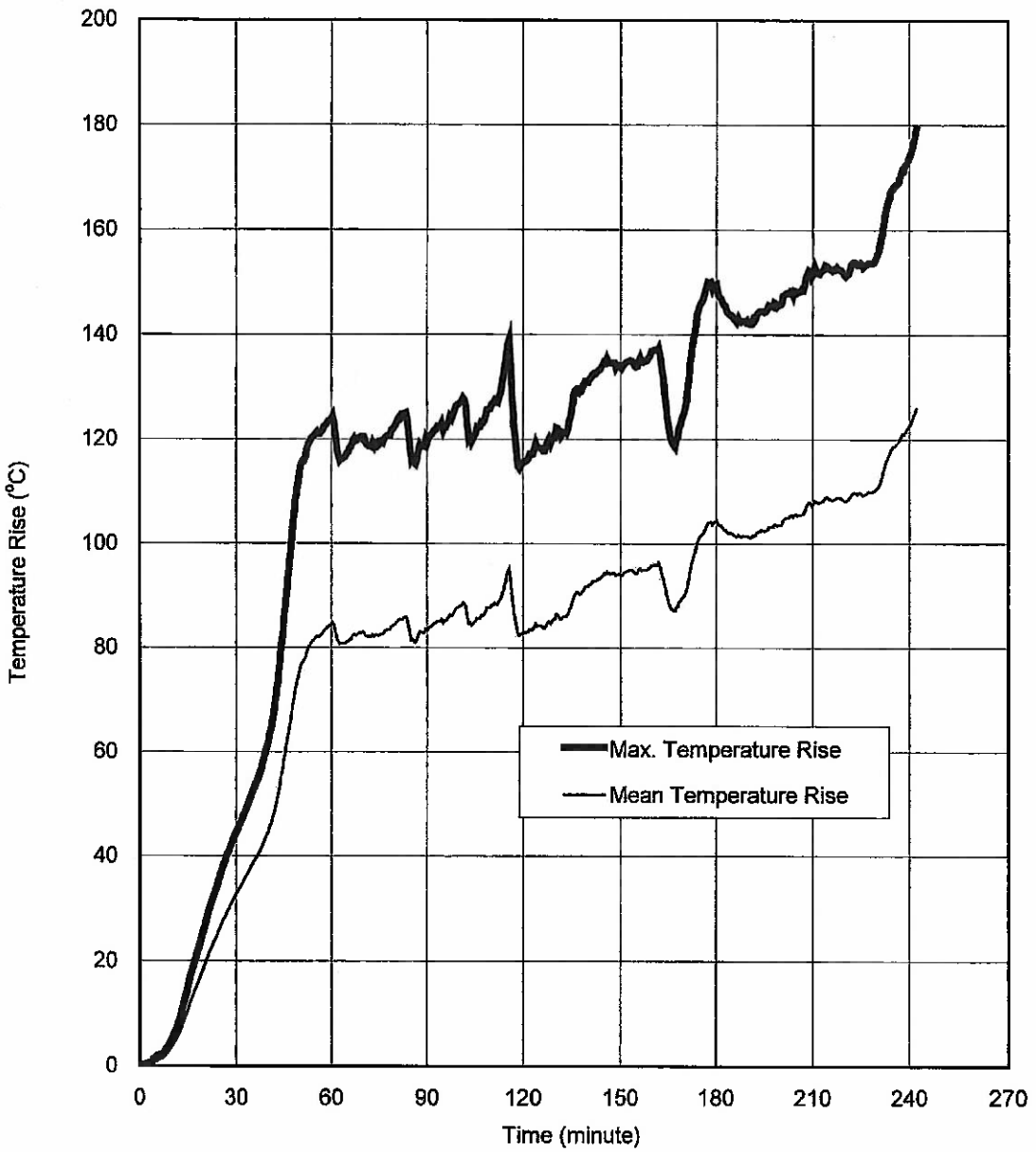


Figure 11 – Temperature rises of unexposed surface of specimen '19'.

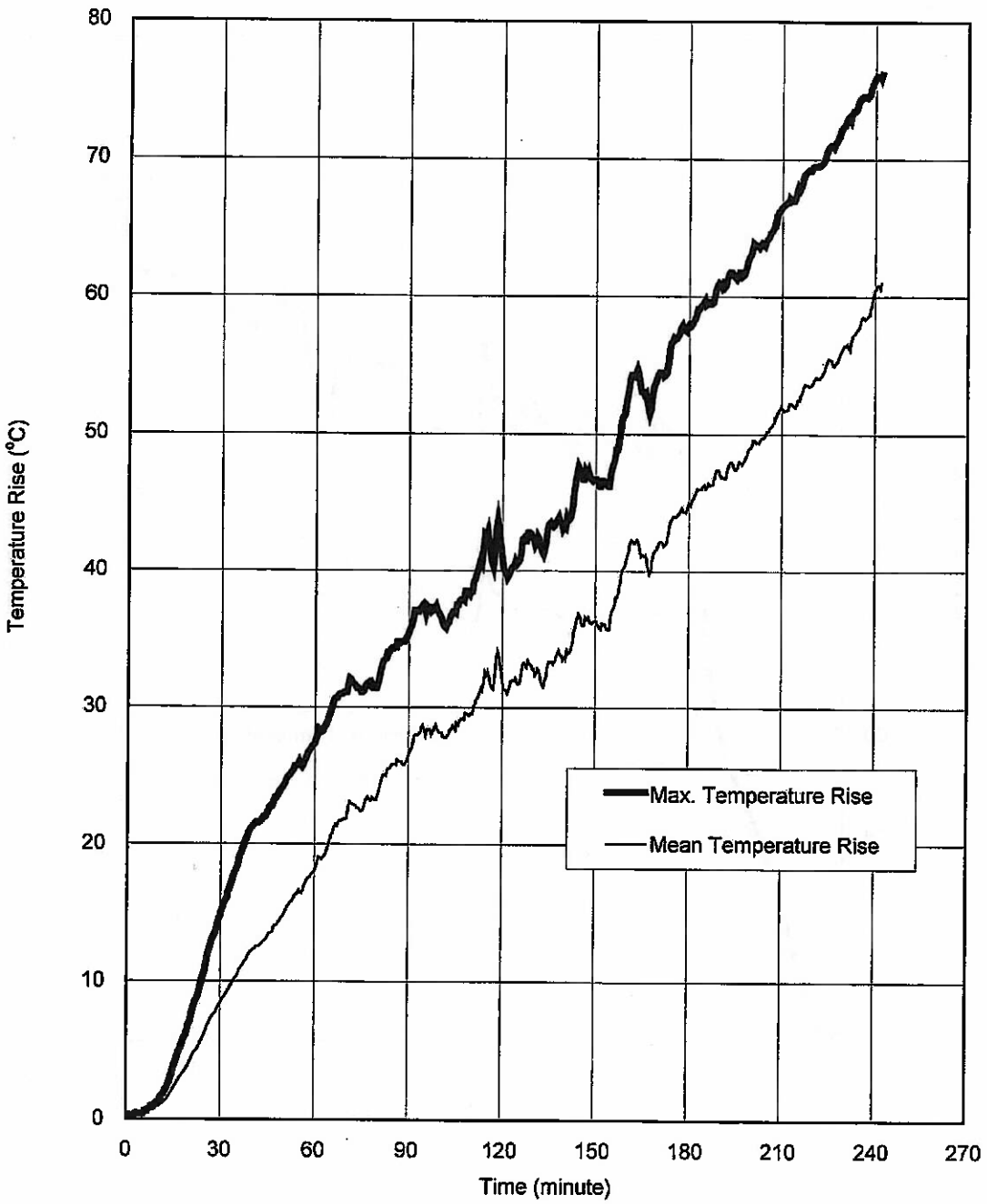


Figure 12 – Temperature rises of unexposed surface of specimen '20'.

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

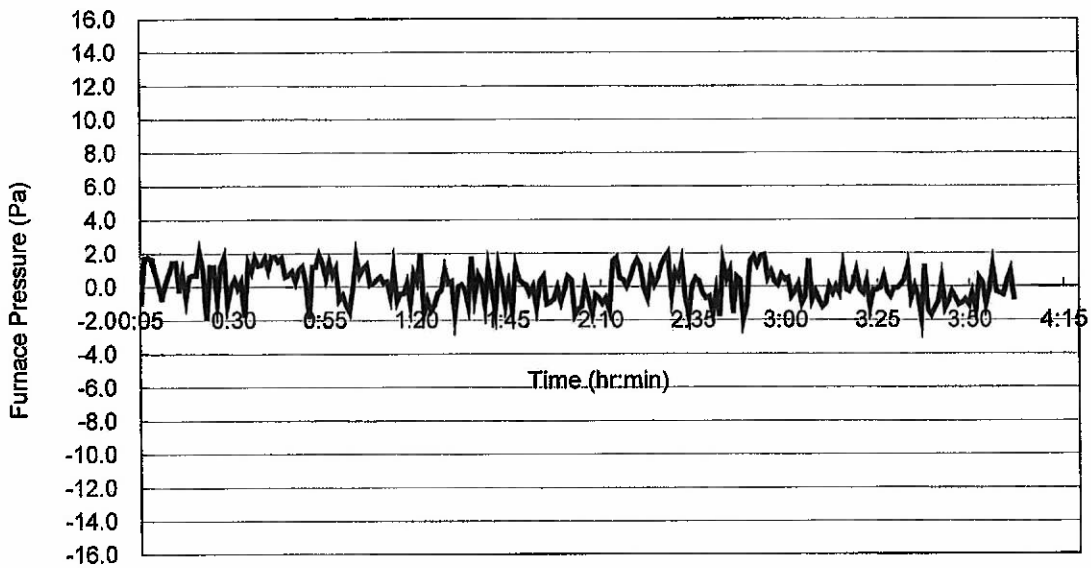


Figure 13 – Furnace pressure.

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

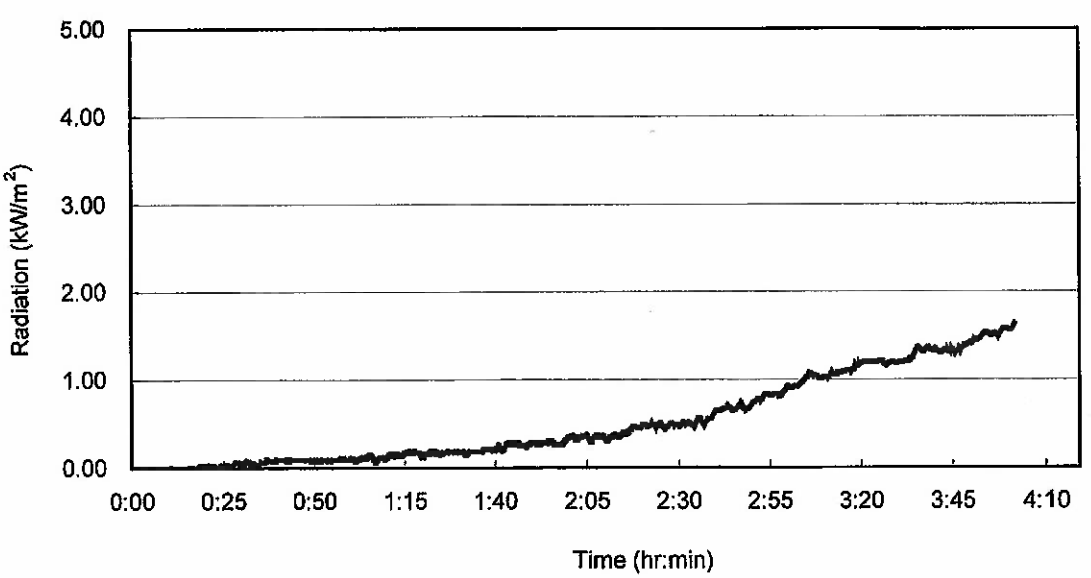


Figure 14 – Radiation.

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)

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	55	40	51
210	--	--	--	--	--	--	--	360	184	339	166	64	39	52
215	--	--	--	--	--	--	--	362	185	340	167	63	38	51
220	--	--	--	--	--	--	--	363	186	338	168	65	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 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 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'

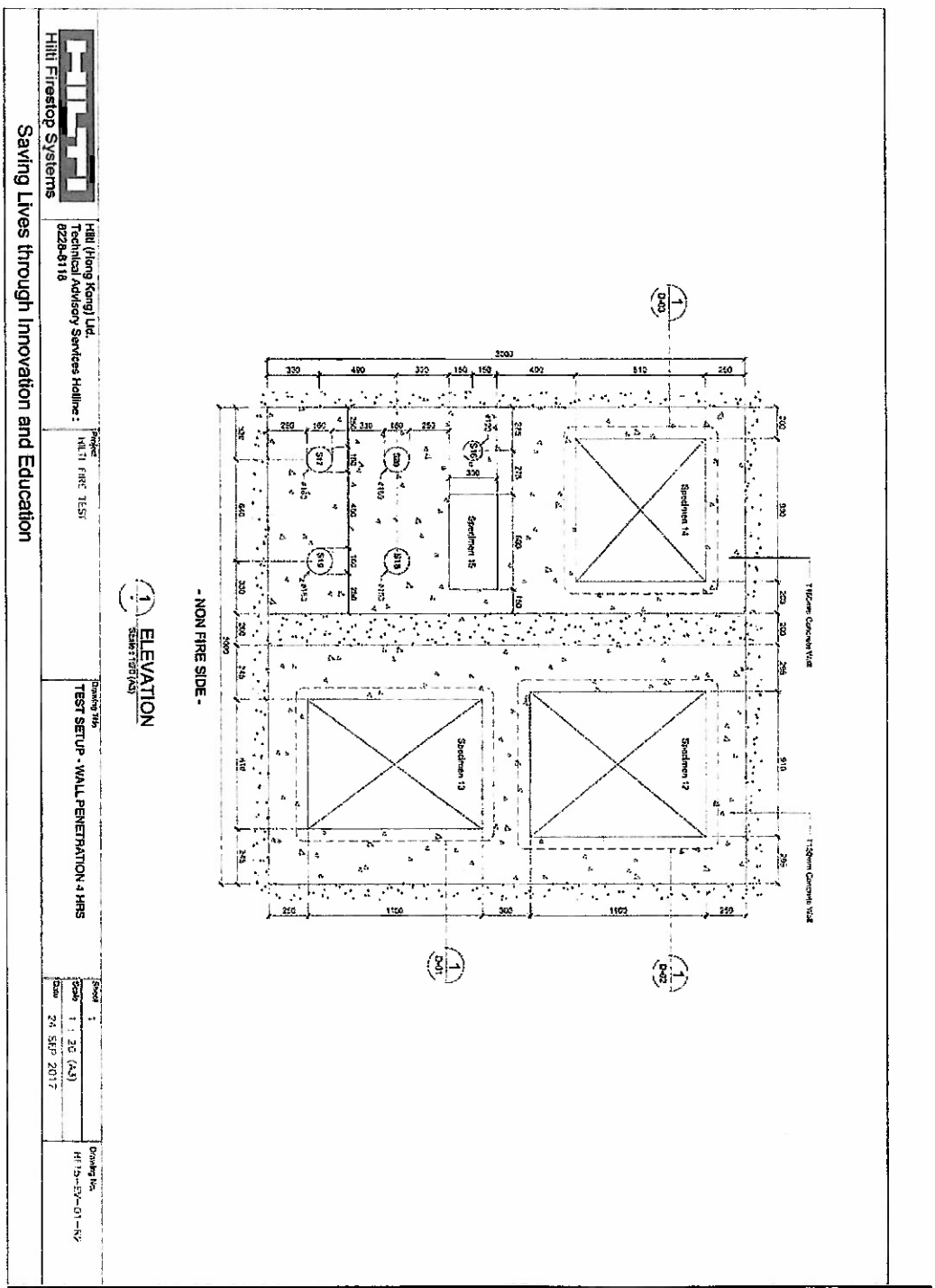
Item	Description		
1a	**PVC Pipe**		
	Material	:	PVC.#
	Overall sizes	:	1 no. of 25 mm outer diameter by 2 mm thick by 1,200 mm long.*
	Fixing method	:	The pipe was supported by fixed to 40 mm by 20 mm by 3 mm thick steel L-angles, located at 120 mm from the concrete wall on both sides. The steel angles 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.*

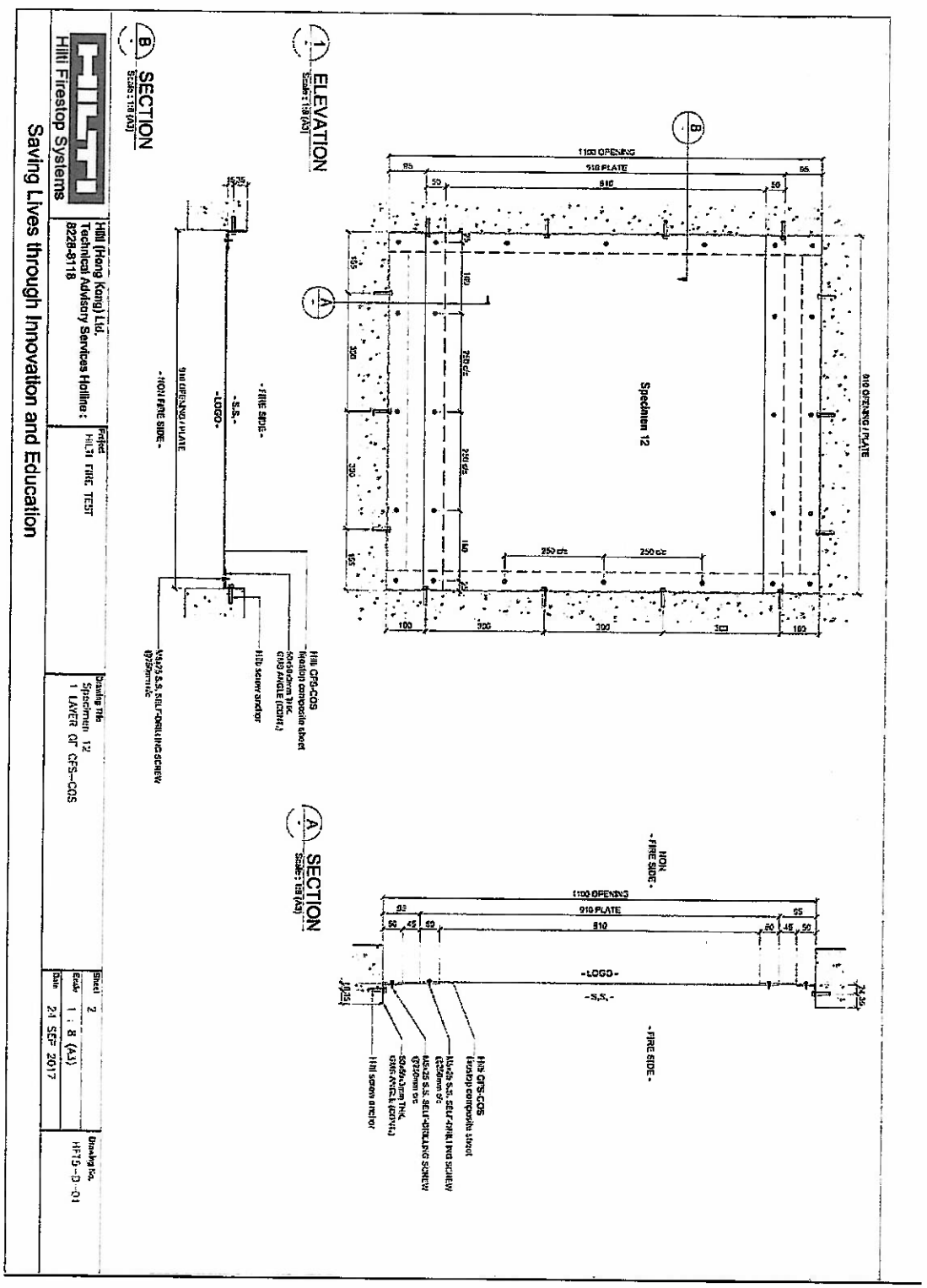
 # As shown on the test construction

Drawings from Test Sponsor

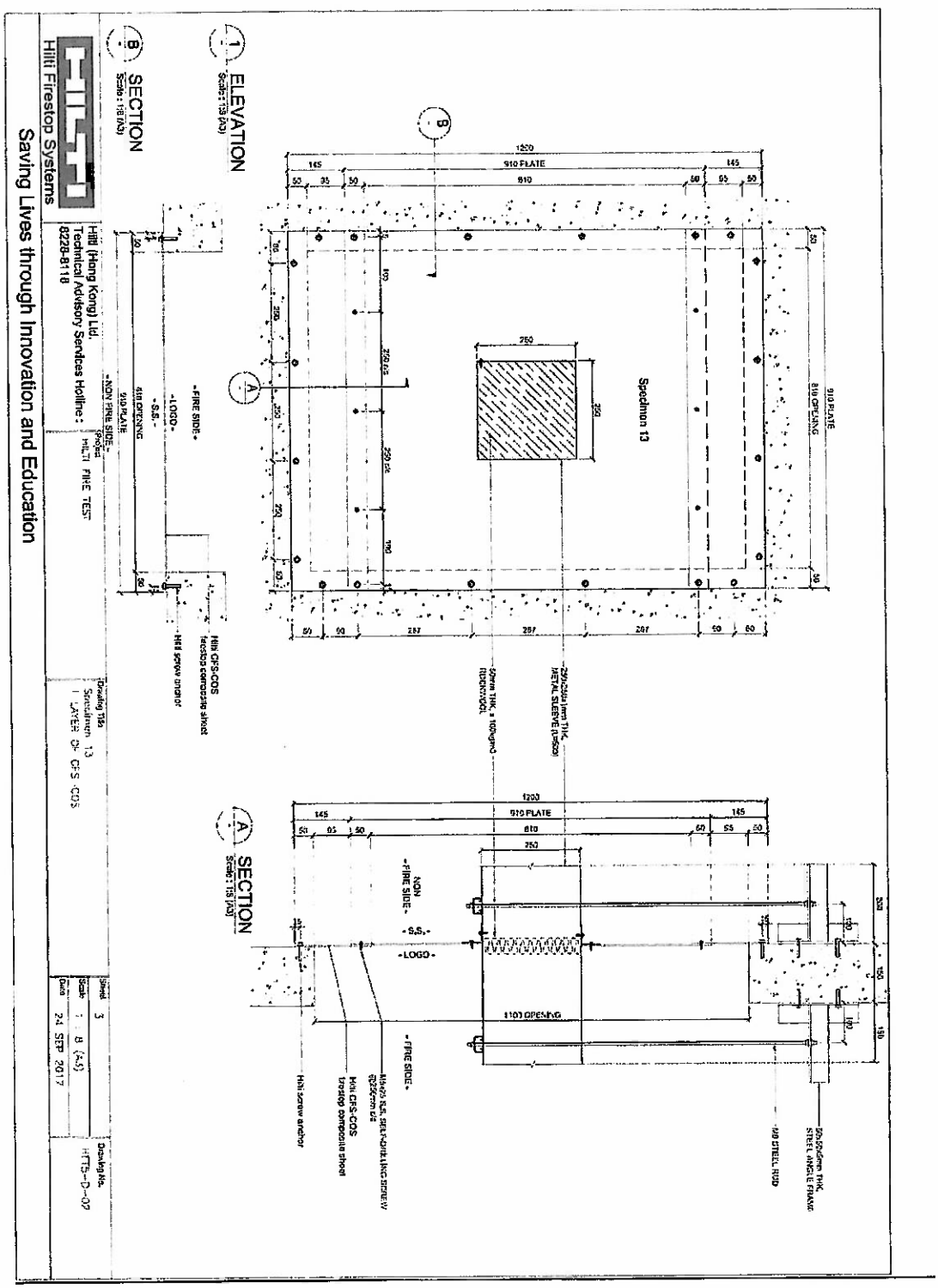
(The drawings provided by test sponsor, which was not verified by RED, except those specified and described in 'information from test sponsor'.)



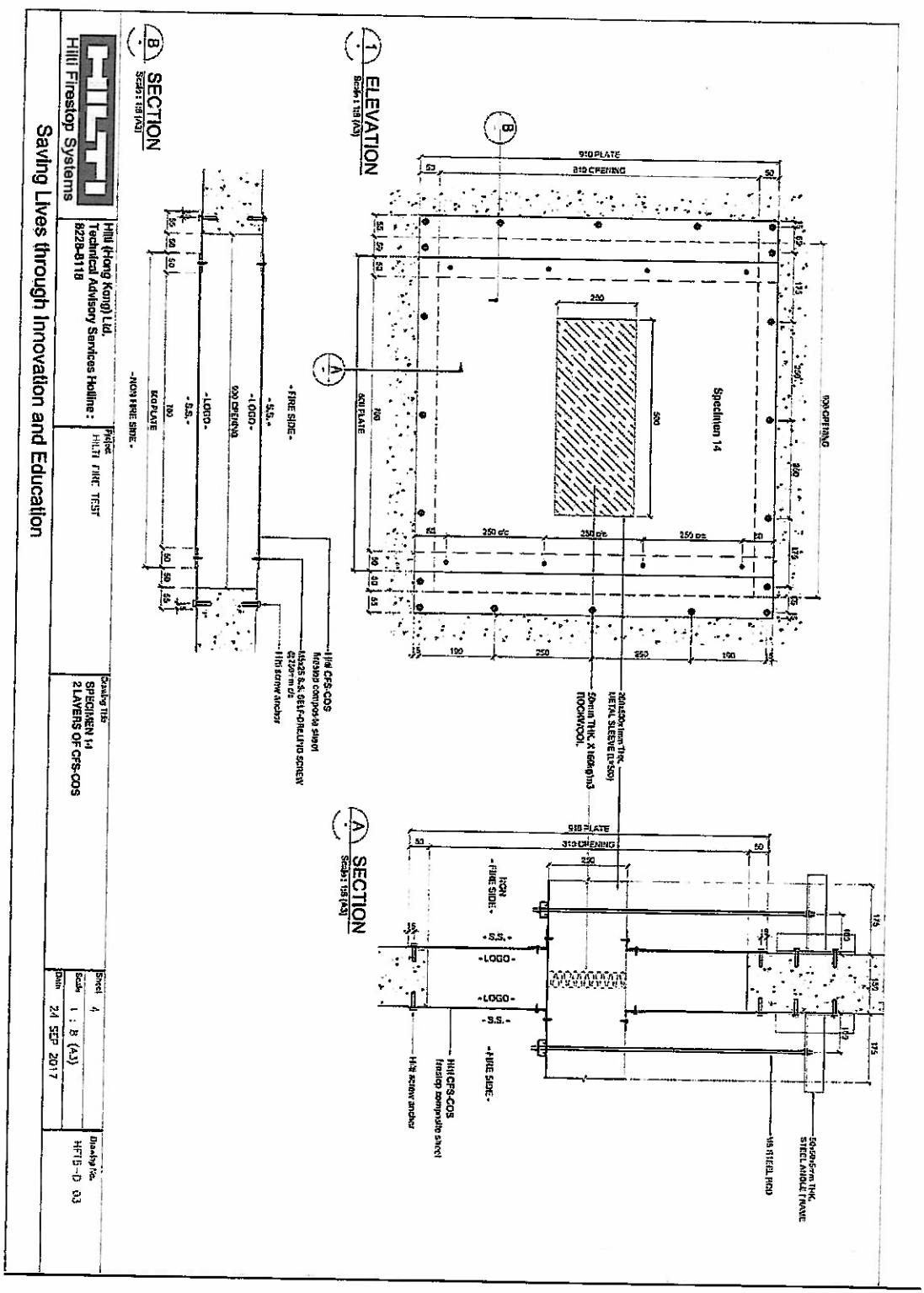
Specimen '12'


Hilti Firestop Systems
Saving Lives through Innovation and Education
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-6116
Project: HILTI FIRE TEST
Drawing title: Specimen 12 1 LAYER OF CFS-COS
Sheet: 2
Scale: 1 : 8 (A3)
Date: 24 SEP 2017
Drawing No.: HFTS-D-01
ELEVATION
SECTION
SECTION
1100 OPENING
910 PLATE
810
Specimen 12
910 OPENING PLATE
- FIRE SIDE -
- S.S. -
- LOGO -
- NON FIRE SIDE -
Hilti CFS-COS
Hilti screw anchor

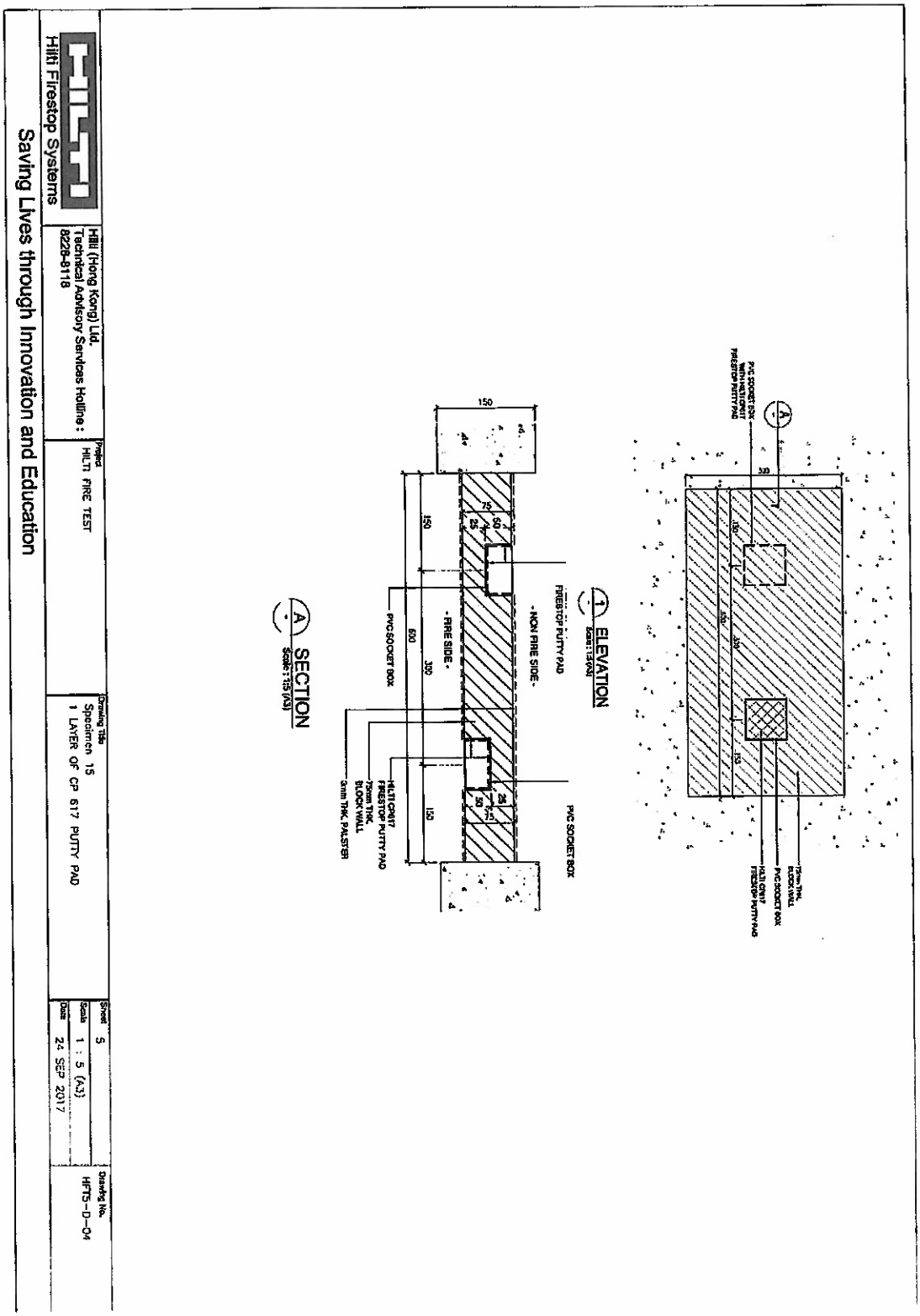
Specimen '13'


Hilti Firestop Systems
Saving Lives through Innovation and Education
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline :
8228-8118
HILTI FIRE TEST
Specimen 13
1 LAYER OF CFS-COS
24 SEP 2017
HTTS-D-07
ELEVATION
SECTION
SECTION
Specimen 13
910 PLATE
810 OPENING
- FIRE SIDE -
- NON FIRE SIDE -
- LOGO -
- S.S. -
M8 screw anchor
Hilti CFS-COS
firestop composite sheet
Hilti screw anchor
- FIRE SIDE -
- NON FIRE SIDE -
- S.S. -
- LOGO -
810 OPENING
910 PLATE
910 STEEL ROD
250x50x6mm THK.
STEEL ANGLE FRAME

Specimen '14'


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 14
2 LAYERS OF CFS-COS
Sheet
4
Scale
1 : 8 (A3)
Date
24 SEP 2017
Drawing No.
HFTS-D 03
SECTION
Scale 1:8 (A3)
ELEVATION
Scale 1:8 (A3)
SECTION
Scale 1:8 (A3)
910 PLATE
910 OPENING
Specimen 14
ROCKWOOL
- FIRE SIDE -
- NON FIRE SIDE -
- S.S. -
- LOGO -
Hilti CFS-COS
firestop composite sheet
Hilti screw anchor
M10 FIEEL ROD
50x50x5mm THK.
STEEL ANGLE FRAME

Specimen '15'


Hilti Firestop Systems
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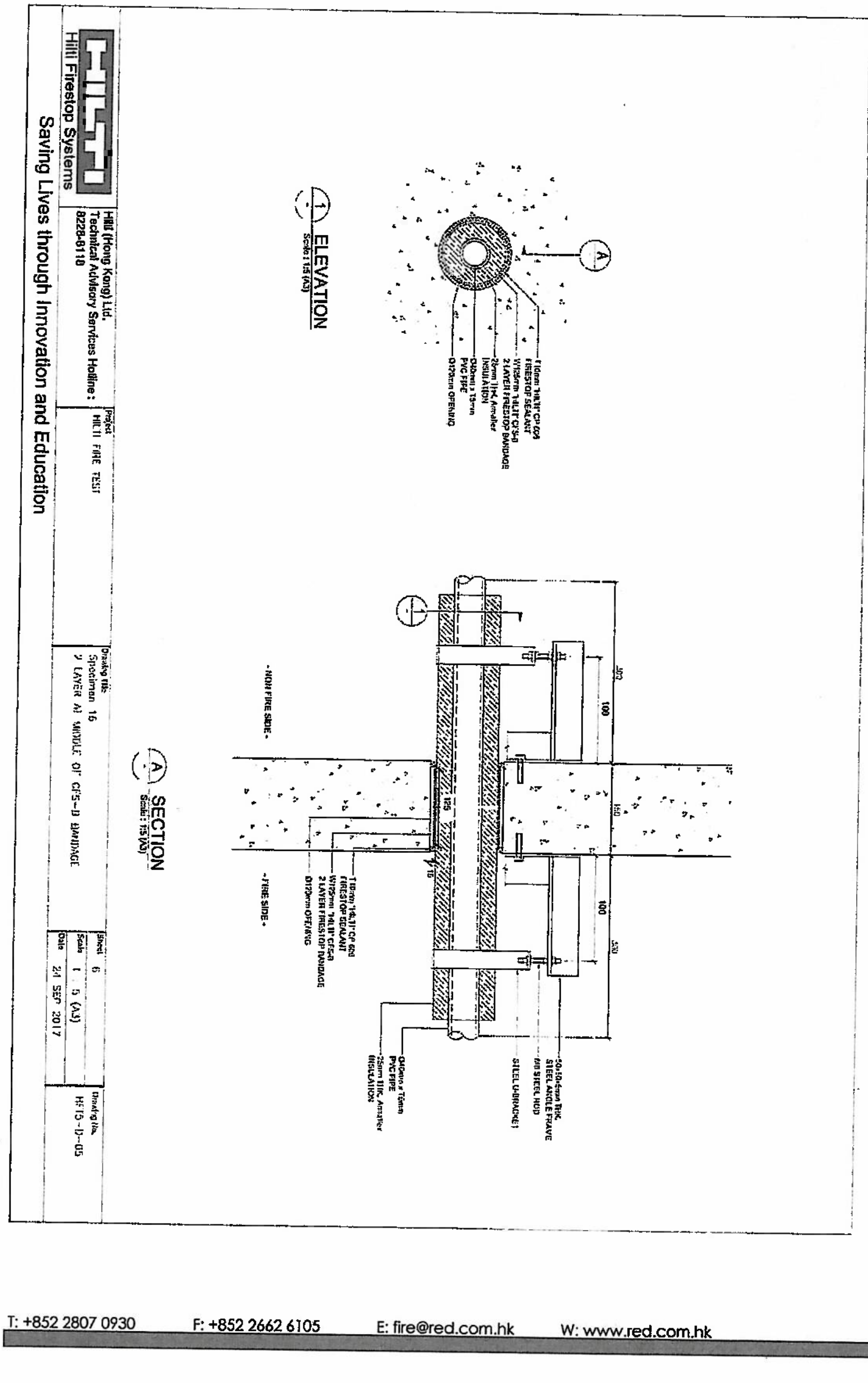
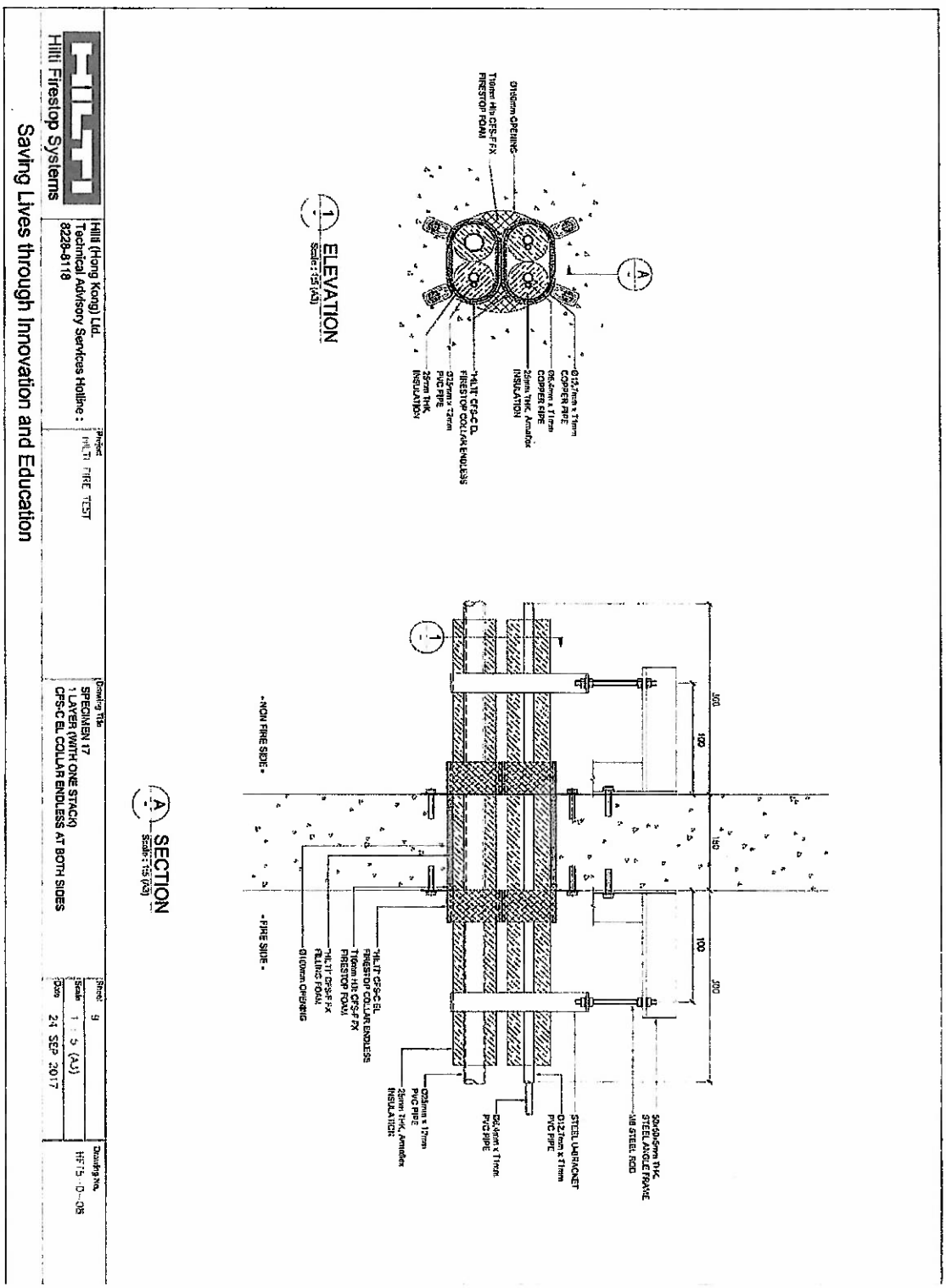
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline :
8228-8118
Project
HILTI FIRE TEST
Drawing Title
Specimen 15
1 LAYER OF CP 617 PUTTY PAD
Sheet
5
Scale
1 : 5 (A3)
Date
24 SEP 2017
Drawing No.
HFTS-D-04
A SECTION
Scale: 1:5 (A3)
1 ELEVATION
Scale: 1:5 (A3)
- NON FIRE SIDE -
- FIRE SIDE -
PVC SOCKET BOX
HILTI CP617 FIRESTOP PUTTY PAD
72mm THK. BLOCK WALL
9mm THK. PALSTER
150
75
50
25
600
320

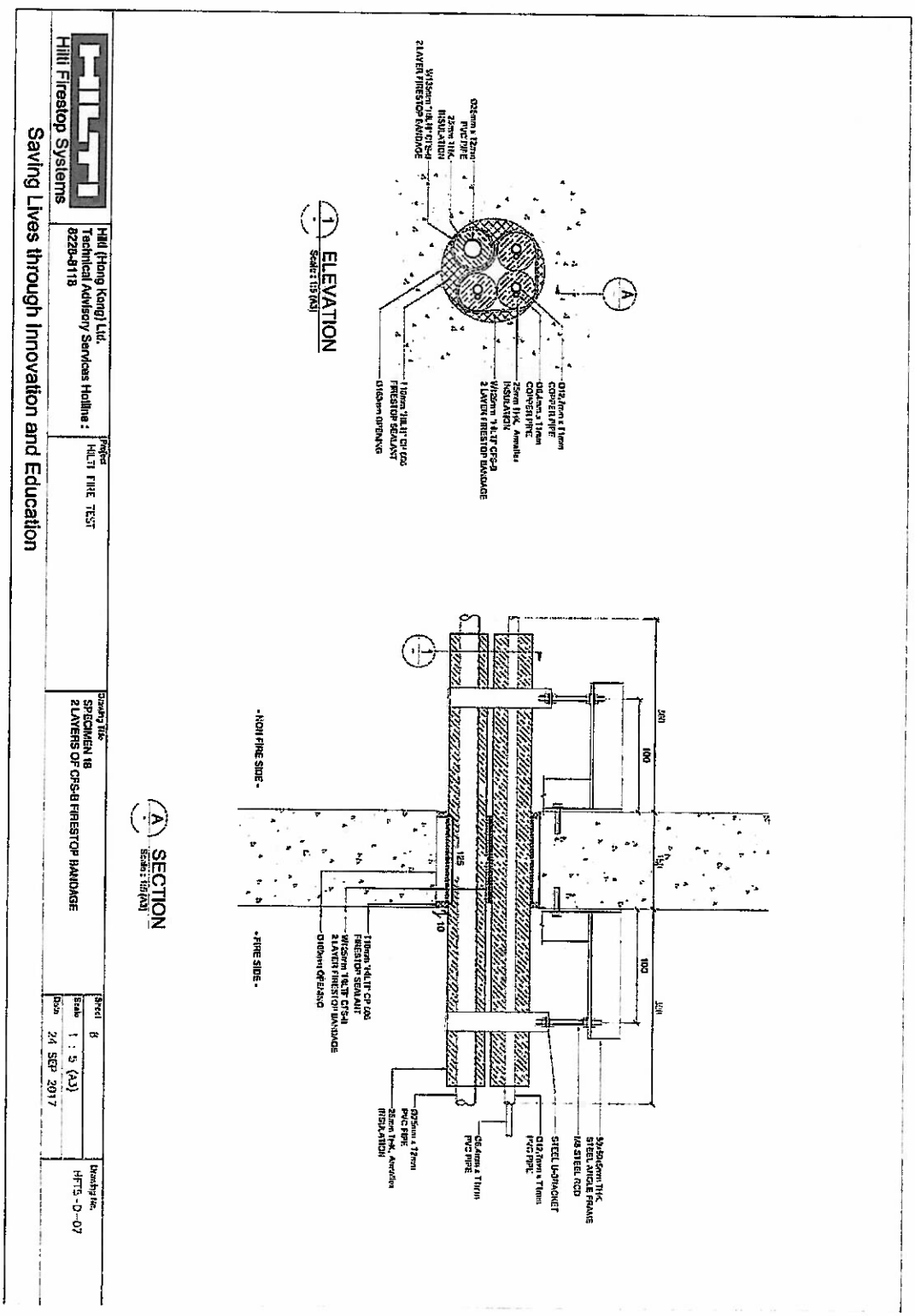
Specimen '16'


Hilti Firestop Systems
Saving Lives through Innovation and Education
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline :
8228-8118
ELEVATION
SECTION
NON FIRE SIDE
FIRE SIDE
HILTI FIRE TEST
Specimen 16
24 SEP 2017

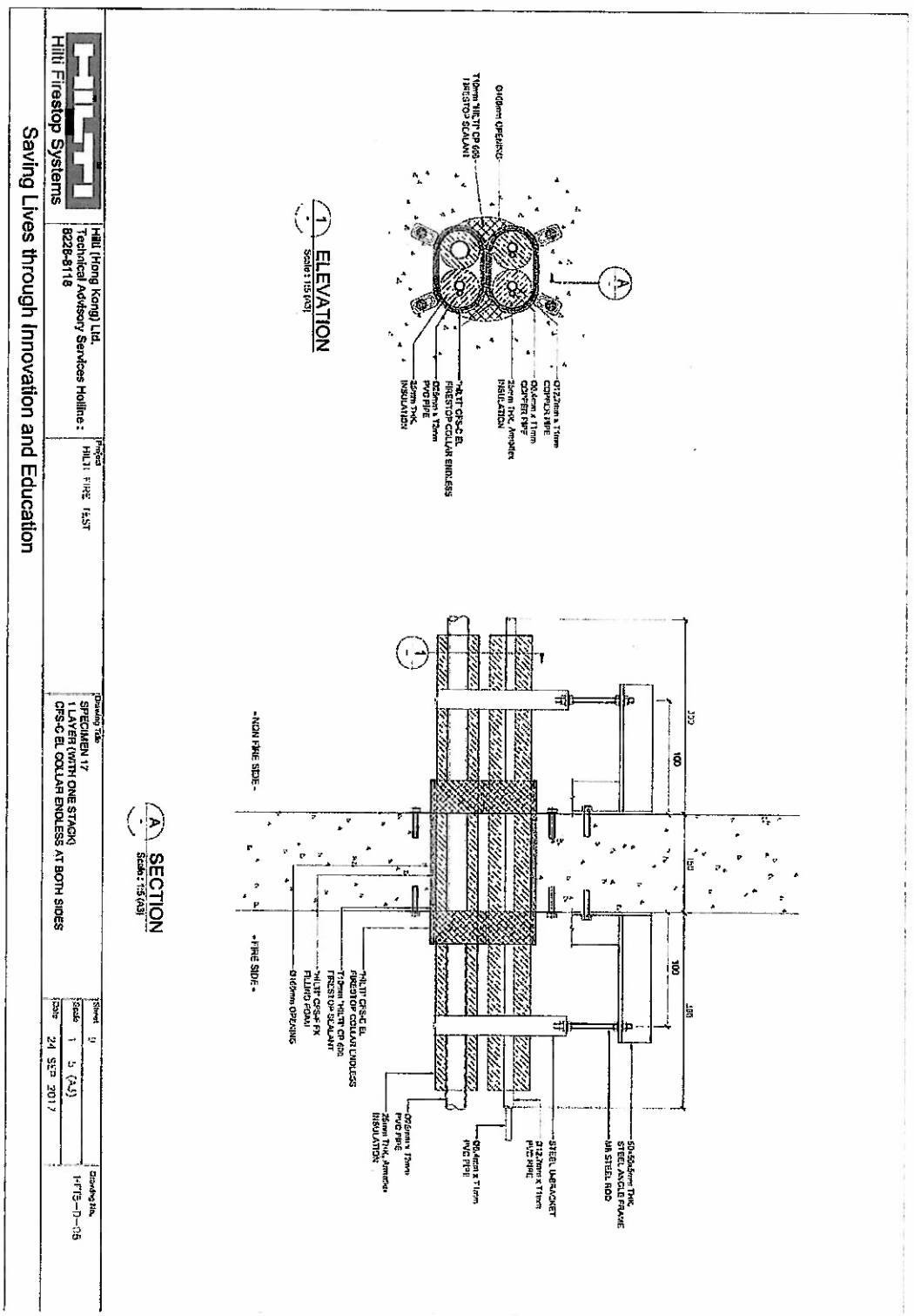
Specimen '17'


Hilti Firestop Systems
Saving Lives through Innovation and Education
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-8118
Project
HILTI FIRE TEST
Drawing Title
SPECIMEN 17
1 LAYER (WITH ONE STACK)
CFS-C EL COLLAR ENDLESS AT BOTH SIDES
Sheet 9
Scale 1 : 2 (A-3)
Date 21 SEP 2017
Drawing no.
HFTS-D-05
1 ELEVATION
Scale: 1:5 (A3)
A SECTION
Scale: 1:5 (A3)
- NON FIRE SIDE -
- FIRE SIDE -
Ø160mm OPENING
Ø117mm x 11mm COPPER PIPE
Ø54.4mm x 11mm COPPER PIPE
25mm THK. Armaflex INSULATION
"HILTI" CFS-C EL FIRESTOP COLLAR ENDLESS
Ø127mm x 12mm PVC PIPE
25mm THK. INSULATION
110mm Hilti CFS-F FX FIRESTOP FOAM
"HILTI" CFS-F FX FILLING FOAM
Ø125mm x 12mm PVC PIPE
Ø54.4mm x 11mm PVC PIPE
STEEL LAMINATE
50x50x5mm THK STEEL ANGLE FRAME
M8 STEEL ROD
500
1200
150
100
100

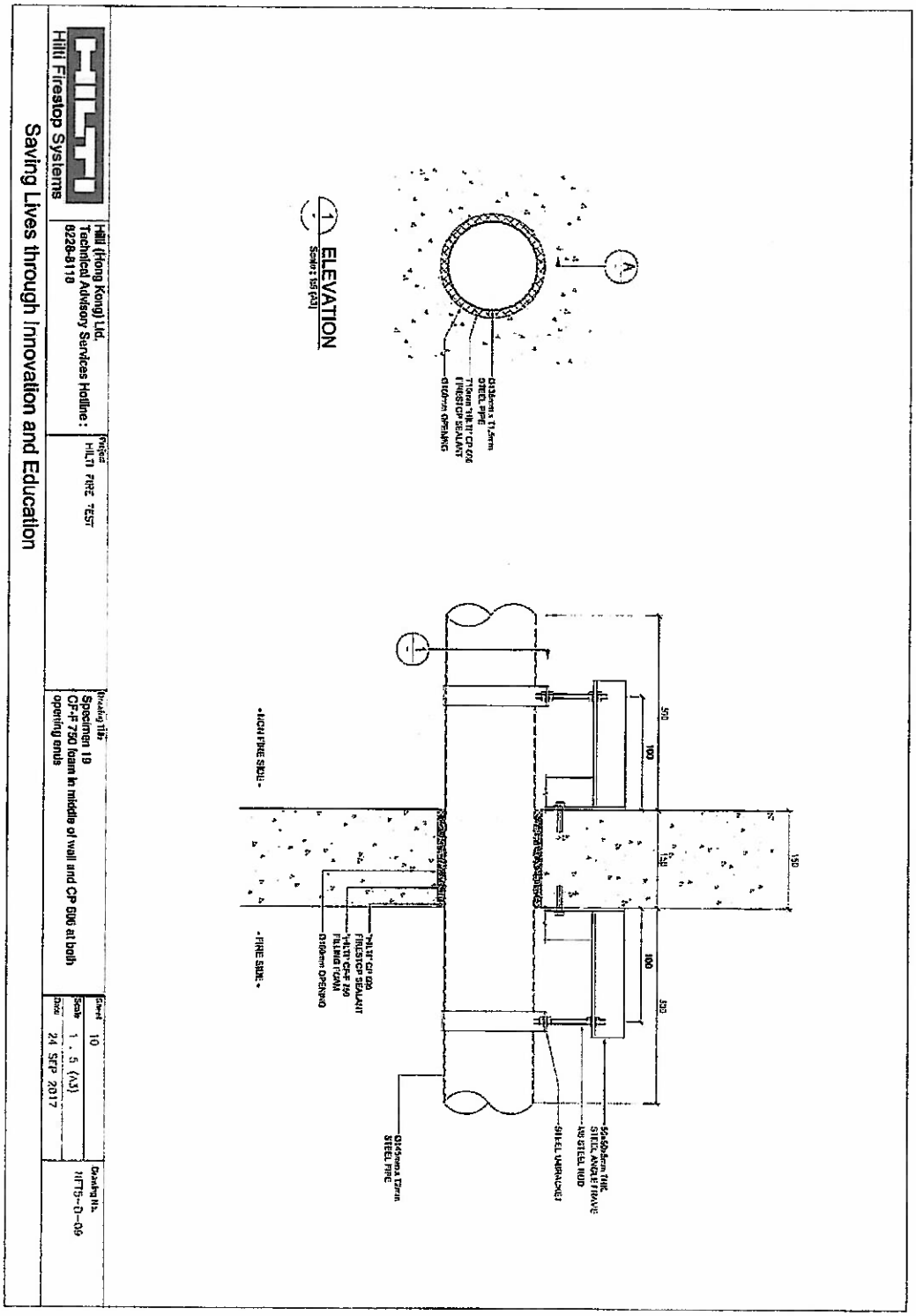
Specimen '18'



Specimen '19'


Hilti Firestop Systems
Saving Lives through Innovation and Education
Hilti (Hong Kong) Ltd.
Technical Advisory Services Hotline : 8228-8118
Drawing Title
SPECIMEN 17
1 LAYER (WITH ONE STACK)
CFS-C EL COLLAR ENDLESS AT BOTH SIDES
Sheet 0
Scale 1 : 5 (A4)
Date 24 SEP 2017
Drawing No. HFTS-D-026
1 ELEVATION
Scale: 1:5 (A3)
A SECTION
Scale: 1:5 (A3)
- NON FIRE SIDE -
- FIRE SIDE -
100
150
100
150
HILTI CFS-C EL FIRESTOP COLLAR ENDLESS
HILTI CFS-F FX FILLING FOAM
HILTI CFS-SP SEALANT
STEEL ANGLE FRAME
STEEL LABYRACKET

Specimen '20'



- End of report -

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

HOKLAS 091 TEST

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

On Insulated Pipe System with CFS-B Bandage

Test Report No.: R15K33-1A

Identification No.: Q15K20

Issue Date: 15th February 2016

Testing Location:

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

Test Sponsor

Hilti (Hong Kong) Limited
701-704 & 708B, Tower A Manulife Financial Centre,
223 Wai Yip Street, Kwun Tong, Kowloon

APPROVED SIGNATORY: _____ **DATE:** 15 FEB 2016

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

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CONTENT

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1 SUMMARY

Fire resistance test conducted in accordance with BS 476: Part 20: 1987 on insulated pipe system with CFS-B bandage.

Five nos. of specimen, namely specimen 'A' to 'E' of insulated pipe systems with CFS-B bandage had been subjected to a test in accordance with BS 476: Part 20: 1987, in order to determine its fire resistance performance. Only specimen 'A' was considered in this report. As requested by the test sponsor, the specimen was horizontally mounted within concrete slab, a concrete floor penetration set up, by the test sponsor. The specimen was asymmetrical and only one side of the specimen was tested, for which the fire side was requested by the test sponsor.

Specimen 'A' 1,200 mm long pre-insulated pipe system. The specimen was constructed by a black steel pipe with sizes of 406 mm diameter and 1,200 mm long. The pipes was surrounded by nominal 75 mm thick armaflex insulation and 3 layers of CFS-B bandages with sizes of 127 mm wide by 2 mm thick at bottom of pipe system.

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

Integrity: **121** Minutes
Insulation: **92** 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 insulated pipe system with CFS-B bandage 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 & 708B, Tower A Manulife Financial Centre,
223 Wai Yip Street, Kwun Tong, Kowloon

3.2 Testing Location

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

RED
Fire and Facade Consultants

3.3 Date of Test

7th December 2015

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 Mr. Andrew Lau, Mr. Jimmy Chan, Dr. Selina Lin and Mr. Dennis Yeung, the representatives of test sponsor.

4 EQUIPMENT

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

Eight (8) 'type K' thermocouples to monitor the temperature of the unexposed face of the specimen (see Figure 2).

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

A micro-manometer provided to monitor the furnace pressure.

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 specimen.

5 CONDITIONING

The specimen's 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 20 °C to 22 °C and 60 % to 66 % respectively.

6 TEST SPECIMEN CONSTRUCTION

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

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

7 TEST PROCEDURES

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

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

The temperature of the unexposed face was monitored by means of eight (8) thermocouples fixed to the unexposed surface (see Figure 2 for the locations and reference numbers of the thermocouples). Thermocouples S1 - S4 were fixed on the specimen 'A' for mean and maximum temperatures of the unexposed surface of specimen 'A'. Thermocouples S5 - S8 were fixed on the concrete slab, 50 mm away from the opening of specimen 'A' for maximum temperature only. The mean and maximum temperatures were recorded.

The 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 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 recorded is shown graphically in Figure 3.

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

The furnace pressure is shown graphically in Figure 5.

The radiation is shown graphically in Figure 6.

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

The mean furnace temperature obtained is summarized in Table 1.

The temperature rises of specimen obtained are 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: **121** Minutes
Insulation: **92** 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.

The 140 °C rise of the mean temperature of the unexposed surface of specimen reached after a heating period of 93 minutes. The 180 °C rise of the maximum temperature of the unexposed surface of specimen reached and measured by thermocouple S1 after a heating period of 92 minutes. The maximum temperature rise was 295 °C measured by thermocouple S1 after a heating period of 100 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.

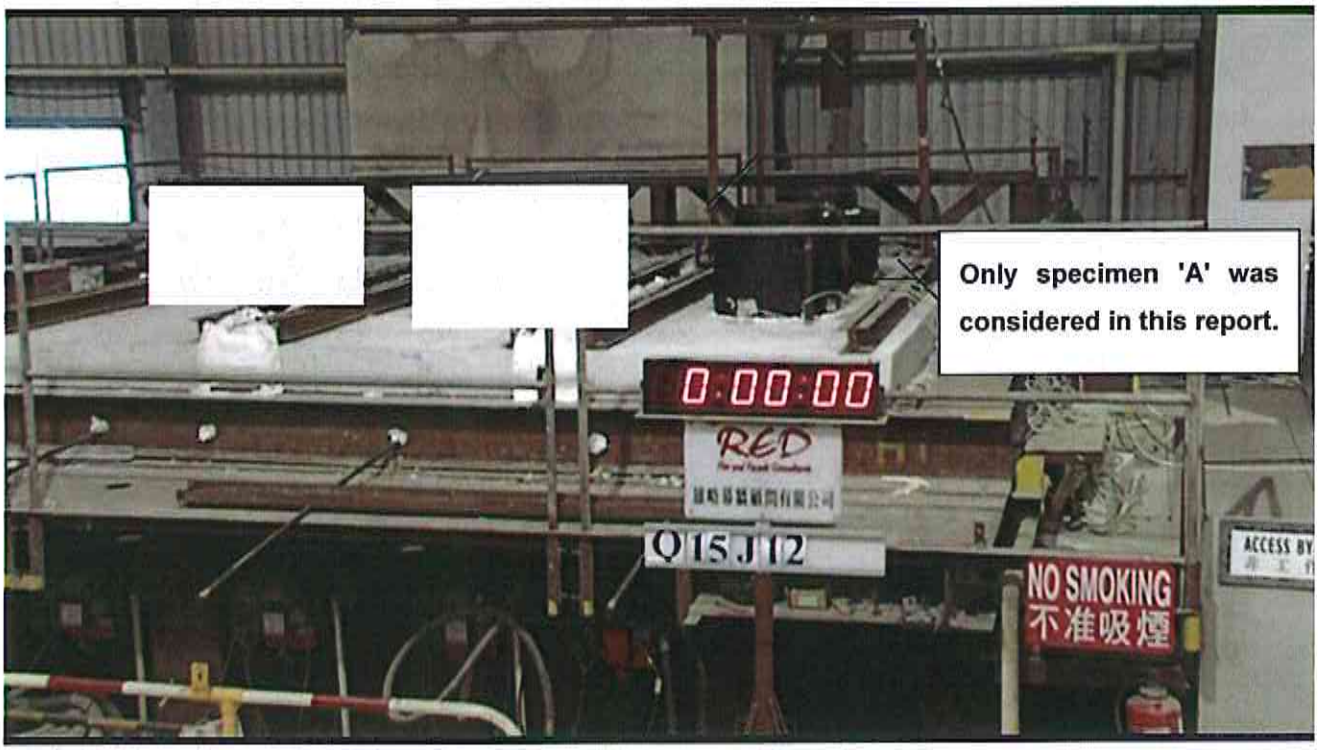
The specimen met the integrity requirements after a heating period of 121 minutes.

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



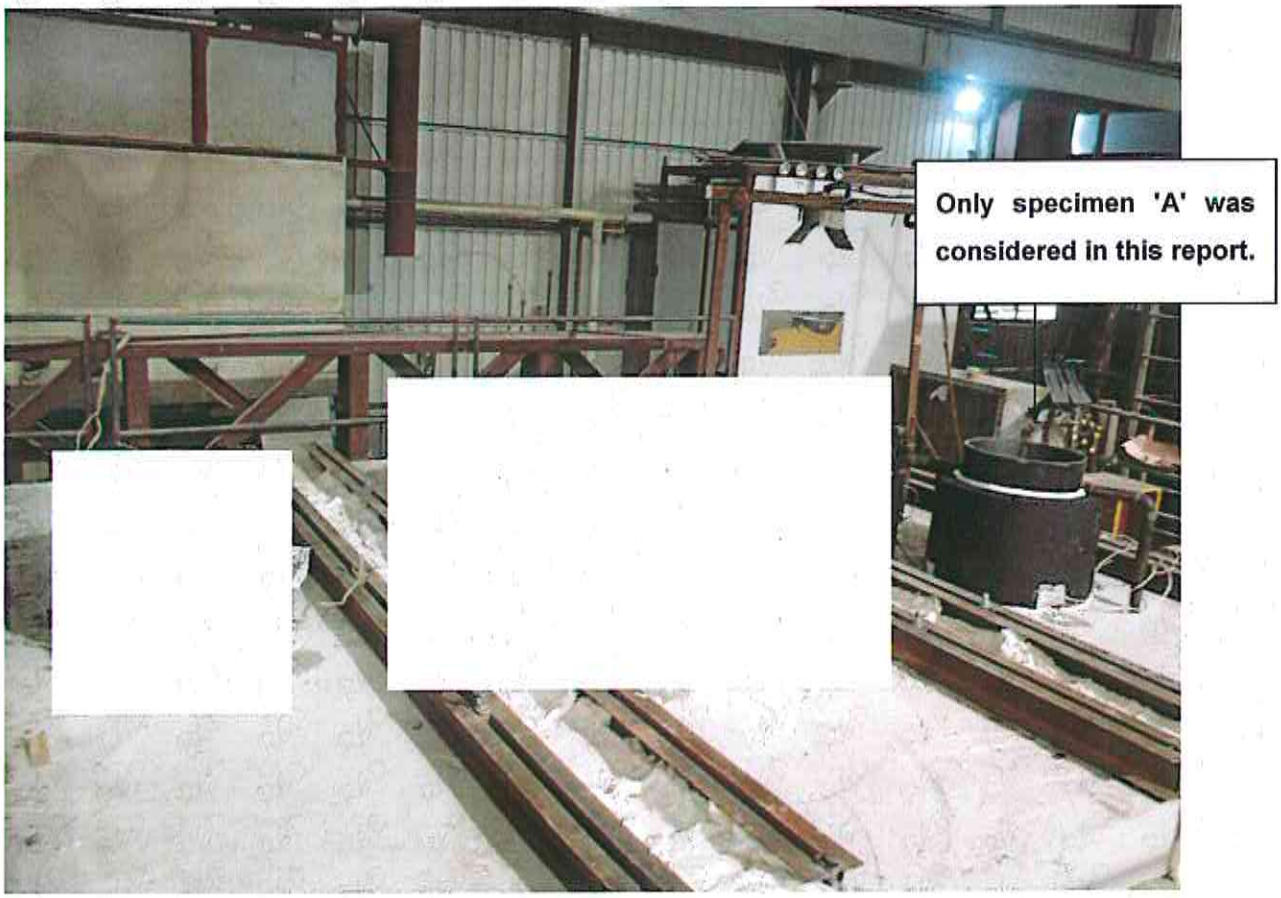


Photo 1: The unexposed face of the specimen before the test.

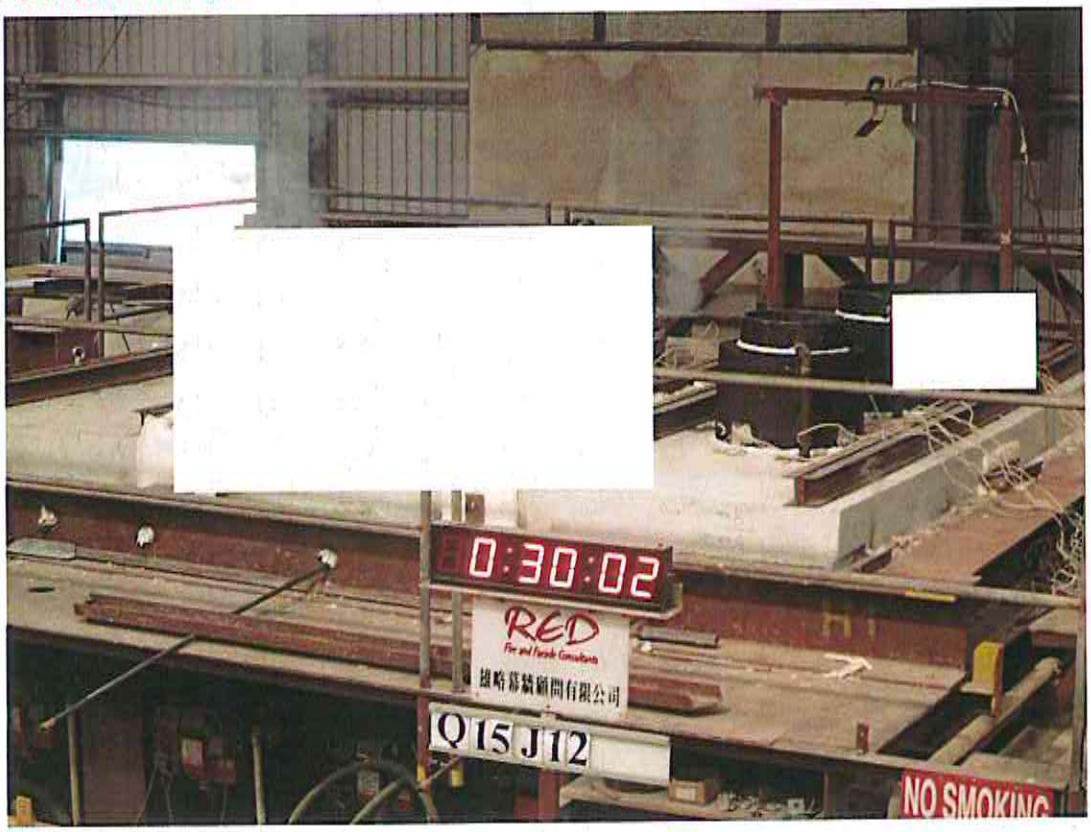


Photo 2: The unexposed face of the specimen after a heating period of 30 minutes.

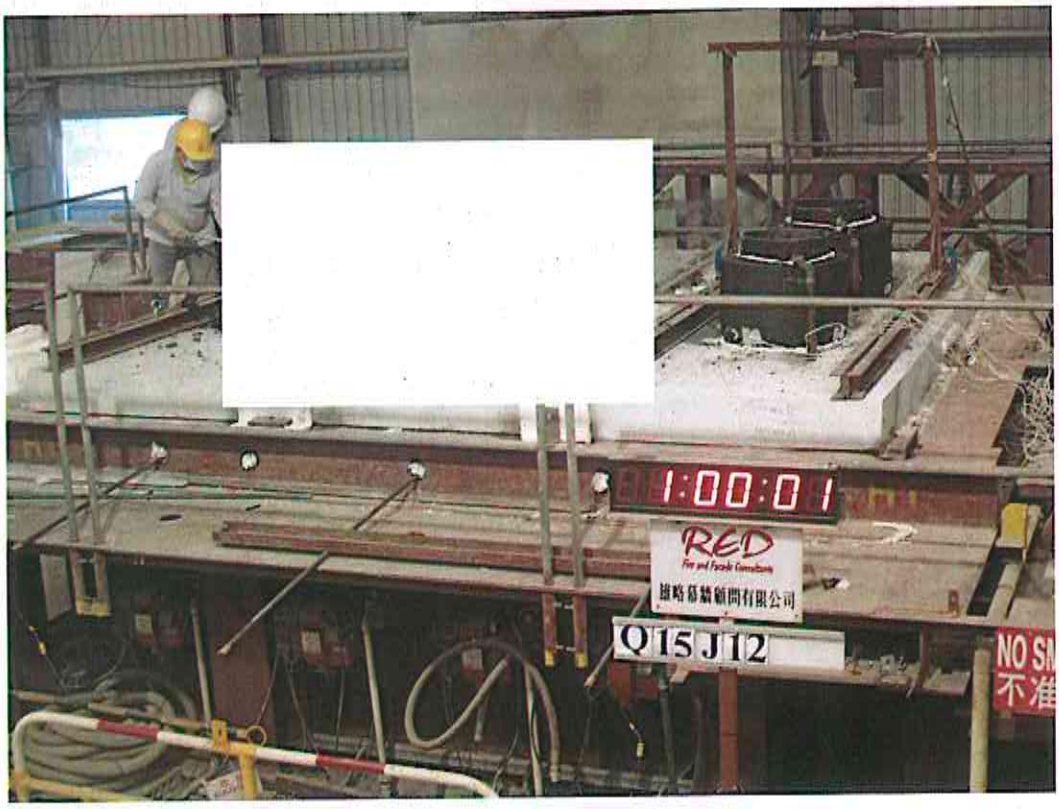


Photo 3: The unexposed face of the specimen after a heating period of 60 minutes.

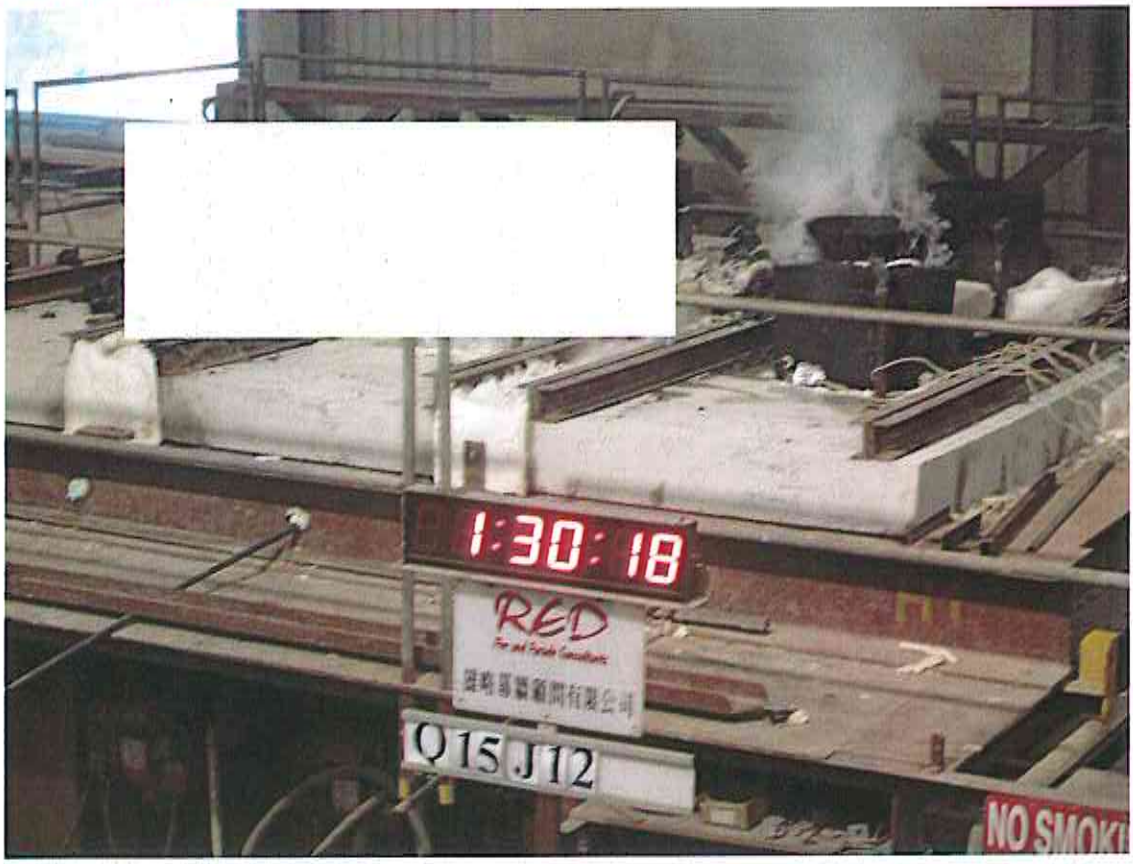


Photo 5: The unexposed face of the specimen after a heating of 90 minutes.

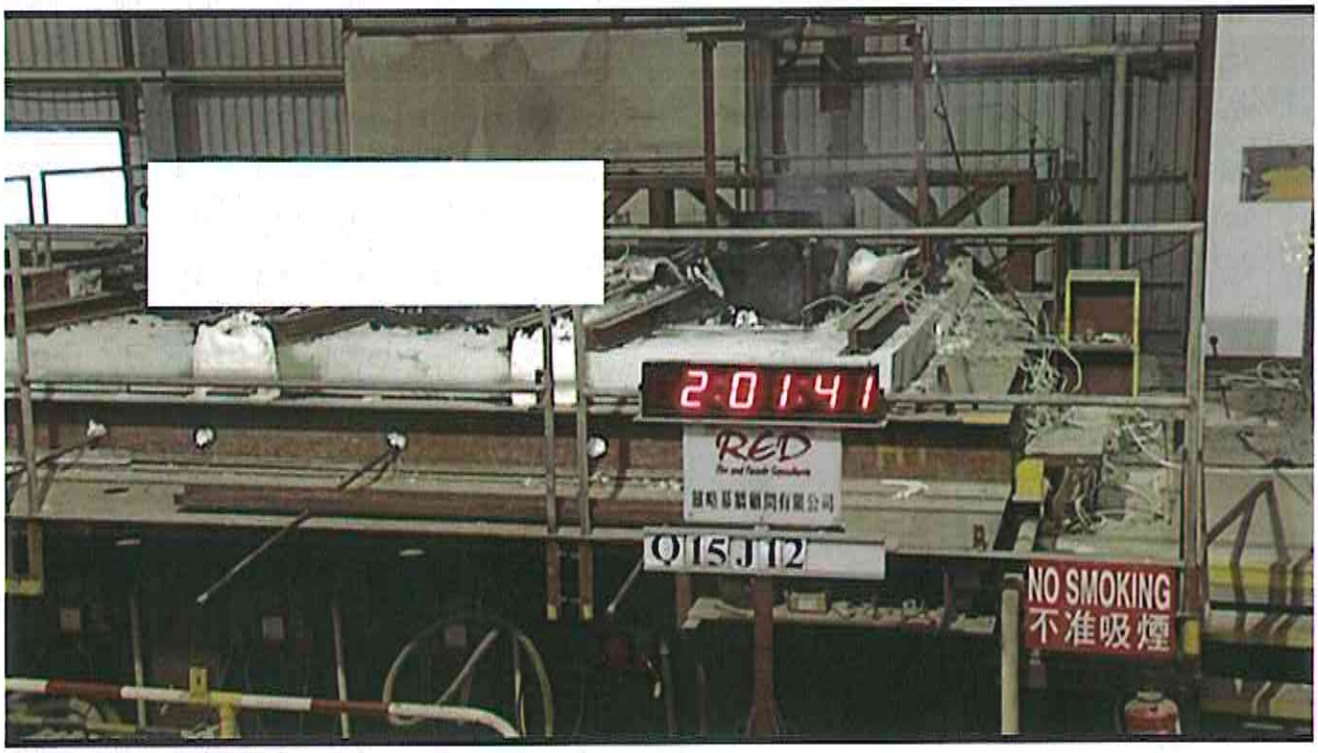


Photo 6: The unexposed face of the specimen after the test.

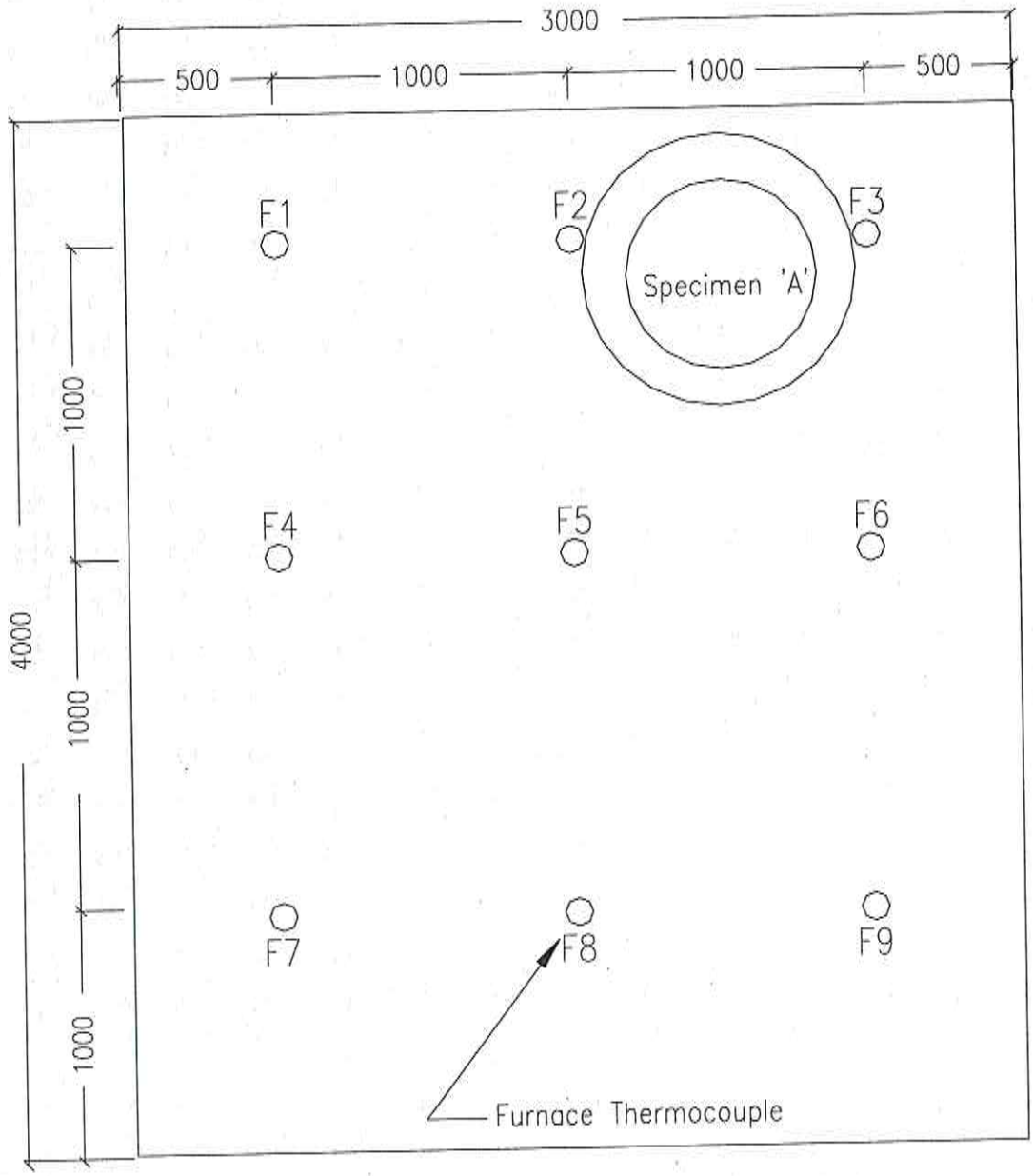


Figure 1 – Locations and reference numbers of furnace thermocouples.
(This figure is not to scale and all dimensions are in millimetres.)

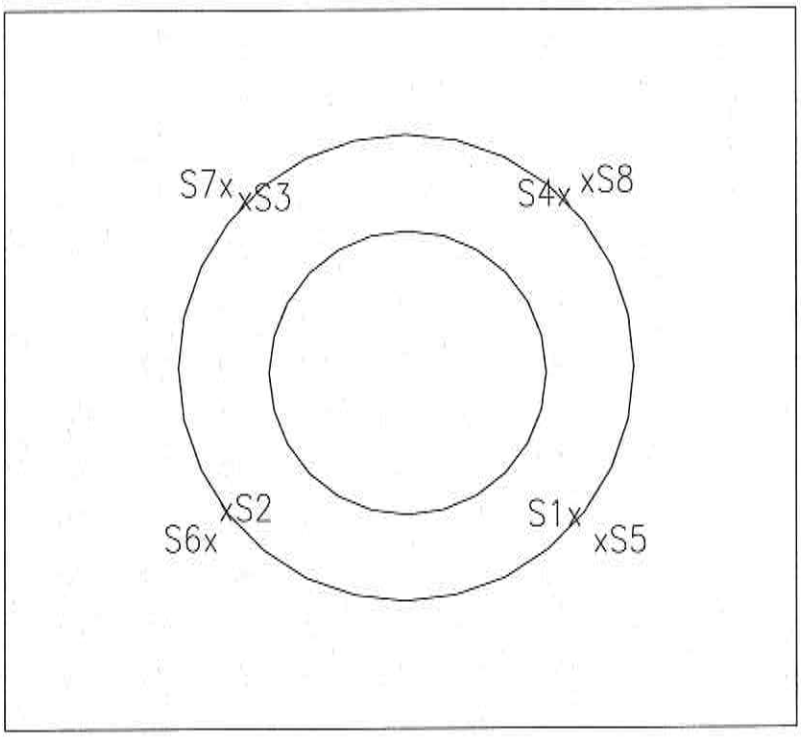


Figure 2 – Locations and reference number of thermocouples to monitor the temperature of unexposed surface of the specimen.
(This figure is not to scale.)

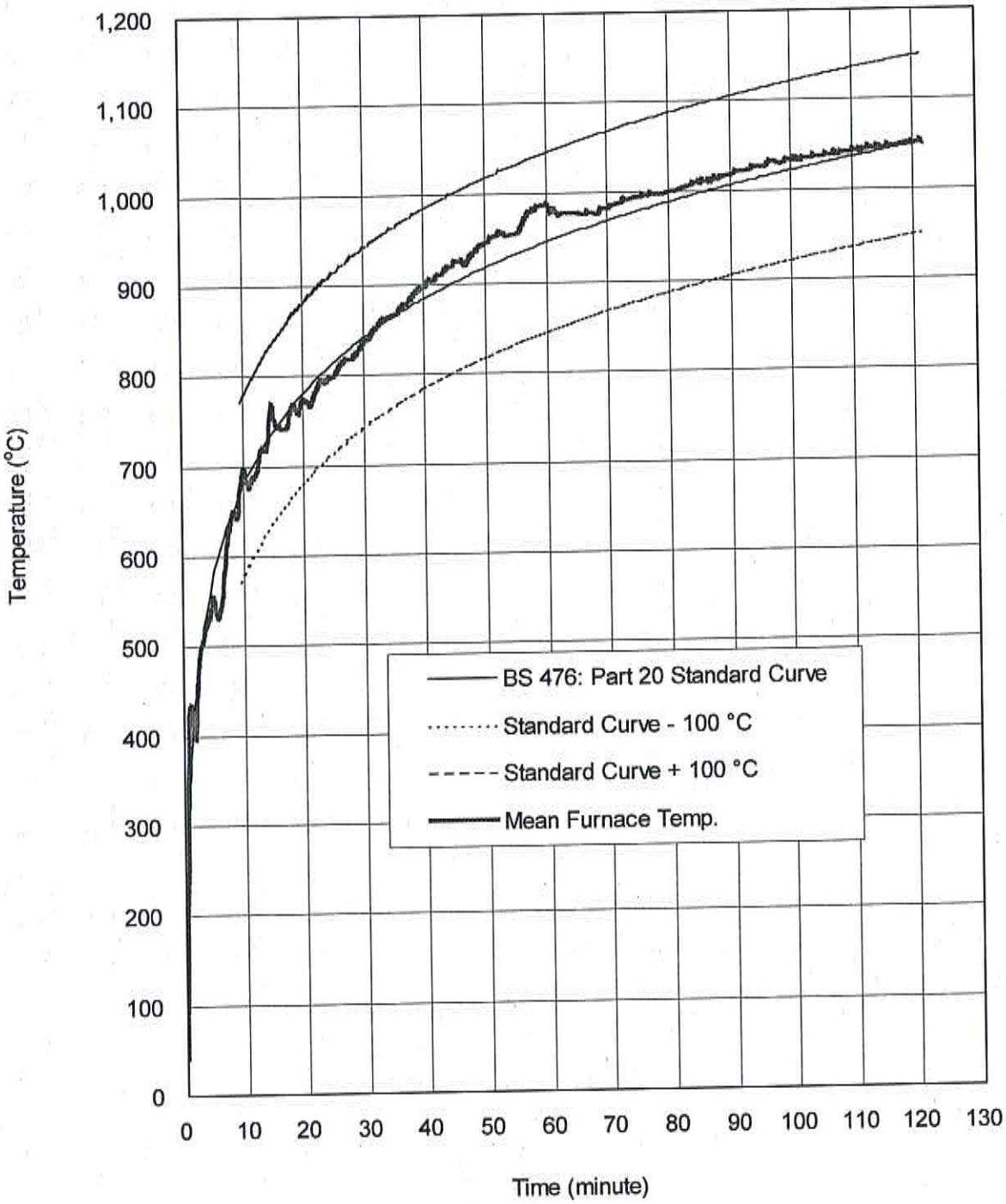


Figure 3 – Mean furnace temperature.

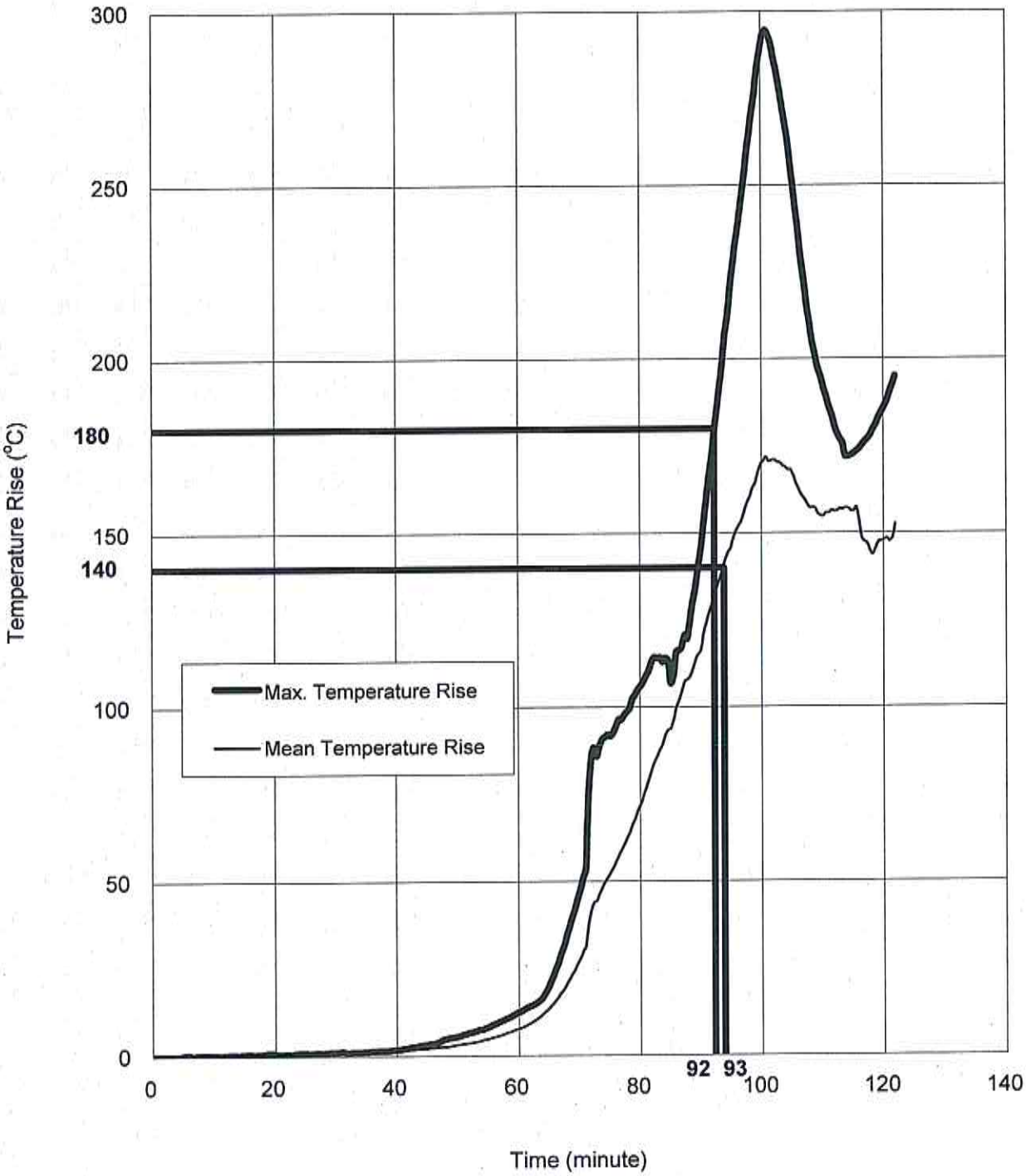


Figure 4 – Temperature rises of unexposed surface of specimen 'A'.

After the first 5 minutes of the test, the furnace pressure was maintained at 20 ± 2 Pa relative to atmosphere, at the bottom of the specimen.

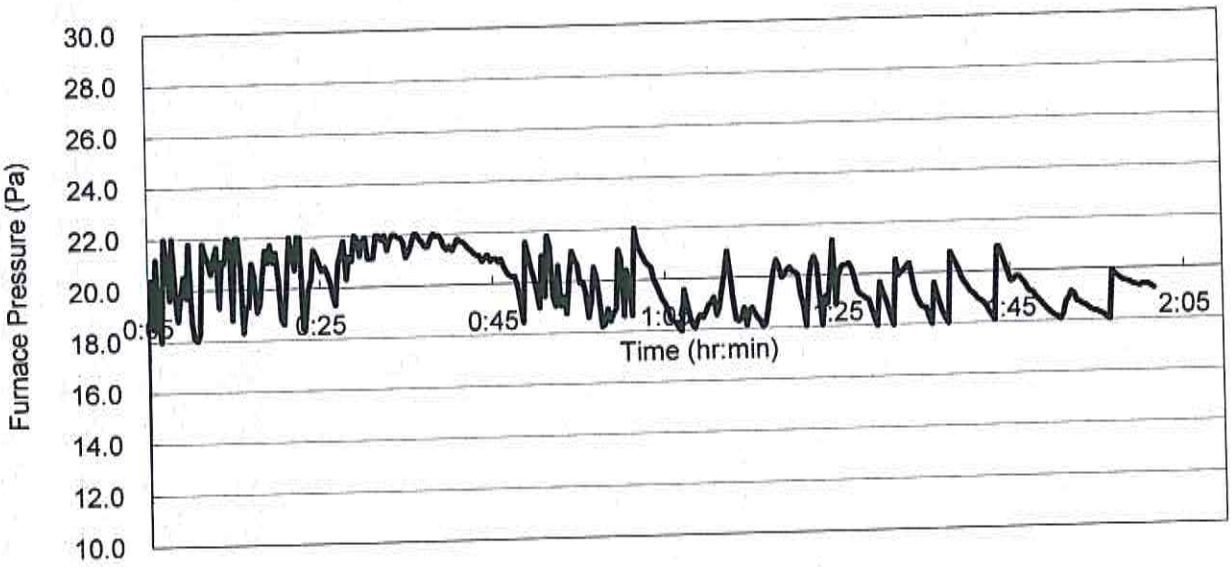


Figure 5 – Furnace pressure.

A radiometer placed at 1,500 mm away from the unexposed surface to measure the radiation of unexposed surface of the specimen.

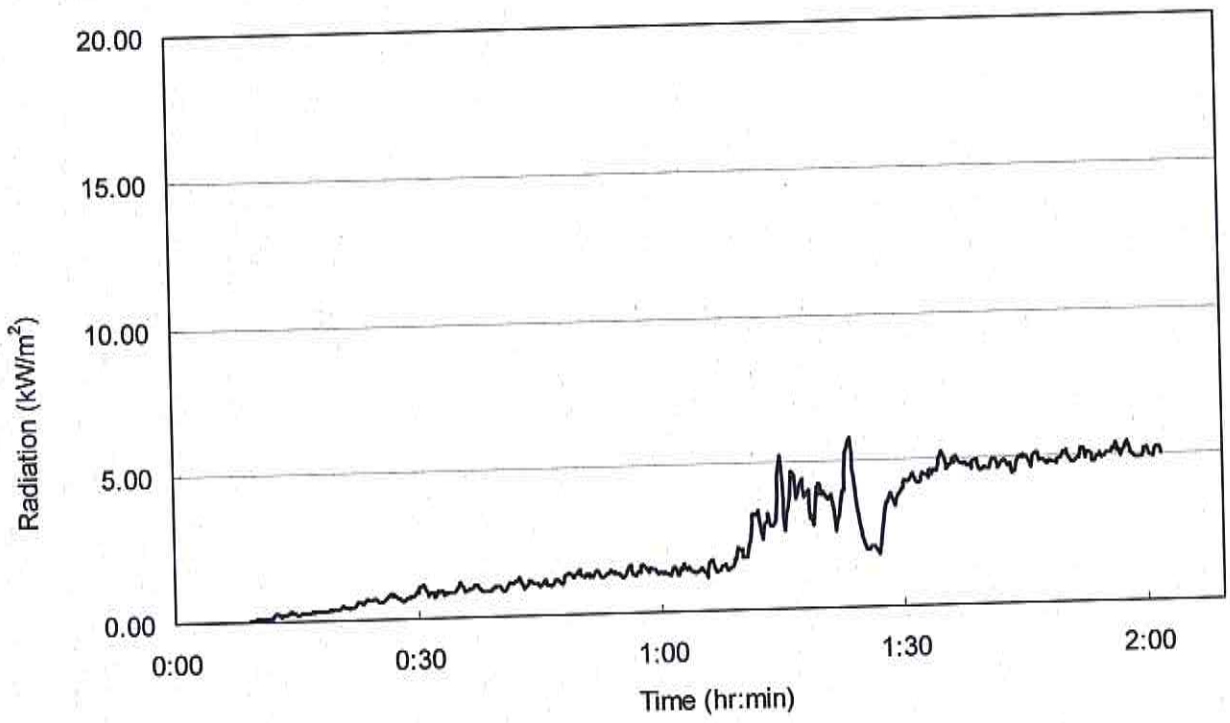


Figure 6 – Radiation.

Fire and Facade Consultants

APPENDIX B – Observation

Time (min.sec)	Exposed (E) or Unexposed (U)	Observation
00.00	-	Test started.
09.29	E	The insulation materials burned.
15.04	U	Pop sound heard from the specimen.
26.28	E	The insulation materials detached from the specimen.
30.00	U	Specimen 'A' satisfied the integrity and insulation requirements.
31.00	E	Fire sealant detached from the specimen.
38.30	U	No significant change was observed from the specimen.
54.00	U	Cotton pad test applied at specimen and the test was passed.
60.00	U	Specimen 'A' satisfied the integrity and insulation requirements.
61.57	U	Smoke started releasing from the specimen.
90.00	U	Specimen 'A' satisfied the integrity and insulation requirements.
91.56	U	Specimen 'A' deformed.
120.00	U	Specimen 'A' satisfied the integrity requirements.
121.41	--	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	41
5	576	555
10	678	697
15	739	746
20	781	771
25	815	799
30	842	836
35	865	867
40	885	899
45	902	925
50	918	944
55	932	955
60	945	986
65	957	978
70	968	983
75	979	996
80	988	1000
85	997	1009
90	1006	1019
95	1014	1028
100	1022	1033
105	1029	1038
110	1036	1043
115	1043	1046
120	1049	1050
121	1050	1050

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 S1 - S8.

Time (min)	S1	S2	S3	S4	S5	S6	S7	S8
0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
15	0	0	0	0	1	0	0	1
20	0	0	0	0	1	0	0	1
25	1	0	0	0	1	0	0	1
30	1	1	1	1	1	0	0	1
35	1	1	1	1	1	1	1	1
40	2	2	2	1	1	1	2	1
45	2	2	2	2	1	1	3	1
50	3	3	4	3	2	2	6	2
55	5	5	6	4	2	4	8	2
60	7	7	10	7	2	6	12	2
65	11	12	21	12	4	9	18	3
70	22	21	48	22	3	11	24	3
75	41	38	92	39	4	14	31	4
80	60	70	106	53	3	17	37	5
85	94	101	107	74	3	20	42	6
90	146	121	108	92	3	24	43	7
95	220	139	120	104	3	28	43	8
100	289	151	124	115	3	32	44	10
105	257	161	125	130	3	35	44	10
110	192	169	113	145	4	38	44	10
115	167	173	124	162	4	41	45	14
120	102	186	130	174	3	44	46	11
121	102	195	133	179	3	45	46	11

Notes: Locations of thermocouples S1 - S8 are shown in Figure 2.

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

APPENDIX D – Information from Test Sponsor

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

Item	Description	
1	**Black Metal Pipe**	
	Brand	: SeAH (PSP).
	Manufacturer	: SeAH steel pipe.
	Materials	::Black steel.#
	Inner pipe sizes	1,210 mm long by 406 mm diameter by 8 mm thick.*
	Fixing details	Welded to 2 nos. of black steel handles which placed on the concrete slab.#
2b	**Insulation (Armaflex)**	
	Brand & Model	::Armaflex.
	Generic type	: Type "D" - Flexible Closed Cell Elastomeric Insulation - Armaflex.
	Density	: 40 kg/m^3.
	Thickness	: 75 mm.
	Fixing method	: Adhere at the surface and mechanically attached with metal wire.
	Applied location	Surrounded the pipe with 1,000 mm long at bottom portion of pipe.#
3	**CFS-B Bandage**	
	Brand & Model	::Hilti Firestop Bandage CFS-B.
	Material	: Polymer-bonded intumescent material.
	Sizes	: 3 layers of 127 mm wide by 2 mm thick.*
	Applied location	: Surrounded the insulation at centre portion of pipe below the concrete slab.#
4	**Fire Sealant**	
	Brand & Model	::Hilti Acrylic Firestop Sealant CP606.#
	Applied location	Filled the gaps between the pipes and concrete slabs at exposed and unexposed sides.#

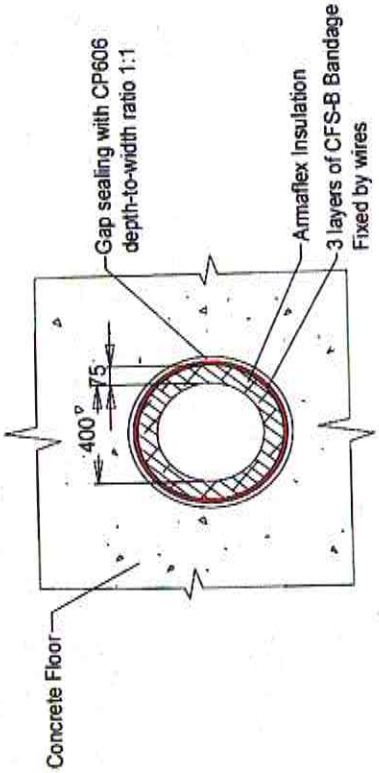
*Notes: * Verified on site by RED.*

 # As shown on the test construction.

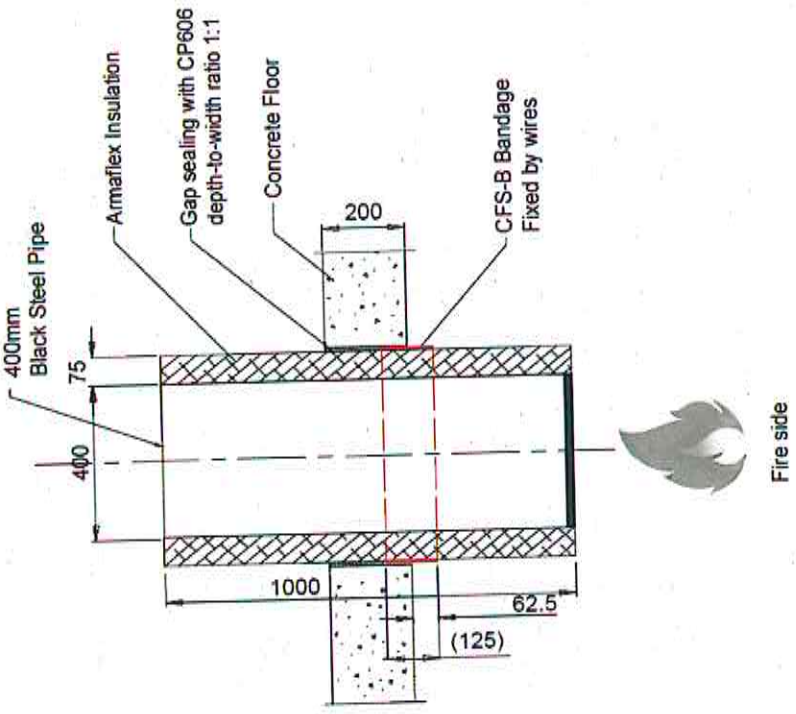
Drawings from Test Sponsor

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

TOP VIEW



SIDE VIEW



- End of report -

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
電訊掣號 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

Number and date should be quoted in reference to this letter

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

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

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

Dear Sirs,

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

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

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

Yours faithfully,

WM Tang

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

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

Attn. : To whom it may concern

Date : 26 September 2023
Ref. : 095/FP/DY/23

Subject : Country of Origin- Hilti CFS-B Firestop Bandage

Dear Sir / Madam,

Enclosed please find the information of Hilti CFS-B Firestop Bandage.

Brand Name : Hilti

Model Name : Hilti CFS-B Firestop Bandage

Manufacturer : Hilti Corporation

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

Manufacturer Contact Person : Dennis Yeung

Supplier : Hilti (Hong Kong) Ltd

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

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

Country of Origin : Germany

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

Yours faithfully,

Dennis Yeung
Head of Product Leadership Strategy, F&P

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

To whom it may concern

Date:13th Mar 2018

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-B Firestop Bandage 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-B Firestop Bandage Job Reference

Year	Project Name	Customer Name	Project type
2021	HING WAH ST WEST LOT 6550 HOTEL	CONCORD AIR-CONDITIONING &	Hospitality
2021	1-11 AU PUI WAN ST, FO TAN	KEUNG FAT ENGINEERING CO LTD	Residential
2021	LO FAI RD (EAST) TPTL 223 & 229	CHIT TAT ELECTRICAL ENGINEERING LTD	Residential
2021	SCL 1123 EXHIBITION STATION	LUEN SHING ENGINEERING COMPANY	Infrastructure
2021	TKO LOHAS PARK PH9 (SITE J)	TECHNICON ENGINEERING LIMITED	Residential
2021	WONG CHUK HANG STATION PH1 (SITE A)	LUEN FAT (UNI) AIR-CONDITIONING	Residential
2021	166 CASTLE PEAK RD - TAI LAM, TMTL 523	PAK MING ENGINEERING CO	Residential
2021	7 MUK TAI ST, KAI TAK 1K3 (6565)	EVER GAIN AIR CONDITION ENGINEERING	Residential
2022	QUEEN MARY HOSPITAL PH1 (SS F501)	SHUN CHEONG BUILDING SERVICES	Health
2022	KAI TAK SPORTS PARK	SHING FUNG ENGINEERING LTD	Sport & Recreation
2022	HING WAH ST WEST LOT 6550 HOTEL	CONCORD AIR-CONDITIONING &	Hospitality
2022	SHING KAI RD, KAI TAK NKIL 6607	MAJESTIC PLUMBING ENGINEERS LTD	Hospitality
2022		ELEGANT ENGINEERING CO.	Industrial
2022	YAU MA TEI- KWONG WAH HOSPITAL PHASE 1	WING FUNG ENGINEERING (H.K.) LTD	Health
2022	YIN PING RD, TAI WO PING (6542)	YUK WAI ENG CO	Residential
2023	WEST KOWLOON - LYRIC THEATRE - (IPS)	PATWIN ENGINEERING CO. LIMITED	Community & Cultural
2023	HKIA 3508 TERMINAL 2	LUEN SHING ENGINEERING COMPANY	Transport
2023	CYBERPORT PH5	HOI KO E&M ENGINEERING COMPANY	Office
2023	TKO LOHAS PARK PH12 (SITE D)	ZHONG HENG ENGINEERING (HK) LIMITED	Residential
2023	SHING KAI RD, KAI TAK NKIL 6607	MAJESTIC PLUMBING ENGINEERS LTD	Hospitality
2023	R6 CTL KLN ROUTE-KAI TAK WEST HY/2014/07	HOI KO E&M ENGINEERING COMPANY	Infrastructure
2024	QUEEN MARY HOSPITAL PH1 (SS F501)	SHUN CHEONG BUILDING SERVICES	Health
2024	TKO LOHAS PARK PH12 (SITE D)	ZHONG HENG ENGINEERING (HK) LIMITED	Residential
2024	53-55A KWUN TONG RD	EVER GAIN AIR CONDITION ENGINEERING	Residential