Hilti CP644 Firestop Collar

Submission Folder

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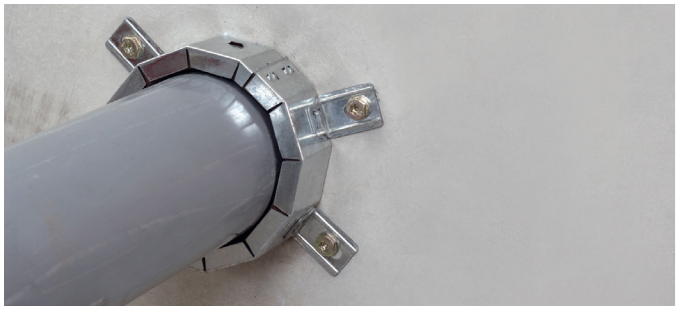
Firestop collar CP 644



APPLICATIONS

- Sealing flammable pipes from 180 mm to 250 mm in diameter in penetrations through fire compartment walls and floors

ADVANTAGES

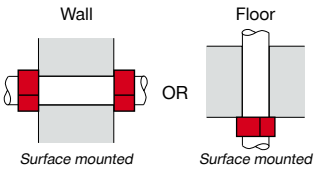
- Ready-to-use firestop collar with a galvanized steel housing
- Latch mechanism for quick and easy closure
- Flexible hook positioning for convenient fastening

Technical data	
Base materials	Concrete, Masonry, Drywall
Expansion temperature (approx.)	210 °C
Expansion ratio (unrestricted, up to)	1:17
Storage and transportation temperature range	-5 - 50 °C
Colour	Metallic grey

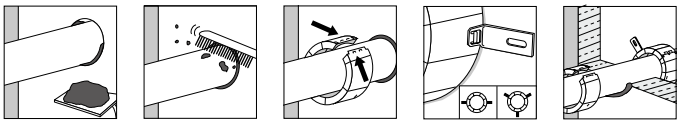
Siesmic

Mould & Mildew

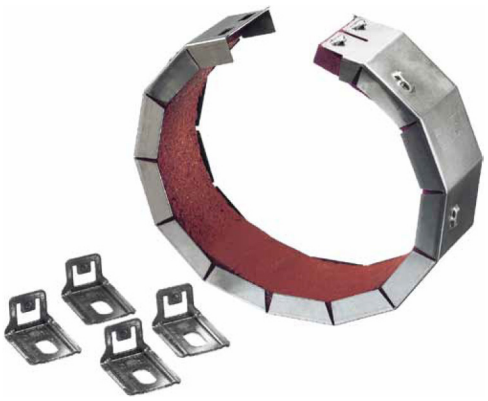
Fixing Method



Application Procedure



1. Close remaining gap by mortar or by CP606 for smoke and acoustic seal
2. Clean plastic pipe
3. Close jacket
4. Attach fastening hooks
5. Repeat the same jacket installation procedure for the other side of the wall



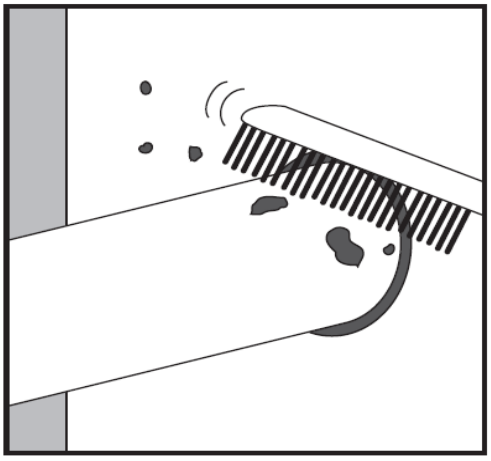
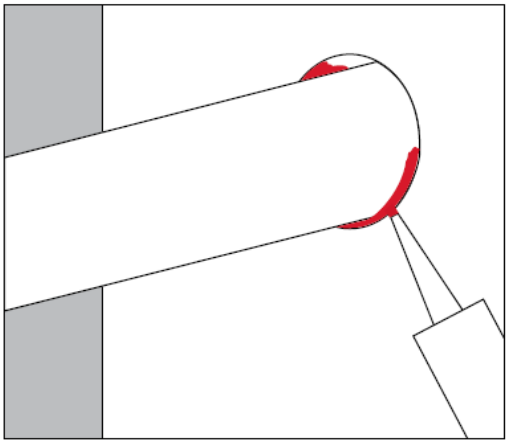
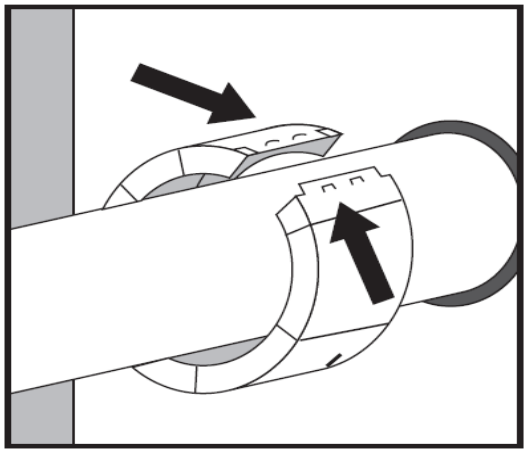
Order Now

Ordering designation	Collar outer diameter	Sales pack quantity	Item number
CP 644-180/7”	228 mm	1 pc	**304339**[1)]
CP 644-200/8”	257 mm	1 pc	**304340**[1)]
CP 644-225/9”	289 mm	1 pc	**304342**[1)]
CP 644-250/10”	319 mm	1 pc	**304343**[1)]
CP 644-250/10” US	319 mm	1 pc	**304344**[1)]

[1)] This is a non-stock item. For detailed lead time information please contact your Hilti representative.

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

Subject: **Method Statement of CP 643N / CP 644**
Material: CP 643N / CP 644 firestop collar and CP 606/ CP 601S Firestop sealant
Accessory: Nil

Setting Operation		
1	Clean the plastic pipes. Expansion of the intumescent material during a fire acts to close the plastic pipe. Very dirty pipes (i.e. pipes with the remains of mortar) may lead to a delay in this closing action. Soiled plastic pipes should, therefore, be cleaned in the area where the CP 643N / CP 644 Firestop Collar is to be installed.	
2	Seal the opening if required. Gaps may be closed with CP 606 / CP 601S firestop sealant.	
3	Close the CP 643N / CP 644 Firestop Collar. Place the CP 643N / CP 644 Firestop Collar around the plastic pipe and lock the closure by applying firm pressure until it latches.	

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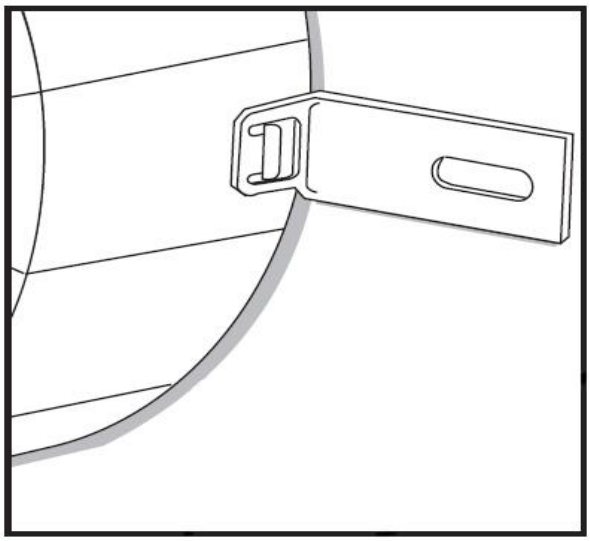
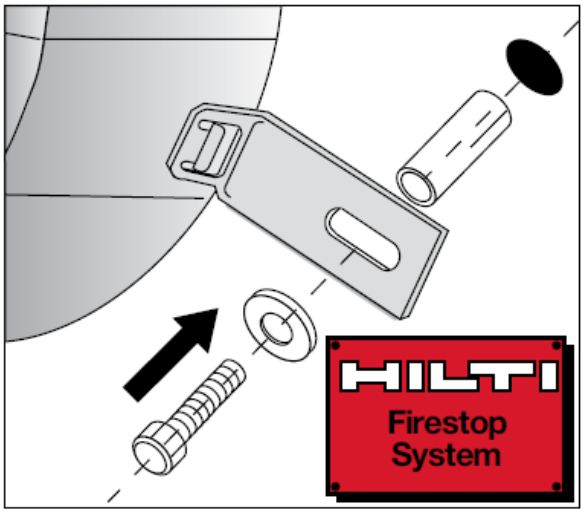
4	Attach fastening hooks. The fastening hooks can be attached to various points on the metal housing.	
5	Fasten the CP 643N Firestop Collar. Only when fastened properly can CP 643N offer protection against fire. a. Mark the fastening points. b. Drill holes with a Hilti rotary hammer drill (i.e. TE 4-A18) or, depending on the base material, fasten using Hilti powder-actuated tool. c. To secure the CP 643N Firestop Collar, use Hilti anchors/fasteners. d. For maintenance reasons, a penetration can be permanently marked with an identification plate	

Safety precautions:

- Never use with metal pipes or with unapproved anchors or fasteners or in highly corrosive surroundings
- Keep out of the reach of children

ASSESSMENT REPORT

The Fire Resistance Performance of Hilti Pipe Penetration Sealing Systems

Report No.: R23A14-2A Issue 1

Issue Date: 21 June, 2024

Date of Review: 18 June, 2027

Report Sponsor

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

CONTENT

REVISION HISTORY

Issue date (DD/MM/YYYY)	Issue number	Remark
19/06/2024	0	Initial version
21/6/2024	1	Update of supporting evidence

THE FIRE RESISTANCE PERFORMANCE OF PIPE PENETRATION SYSTEMS

1 INTRODUCTION

This assessment report presents an appraisal for the use of the Hilti "CP648", "CP643N/644", "CFS-C EL", "CFS-B" and "CFS-CID" for pipe penetration sealing purpose in either floor mounted or wall mounted situation. The appraisal will be based on the test evidence as shown in section 3 of this report. This report is prepared for Hilti (Hong Kong) Limited of 701-704 & 708B, Tower A, Manulife Finance Centre, 223 Wai Yip Street, Kwun Tong, Kowloon, HK.

The proposed sealing for the pipe penetration system are required to provide a fire resistance performance of up to 240 minutes integrity and insulation 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 Evidence

Report no.	Sections	Description
Primary Test Evidence		
WARRES report no. 128944/A and B	4.2	Supporting test evidence for the use of the Hilt 'CP648-E' firestop wrap strip for plastic pipe penetration system through floor supporting construction.
WARRES report no. 128948	4.2	Supporting test evidence for the use of the Hilt 'CP648-E' firestop wrap strip for plastic pipe penetration system through wall and floor supporting construction.
WARRES report no. 132995 Issue 2	4.2	Supporting test evidence for the use of the Hilt 'CP648-E' firestop wrap strip for plastic pipe penetration system through wall and floor supporting construction.
WARRES report no. 146725 Issue 2	4.2	Supporting evidence for the use of Hilti 'CP648-E' firestop wrap strip for plastic pipe penetration system through floor supporting construction.
RED report no. R16L28-1A	4.2	Supporting test evidence for the use of various Hilti firestop sealant products penetrating wall application.
WARRES report no. 128947/A Issue 2	4.3	Supporting test evidence for the use of the Hilt 'CP643N' firestop jacket for plastic pipe penetration system through floor supporting construction.
WARRES report no. 128947/B	4.3	Supporting test evidence for the use of the Hilt 'CP644' firestop jacket for plastic pipe penetration system through floor supporting construction.
WARRES report no. 128949/A	4.3	Supporting test evidence for the use of the Hilt 'CP643N' firestop jacket for plastic pipe penetration system through floor supporting construction.

WARRES no. 131014/A	4.3	Supporting test evidence for the use of the Hilt 'CP643N' firestop jacket for plastic pipe penetration system through floor supporting construction.
WARRES no. 137929/A	4.3	Supporting test evidence for the use of the Hilt 'CP643N' firestop jacket for plastic pipe penetration system through floor supporting construction.
CSIRO report no. FSV1026	4.3	Supporting test evidence for the use of the Hilt 'CP648-E' and 'CP643N' firestop jacket for plastic pipe penetration system through floor supporting construction.

3.2 *Primary Test Evidence*

3.2.1 *WARRES Test Report No. 128944/A and 128944/B**

An ad-hoc fire resistance test on total eighteen specimens of various plastic pipe penetration sealing system mounted within an aerated concrete floor assembly stated to be using heating condition and general principles of BS EN 1363-1: 1999, the performance criteria in BS 476: Part 20: 1987, and additional guideline taken from the latest draft of prEN 1366-3: 2002 was performed at the WARRES (former Warringtonfire) laboratory on 10th April, 2003. The test sponsor was Hilti Entwicklungsgesellschaft mbH, who had given permission to use this data.

The test assemblies comprised an aerated concrete floor construction of overall dimensions 2,700 mm wide by 4,000 mm high by 150 mm thick. The floor was provided with various circular apertures of various dimensions, through which various diameter plastic pipes passed. Each pipe was fitted with an intumescent wrap on each face of the wall referenced "CP648-E" or "CP648-S" collars. The specimens were referenced as '1' to '18' and are detailed in the table below. The intumescent wrap was fitted within flush with the underside of the floor. Above the intumescent wrap the gaps were filled with either CP606 or mortar. For the pipe diameter of 32 mm and 75 mm, one layer of 4.5 mm thick "CP648-E" was fitted, for pipe diameter 110 mm and 125 mm, two layers of 4.5 mm thick "CP648-E" was fitted, for pipe diameter of 160 mm, three layers of 4.5 mm thick "CP648-E was fitted. "CP648-S" was 13.5 mm thick used for pipe diameter of 160 mm only in the test.

The temperature rise of which was controlled using plate thermometers so that its means temperature complied with the requirements of BS EN 1363-1: 1999, the performance criteria in terms of integrity and insulation were assessed against BS 476: Part 20: 1987, the results were expressed as follow:

Specimen ref.	Item description	Integrity (mins)	Insulation (mins)
1	PP Pipe, 32 mm diameter by 2.1 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	241	241
2	PP Pipe, 75 mm diameter by 4.6 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	241	157Note
3	PP Pipe, 110 mm diameter by 6.3 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	231	157Note
4	PP Pipe, 125 mm diameter by 7.4 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	235	157Note
5	PP Pipe, 160 mm diameter by 9.6 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	241	241

6	PP Pipe, 160 mm diameter by 9.4 mm wall thickness passing through an endless 'CP648-S' pipe wrap.	241	241
7	ABS Pipe, 32 mm diameter by 2.2 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	241	241
8	ABS Pipe, 75 mm diameter by 4.8 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	241	241
9	ABS Pipe, 110 mm diameter by 7.2 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	241	241
10	ABS Pipe,160 mm diameter by 10.0 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	241	241
11	ABS Pipe, 160 mm diameter by 10.0 mm wall thickness passing through an endless 'CP648-S' pipe wrap.	241	229
12	PVC Pipe, 160 mm diameter by 12.5 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	226	222
13	PVC Pipe, 160 mm diameter by 12.5 mm wall thickness passing through an endless 'CP648-S' pipe wrap.	241	241
14	PE Pipe, 160 mm diameter by 15.3 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	241	233
15	PE Pipe, 160 mm diameter by 15.3 mm wall thickness passing through an endless 'CP648-S' pipe wrap.	241	241
16	PP Pipe, 32 mm diameter by 2.2 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	241	157[Note]
17	ABS Pipe, 110 mm diameter by 7.2 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	241	241
18	PVC Pipe, 160 mm diameter by 12.6 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	158	158

Note: Insulation readings unable to be taken after this time due to collapse of end floor slab and subsequent thermocouple malfunction.

Specimens 1 to 15 were reported under the test evidence WARRES No. 128944/A, in this test, the gaps between the pipe and the wall aperture above the intumescent wrap were filled using mortar. Specimens 16 to 18 were filled using CP606.

The test was terminated at 241 minutes (See WARRES report no. 128944/A and 128944/B for full details).

**Note: the test data is more than five years old; we have reviewed this data against the current test procedures as per BS EN 1363-1: 1999 and found it suitable for this assessment.*

3.2.2 *WARRES Test Report No. 128948**

An ad-hoc fire resistance test on eighteen specimens of various plastic pipe penetration sealing system mounted within an aerated concrete wall assembly stated to be using heating condition and general principles of BS EN 1363-1: 1999, the performance criteria in BS 476: Part 20: 1987, and additional guideline taken from the latest draft of prEN 1366-3: 2002 was performed at the WARRES (former Warringtonfire) laboratory on 9th April, 2003. The test sponsor was Hilti Entwicklungsgesellschaft mbH, who had given permission to use this data.

The test assemblies comprised a blockwork assembly formed from light weight concrete blocks of overall dimensions 3,035 mm wide by 3,050 mm high by 100 mm thick. The wall was provided with eighteen circular apertures of various dimensions, through which various diameter plastic pipes passed. Each pipe was fitted with an intumescent wrap on each face of the wall referenced "CP648-E" or "CP648-S". The specimens were referenced as '1' to '18' and are detailed in the table below. For the pipe diameter of 32 mm and 75 mm, one layer of 4.5 mm thick "CP648-E" was fitted, for pipe diameter 110 mm and 125 mm, two layers of 4.5 mm thick "CP648-E" was fitted, for pipe diameter of 160 mm, three layers of 4.5 mm thick "CP648-E was fitted. "CP648-S" was 13.5 mm thick used for pipe diameter of 160 mm only in the test.

The temperature rise of which was controlled using plate thermometers so that its means temperature complied with the requirements of BS EN 1363-1: 1999, the performance criteria in terms of integrity and insulation were assessed against BS 476: Part 20: 1987, the results were expressed as follow:

Specimen ref.	Item description	Integrity (mins)	Insulation (mins)
1	PP Pipe, 32 mm diameter by 2.2 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	240	240
2	PP Pipe, 75 mm diameter by 5.0 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	240	240
3	PP Pipe, 110 mm diameter by 6.6 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	240	222
4	PP Pipe,125 mm diameter by 7.6 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	219	181
5	PP Pipe, 160 mm diameter by 9.4 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	213	176
6	PP Pipe, 160 mm diameter by 9.4 mm wall thickness passing through an endless 'CP648-S' pipe wrap.	219	161
7	ABS Pipe, 32 mm diameter by 2.2 mm wall thickness passing	240	220

	through an endless 'CP648-E' pipe wrap.		
8	ABS Pipe, 75 mm diameter by 4.8 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	240	240
9	ABS Pipe, 110 mm diameter by 7.0 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	240	240
10	ABS Pipe,160 mm diameter by 10.2 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	219	157
11	ABS Pipe, 160 mm diameter by 10.2 mm wall thickness passing through an endless 'CP648-S' pipe wrap.	213	190
12	PVC Pipe, 160 mm diameter by 10.2 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	199	161
13	PVC Pipe, 160 mm diameter by 12.2 mm wall thickness passing through an endless 'CP648-S' pipe wrap.	217	176
14	PE Pipe, 160 mm diameter by 15.6 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	240	204
15	PE Pipe, 160 mm diameter by 15.6 mm wall thickness passing through an endless 'CP648-S' pipe wrap.	240	240
16	PE Pipe, 32 mm diameter by 2.2 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	219	219
17	ABS Pipe, 110 mm diameter by 7.0 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	219	159
18	PVC Pipe, 160 mm diameter by 12.2 mm wall thickness passing through an endless 'CP648-E' pipe wrap.	219	219

For specimens 1 to 15, gaps between the wrap and the wall aperture were filled using CP606 gap filler. Specimens 16 to 18 were filled using mortar.

The integrity failure of Specimen 11 at 213 minutes was caused by the spread of flames from the adjacent specimen, Specimen 5.

The result given for specimens 4, 6, 10, 16, 17 and 18 are the maximum times that can be quoted for these specimens. The specimens were affected at that time by a water spray used to extinguish severe flaming on adjacent specimens. The use of the water spray was with the sponsor's consent and deemed necessary to allow continuation of the test for other specimens.

The test was terminated at 240 minutes (See WARRES report no. 128948 for full details).

**Note: the test data is more than five years old; we have reviewed this data against the current test procedures as per BS EN 1363-1: 1999 and found it suitable for this assessment.*

*3.2.3 WARRES Test Report No. 132995 Issue 2**

A fire resistance test on ten specimens of PVC pipe penetration sealing system mounted within an aerated concrete floor and wall assembly stated to be using heating condition and general principles of BS EN 1363-1: 1999, the performance criteria in BS 476: Part 20: 1987, and additional guideline taken from the latest draft of prEN 1366-3: 2002 was performed at the WARRES (former Warringtonfire) laboratory on 10th July, 2003. The test sponsor was Hilti Entwicklungsgesellschaft mbH, who had given permission to use this data.

The test assemblies comprised a floor assembly formed from aerated concrete of overall dimensions 1,000 mm wide by 1,000 mm long by 150 mm thick, and a wall assembly formed from autoclaved blocks of overall 1,000 mm wide by 1,000 mm high by 100 mm thick. The floor and wall were both provided with five circular apertures of various dimensions, through which various diameter PVC pipes passed. Each pipe was fitted with an intumescent wrap referenced "CP648-E".

The assemblies formed the upper horizontal face and the front vertical face of a one metre cubed gas fired furnace chamber, the temperature rise of which was controlled using plate thermometers so that its means temperature complied with the requirements of BS EN 1363-1: 1999, the results were expressed as follow:

Specimen Ref:	Supporting Construction	Actual Pipe Size Diameter x wall thickness	Integrity (Min)	Insulation (Min)
1	Wall	160 mm x 8.1 mm	240	166
2	Wall	125 mm x 6.3 mm	240	240
3	Wall	90 mm x 4.3 mm	240	240
4	Wall	75 mm x 3.9 mm	240	240
5	Wall	32 mm x 2.1 mm	240	223
6	Floor	160 mm x 8.1 mm	121	121
7	Floor	125 mm x 6.3 mm	161	158
8	Floor	90 mm x 4.3 mm	240	240
9	Floor	75 mm x 3.9 mm	240	240
10	Floor	32 mm x 2.1 mm	240	240

The test was discontinued after a period of 240 minutes (See WARRES 132995 Issue 2 for full details).

**Note: the test data is more than five years old; we have reviewed this data against the current test procedures as per BS EN 1363-1: 1999 and found it suitable for this assessment.*

3.2.4 *WARRES Test Report No. 146725 Issue 2**

A fire resistance test stated to be in accordance with BS EN 1363-1: 1999 and in conjunction with the EN 1366-3: 2004 on ten (10) specimens of PVC pipe penetration sealing systems mounted within an autoclaved blockwork wall assembly was performed at the Warringtonfire Laboratory on 8 June 2005. The test sponsor was Hilti (Great Britain) Limited, who had given permission to use this data.

In this test report, eight of the penetration sealing systems incorporated Hilti 'CP 648' Firestop Wrap Strip. The specimens were referenced as 1, 12, 13, 14, 15, 16, 17 and 18 as shown in the table below. The specimen was assessed against the criteria for integrity and insulation (max. temperature rise only) specified in BS 476: Part 20: 1987 as shown in the table below as well.

Specimen	Pipe Material	Diameter	Wall Thickness	Integrity	Insulation
1	ABS	160 mm	11.4 mm	33 mins	33 mins
12	PVC	160 mm	12.6 mm	241 mins	241 mins
13	PP	160 mm	15.1 mm	232 mins	205 mins
14	HDPE	160 mm	15.1 mm	112 mins	112 mins
15	PP	50 mm	5.4 mm	241 mins	241 mins
16	HDPE	50 mm	5.2 mm	241 mins	241 mins
17	ABS	50 mm	3.5 mm	241 mins	241 mins
18	PVC	50 mm	3.9 mm	241 mins	241 mins

The test was discontinued after a heating period of 241 minutes (See WF no. 146725 Issue 2 for details).
**Note: the test data is more than five years old; we have reviewed this data against the current test procedures as per BS EN 1363-1: 1999 and found it suitable for this assessment.*

3.2.5 *RED Test Report No. R16L28-1A#*

A fire resistance test on twenty-seven specimens penetration systems, namely specimens '1a' to '27', had been subjected to a test in accordance with BS 476: Part 20: 1987 was performed at the RED testing laboratory on 20th January, 2017. The test sponsor was Hilti (Hong Kong) Limited. n 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. 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 RED test report no. R16L28-1A for full details).

#Note: the test data is more than five years old; we have reviewed this data against the current test procedures as per BS 476: Part 20: 1987 and found it suitable for this assessment.

3.2.6 *WARRES Test Report No. 128947/A Issue 2**

A fire resistance test on total twelve specimens of various plastic pipe penetration sealing system mounted within a blockwork wall assembly stated to be using heating condition and general principles of BS EN 1363-1: 1999, the performance criteria in BS 476: Part 20: 1987, and additional guideline taken from the latest draft of prEN 1366-3: 2002 was performed at the WARRES (former Warringtonfire) laboratory on 13th March, 2003. The test sponsor was Hilti Entwicklungsgesellschaft mbH, who had given permission to use this data.

In this test report, each pipe was fitted with an intumescent collar on each face of the wall which was referenced 'CP643'. The specimens were referenced as E,F,G,H,I,J,K,L,M,N,Q,R and S as shown in the table below. The specimen was assessed against the criteria for integrity and insulation (max. temperature rise only) specified in BS 476: Part 20: 1987 as shown in the table below as well.

Specimen	Pipe Material	Diameter	Wall Thickness	Opening Size	Collar Reference	Integrity	Insulation
E	PE	50 mm	2.0 mm	82 mm	CP643/50	245 mins	245 mins
F	PVC	50 mm	2.4 mm	82 mm	CP643/50	245 mins	245 mins
G	PVC	40 mm	1.9 mm	82 mm	CP643/50	245 mins	245 mins
H	ABS	110 mm	7.1 mm	132 mm	CP643/110	245 mins	241 mins

I	PE	160 mm	4.6 mm	182 mm	CP643/160	245 mins	245 mins
J	PE	110 mm	3.0 mm	132 mm	CP643/110	245 mins	245 mins
K	PVC	110 mm	3.7 mm	132 mm	CP643/110	245 mins	245 mins
L	PE	110 mm	2.7 mm	150 mm	CP643/110	245 mins	242 mins
M	ABS	160 mm	11.0 mm	182 mm	CP643/160	123 mins	122 mins
Q	PE	160 mm	4.0 mm	250 mm	CP643/160	245 mins	245 mins
R	PVC	160 mm	4.7 mm	250 mm	CP643/160	245 mins	245 mins
S	PVC	160 mm	4.7 mm	182 mm	CP643/160	245 mins	245 mins

The test was discontinued after a heating period of 245 minutes (See WARRES no. 128947/A Issue 2 for details).

**Note: the test data is more than five years old; we have reviewed this data against the current test procedures as per BS EN 1363-1: 1999 and found it suitable for this assessment.*

3.2.7 *WARRES Test Report No. 128949/A**

A fire resistance test on total seven specimens of various plastic pipe penetration sealing system mounted within a blockwork wall assembly stated to be using heating condition and general principles of BS EN 1363-1: 1999, the performance criteria in BS 476: Part 20: 1987, and additional guideline taken from the latest draft of prEN 1366-3: 2002 was performed at the WARRES (former Warringtonfire) laboratory on 10th April, 2003. The test sponsor was Hilti Entwicklungsgesellschaft mbH, who had given permission to use this data.

In this test report, each pipe was fitted with an intumescent collar on each face of the wall which was referenced 'CP643'. The specimens were referenced as A, B, C, H, I, O and P as shown in the table below. The specimen was assessed against the criteria for integrity and insulation (max. temperature rise only) specified in BS 476: Part 20: 1987 as shown in the table below as well.

Specimen	Pipe Material	Diameter	Wall Thickness	Opening Size	Collar Reference	Integrity	Insulation
A	PVC	160 mm	11 mm	182 mm	CP 643/160	115 mins	115 mins
B	ABS	110 mm	7 mm	132 mm	CP 643/110	180 mins	170 mins
C	PVC	40 mm	2.2 mm	82 mm	CP 643/50	180 mins	180 mins
H	PE	160 mm	4 mm	182 mm	CP 643/160	180 mins	180 mins
I	PE	110 mm	3.1 mm	132 mm	CP 643/110	180 mins	180 mins
O	PVC	160 mm	4.7 mm	182 mm	CP 643/160	180 mins	180 mins
P	PVC	110 mm	3.2 mm	132 mm	CP 643/110	180 mins	180 mins

The test was discontinued after a heating period of 180 minutes (See WARRES no. 128949/A for details).

**Note: the test data is more than five years old; we have reviewed this data against the current test procedures as per BS EN 1363-1: 1999 and found it suitable for this assessment.*

3.2.8 *WARRES Test Report No. 131014/A**

An ad-hoc fire resistance test stated to be using heating condition and general principles of BS EN 1363-1: 1999, the performance criteria in BS 476: Part 20: 1987, and additional guideline taken from the latest draft of prEN 1366-3: 2002 on thirteen (13) specimens of pipe penetration sealing systems mounted within an aerated concrete floor assembly was performed at the Warringtonfire Research Centre Laboratory on 14th August 2003. The test sponsor was Hilti Entwicklungsgesellschaft mbH, who had given permission to use this data.

In this test report, each pipe was fitted with an intumescent collar on the lower face of the floor only, which was referenced 'CP643'. The specimens were referenced as A, B, C, H, I, O and P as shown in the table below. The specimen was assessed against the criteria for integrity and insulation (max. temperature rise only) specified in BS 476: Part 20: 1987 as shown in the table below as well.

Specimen	Pipe Material	Diameter	Wall Thickness	Opening Size	Collar Reference	Integrity	Insulation
M	PE	110 mm	2.7 mm	132 mm	CP 643/110	245 mins	245 mins
N	ABS	110 mm	6.6 mm	132 mm	CP 643/110	215 mins	213 mins
O	PVC	160 mm	10.45 mm	182 mm	CP 643/160	245 mins	245 mins
P	PVC	160 mm	4.7 mm	250 mm	CP 643/160	214 mins	190 mins
Q	PVC	110 mm	3.2 mm	150 mm	CP 643/110	245 mins	245 mins
R	PVC	50 mm	2.4 mm	82 mm	CP 643/50	245 mins	245 mins
S	PVC	50 mm	2.4 mm	62 mm	CP 643/50	245 mins	245 mins
T	PE	160 mm	4.0 mm	182 mm	CP 643/160	245 mins	245 mins
U	PE	160 mm	4.0 mm	250 mm	CP 643/160	64 mins	64 mins
V	PE	110 mm	2.7 mm	150 mm	CP 643/110	245 mins	245 mins
W	PE	50 mm	2.9 mm	82 mm	CP 643/50	245 mins	245 mins
X	PE	50 mm	2.9 mm	62 mm	CP 643/50	245 mins	245 mins
Y	ABS	160 mm	10.45 mm	182 mm	CP 643/160	245 mins	245 mins

The test was discontinued after a heating period of 245 minutes (See WARRES no. 131014/A for details).

**Note: the test data is more than five years old; we have reviewed this data against the current test procedures as per BS EN 1363-1: 1999 and found it suitable for this assessment.*

3.2.9 *WARRES Test Report No. 137929/A**

A fire resistance test on total nine specimens of various plastic pipe penetration sealing system mounted within a plasterboard partition wall assembly stated to be using heating condition and general principles of BS EN 1363-1: 1999, the performance criteria in BS 476: Part 20: 1987, and additional guideline taken from the latest draft of prEN 1366-3: 2002 was performed at the WARRES (former Warringtonfire) laboratory on 10th April, 2003. The test sponsor was Hilti Entwicklungsgesellschaft mbH, who had given permission to use this data.

In this test report, each pipe was fitted with an intumescent collar on each face of the 100 mm thick wall which was referenced 'CP643N'. The specimens were referenced '1' to '9' as shown in the table below. The specimen was assessed against the criteria for integrity and insulation (max. temperature rise only) specified in BS 476: Part 20: 1987 as shown in the table below as well.

Specimen	Pipe Material	Diameter	Wall Thickness	Opening Size	Collar Reference	Integrity	Insulation
1	PE	50 mm	2.9 mm	55 mm	CP643/50	135	135
2	PE	160 mm	14.6 mm	165 mm	CP643/160	135	135
3	PE	160 mm	4.0 mm	165 mm	CP643/160	135	135
4	PVC	50 mm	1.8 mm	55 mm	CP643/50	135	135
5	PVC	160 mm	11.9 mm	165 mm	CP643/160	135	135
6	PVC	160 mm	3.2 mm	165 mm	CP643/160	135	135
7	ABS	160 mm	10.45 mm	165 mm	CP643/160	135	135
8	PP	160 mm	3.9 mm	165 mm	CP643/160	135	135
9	PE	75 mm	5.2 mm	80 mm	CP643/90	135	135

The test was discontinued after a heating period of 135 minutes (See WARRES test report no. 137929/A for details

**Note: the test data is more than five years old; we have reviewed this data against the current test procedures as per BS EN 1363-1: 1999 and found it suitable for this assessment.*

3.2.10 *CSIRO Test Report No. FSV1026#*

A fire resistance test stated to be in accordance with BS 476: Part 20: 1987 on a total of eighteen (18) specimens of pipe penetration sealing systems mounted within the plater board partition wall system was performed at the CISRO Laboratory on 18th December 2003. The test sponsor was Hilti (Aust.) Pty Ltd., who had given permission to use this data.

In this test report, each pipe was fitted with an intumescent collar on each face of the wall, which was referenced 'CP643'. The specimens were referenced as 1 to 18 as shown in the table below. The specimen was assessed against the criteria for integrity and insulation (max. temperature rise only) specified in BS 476: Part 20: 1987 as shown in the table below as well.

Specimen	Pipe Material	Diameter	Wall Thickness	Opening Size	Collar Reference	Integrity	Insulation
1	PVC	40 mm	2 mm	55 mm	CP643/50	120	114
2	PVC	50 mm	2.2 mm	65 mm	CP643/63	120	120
3	PVC	65 mm	2.7 mm	80 mm	CP643/75	120	115
4	PVC	80 mm	2.9 mm	95 mm	CP643/90	120	120
5	PVC	100 mm	3.2 mm	112 mm	CP643/110	118	108
6	PVC	150 mm	4.5 mm	175 mm	CP643/160	120	120
7	HDPE	50 mm	3 mm	55 mm	CP643/50	120	120
8	HDPE	56 mm	3 mm	65 mm	CP643/63	120	120
9	HDPE (Silent)	56 mm	3.2 mm	65 mm	CP643/63	120	120
10	HDPE	75 mm	3 mm	80 mm	CP643/75	120	106
11	HDPE	90 mm	3.5 mm	95 mm	CP643/90	120	97
12	HDPE	110 mm	4.3 mm	125 mm	CP643/110	120	116
13	HDPE	160 mm	6.2 mm	175 mm	CP643/160	120	120
14	PVC	40 mm	2 mm	55 mm	CP648-E (1 layers)	120	120
15	PVC	65 mm	2.7 mm	80 mm	CP648-E (1 layers)	111	111
16	PVC	80 mm	2.9 mm	105 mm	CP648-E (2 layers)	120	120
17	PVC	110 mm	3.2 mm	132 mm	CP648-E (2 layers)	7	7
18	PVC	160 mm	4.5 mm	202 mm	CP648-E (3 layers)	6	6

The test was discontinued after a heating period of 120 minutes (See CSIRO test report no. FSV1026 for details.

#Note: the test data is more than five years old; we have reviewed this data against the current test procedures as per BS 476: Part 20: 1987 and found it suitable for this assessment.

3.2.11 *WARRES Test Report No. 128947/B**

A fire resistance test on total seven specimens of various plastic pipe penetration sealing system mounted within a blockwork wall assembly stated to be using heating condition and general principles of BS EN 1363-1: 1999, the performance criteria in BS 476: Part 20: 1987, and additional guideline taken from the latest draft of prEN 1366-3: 2002 was performed at the WARRES (former Warringtonfire) laboratory on 13th March, 2003. The test sponsor was Hilti Entwicklungsgesellschaft mbH, who had given permission to use this data.

In this test report, each pipe was fitted with an intumescent collar on each face of the wall which was referenced 'CP644'. The specimens were referenced as A, B, C, D, N, O and P as shown in the table below. The specimen was assessed against the criteria for integrity and insulation (max. temperature rise only) specified in BS 476: Part 20: 1987 as shown in the table below as well.

Specimen	Pipe Material	Diameter	Wall Thickness	Opening Size	Collar Reference	Integrity	Insulation
A	PE	250 mm	8.0 mm	300 mm	CP644/250	245 mins	245 mins
B	PVC	250 mm	11.9 mm	300 mm	CP644/250	245 mins	161 mins
C	PE	50 mm	2.9 mm	82 mm	CP644/50	245 mins	245 mins
D	PVC	50 mm	2.0 mm	82 mm	CP644/50	245 mins	245 mins
N	PE	250 mm	24.0 mm	300 mm	CP644/250	245 mins	93 mins
O	PVC	250 mm	5.9 mm	300 mm	CP644/250	245 mins	245 mins
P	ABS	160 mm	10.5 mm	182 mm	CP644/160	120 mins	119 mins

The test was discontinued after a heating period of 245 minutes (See WARRES no. 128947/B for details).
**Note: the test data is more than five years old; we have reviewed this data against the current test procedures as per BS EN 1363-1: 1999 and found it suitable for this assessment.*

3.2.12 *WARRES Test Report No. 131014/B**

An ad-hoc fire resistance test stated to be using heating condition and general principles of BS EN 1363-1: 1999, the performance criteria in BS 476: Part 20: 1987, and additional guideline taken from the latest draft of prEN 1366-3: 2002 on twelve (12) specimens of pipe penetration sealing systems mounted within an aerated concrete floor assembly was performed at the Warringtonfire Research Centre Laboratory on 14th August 2003. The test sponsor was Hilti Entwicklungsgesellschaft mbH, who had given permission to use this data.

In this test report, each pipe was fitted with an intumescent collar on the lower face of the floor only, which was referenced 'CP643'. The specimens were referenced as A, B, C, D, E, F, G, H, I, J, K and L as shown in the table below. The specimen was assessed against the criteria for integrity and insulation (max. temperature rise only) specified in BS 476: Part 20: 1987 as shown in the table below as well.

Specimen	Pipe Material	Diameter	Wall Thickness	Opening Size	Collar Reference	Integrity	Insulation
A	PVC	250 mm	11.9 mm	300 mm	CP644/250	213 mins	101 mins
B	PP	160 mm	3.9 mm	182 mm	CP644/160	169 mins	101 mins
C	PVC	50 mm	1.8 mm	62 mm	CP644/50	245 mins	101 mins
D	PVC	160 mm	11.9 mm	250 mm	CP644/160	100 mins	91 mins
E	PE	250 mm	22.8 mm	300 mm	CP644/250	64 mins	64 mins
F	PVC	250 mm	4.9 mm	300 mm	CP644/250	245 mins	245 mins
G	PVC	160 mm	3.2 mm	182 mm	CP644/160	190 mins	190 mins
H	PE	50 mm	2.9 mm	62 mm	CP644/50	245 mins	245 mins
I	ABS	160 mm	10.0 mm	182 mm	CP644/160	138 mins	120 mins
J	PE	250 mm	7.8 mm	300 mm	CP644/250	212 mins	212 mins
K	PE	160 mm	14.6 mm	250 mm	CP644/160	164 mins	164 mins
L	PE	160 mm	4.0 mm	250 mm	CP644/160	133 mins	128 mins

The test was discontinued after a heating period of 245 minutes (See WARRES no. 131014/B for details).

**Note: the test data is more than five years old; we have reviewed this data against the current test procedures as per BS EN 1363-1: 1999 and found it suitable for this assessment.*

4 PROPOSAL & DISCUSSION

4.1 The use of test evidence, which were tested in accordance with BS EN 1363-1: 1999, for the assessment of linear joint sealing system to BS 476: Part 20: 1987

Proposal

It is proposed that the test evidence of WF report no. 146725 Issue 2 for the linear joint seal system, which were tested in accordance with BS EN 1363-1: 1999, is suitable for use in the assessment against BS 476: Part 20: 1987.

Discussion

The fire test on the linear joint seal systems as tested and described in the above test evidence were carried out in accordance with BS EN 1363-1: 1999. In reviewing the tests, we have considered the design 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 tests, it is expected that if these fire tests had been conducted in accordance with BS 476: Part 20: 1987 very similar results would have been achieved.

Fire tests to BS EN 1363-1: 1999 and BS 476: Part 20: 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 1363-1: 1999 was used, which was normally deemed to be more onerous. The passing criteria for the standards of BS EN 1363-1: 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 (a) the mean unexposed face temperature increases by more than 140 °C above its initial value; or (b) the temperature recorded at any position on the unexposed face is in excess of 180 °C above its initial value; or (c) when integrity failure occurs.

Having stated these criteria, there is no significant difference between the tests to BS EN and British standards. Since the integrity and insulation criteria of BS EN 1363-1: 1999 are basically the same, we can conservatively conclude that the linear joint sealing system as tested and described in WF report no. 146725 Issue 2 will achieve fire resistance performance not worse than tested if test to BS 476: Part 20: 1987.

4.2 The fire resistance performance of plastic pipe penetration system using the Hilti "CP648-E" with respect to BS 476: Part 20: 1987.

Proposal

It is proposed that Hilti 'CP648E' may be used for the purpose of plastic pipe penetration sealing under either the wall mounted or floor mounted situation referenced to the test evidence WARRES 128944/A, 128948 and 132995 Issue 2. purpose of sealing the penetration annular gap in between the plastic pipe and the surrounding masonry supporting construction when the pipe penetrating through. The 'CP648-E' was endless intumescent wrap of 4.5 mm thick. Depends on the pipe materials, one, two or three layers of "CP 648-E" shall be used to wrap the pipe materials and fill the annular gap.

(a) The application of Hilti "CP648-E" for floor mounted situation with the intumescent wrap fitted within and flush with the underside of the floor. The floor construction shall be masonry type with minimum 150 mm thick, and it is assumed that the floor shall carry at least up to the same fire resistance performance in terms of both integrity and insulation as the proposed scenario. The gap in between the pipe and the floor aperture above the intumescent shall be fully fitted with cement sand mortar, and the annular gap shall be in nominal width of the overall thickness of "CP648-E" to be applied. Tables below shows the conditions for the pipe penetration protection:

PE pipes				
Pipe Diameter (mm)	Max pipe wall thickness (mm)	CP 648-E thickness (mm)	Integrity (mins)	Insulation (mins)
140	15.3	3 layers of 4.5	240	180
160	15.3	3 layers of 4.5	240	180
PVC Pipes				
Pipe Diameter (mm)	Max pipe wall thickness (mm)	CP 648-E thickness (mm)	Integrity (mins)	Insulation (mins)
32	2.1	1 layer of 4.5	240	240
32	3.9	1 layer of 4.5	240	180
50	3.9	1 layer of 4.5	240	240
56	3.9	1 layer of 4.5	240	240
63	3.9	1 layer of 4.5	240	240
75	3.9	1 layer of 4.5	240	240
90	4.3	2 layers of 4.5	240	240
110	6.3	2 layers of 4.5	240	240
125	6.3	2 layers of 4.5	120	120
140	12.5	3 layers of 4.5	180	180
160	12.6	3 layers of 4.5	180 (mortar 120(CP606)	120 (mortar) 120 (CP606)

PP pipes				
Pipe Diameter (mm)	Max pipe wall thickness (mm)	CP 648-E thickness (mm)	Integrity (mins)	Insulation (mins)
32	2.1	1 layer of 4.5	240	240
50	4.6	1 layer of 4.5	240	120
56	4.6	1 layer of 4.5	240	120
63	4.6	1 layer of 4.5	240	120
75	4.6	1 layer of 4.5	240	120
90	4.3	2 layers of 4.5	180	120
110	6.3	2 layers of 4.5	180	120
125	7.4	2 layers of 4.5	180	120
140	9.6	3 layers of 4.5	240	240
160	9.6	3 layers of 4.5	240	240
ABS pipes				
Pipe Diameter (mm)	Max pipe wall thickness (mm)	CP 648-E thickness (mm)	Integrity (mins)	Insulation (mins)
32	2.2	1 layer of 4.5	240	240
50	4.8	1 layer of 4.5	240	240
56	4.8	1 layer of 4.5	240	240
63	4.8	1 layer of 4.5	240	240
75	4.8	1 layer of 4.5	240	240
90	7.2	2 layers of 4.5	240	240
110	7.2	2 layers of 4.5	240	240
125	10.0	3 layers of 4.5	240	240
140	9.6	3 layers of 4.5	240	240
160	9.6	3 layers of 4.5	240	240

(b) The application of Hilti "CP648-E" for wall mounted situation with the intumescent wrap fitted within and on each end of the wall. The wall construction shall be masonry type with minimum 100 mm thick, and it is assumed that the wall shall carry at least up to the same fire resistance performance in terms of both integrity and insulation as the proposed scenario. The gap in between the pipe and the wall aperture shall be sealed up with either mortar or CP 606, and the annular gap shall be in nominal width of the overall thickness of "CP648-E" to be applied. Tables below shows the conditions for the pipe penetration protection:

PE pipes				
Pipe Diameter (mm)	Max pipe wall thickness (mm)	CP 648-E thickness (mm)	Integrity (mins)	Insulation (mins)
140	15.6	3 layers of 4.5	240	180
160	15.6	3 layers of 4.5	240	180
PVC Pipes				
Pipe Diameter (mm)	Max pipe wall thickness (mm)	CP 648-E thickness (mm)	Integrity (mins)	Insulation (mins)
32	2.1	1 layer of 4.5	240	180
50	3.9	1 layer of 4.5	240	240
56	3.9	1 layer of 4.5	240	240
63	3.9	1 layer of 4.5	240	240
75	3.9	1 layer of 4.5	240	240
90	4.3	2 layers of 4.5	240	240
110	6.3	2 layers of 4.5	240	240
125	6.3	2 layers of 4.5	240	240
140	8.1	3 layers of 4.5	180	180
140	12.5	3 layers of 4.5	240	180
160	8.1	3 layers of 4.5	180	180
160	12.5	3 layers of 4.5	240	180
PP pipes				
Pipe Diameter (mm)	Max pipe wall thickness (mm)	CP 648-E thickness (mm)	Integrity (mins)	Insulation (mins)
32	2.2	1 layer of 4.5	240	240
50	5	1 layer of 4.5	240	240
56	5	1 layer of 4.5	240	240
63	5	1 layer of 4.5	240	240
75	5	1 layer of 4.5	240	240
90	6.6	2 layers of 4.5	240	240
110	6.6	2 layers of 4.5	240	240
125	7.4	2 layers of 4.5	240	180
140	9.4	3 layers of 4.5	180	120
160	9.4	3 layers of 4.5	180	120

ABS pipes				
Pipe Diameter (mm)	Max pipe wall thickness (mm)	CP 648-E thickness (mm)	Integrity (mins)	Insulation (mins)
32	2.2	1 layer of 4.5	240	180
50	4.8	1 layer of 4.5	240	240
56	4.8	1 layer of 4.5	240	240
63	4.8	1 layer of 4.5	240	240
75	4.8	1 layer of 4.5	240	240
90	7.0	2 layers of 4.5	240	240
110	7.0	2 layers of 4.5	240	240
125	10.2	3 layers of 4.5	240	180
140	10.2	3 layers of 4.5	240	180
160	10.2	3 layers of 4.5	240	180

(c) The application of Hilti "CP648-E" for wall mounted situation with the intumescent wrap fitted centrally recessed within the wall and the voids were filled with sand cement mortar. The wall construction shall be masonry type with minimum 100 mm thick, and it is assumed that the wall shall carry at least up to the same fire resistance performance in terms of both integrity and insulation as the proposed scenario. The annular gap shall be in nominal width of the overall thickness of "CP648-E" to be applied. Tables below shows the conditions for the pipe penetration protection:

Pipe material	Min. Pipe Dia (mm)	Max. Pipe Dia (mm)	Max. pipe wall thickness (mm)	Ratio of pipe area to CP 648 cross sectional area (Ap/Aa)	Minimum wrap thickness (mm)	Integrity (mins)	Insulation (mins)
PVC	50	160	12.6	5.47:1	4	240	240
HDPE	50	50	5.2	2.89:1	4	240	240
HDPE	110	110	15.1	3.69:1	7	120	120
HDPE	50	160	15.1	5.47:1	4	60	60
ABS	50	50	3.5	2.89:1	4	240	240
ABS	50	160	11.4	5.47:1	4	30	30
PP	50	50	5.4	2.89:1	4	240	240
PP	110	110	15.1	3.69:1	7	240	180
PP	50	160	15.1	5.47:1	4	180	180

Discussion

The intumescent wrap Hilti 'CP648-E' had been substantially tested in various test evidence that used for plastic pipe penetration of PVC, PE, PP and ABS materials, of various pipe diameter and various pipe wall thickness. For the sealing of the plastic pipe penetration through masonry wall, since the pipe may melt under the heating condition, the sealing materials will need to expand and seal up the whole aperture after the plastic pipe collapsed. Therefore, the key issue will be whether the intumescent materials are good enough to seal up the aperture during the heating conditions

(a) The scope of the application of 'CP648-E' as proposed in the table was basically referenced to the tested scenarios in the previous tested evidence. Some of the smaller pipe diameter application is projected from the tested larger pipe diameter. Since the smaller pipe diameter with the same wall thickness and same application thickness of the 'CP648-E' intumescent wrap is considered as a less onerous situation. In the floor application, the intumescent wrap shall be applied within the wall and flush with the underside of the annular gap. The proposed overall thickness of the intumescent wrap was referenced to the test evidence as well.

(b) The scope of the application of 'CP648-E' as proposed in the table was basically referenced to the tested scenarios in the previous tested evidence. Some of the smaller pipe diameter application is projected from the tested larger pipe diameter. Since the smaller pipe diameter with the same wall thickness and same application thickness of the 'CP648-E' intumescent wrap is considered as a less onerous situation. In the wall application, the intumescent wrap shall be applied within on each end of the annular gap. The proposed overall thickness of the intumescent wrap was referenced to the test evidence as well.

(c) The test evidence WARRES no. 146725 Issue 2 described the test of the use of Hilti CP648 for different types of pipe materials, pipe wall thickness and the pipe diameter, whilst the report R16L28-1A provides an updated test evidence for the similar materials tested to BS 476: Part 20: 1987.

Based on the ratio of the overall cross-sectional area of the pipe to the annular area (Ap/Aa) of the "CP 648" would be the critical parameter in this consideration.

The table below presents the result from different specimens:

Pipe material	Pipe Dia. (mm)	Pipe wall thickness (mm)	Pipe cross sectional area	CP 648 Thickness (mm)	CP648 annular area (m^2)	(Ap/Aa) Ratio	Integrity (min)	Insulation (min)
PVC	50	3.9	0.001963	4	0.00068	2.89	240	240
PVC	160	12.6	0.020106	7	0.00367	5.47	240	240
HDPE	50	5.2	0.001963	4	0.00068	2.89	240	240

HDPE	160	15.1	0.020106	7	0.00367	5.47	60	60
ABS	50	3.5	0.001963	4	0.00068	2.89	240	240
ABS	160	11.4	0.020106	7	0.00367	5.47	30	30
PP	50	5.4	0.001963	4	0.00068	2.89	240	240
PP	160	15.1	0.020106	7	0.00367	5.47	180	180

From the test results, the CP 648 applied to different materials with different pipe diameters and wall thicknesses will have different performance.

For PVC piping

For the specimens of PVC piping with diameters of 50 mm and 160 mm and wall thickness of 3.9 mm and 12.6 mm, both cases satisfied 240 minutes integrity and insulation performance. In terms of fire protection, the case with larger pipe diameter and thicker pipe wall is considered as a more onerous situation. And in the test of PVC pipe penetration, the (Ap/Aa) ratio for 50 mm piping is 2.89:1 while for the 160 mm piping is 5.47:1. Since, both cases had achieved 240 minutes integrity and insulation, it is reasonable to use the minimum ratio to 5.47:1 for all the application range, subjected to the minimum thickness of 4 mm.

For HDPE piping

For the specimens of High Density Polyethylene (HDPE) piping, using the same justification above, the worked out (Ap/Aa) ratio is again 2.89:1 for 50 mm pipe and 5.47:1 for 160 mm pipe, respectively. However, in the case of HDPE piping, for larger diameter pipe with the ratio of 5.47:1, the achieved fire resistance performance was 112 minutes integrity and insulation only.

From the test results, it can be generally concluded that pipe with smaller diameter is a less onerous situation. Therefore, it is reasonable to assume that pipes with a smaller diameter shall have a better performance. Therefore, for pipe diameter of 110 mm, which is approximately the middle between the tested pipe diameters, a more favourable ratio of 3.69:1 and with minimum thickness of 7 mm may provide confidence for the enhancement of performance to up to 120 minutes integrity and insulation.

For ABS piping

In the test to ABS piping, the test results for small pipe sizes 50 mm and larger pipe sizes 160 mm were quite extreme. In such case, the appraised result can only be conservatively concluded that for pipe diameter up to 50 mm and wall thickness up to 3.5 mm, the use of 4 mm thick CP 648, can provide the fire resistance performance of up to 240 minutes integrity and insulation.

While for the pipe diameter up to 160mm and wall thickness up to 11.4 mm, the (Ap/Aa) ratio of 5.47:1 with the minimum thickness of 4 mm, is considered as an acceptable application range for the system to maintain the fire resistance performance of 30 minutes integrity and insulation.

For the Polypropylene (PP) piping

The test results to Polypropylene piping were similar to that in HDPE, but in this case, the smaller pipe diameter with the (Ap/Aa) ratio of 2.89:1 achieved the fire resistance performance of 241 minutes integrity and insulation performance while the larger pipe diameter with the (Ap/Aa) ratio of 5.47:1 achieved the fire resistance performance of 232 minutes integrity and insulation performance.

From the test results, it can be generally concluded that pipe with smaller diameter is a less onerous situation. Therefore, it is reasonable to assume that pipes with a smaller diameter shall have a better performance. Therefore, for pipe diameter of 110 mm, which is approximately the middle between the tested pipe diameters, a more favourable ratio of 3.69:1 and with minimum thickness of 7 mm may provide confidence for the enhancement of performance to up to 240 minutes integrity and 180 minutes insulation.

Apart from the thickness of the CP 648 to be applied, the use of the sand cement mortar seal, and the annular gap width shall repeat the same as that tested.

In summary, the proposed application conditions of the Hilti "CP648-E" as stated above are generally referenced to the tested condition, with some of them are appraised with a conservative approach.

4.3 The fire resistance performance of plastic pipe penetration system using the Hilti "CP643N" and "CP644" with respect to BS 476: Part 20: 1987.

Proposal

It is proposed that Hilti 'CP643N' may be used for the purpose of plastic pipe penetration sealing through either the masonry wall, masonry flooring or the gypsum type drywall partition referenced to the test evidence WARRES 128947/A Issue 2, 128947/B, 128949/A, 131014/A and CSIRO FSV1026. The 'CP643N' were intumescent wrap with metal collar casing with various length for protection of specific pipe diameter. The CP643N, are of various model, 643/50 consists of 1 layer of 6 mm thick intumescent wrap, 643/110 consists of 1 layer of 10 mm thick intumescent wrap, 643/160 consists of 2 layers of 12 mm thick intumescent wrap.

It is assumed that the wall or floor system of the surrounding supporting construction shall carry at least up to the same fire resistance performance in terms of both integrity and insulation as the proposed scenario.

(a) In the situation that the pipe penetration through the masonry wall system the test evidence WARRES no. 128947/A Issue 2 are referenced. The wall shall be of minimum 150 mm thick, the annular gap may be up to 45 mm wide for the PVC and PE pipes and up to 20 mm wide for the ABS pipes. The Hilti 'CP643N' shall be mounted on each side of the wall and the clearance in between the pipe and the apertures shall be filled with mortar. The cross sectional area of the pipe to the annular area of the intumescent wrap (Ap/Aa ratio) gives the necessary thickness of the intumescent wrap for various pipe diameter. The summary of the application is given in the table below:

Material	Pipe Dia. (mm)	Pipe wall thickness (mm)	(Ap/Aa) Ratio	Insulation (mins)	Integrity (mins)
PVC	40 – 160	1.9 – 4.7	1.45	240	240
PE	50-160	2.0-4.6	1.45	240	240
ABS	110	7.1	1.45	240	240
ABS	160	11.0	1.45	120	120

(b) In the situation that the pipe penetration through the masonry floor system the test evidence WARRES no. 131014/A are referenced. The floor shall be of minimum 150 mm thick, the annular gap may be up to 20 mm wide for the PVC and PE pipes and up to 20 mm wide for the ABS pipes. The cross sectional area of the pipe to the annular area of the intumescent wrap (Ap/Aa ratio) gives the necessary thickness of the intumescent wrap for various pipe diameter. The summary of the application is given in the table below:

Material	Pipe Dia. (mm)	Pipe wall thickness (mm)	(Ap/Aa) Ratio	Insulation (mins)	Integrity (mins)
PVC	50 – 160	1.9 – 10.45	1.45	240	240
PE	50-160	2.7-4.0	1.45	240	240

ABS	110	6.6	1.45	180	180
ABS	160	10.45	1.45	240	240

(c) In the situation that the pipe penetration through the gypsum type partition wall system, the test evidence WARRES no. 137929/A and CSIRO FSV1026 are referenced. The partition wall shall be of minimum 115 mm thick, the annular gap may be up to 15 mm wide for all the plastic pipes of concern. The cross sectional area of the pipe to the annular area of the intumescent wrap (Ap/Aa ratio) gives the necessary thickness of the intumescent wrap for various pipe diameter. The summary of the application is given in the table below:

Material	Pipe. Dia. (mm)	Pipe wall thickness (mm)	(Ap/Aa) Ratio	Insulation (mins)	Integrity (mins)
PVC	50 – 160	1.8 – 11.9	1.12	120	120
PE	50 – 160	2.9 – 14.6	1.12	120	120
PP	160	3.9	1.12	120	120
ABS	160	10.45	1.12	120	120
HDPE	50 – 160	3 – 6.2	2.27	120	60

It is proposed that for the pipe diameter larger than 160 mm up to 260 mm for the PVC and PE pipe penetration, the 'CP644' will be used for the sealing purpose. The application of CP644 is basically referenced to the test evidence WARRES 128947/B and 131014/B. The Hilti 'CP644' were intumescent wrap with metal collar casing which is very similar to the 'CP643N' but is proposed to use with larger pipe diameter from 160 mm to 260 mm. One layer of 15 mm thick CP'644' will be used in this case. For wall application the CP 644 shall be applied on both ends of the wall, while for the flooring application, the Hilti 'CP644' shall be applied to the underside of the floor.

(d) In the situation that the pipe penetration through the masonry wall system, the test evidence WARRES no. 128947/B are referenced. The wall shall be of minimum 150 mm thick, the annular gap may be up to 25 mm wide for all the plastic pipes of concern. In all cases below, the CP644 (composed of 1 mm thick steel casing and 1 layer of 15 mm thick intumescent strip) will be applied on both ends of the wall. The summary of the application is given in the table below:

Material	Pipe. Dia. (mm)	Pipe wall thickness (mm)	(Ap/Aa) Ratio	Insulation (mins)	Integrity (mins)
PVC	160-260[Note1]	1.8 -5.9	3.93	240	240
PVC	160-260[Note1]	6.0-11.9	3.93	240	120
PE	160-260[Note1]	2.9 – 8.0	3.93	240	240
PE	160-260[Note1]	8.1 – 24.0	3.93	240	60

Note 1: See discussion below.

(e) In the situation that the pipe penetration through the masonry floor system, the test evidence WARRES no. 131014/B are referenced. The floor shall be of minimum 150mm thick, the annular gap may be up to 25 mm wide for all the plastic pipes of concern. In all cases below, the CP644 (composed of 1 mm thick steel casing and 1 layer of 15 mm thick intumescent strip) will be applied to the underside of the wall (exposed face). The summary of the application is given in the table below:

Material	Pipe. Dia. (mm)	Pipe wall thickness (mm)	(Ap/Aa) Ratio	Insulation (mins)	Integrity (mins)
PVC	160-260[Note2]	1.8 -4.9	3.93	240	240
PVC	160-260[Note2]	5.0-11.9	3.93	180	60
PE	160-260[Note2]	2.9 – 7.8	3.93	180	180
PE	160-260[Note2]	7.9-22.8	3.93	60	60

Note1: See discussion below

Discussion

For the application of the Hilti 'CP643N'

The intumescent wrap Hilti 'CP643N' had been substantially tested in various test evidence that used for plastic pipe penetration of PVC, PE, PP, ABS and HDPE materials, of various pipe diameter and various pipe wall thickness. For the sealing of the plastic pipe penetration through masonry wall, since the pipe may melt under the heating condition, the sealing materials will need to expand and seal up the whole aperture after the plastic pipe collapsed. Therefore, the key issue will be whether the intumescent materials are good enough to seal up the aperture during the heating condition.

(a) The scope of the application of 'CP643N' as proposed in the table was basically referenced to the tested scenarios in the previous tested evidence. Some of the smaller pipe diameter application is projected from the tested larger pipe diameter. Since the smaller pipe diameter with the same wall thickness and same application thickness of the 'CP643N' intumescent wrap is considered as a less onerous situation. The intumescent wrap shall be applied same as that tested, i.e. each side of the wall is fitted with the CP 643N and the thickness of the intumescent wrap depends on the pipe diameter. The opening sizes of the penetration is also discovered as one of the critical factor that affect the fire resistance performance. The annular gap of maximum 45 mm for PVC and PE pipes and the 20 mm wide for the ABS pipe is considered as supported by direct test evidence.

(b) The scope of the application of 'CP643N' as proposed in the table was basically referenced to the tested scenarios in the previous tested evidence. Some of the smaller pipe diameter application is projected from the tested larger pipe diameter. Since the smaller pipe diameter with the same wall thickness and same application thickness of the 'CP643N' intumescent wrap is considered as a less onerous situation. In the floor application, the intumescent wrap shall be applied within and flush with the underside of the floor. The clearance in between the pipe and

the aperture shall be fully filled with the mortar. The proposed overall thickness of the intumescent wrap was referenced to the test evidence as well.

(c) The scope of the application of 'CP643N' as proposed in the table when penetrating through partition wall was basically referenced to the tested scenarios in the previous tested evidence. In this test evidence, the partition wall was built by the 50 mm x 34 mm 0.6 mm G.M.S. channels faced with two layers of 12.5 mm thick gypsum boards on each side without infill. The overall thickness of the partition is 115 mm. The circular apertures left on the wall were penetrated by the plastic pipe sections. In the proposed scope, some of the smaller pipe diameter application is projected from the tested larger pipe diameter. Since the smaller pipe diameter with the same wall thickness and same application thickness of the 'CP643N' intumescent wrap is considered as a less onerous situation. The intumescent wrap shall be applied same as that tested, i.e. each side of the wall is fitted with the CP 643N and the thickness of the intumescent wrap depends on the pipe diameter. The opening sizes of the penetration is also discovered as one of the critical factor that affect the fire resistance performance. The annular gap of maximum 15 mm for all types of pipe is considered as supported by direct test evidence.

For the application of the Hilti 'CP644'

(d) The scope of the application of 'CP644' for use with pipe penetration through masonry wall as proposed in the table was basically referenced to the tested scenarios in the previous tested evidence. The test evidence only presents the result of the use of 'CP644' with PVC and PE pipes, so the application is confined to these two materials. Some of the smaller pipe diameter application is projected from the tested larger pipe diameter. Since the smaller pipe diameter with the same wall thickness and same application thickness of the 'CP644' intumescent wrap is considered as a less onerous situation. It is as declared by the client that the CP644 is applicable to the pipe diameter range up to 260 mm. The slight increase in 10 mm in diameter of the pipe shall not significant deteriorate the achieved fire resistance performance, it is therefore considered acceptable. The intumescent wrap shall be applied same as that tested, i.e. each side of the wall is fitted with the "CP644" and the thickness of the intumescent wrap depends on the pipe diameter. The opening sizes of the penetration is also discovered as one of the critical factor that affect the fire resistance performance. The annular gap of maximum 25 mm for PVC and PE pipes is considered as supported by direct test evidence.

(e) The scope of the application of 'CP644' as proposed in the table was basically referenced to the tested scenarios in the previous tested evidence. Some of the smaller pipe diameter application is projected from the tested larger pipe diameter. Since the smaller pipe diameter with the same wall thickness and same application thickness of the 'CP644' intumescent wrap is considered as a less onerous situation. It is as declared by the client that the CP644 is applicable to the pipe

diameter range up to 260 mm. The slight increase in 10 mm in diameter of the pipe shall not significant deteriorate the achieved fire resistance performance, it is therefore considered acceptable. In the floor application, the intumescent wrap shall be applied within and flush with the underside of the floor. The clearance in between the pipe and the aperture shall be fully filled with the mortar. The proposed overall thickness of the intumescent wrap was referenced to the test evidence as well.

5 CONCLUSION

The proposed use of Hilti pipe penetration sealing systems in both floor mounted and wall mounted as discussed in Section 4 of this report, are capable to maintain the fire resistance performance of up to 240 minutes integrity and various insulation performance 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:

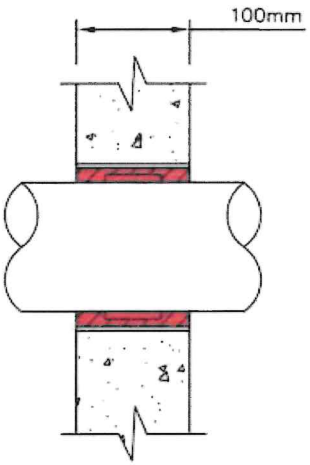
Ir Dr. YUEN Sai-wing, MHKIE (Fire)
Authorized Signature
Research Engineering Development
Façade Consultants Limited

APPENDIX – DRAWINGS PROVIDED BY THE CLEINT

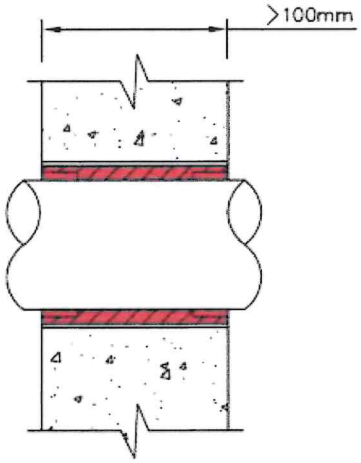
Drawing refers to Section 4.2 on plastic pipe penetration system by using CP648-E

FIRE RESISTANCE RATING: UP TO -/240/240

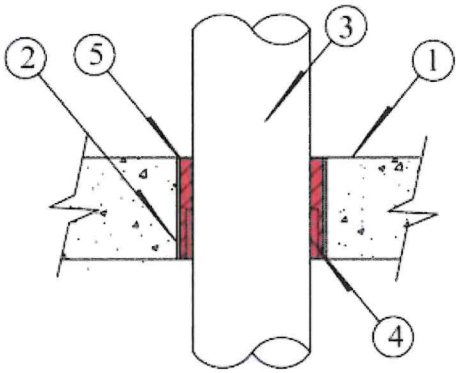
WALL CASE



WALL CASE



FLOOR CASE

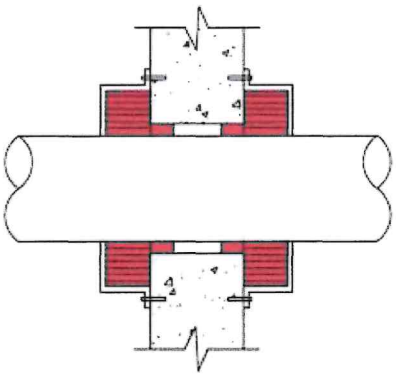


1. CONCRETE FLOOR OR WALL ASSEMBLY:
   A. CONCRETE WALL OR FIRE-RATED BLOCKWALL.
   B. CONCRETE FLOOR.
2. OPTIONAL: METAL SLEEVE (CIRCULAR / RECTANGULAR)
3. PENETRATING ITEM TO BE ONE OR SEVERAL OF THE FOLLOWING:
   -PLASTIC PIPE (MAX 160mm O.D. EACH)
4. **CP 648-E FIRESTOP WRAP STRIP** CONTINUOUSLY WRAPPED AROUND THE OUTER CIRCUMFERENCE OF THE INSULATION. (SEE NOTES 1 & 3)
   FOR O.D.≤ 75mm, --- 4.5mm THK CP648-E x 1 LAYER;
   FOR 75mm < O.D.≤ 125mm, --- 4.5mm THK CP648-E x 2 LAYER;
   FOR 125mm < O.D.≤ 160mm, --- 4.5mm THK CP648-E x 3 LAYER;
5. FOR ANNULAR SPACE ≤ 30mm, FULL THE VOID UP BY MINERAL WOOL WITH **CP 648-E** FIRESTOP **WRAP STRIPS** ON BOTH SIDES OF THE FLOOR/WALL ASSEMBLY. OTHERWISE, VOIDS TO BE FILLED BY **CP636 FIRESTOP MORTAR.** (SEE NOTES 2)

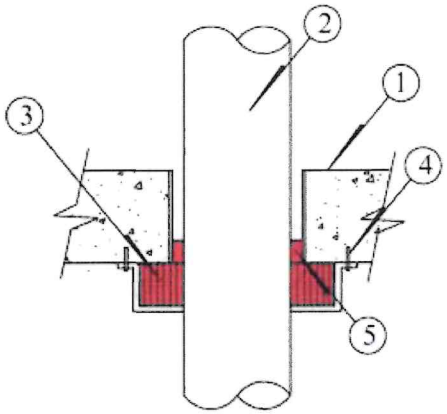
Drawing refers to Section 4.3 on plastic pipe penetration system by using CP643N/CP644

FIRE RESISTANCE RATING: UP TO -/240/240

WALL CASE



FLOOR CASE



1. CONCRETE WALL OR WALL ASSEMBLY:
   -LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR OR WALL
2. MAX. 260MM OUTER-DIAMETER PLASTIC PIPE.(SEE TABLE BELOW).
3. CP643 N / CP644 FIRESTOP COLLAR WITH ANCHOR HOOK.(SEE NOTE 1 & 3)
4. SLEEVE ANCHOR HAS-R M6.
5. HILTI CP 606 FIRESTOP ACRYLIC SEALANT.

Application Detail:

Pipe O.D (mm)	Product(s)	No. of Hooks
20-51	CP643-50/1.5" N or CP643-50/1.5" N (A2 S.S)	2
52-64	CP643-63/2" N or CP643-63/2" N (A2 S.S)	2
65-78	CP643-75/2.5" N or CP643-72/2.5" N (A2 S.S)	3
79-91	CP643-90/3" N or CP643-90/3" N (A2 S.S)	3
92-115	CP643-110/4" N or CP643-110/4" N (A2 S.S)	3
116-125	CP643-125/5" N or CP643-125/5" N (A2 S.S)	4
126-170	CP643-160/6" N or CP643-160/6" N (A2 S.S)	4
171-180	CP644-180/7"	8
181-210	CP644-200/8"	8
211-240	CP644-225/9"	10
241-260	CP644-250/10"	12

- End of Report -

An Ad-Hoc Fire Resistance Test Utilising the Heating Conditions Specified in BS EN 1363-1:1999, in Conjunction with the Additional Guidelines Taken from prEN 1366-3: 2002 and the Performance Criteria of BS 476: Part 20; 1987 On Twelve Specimens of Pipe Penetration Sealing System

Test Sponsor

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Warrington FIRE research

An Ad-Hoc Fire Resistance Test Utilising the Heating Conditions Specified in BS EN 1363-1:1999, in Conjunction with the Additional Guidelines Taken from prEN 1366-3: 2002 and the Performance Criteria of BS 476: Part 20; 1987 On Twelve Specimens of Pipe Penetration Sealing System

Test Sponsor

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Report	Name	Signature*
Responsible Officer	C. Abbott	
Approved	D. Forshaw	

* For and on behalf of Warrington Fire Research Centre

Report Issued : 14th August 2003

An Ad-Hoc Fire Resistance Test Utilising the Heating Conditions Specified in BS EN 1363-1:1999, in Conjunction with the Additional Guidelines Taken from prEN 1366-3: 2002 and the Performance Criteria of BS 476: Part 20; 1987 On Twelve Specimens of Pipe Penetration Sealing System

Summary

An ad-hoc fire resistance test has been conducted to evaluate the ability of twelve specimens of pipe penetration sealing system mounted within an aerated concrete floor assembly, to reinstate the integrity and insulation performance (as defined in BS 476: Part 20: 1987) of the floor construction where it has been provided with apertures to allow for the penetration of various diameters of pipe services. Since no standardised test for this purpose yet exists, an ad-hoc fire resistance test was performed utilising the heating conditions specified in BS EN 1363-1: 1999, in conjunction with the additional guidelines taken from the latest draft document prEN 1366-3: 2002 and the performance criteria of BS 476: Part 20; 1987. 'Methods of determination of the fire resistance of elements of construction (general principles)'

The test assembly comprised an aerated concrete floor assembly with overall dimensions of 4200 mm long by 2700 mm wide by 150 mm thick. The floor was provided with twelve circular apertures of various diameters, through which the pipes were passed. Each pipe was fitted with an intumescent collar which was referenced 'CP644'. The specimens were referenced as A, B, C, D, E, F, G, H, I, J, K, and L are detailed in the table below:

Specimen	Pipe Material	Pipe Diameter (Nominal)	Wall Thickness (Nominal)	Opening Size (Nominal)	Collar Reference
A	PVC	250 mm	11.9 mm	300 mm	CP 644/250
B	PP	160 mm	3.9 mm	182 mm	CP 644/160
C	PVC	50 mm	1.8 mm	62 mm	CP 644/50
D	PVC	160 mm	11.9 mm	250 mm	CP 644/160
E	PE	250 mm	22.8 mm	300 mm	CP 644/250
F	PVC	250 mm	4.9 mm	300 mm	CP 644/250
G	PVC	160 mm	3.2 mm	182 mm	CP 644/160
H	PE	50 mm	2.9 mm	62 mm	CP 644/50
I	ABS	160 mm	10.0 mm	182 mm	CP 644/160
J	PE	250 mm	7.8 mm	300 mm	CP 644/250
K	PE	160 mm	14.6 mm	250 mm	CP 644/160
L	PE	160 mm	4.0 mm	250 mm	CP 644/160

If the performance of the specimens was assessed against the criteria for integrity and insulation (maximum temperature rise only) specified in BS 476: Part 20: 1987, the results obtained could be expressed as follows:

WFRC Ref.	Integrity	Insulation
A	213 minutes	101 minutes#
B	169 minutes	101 minutes#
C	245 minutes	101 minutes#
D	100 minutes	91 minutes
E	64 minutes	64 minutes
F	245 minutes	245 minutes
G	190 minutes	190 minutes
H	245 minutes	245 minutes
I	138 minutes	120 minutes
J	212 minutes	212 minutes
K	164 minutes	164 minutes
L	133 minutes	128 minutes

#No further evaluation for insulation performance was possible due to thermocouple malfunction

The test was discontinued after a period of 245 minutes.

A further thirteen specimens were also included in the test but are the subject of a separate report referenced WARRES 131014/A.

Date of Test : 1st May 2003

Contents

1 Purpose of the Test

1.1 To evaluate the ability of twelve specimens of pipe penetration sealing system to reinstate the fire resistance performance in terms of integrity and insulation, as defined in BS 476: Part 20: 1987, of an aerated concrete floor at positions where it has been provided with apertures to allow for the penetration of various diameters of pipe services. The test was performed utilising the heating conditions specified in BS EN 1363-1: 1999, in conjunction with the additional guidelines of the latest draft document prEN 1366-3: 2002 and the performance criteria of BS 476: Part 20; 1987. 'Methods of determination of the fire resistance of elements of construction (general principles)'

2 Introduction

2.1 At the present time there is no British Standard test procedure applicable to the evaluation of a method or a system designed to reinstate the fire resistance of a wall or a floor where it has been provided with an aperture to allow for its penetration by service items.

2.2 This report covers an ad-hoc test which at the request of the sponsor utilised the heating conditions of BS EN 1363-1: 1999, together with the performance criteria of BS 476: Part 20: 1987 'Methods of determination of the fire resistance of elements of construction (general principles)' and the additional guidelines taken from latest draft document prEN 1366-3: 2002.

2.3 In BS 476: Part 20: 1987, the performance criteria appropriate to separating elements are integrity and insulation. An integrity failure is deemed to occur when collapse of the specimen occurs, when cracks or other openings exist in a separating element through which flame or hot gasses can pass which would lead to the ignition of a cotton pad, when through gaps form which are in excess of 6 mm wide by 150 mm long or 25 mm diameter or when flaming occurs on the unexposed face for a duration greater than 10 seconds. An insulation failure is deemed to occur when the mean temperature of the unexposed surface increases by more than 140 °C above the initial temperature or the temperature of the unexposed surface increases at any point by more than 180°C above the initial temperature. As per the guidelines taken from prEN 1366-3:2002, only the maximum temperature rise criterion was utilised for the test.

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

2.5 The investigation was conducted on the 1st May 2003 at the request of Hilti Entwicklungsgesellschaft mbH, the sponsor of the test.

2.6 The test was witnessed by Mr. D. Williams, a representative of the test sponsor.

3 Test Specimen Construction

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

3.2 The specimens were supplied by the sponsor the week commencing 28th April 2003. Warrington Fire Research Centre was not involved in any sampling or selection procedure of the components.

3.3 The floor assembly was supplied and built by Warrington Fire Research Centre on the 25th April 2003.

3.4 Installation of the specimens was conducted by representatives of the test sponsor between the 28th and 30th of April 2003.

4 Instrumentation and Measuring Equipment

4.1 The temperature rise within the furnace chamber was controlled in accordance with the requirements of BS EN 1363-1:1999.

4.2 Eight plate thermometers distributed over a plane 100 mm from the soffit of the assembly were provided to monitor the temperature of the furnace atmosphere.

4.3 Eight 1.5 mm mineral insulated thermocouples were also included within the furnace chamber distributed over a plane 100 mm from the soffit of the assembly. These thermocouples were used for information purposes only.

4.4 Pressure sensors were provided within the furnace to monitor the furnace pressure, which was measured and controlled in accordance with the requirements of BS EN 1363-1:1999.

4.5 Thermocouples were provided to monitor the temperature of the unexposed surface of the individual penetrating items and their seals.

4.6 The locations and reference numbers of the various unexposed surface thermocouples are shown in Figures 2 to 4 of Annex A.

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

4.8 Cotton pads and gap gauges were available to evaluate the impermeability of the specimens to hot gases.

5 Test Procedure

5.1 The test was performed in conjunction with the general principles of latest draft document prEN 1366-3: 2002 and BS 476: Part 20: 1987 'Methods of determination of the fire resistance of elements of construction (general principles)'.

5.2 The furnace was controlled using plate thermometers, so that its mean temperature complied with the requirements of BS EN 1363-1: 1999 General requirements.

5.3 After the first five minutes of testing and for the remainder of the test, the furnace atmospheric pressure was controlled so that it complied with the requirements of BS EN 1363-1: 1999. The calculated pressure differential relative to the laboratory atmosphere at a position of 100m below the soffit of the assembly was17 Pa (±3) Pa.

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

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

5.6 The thermocouples referred to in 4.5 and detailed in Figures 2 to 4 were used to determine compliance with the maximum unexposed face temperature rise criterion as required by prEN 1366-3:2002.

5.7 The roving thermocouple, cotton pads and gap gauges were used if considered appropriate. The occurrence of any sustained flaming on the unexposed surface of the specimen was also recorded to determine compliance with the integrity performance criteria.

6 Test Data and Information

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

6.1.1 Mean furnace temperature, together with the temperature/time relationship specified in BS EN 1363-1:1999.

6.1.2 Individual unexposed surface temperatures recorded by the thermocouples fixed to the individual penetrating items and their seals.

6.1.3 Individual furnace temperatures recorded by the 1.5 mm mineral insulated thermocouples.

6.1.4 Pressure measured within the furnace chamber at a position 100 mm below the soffit of the assembly.

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

6.3 Photographs of the specimens before, during and after testing are given in Annex D.

6.4 The ambient air temperature in the vicinity of the test construction was 13°C at the start of the test, with a maximum variation of -3°C during the test.

6.5 The test was discontinued after a period of 245 minutes.

7 Evaluation Against the Performance Criteria

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

7.1.1 **Integrity** - It is required that there is no collapse of the specimen, no sustained flaming on the unexposed surfaces and no loss of impermeability. These requirements were satisfied by the specimens for periods shown in the table in 8.2.

7.1.2 **Insulation** - it is required that the mean temperature rise of the unexposed surface shall not be greater than 140°C and that the maximum temperature rise shall not be greater than 180°C. In line with guidelines given in the draft document prEN 1366-3: 2002, only the maximum temperature rise criterion was utilised for the test. This requirement was satisfied by the specimens for periods shown in the table in 8.2.

8 Conclusions

8.1 An ad-hoc fire resistance test has been conducted to evaluate the ability of twelve specimens of pipe penetration sealing system, to reinstate the fire resistance performance in terms of integrity and insulation, as defined in BS 476: Part 20: 1987, of an aerated concrete floor assembly at positions where it has been provided with apertures to allow for the penetration of various diameters of pipe services. The test was performed utilising the heating conditions specified in BS EN 1363-1: 1999, in conjunction with the general principles of the latest draft document prEN 1366-3: 2002 and BS 476: Part 20; 1987. 'Methods of determination of the fire resistance of elements of construction (general principles)'

8.2 If the performance of the individual penetrating items was assessed against the integrity and insulation (maximum temperature rise) criteria of BS 476: Part 20: 1987, the results obtained could be expressed as follows:

Specimen	Integrity	Insulation
A	213 minutes	101 minutes#
B	169 minutes	101 minutes#
C	245 minutes	101 minutes#
D	100 minutes	91 minutes
E	64 minutes	64 minutes
F	245 minutes	245 minutes
G	190 minutes	190 minutes
H	245 minutes	245 minutes
I	138 minutes	120 minutes
J	212 minutes	212 minutes
K	164 minutes	164 minutes
L	133 minutes	128 minutes

#No further evaluation for insulation performance was possible due to thermocouple malfunction

The test was discontinued after a period of 245 minutes.

9 Limitations

9.1 The results relate only to the behaviour of the specimens 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.

10 Review

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

14th August 2003

Warrington FIRE research

Annex A

Schedule of Components
(Refer to Figures 1 to 4)
(All values are nominal unless stated otherwise)
(All other details are as stated by the sponsor)

Item		Description
Floor Slabs		
Material	:	Aerated concrete slabs
Overall size	:	3000 mm x 600 mm x 150 mm thick
Density	:	670 kg/m^3
Specimen A		
Pipe material	:	Polyvinyl chloride (PVC)
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	250 mm outer diameter x 11.9 mm wall thickness
iii. actual size	:	250 mm outer diameter x 12.7 mm wall thickness
Fixing method	:	Fitted through the floor slab and sealed with sand and cement mortar
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/250
iii. material	:	1.0 mm steel casing with 1 layer of 15 mm thick graphite based intumescent
iv. fitting method	:	1 off fitted around service pipe on the exposed face of the floor and through bolted via 12 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 160 mm and 420 mm centres from the floor on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation

Annex A (Continued)

Item		Description
Specimen B		
Pipe material	:	Polypropylene (PP)
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	160 mm outer diameter x 3.9 mm wall thickness
iii. actual size	:	160 mm outer diameter x 4.5 mm wall thickness
Fixing method	:	Fitted through the floor slab and sealed with sand and cement mortar
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/160
iii. material	:	1.0 mm steel casing with 2 layers of 15 mm thick graphite based intumescent
iv. fitting method	:	1 off fitted around service pipe on the exposed face and through bolted via 6 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 160 mm and 420 mm centres from the floor on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation
Specimen C		
Pipe material	:	PVC
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	50 mm outer diameter x 1.8 mm wall thickness
iii. actual size	:	50 mm outer diameter x 2.1 mm wall thickness
Fixing method	:	Fitted through the floor slab and sealed with sand and cement mortar
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/50
iii. material	:	0.6 mm steel casing with 1 layer of 6 mm thick graphite based intumescent
iv. fitting method	:	1 off fitted around service pipe on the exposed face and through bolted via 2 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 160 mm and 420 mm centres from the floor on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation

Annex A (Continued)

Item		Description
Specimen D		
Pipe material	:	PVC
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	160 mm outer diameter x 11.9 mm wall thickness
iii. actual size	:	160 mm outer diameter x 12.1 mm wall thickness
Fixing method	:	Fitted through the floor slab and sealed with sand and cement mortar
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/160
iii. material	:	1.0 mm steel casing with 2 layer of 15 mm thick graphite based intumescent
iv. fitting method	:	1 off fitted around the service pipe so that it was within the floor aperture and flush with the underside of the floor slab. The gaps behind the collar were back filled with sand and cement mortar, any gaps on the exposed face were sealed with 'Hilti' CP606 acrylic mastic
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 160 mm and 420 mm centres from the floor on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation
Specimen E		
Pipe material	:	Polyethylene (PE)
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	250 mm outer diameter x 22.8 mm wall thickness
iii. actual size	:	250 mm outer diameter x 23.5 mm wall thickness
Fixing method	:	Fitted through the floor slab and sealed with sand and cement mortar
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/250
iii. material	:	1.0 mm steel casing with 1 layer of 15 mm thick graphite based intumescent
iv. fitting method	:	1 off fitted around service pipe on the exposed face of the floor and through bolted via 12 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 160 mm and 420 mm centres from the floor on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation

Annex A (Continued)

Item		Description
Specimen F		
Pipe material	:	PVC
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	250 mm outer diameter x 4.9 mm wall thickness
iii. actual size	:	250 mm outer diameter x 5.2 mm wall thickness
Fixing method	:	Fitted through the floor slab and sealed with sand and cement mortar
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/250
iii. material	:	1.0 mm steel casing with 1 layer of 15 mm thick graphite based intumescent
iv. fitting method	:	1 off fitted around service pipe on the exposed face of the floor and through bolted via 12 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 160 mm and 420 mm centres from the floor on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation
Specimen G		
Pipe material	:	PVC
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	160 mm outer diameter x 3.2 mm wall thickness
iii. actual size	:	160 mm outer diameter x 3.4 mm wall thickness
Fixing method	:	Fitted through the floor slab and sealed with sand and cement mortar
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/160
iii. material	:	1.0 mm steel casing with 2 layers of 15 mm thick graphite based intumescent
iv. fitting method	:	1 off fitted around service pipe on the exposed face and through bolted via 6 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 160 mm and at 420 mm centres from the floor on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation

Annex A (Continued)

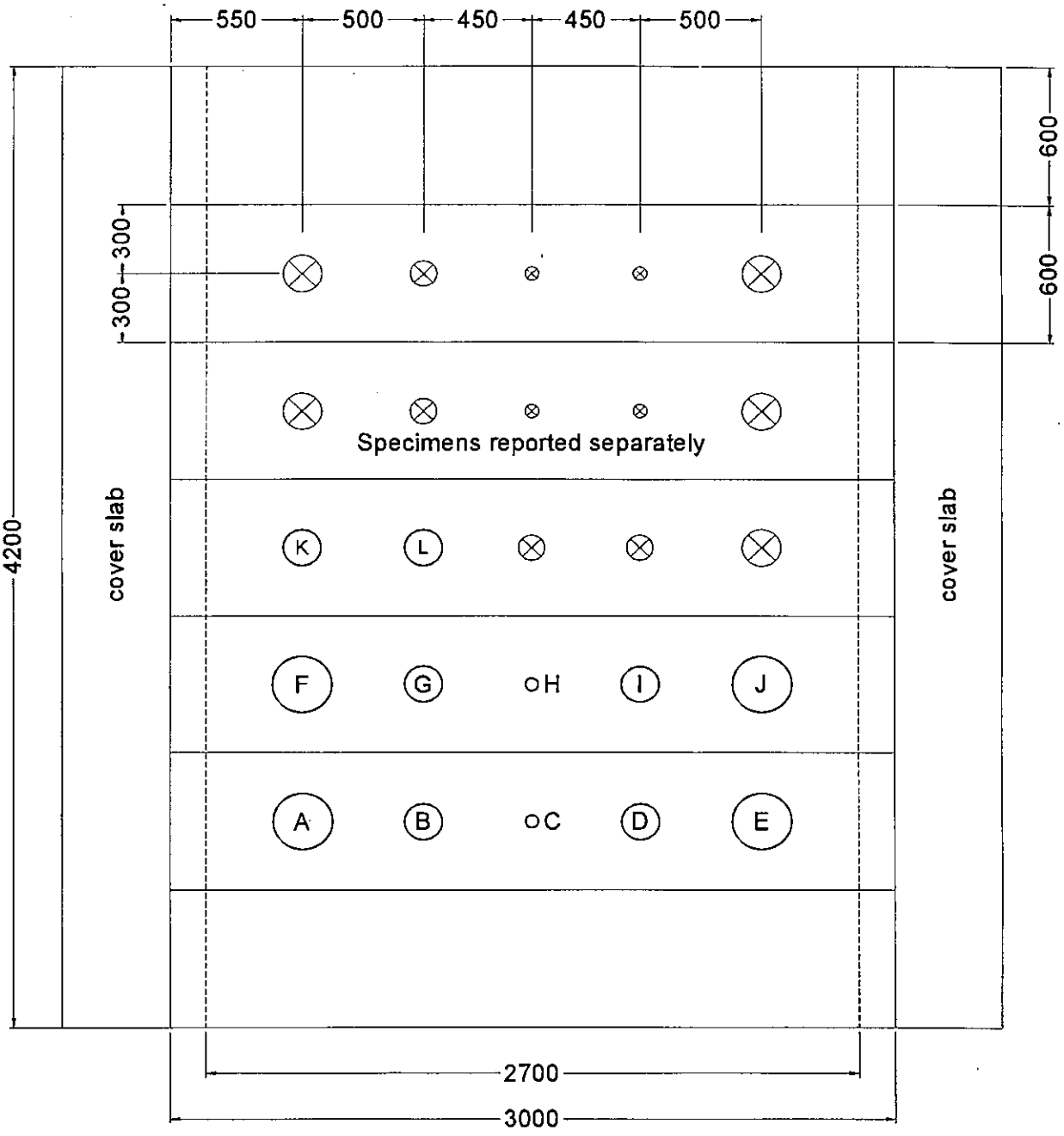
Item		Description
Specimen H		
Pipe material	:	PE
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	50 mm outer diameter x 2.9 mm wall thickness
iii. actual size	:	50 mm outer diameter x 3.6 mm wall thickness
Fixing method	:	Fitted through the floor slab and sealed with sand and cement mortar
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/50
iii. material	:	0.6 mm steel casing with 1 layer of 6 mm thick graphite based intumescent
iv. fitting method	:	1 off fitted around service pipe on the exposed face and through bolted via 2 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 160 mm and 420 mm centres from the floor on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation
Specimen I		
Pipe material	:	Acrylonitrile butadiene styrene (ABS)
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	160 mm outer diameter x 10.45 mm wall thickness
iii. actual size	:	160 mm outer diameter x 10.0 mm wall thickness
Fixing method	:	Fitted through the floor slab and sealed with sand and cement mortar
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/160
iii. material	:	1.0 mm steel casing with 2 layers of 15 mm thick graphite based intumescent
iv. fitting method	:	1 off fitted around service pipe on the exposed face of the floor and through bolted via 6 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 160 mm and 420 mm centres from the floor on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation

Annex A (Continued)

Item		Description
Specimen J		
Pipe material	:	PE
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	250 mm outer diameter x 7.8 mm wall thickness
iii. actual size	:	250 mm outer diameter x 8.1 mm wall thickness
Fixing method	:	Fitted through the floor slab and sealed with sand and cement mortar
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/250
iii. material	:	1.0 mm steel casing with 1 layer of 15 mm thick graphite based intumescent
iv. fitting method	:	1 off fitted around service pipe on the exposed face of the floor and through bolted via 12 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 160 mm and 420 mm centres from the floor on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation
Specimen K		
Pipe material	:	PE
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	160 mm outer diameter x 14.6 mm wall thickness
iii. actual size	:	160 mm outer diameter x 15.1 mm wall thickness
Fixing method	:	Fitted through the floor slab and sealed with sand and cement mortar
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/160
iii. material	:	1.0 mm steel casing with 2 layers of 15 mm thick graphite based intumescent
iv. fitting method	:	1 off fitted around the service pipe so that it was within the floor aperture and flush with the underside of the floor slab. The gaps behind the collar were back filled with sand and cement mortar, any gaps on the exposed face were sealed with 'Hilti' CP606 acrylic mastic
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 160 mm and 420 mm centres from the floor on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation

Annex A (Continued)

Item		Description
Specimen L		
Pipe material	:	PE
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	160 mm outer diameter x 4.0 mm wall thickness
iii. actual size	:	160 mm outer diameter x 4.5 mm wall thickness
Fixing method	:	Fitted through the floor slab and sealed with sand and cement mortar
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/160
iii. material	:	1.0 mm steel casing with 2 layers of 15 mm thick graphite based intumescent
iv. fitting method	:	1 off fitted around the service pipe so that it was within the floor aperture and flush with the underside of the floor slab. The gaps behind the collar were back filled with sand and cement mortar, any gaps on the exposed face were sealed with 'Hilti' CP606 acrylic mastic
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 160 mm and 420 mm centres from the floor on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation

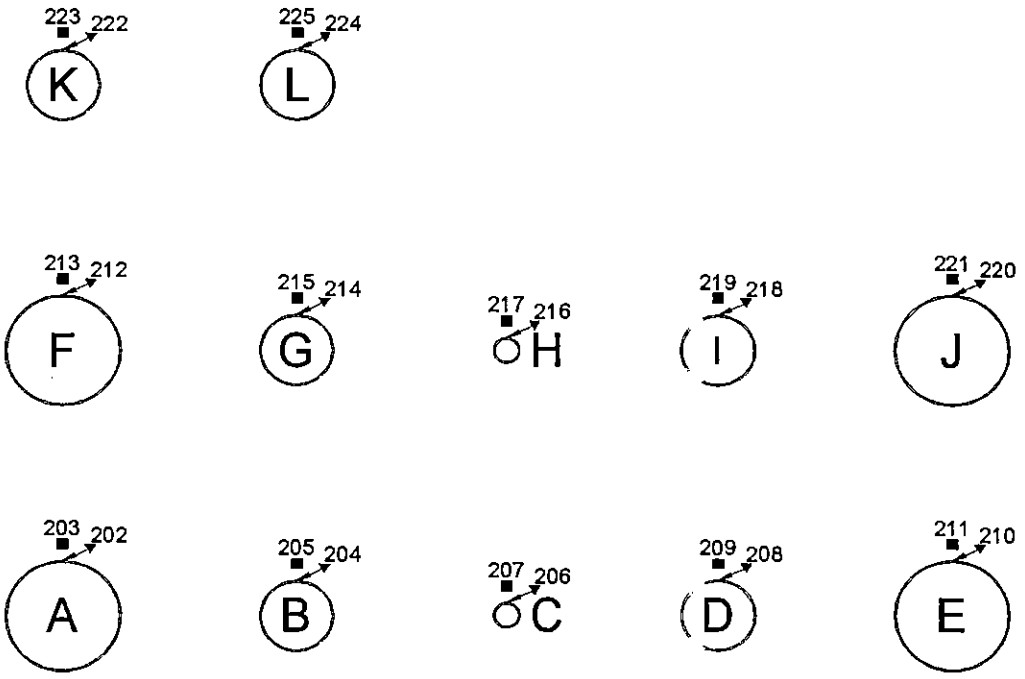


PLAN VIEW OF
TEST ARRANGEMENT

Do not scale

See Annex A for schedule
All dimensions are in mm

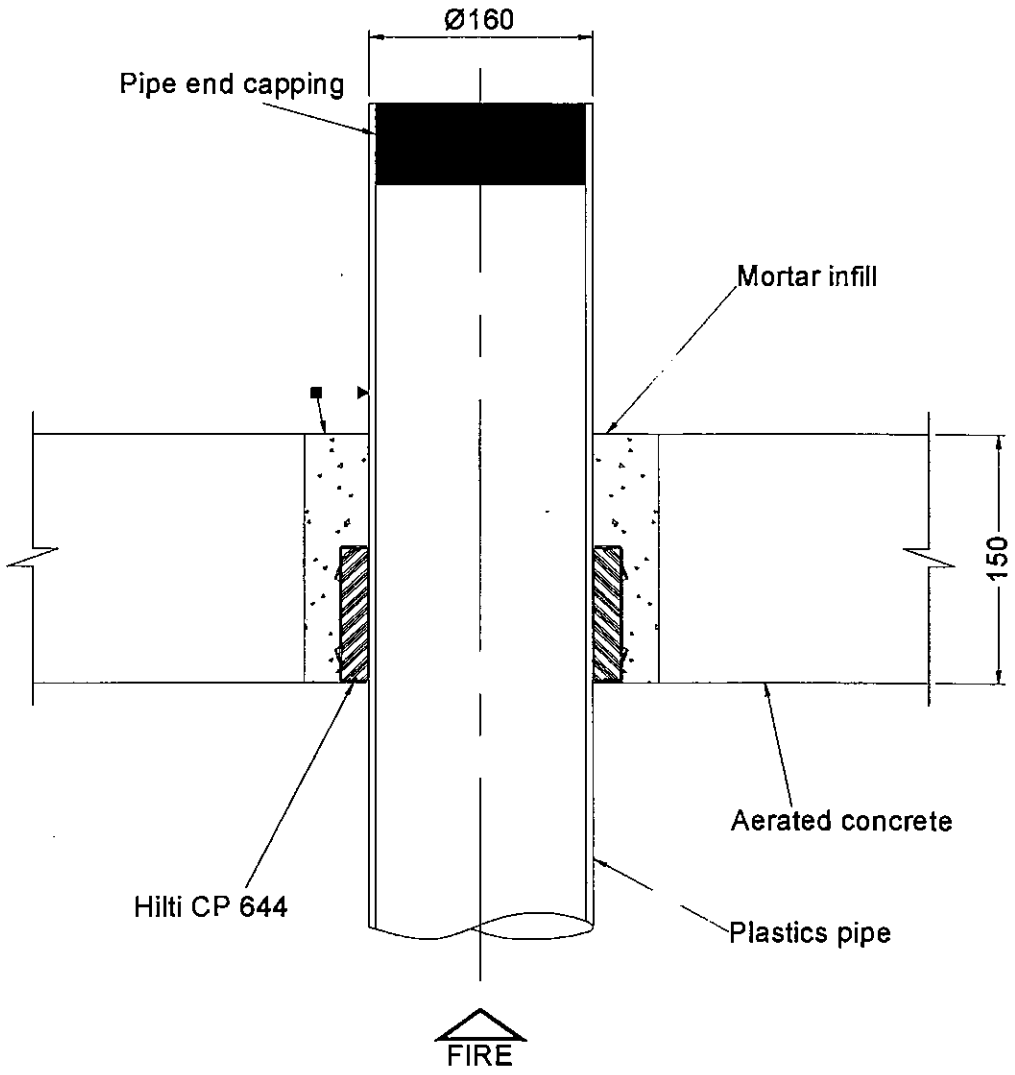
FIGURE 1



■◆ Positions of thermocouples, also refer to Figures 3 & 4

Do not scale

FIGURE 2



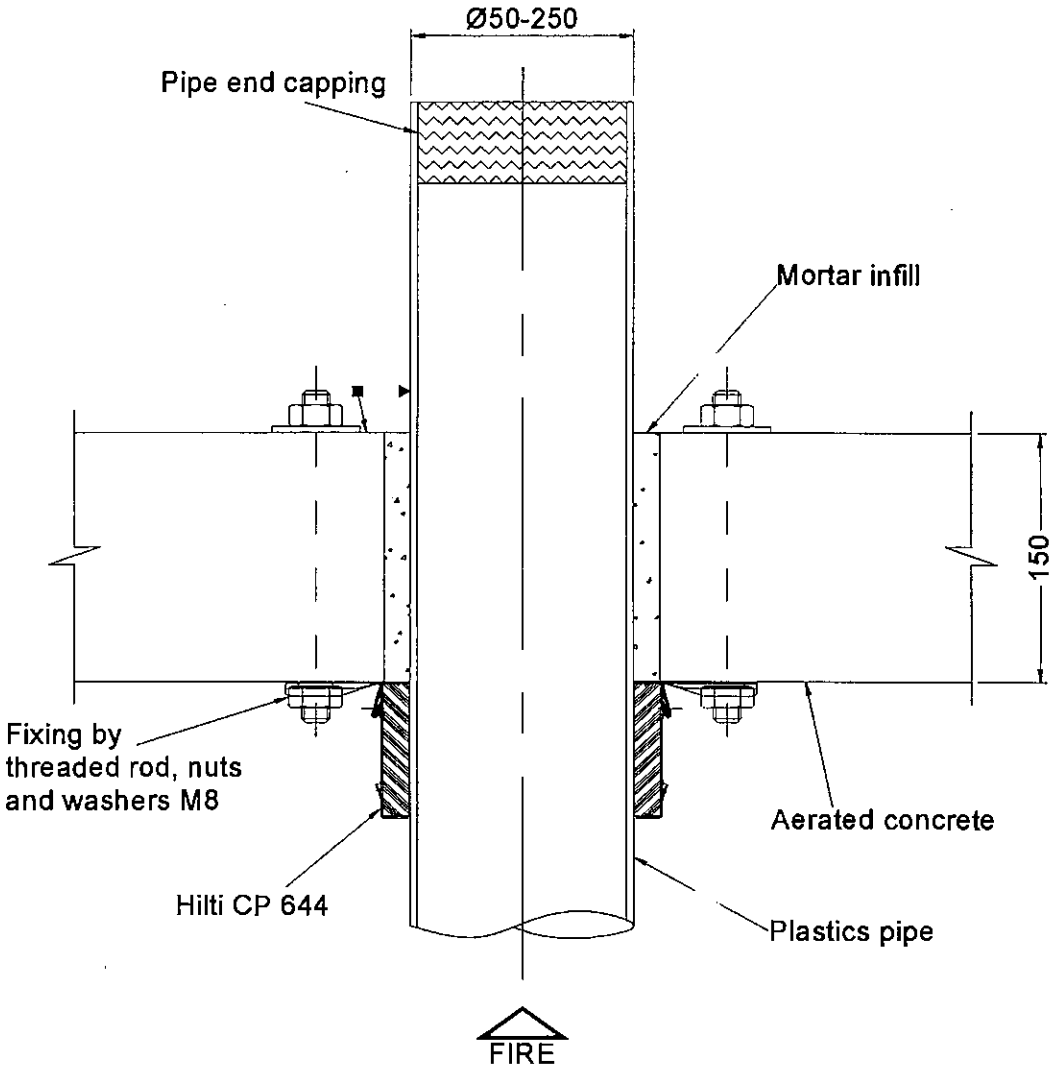
TYPICAL SECTION THROUGH
SPECIMENS REFERENCED D, K & L

■ ▼ Positions of thermocouples relating to Figure 2

Do not scale

See Annex A for schedule
All dimensions are in mm

FIGURE 3



TYPICAL SECTION THROUGH
SPECIMENS REFERENCED A, B, C, E, F, G, H, I & J

■ ▼ Positions of thermocouples relating to Figure 2

Do not scale

See Annex A for schedule
All dimensions are in mm

FIGURE 4

Annex B

Data Recorded During The Test

Table 1

Specified and Actual Furnace Temperatures

Time Mins	Specified Furnace Temperature Deg. C	Actual Furnace Temperature Deg. C
0	20	22
10	678	707
20	781	758
30	842	823
40	885	863
50	918	911
60	945	945
70	968	955
80	988	972
90	1006	992
100	1022	1007
110	1036	1034
120	1049	1052
130	1061	1057
140	1072	1069
150	1082	1079
160	1092	1077
170	1101	1103
180	1110	1127
190	1118	1133
200	1126	1146
210	1133	1164
220	1140	1161
230	1146	1170
240	1153	1156
245	1156	1141

Annex B (Continued)

Table 2

Individual Temperatures Recorded on
the Unexposed Surface of Specimen A

Time Mins	T/C Number 202 Deg. C	T/C Number 203 Deg. C
0	12	12
10	13	30
20	18	46
30	21	49
40	25	51
50	29	53
60	39	56
70	59	56
80	75	59
90	80	59
100	82	61
110	*	*
120		
130		
140		
150		
160		
170		
180		
190		
200		
210		
220		
230		
240		
245		

*Thermocouple Malfunction

Annex B (Continued)

Table 3

Individual Temperatures Recorded on
the Unexposed Surface of Specimen B

Time Mins	T/C Number 204 Deg. C	T/C Number 205 Deg. C
0	13	12
10	60	14
20	59	22
30	58	30
40	59	37
50	59	45
60	57	53
70	65	63
80	73	71
90	71	72
100	*	73
110		75
120		*
130		
140		
150		
160		
170		
180		
190		
200		
210		
220		
230		
240		
245		

* Thermocouple Malfunction

Annex B (Continued)

Table 4

Individual Temperatures Recorded on
the Unexposed Surface of Specimen C

Time Mins	T/C Number 206 Deg. C	T/C Number 207 Deg. C
0	13	12
10	23	14
20	40	18
30	53	25
40	65	31
50	66	38
60	75	47
70	81	61
80	86	72
90	85	76
100	173	76
110	*	*
120		
130		
140		
150		
160		
170		
180		
190		
200		
210		
220		
230		
240		
245		

* Thermocouple Malfunction

Annex B (Continued)

Table 5

Individual Temperatures Recorded on
the Unexposed Surface of Specimen D

Time Mins	T/C Number 208 Deg. C	T/C Number 209 Deg. C
0	15	15
10	25	15
20	38	18
30	41	21
40	46	32
50	55	53
60	75	71
70	101	81
80	120	87
90	160	94
100	246	107
110	*	*
120		
130		
140		
150		
160		
170		
180		
190		
200		
210		
220		
230		
240		
245		

* Integrity Failure occurred at 100 Minutes

Annex B (Continued)

Table 6

Individual Temperatures Recorded on
the Unexposed Surface of Specimen E

Time Mins	T/C Number 210 Deg. C	T/C Number 211 Deg. C
0	16	15
10	22	16
20	34	19
30	47	25
40	62	33
50	79	46
60	91	72
70	*	*
80		
90		
100		
110		
120		
130		
140		
150		
160		
170		
180		
190		
200		
210		
220		
230		
240		
245		

* Integrity Failure occurred at 64 Minutes

Annex B (Continued)

Table 7

Individual Temperatures Recorded on
the Unexposed Surface of Specimen F

Time Mins	T/C Number 212 Deg. C	T/C Number 213 Deg. C
0	16	15
10	69	16
20	76	13
30	71	29
40	72	31
50	76	34
60	75	37
70	75	36
80	76	34
90	76	34
100	77	35
110	76	37
120	75	37
130	75	37
140	74	40
150	75	42
160	74	43
170	75	43
180	74	44
190	72	56
200	73	66
210	73	64
220	104	*
230	105	
240	122	
245	130	

* Thermocouple Malfunction

Annex B (Continued)

Table 8

Individual Temperatures Recorded on
the Unexposed Surface of Specimen G

Time Mins	T/C Number 214 Deg. C	T/C Number 215 Deg. C
0	16	13
10	89	17
20	69	23
30	73	29
40	75	35
50	74	45
60	81	70
70	92	82
80	103	83
90	112	84
100	124	85
110	137	85
120	151	86
130	161	86
140	157	87
150	163	87
160	166	89
170	177	93
180	178	92
190	*	*
200		
210		
220		
230		
240		
245		

* Integrity Failure occurred at 190 Minutes

Annex B (Continued)

Table 9

Individual Temperatures Recorded on
the Unexposed Surface of Specimen H

Time Mins	T/C Number 216 Deg. C	T/C Number 217 Deg. C
0	14	13
10	17	14
20	19	17
30	23	24
40	26	34
50	30	46
60	33	56
70	37	65
80	39	70
90	41	74
100	42	76
110	42	77
120	43	78
130	44	79
140	47	80
150	46	81
160	44	81
170	45	82
180	44	81
190	46	81
200	49	82
210	50	82
220	74	89
230	63	86
240	56	85
245	56	86

Annex B (Continued)

Table 10

Individual Temperatures Recorded on the Unexposed Surface of Specimen I

Time Mins	T/C Number 218 Deg. C	T/C Number 219 Deg. C
0	14	14
10	27	14
20	34	18
30	38	24
40	43	29
50	81	37
60	111	57
70	123	77
80	131	80
90	137	81
100	146	83
110	164	85
120	191	89
130	243	91
140	*	*
150		
160		
170		
180		
190		
200		
210		
220		
230		
240		
245		

Annex B (Continued)

Table 11

Individual Temperatures Recorded on
the Unexposed Surface of Specimen J

Time Mins	T/C Number 220 Deg. C	T/C Number 221 Deg. C
0	15	14
10	53	16
20	60	19
30	54	22
40	53	25
50	57	30
60	60	37
70	64	46
80	63	53
90	62	59
100	61	64
110	60	68
120	58	72
130	58	74
140	59	76
150	61	76
160	65	77
170	63	78
180	61	78
190	62	79
200	81	80
210	126	82
220	*	*
230		
240		
245		

* Integrity Failure occurred at 212 Minutes

Annex B (Continued)

Table 12

Individual Temperatures Recorded on
the Unexposed Surface of Specimen K

Time Mins	T/C Number 222 Deg. C	T/C Number 223 Deg. C
0	16	16
10	17	16
20	19	17
30	23	18
40	26	22
50	29	28
60	37	38
70	44	54
80	51	64
90	55	72
100	58	80
110	60	88
120	61	93
130	65	99
140	68	103
150	70	112
160	73	141
170	*	*
180		
190		
200		
210		
220		
230		
240		
245		

* Integrity Failure occurred at 164 Minutes

Annex B (Continued)

Table 13

Individual Temperatures Recorded on
the Unexposed Surface of Specimen L

Time Mins	T/C Number 224 Deg. C	T/C Number 225 Deg. C
0	15	16
10	20	40
20	31	51
30	43	66
40	66	84
50	86	87
60	97	88
70	103	88
80	112	88
90	122	88
100	152	87
110	165	83
120	176	82
130	196	85
140	*	*
150		
160		
170		
180		
190		
200		
210		
220		
230		
240		
245		

* Integrity Failure occurred at 133 Minutes

Annex B (Continued)

Table 14

Individual Furnace Temperatures Recorded by
the 1.5 mm Thermocouples

Time	T/C Number 252	T/C Number 253	T/C Number 254	T/C Number 255	T/C Number 256	T/C Number 257
Mins	Deg. C	Deg. C	Deg. C	Deg. C	Deg. C	Deg. C
0	20	21	23	24	24	17
10	689	767	716	768	781	737
20	706	827	788	768	783	782
30	809	862	882	821	824	817
40	870	895	911	863	871	853
50	911	939	954	906	915	908
60	946	962	975	935	944	935
70	954	976	983	949	959	947
80	979	984	993	959	976	968
90	993	1007	1010	987	994	988
100	1001	1014	1021	1013	1015	1004
110	1022	1031	1036	1027	1033	1020
120	*	1052	1053	1038	1045	1029
130		*	*	1045	1047	1041
140	1051	1061	1025	1057	1059	1047
150	1073	1076	1064	1066	1068	1063
160	1080	1084	*	1083	1087	1087
170	1004	1082		1078	1074	1098
180	*	1143		1140	1140	1121
190		1160		1143	1142	1127
200		1161		1169	1155	1136
210		*		1197	1183	1153
220				1179	1182	1158
230				1190	1191	1164
240				1193	1191	1161
245				1194	1191	1149

* Thermocouple Malfunction

Annex B (Continued)

Table 14

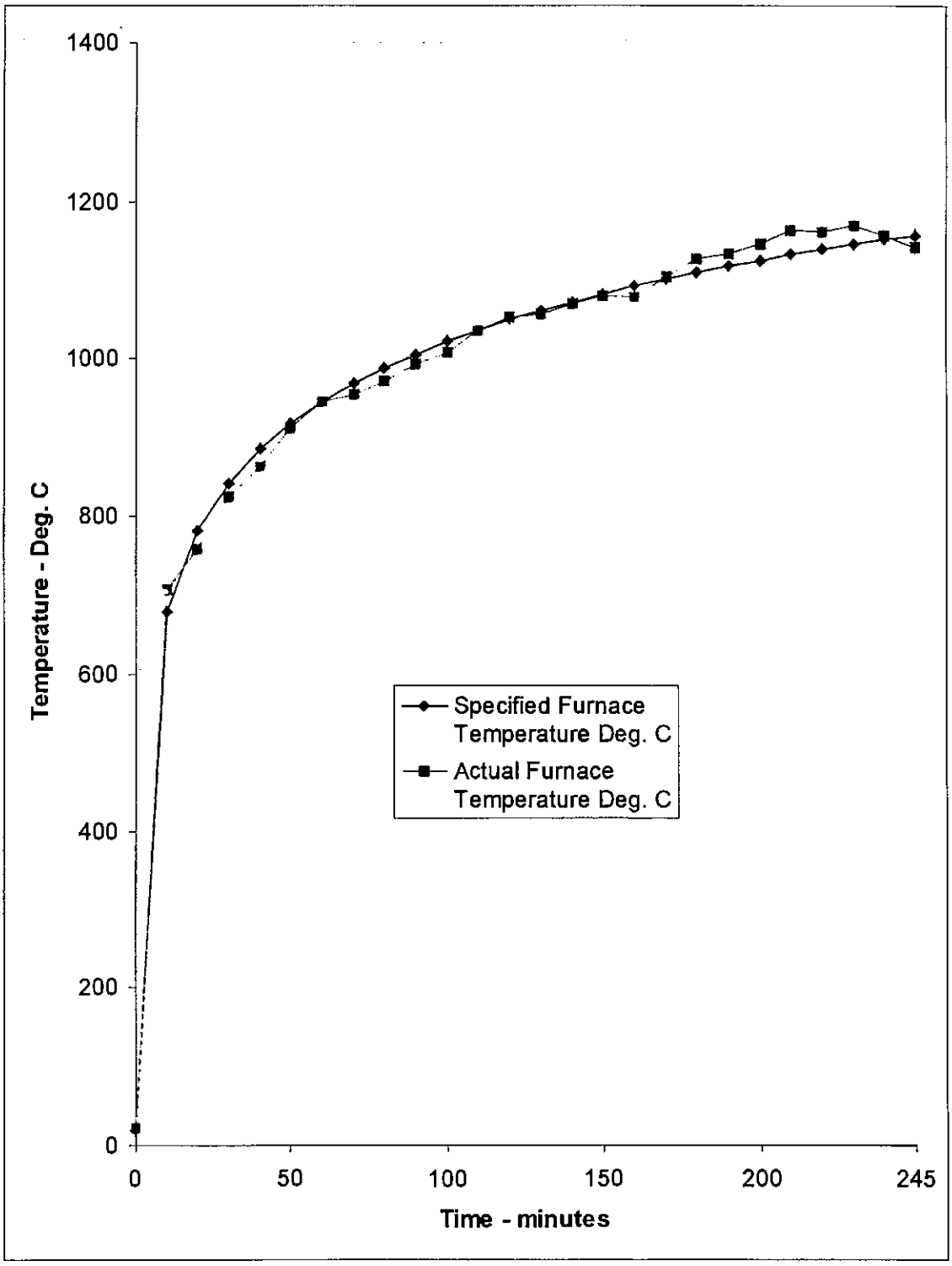
Furnace Pressure

Time Mins	Pressure Pa
0	0
10	16.9
20	18.3
30	20.2
40	19
50	18
60	20
70	18.3
80	19.7
90	20.8
100	19
110	20.4
120	18.3
130	20.9
140	20.8
150	20.8
160	21.5
170	18.5
180	17.3
190	18.5
200	19.7
210	20.2
220	18
230	18.2
240	17.7
245	18.5

Annex B (Continued)

Graph 1

Specified and Actual Furnace Temperatures



Annex C

Observations Made by the Responsible Officer

U – Observations made from unexposed side
E – Observations made from exposed side

Time			
Mins	**Secs**		
0	00		**The test commences.**
03	10	U	Small quantities of white smoke release begin to issue from Specimen C.
08	10	U	Small quantities of white smoke release begin to issue from Specimen F.
17	00	U	Cracks are evident in mortar infill to Specimen A.
21	10	U	The body of the pipe to Specimen F appears to be softening slightly.
27	00	U	A crack is evident in the floor slab between Specimens D and E.
27	30	U	Further cracks are evident around Specimens D and E.
29	42	U	Smoke release is visible from the cracks in the mortar around Specimen A.
32	00	U	Smoke release increases from Specimen E.
46	55	U	A large crack is evident in the floor slab around Pipe A.
59	00	U	A crack is evident in the floor slab from Specimen A to E.
62	00	U	Large amounts of smoke and discolouration around the seal of Pipe D.
62	45	U	A gap is evident in Specimen E, a through gap into the furnace is evident.
64	00	U	Sustained flames issue from Specimen E. **Integrity failure of Specimen E is deemed to occur.**
70	00	U	Discolouration increases around the base of Specimen D.
72	00	U	Smoke release increased from base of Specimen D.
84	00	U	Smoke release continues to increase from the base of Specimen D.
88	00	U	Large quantities of brown smoke now issues from base of Specimen D.

Annex C (continued)

Time			
Mins	**Secs**		
91	00	U	A temperature rise in excess of 180°C is recorded from Specimen D. **Insulation failure of Specimen D is deemed to occur.**
100	00	U	Sustained flames issue from Specimen D. **Integrity failure of Specimen D is deemed to occur.**
120	00	U	A temperature rise in excess of 180°C is recorded from Specimen I. **Insulation failure of Specimen I is deemed to occur.**
123	00	U	Smoke release increases from the cracks around the base of Specimens A and B.
125	00	U	The pipe to Specimen I has softened and begins to slump. A crack is evident from the seal of Specimen I across the slab.
128	00	U	A temperature rise in excess of 180°C is recorded from Specimen L. **Insulation failure of specimen L is deemed to occur.**
130	00	U	Smoke increases from around Specimen I.
132	00		A cotton wool pad is applied to seal of Specimen L and fails to ignite
133	45	U	Sustained flames issue from Specimen L. **Integrity failure of Specimen L is deemed to occur.**
164	00	U	Sustained flames issue from Specimen K. **Integrity failure of Specimen K is deemed to occur.**
165	00	U	Large quantities of smoke release are evident from Specimen B.
169	00	U	Sustained flames issue from Specimen B. **Integrity failure of Specimen B is deemed to occur.**
182	00	U	Large quantities of smoke release are evident from Specimen G. The pipe begins to slump as it melts.
183	00	U	Holes are now present in the body of Specimen G.
186	00	U	Brown smoke release is evident from Specimen G.

Annex C (Continued)

Time			
Mins	**Secs**		
190	00	U	Sustained flames issue from Specimen G. **Integrity failure of Specimen G is deemed to occur.**
211	00	U	Gaps are evident at the base of Specimen A, glowing is evident at these positions. A cotton wool pad is applied but fails to ignite.
212	00	U	Sustained flames issue from Specimen J. **Integrity failure of Specimen J is deemed to occur.**
213	00	U	Sustained flames issue from Specimen A. **Integrity failure of Specimen A is deemed to occur.**
245			**The test is discontinued.**
			Post Test Observations
			No through gaps into the furnace were evident during the test for Specimens C, F, and H.

Annex D

Photographs Taken During the Test

Plate 1 : Showing the exposed face of the specimens prior to the test

Plate 2 : Showing the exposed face of the specimens prior to the test

Plate 3 : Showing the exposed face of the specimens prior to the test

Plate 4 : Showing the unexposed face of the specimens during the test

Plate 5 : Showing the unexposed face of the specimens during the test

Plate 6 : Showing the unexposed face of the specimens during the test

Plate 7 : Showing the unexposed face of the specimens during the test

Plate 8 : Showing the unexposed face of the specimens during the test

Plate 9 : Showing the unexposed face of the specimens during the test

Plate 10: Showing the unexposed face of the specimens directly after the test

Plate 1

Plate 2

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Plate 3

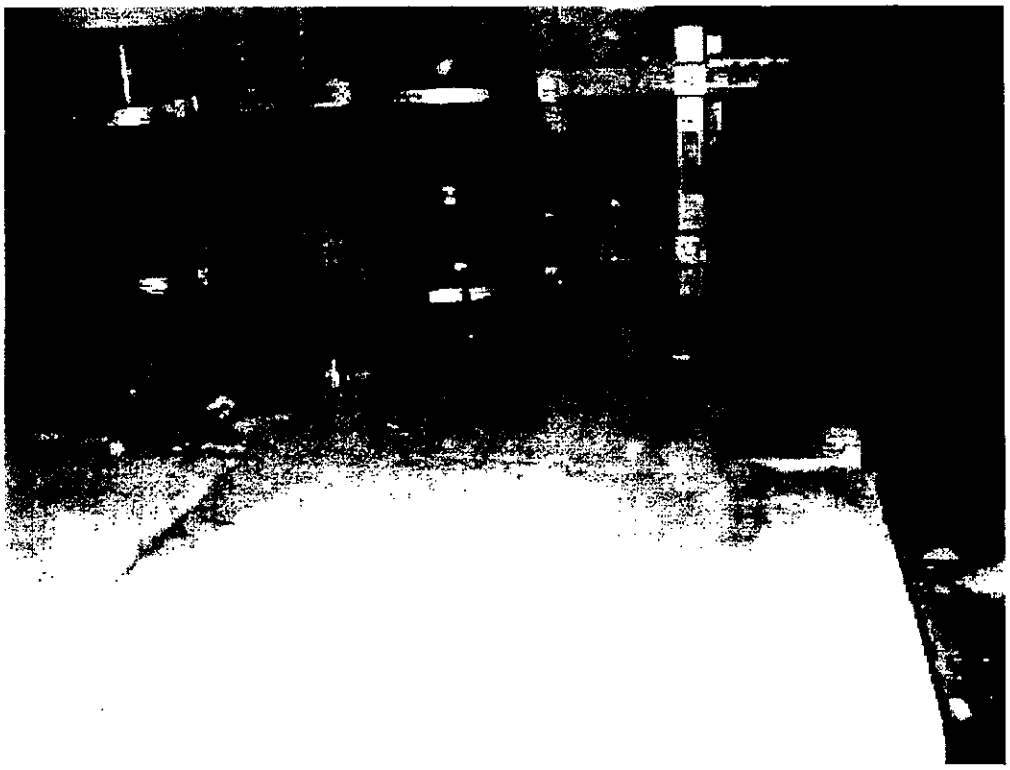

Plate 4

Warrington FIRE research

Plate 5

Plate 6

Plate 7

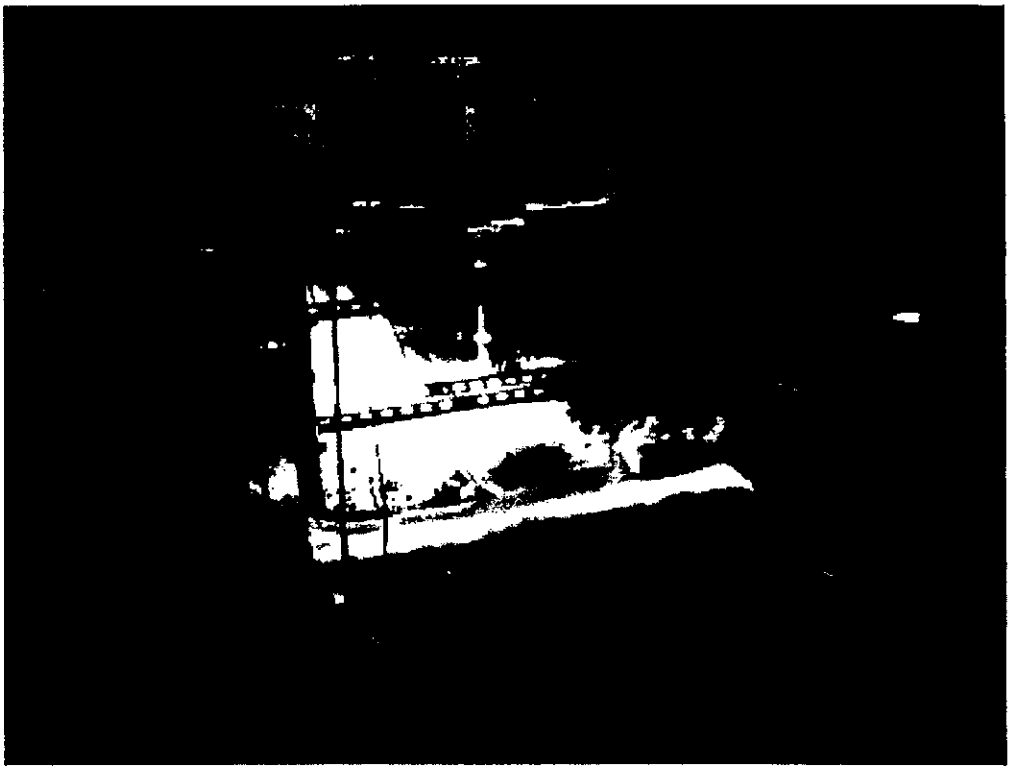

Plate 8

Warrington FIRE research

warringtonfire
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24th May 2019

Mr Uwe Bohn
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Germany

Review of Fire Test Report Referenced WARRES No. 131014/B

1 Introduction

The report referenced WARRES No. 131014/B relates to a fire resistance test conducted to evaluate the ability of twelve specimens of pipe penetration sealing system mounted within an aerated concrete floor assembly, to reinstate the integrity and insulation performance (as defined in BS 476: Part 20: 1987) of the floor construction where it has been provided with apertures to allow for the penetration of various diameters of pipe services. Since no standardised test for this purpose yet exists, an ad-hoc fire resistance test was performed utilising the heating conditions specified in BS EN 1363-1: 1999, in conjunction with the additional guidelines taken from the latest draft document prEN 1366-3: 2002 and the performance criteria of BS 476: Part 20; 1987. 'Methods of determination of the fire resistance of elements of construction (general principles)'

The test assembly comprised an aerated concrete floor assembly with overall dimensions of 4200 mm long by 2700 mm wide by 150 mm thick. The floor was provided with twelve circular apertures of various diameters, through which the pipes were passed. Each pipe was fitted with an intumescent collar which was referenced 'CP644'. The specimens were referenced as A, B, C, D, E, F, G, H, I, J, K, and L are detailed in the table below:

The results were as follows:

WFRC Ref.	Integrity	Insulation
A	213 minutes	101 minutes#
B	169 minutes	101 minutes#
C	245 minutes	101 minutes#
D	100 minutes	91 minutes
E	64 minutes	64 minutes
F	245 minutes	245 minutes
G	190 minutes	190 minutes
H	245 minutes	245 minutes
I	138 minutes	120 minutes
J	212 minutes	212 minutes
K	164 minutes	164 minutes
L	133 minutes	128 minutes

2 Confirmation of Specification

It has been confirmed by Hilti Entwicklungsgesellschaft mbH that there have been no changes to the specification or the construction given in the original report referenced WARRES No. 131014/B

3 Considerations

While there is now a published European Standard (EN 1366-3: 2009) relating to the fire resistance testing of penetration sealing systems, this standard was not available when the test was conducted and therefore, as the fire resistance of the floor or wall construction into which the seal would be installed, is determined by test procedures detailed within BS 476: Part 20: 1987, 'Method for determination of the fire resistance of elements of construction (general principles)' or BS EN 1363-1: 1999, it was deemed appropriate to use this as the basis for a test for evaluating the penetration sealing systems themselves.

The current test methodology with respect to the fire resistance testing of penetration sealing systems, i.e. utilising the heating conditions and performance criteria for integrity and insulation given in BS 476: Part 20: 1987 or EN 1363-1, has not been amended and would, therefore, still be utilised for this purpose.

At present there are no existing Resolutions adopted by the Fire Test Study Group since the original test was performed, which would affect the manner in which the test would be conducted, or the interpretation of the test results.

4 Conclusions

At present there are no additional resolutions adopted by the Fire Test Study Group since the original test was performed which would affect the manner in which the test would be conducted or the interpretation of the test results.

The procedures adopted for the original test have been re-examined and are similar to those currently in use.

Therefore, with respect to the fire resistance test report referenced WARRES No. 131014/B its contents should remain valid until 1st June 2024.

5 Validity

This review is based on information used to formulate the original test report. No other information or data has been submitted by Hilti Entwicklungsgesellschaft mbH, which could affect this review.

Performed by:

C. Abbott
Principal Certification Engineer
Warringtonfire

Reviewed By:

D. Hankinson
Principal Certification Engineer
Warringtonfire

An Ad-Hoc Fire Resistance Test Utilising the Heating Conditions Specified in BS EN 1363-1:1999, in Conjunction with Additional Guidelines Taken from prEN 1366-3: 2002 and the Performance Criteria of BS 476: Part 20; 1987 on Seven Specimens of Pipe Penetration Sealing System

Test Sponsor

Hilti Entwicklungsgesellschaft mbH

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An Ad-Hoc Fire Resistance Test Utilising the Heating Conditions Specified in BS EN 1363-1:1999, in Conjunction with Additional Guidelines Taken from prEN 1366-3: 2002 and the Performance Criteria of BS 476: Part 20: 1987 on Seven Specimens of Pipe Penetration Sealing System

Summary

An ad-hoc fire resistance test has been conducted to evaluate the ability of seven specimens of pipe penetration sealing system mounted within a blockwork wall assembly, to reinstate the integrity and insulation performance (as defined in BS 476: Part 20: 1987) of the wall construction where it has been provided with apertures to allow for the penetration of various diameters of pipe services. Since no standardised test for this purpose yet exists, an ad-hoc fire resistance test was performed utilising the heating conditions specified in BS EN 1363-1: 1999, together with the performance criteria of BS 476: Part 20: 1987 'Methods of determination of the fire resistance of elements of construction (general principles)', in conjunction with additional guidelines taken from prEN 1366-3: 2002.

The test assembly comprised a blockwork wall assembly formed from lightweight concrete blocks with overall dimensions of 3035 mm high by 3050 mm wide by 150 mm thick. The wall was provided with seven circular apertures of various diameters, through which the pipes were passed. Each pipe was fitted with an intumescent collar on each face of the wall which was referenced 'CP644'. The specimens were referenced as A, B, C, D, N, O and P and are detailed in the table below:

Specimen	Pipe Material	Diameter	Wall Thickness	Opening Size	Collar Reference
A	PE	250 mm	8.0 mm	300 mm	CP 644/250
B	PVC	250 mm	11.9 mm	300 mm	CP 644/250
C	PE	50 mm	2.9 mm	82 mm	CP 644/50
D	PVC	50 mm	2.0 mm	82 mm	CP 644/50
N	PE	250 mm	24.0 mm	300 mm	CP 644/250
O	PVC	250 mm	5.9 mm	300 mm	CP 644/250
P	ABS	160 mm	10.5 mm	182 mm	CP 644/160

If the performances of the specimens was assessed against the criteria for integrity and insulation (maximum temperature rise only) specified in BS 476: Part 20: 1987, the results obtained could be expressed as follows:

Item Ref.	Integrity	Insulation
A	245 minutes	245 minutes
B	245 minutes	161 minutes
C	245 minutes	245 minutes
D	245 minutes	245 minutes
N	245 minutes	93 minutes
O	245 minutes	245 minutes
P	120 minutes	119 minutes

The test was discontinued after a period of 245 minutes.

Date of Test : 13th March 2003

A further twelve specimens were also included in the test, but are the subject of a separate report referenced WARRES 128947/A.

Warrington FIRE research

An Ad-Hoc Fire Resistance Test Utilising the Heating Conditions Specified in BS EN 1363-1:1999, in Conjunction with Additional Guidelines Taken from prEN 1366-3: 2002 and the Performance Criteria of BS 476: Part 20; 1987 on Seven Specimens of Pipe Penetration Sealing System

Test Sponsor

Hilti Entwicklungsgesellschaft mbH
Business Unit Chemical
Hiltistrasse 6
86916 Kaufering
Germany

Report	Name	Signature*
Responsible Officer	C Abbott	
Approved	D Forshaw	

* For and on behalf of Warrington Fire Research Centre

Report Issued : 3rd July 2003

Contents

1 Purpose of the Test

1.1 To evaluate the ability of seven specimens of pipe penetration sealing system to reinstate the fire resistance performance in terms of integrity and insulation, as defined in BS 476: Part 20: 1987, of a blockwork wall at positions where it has been provided with apertures to allow for the penetration of various diameters of pipe services. The test utilised the heating conditions specified in BS EN 1363-1:1999, together with the performance criteria of BS 476: Part 20: 1987 'Methods of determination of the fire resistance of elements of construction (general principles)', in conjunction with additional guidelines taken from prEN 1366-3: 2002.

2 Introduction

2.1 At the present time there is no British Standard test procedure applicable to the evaluation of a method or a system designed to reinstate the fire resistance of a wall or a floor where it has been provided with apertures to allow for its penetration by service items.

2.2 This report covers an ad-hoc test which, at the request of the sponsor, utilised the heating conditions of BS EN 1363-1: 1999, together with the performance criteria of BS 476: Part 20: 1987, in conjunction with additional guidelines taken from prEN 1366-3: 2002.

2.3 In BS 476: Part 20: 1987, the performance criteria appropriate to separating elements are integrity and insulation. An integrity failure is deemed to occur when collapse of the specimen occurs, when cracks or other openings exist in a separating element through which flame or hot gasses can pass which would lead to the ignition of a cotton pad, when through gaps form which are in excess of 6 mm wide by 150 mm long or 25 mm diameter or when flaming occurs on the unexposed face for a duration greater than 10 seconds. An insulation failure is deemed to occur when the mean temperature of the unexposed surface increases by more than 140 °C above the initial temperature or the temperature of the unexposed surface increases at any point by more than 180°C above the initial temperature. As per the guideline taken from prEN 1366-3: 2002, only the maximum temperature rise criterion was utilised for the test.

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

2.5 The investigation was conducted on the 13th March 2003 at the request of Hilti Entwicklungsgesellschaft mbH, the sponsor of the test.

2.6 The test was witnessed by Mr. C. Viermann and Mr. D. Williams, representatives of the test sponsor.

3 Test Specimen Construction

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

3.2 The specimens were supplied by the sponsor during the week commencing 10th March 2003. Warrington Fire Research Centre was not involved in any sampling or selection procedure of the specimens or their components.

3.3 Installation of the assembly was conducted by representatives of the test sponsor on the 11th and 12th of March 2003.

4 Instrumentation and Measuring Equipment

4.1 The temperature rise within the furnace chamber was controlled in accordance with the requirements of BS EN 1363-1:1999.

4.2 Nine plate thermometers distributed over a plane 100 mm from the exposed face of the assembly were provided to monitor the temperature of the furnace atmosphere.

4.3 Nine 1.5 mm mineral insulated thermocouples were also included within the furnace chamber distributed over a plane 100 mm from the exposed face of the assembly. These thermocouples were used for information purposes only.

4.4 Pressure sensors were provided within the furnace to monitor the furnace pressure, which was measured and controlled in accordance with the requirements of BSEN 1363-1:1999.

4.5 Thermocouples were provided to monitor the temperature of the unexposed faces of the individual penetrating items and their seals.

4.6 The locations and reference numbers of the various unexposed surface thermocouples are shown in Figures 2 and 3 of Annex A.

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

4.8 Cotton pads and gap gauges were available to evaluate the impermeability of the specimens to hot gases.

5 Test Procedure

5.1 The test was performed utilising the performance criteria given in BS 476: Part 20: 1987, in conjunction with additional guidelines taken from the latest draft document prEN 1366-3: 2002.

5.2 The furnace was controlled so that its mean temperature complied with the requirements of BS EN 1363-1: 1999, Clause 5.1.

5.3 After the first five minutes of testing and for the remainder of the test, the furnace atmospheric pressure was controlled so that it complied with the requirements of BS EN 1363-1: 1999. The calculated pressure differential relative to the laboratory atmosphere at mid-height of the lowest specimen was 10.5 (±3) Pa.

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

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

5.6 The thermocouples referred to in 4.6 and detailed in Figures 2, 3 and 4 were used to determine compliance with the maximum unexposed face temperature rise criterion as required by prEN 1366-3: 2002.

5.7 The roving thermocouple, cotton pads and gap gauges were used if considered appropriate. The occurrence of any sustained flaming on the unexposed surface of the specimens was also recorded to determine compliance with the integrity performance criterion.

6 Test Data and Information

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

6.1.1 Mean furnace temperature, together with the temperature/time relationship specified in BS EN 1363-1:1999.

6.1.2 Individual unexposed surface temperatures recorded by the thermocouples fixed to the individual penetrating items and their seals.

6.1.3 Individual furnace temperatures recorded by the 1.5 mm mineral insulated thermocouples.

6.1.4 Pressure measured within the furnace chamber at a position 300 mm below the top of the assembly.

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

6.3 Photographs of the specimens before, during and after testing are included in Annex D.

6.4 The ambient air temperature in the vicinity of the test construction was 10°C at the start of the test, with a maximum variation of +6°C during the test.

6.5 The test was discontinued after a period of 245 minutes.

7 Evaluation Against the Performance Criteria

7.1 The performance of the specimens was judged against the following criteria:

7.1.1 **Integrity** - It is required that there is no collapse of the specimen, no sustained flaming on the unexposed surface and no loss of impermeability. The specimens each satisfied these requirements for periods shown in the table in 8.2.

7.1.2 **Insulation** - it is required that the mean temperature rise of the unexposed surface shall not be greater than 140°C and that the maximum temperature rise shall not be greater than 180°C. as per the guideline taken from the draft document prEN 1366-3: 2002, only the maximum temperature rise criterion was utilised for the test. The specimens satisfied this requirement for periods shown in the table in 8.2.

8 Conclusions

8.1 An ad-hoc fire resistance test has been conducted to evaluate the ability of twelve specimens of pipe penetration sealing system to reinstate the fire resistance performance, in terms of integrity and insulation as defined in BS 476: Part 20: 1987, of a blockwork wall at positions where it has been provided with apertures to allow for the penetration of various diameters of pipe services. The test utilised the heating conditions specified in BS EN 1363-1:1999, together with the performance criteria of BS 476: Part 20: 1987, in conjunction with additional guidelines taken from prEN 1366-3: 2002.

8.2 If the performance of the individual penetrating items were assessed against the integrity and insulation (maximum temperature rise) criteria of BS 476: Part 20: 1987, the results obtained could be expressed as follows:

Specimen	Integrity	Insulation
A	245 minutes	245 minutes
B	245 minutes	161 minutes
C	245 minutes	245 minutes
D	245 minutes	245 minutes
N	245 minutes	93 minutes
O	245 minutes	245 minutes
P	120 minutes	119 minutes

The test was discontinued after a period of 245 minutes.

9 Limitations

9.1 The results relate only to the behaviour of the specimen of the element of construction under the particular conditions of 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.

10 Review

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

3rd July 2003

Warrington FIRE research

Annex A

Schedule of Components
(Refer to Figures 1 to 3)
(All values are nominal unless stated otherwise)
(All other details are as stated by the sponsor)

Item		Description
Blockwork Wall		
Material	:	Aerated concrete blocks
Overall size (Block)	:	440 mm x 210 mm x 150 mm thick
Density	:	760 kg/m^3
Fixing method	:	Bonded with sand and cement mortar
Specimen A		
Pipe material	:	Polyethylene (PE)
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	250 mm diameter x 7.8 mm wall thickness
iii. actual size	:	250 mm diameter x 8.0 mm wall thickness
Fixing method	:	Fitted through the blockwork wall and sealed with sand and cement mortar infill
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/250
iii. material	:	1 mm steel casing with 1 layer of 15 mm thick graphite based intumescent
iv. fitting method	:	2 off fitted around service pipe on both the exposed and unexposed faces so that they were butted up to the wall and were through bolted to each other via 9 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 295 mm and at 475 mm centres from the blockwork wall on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation

Annex A (Continued)

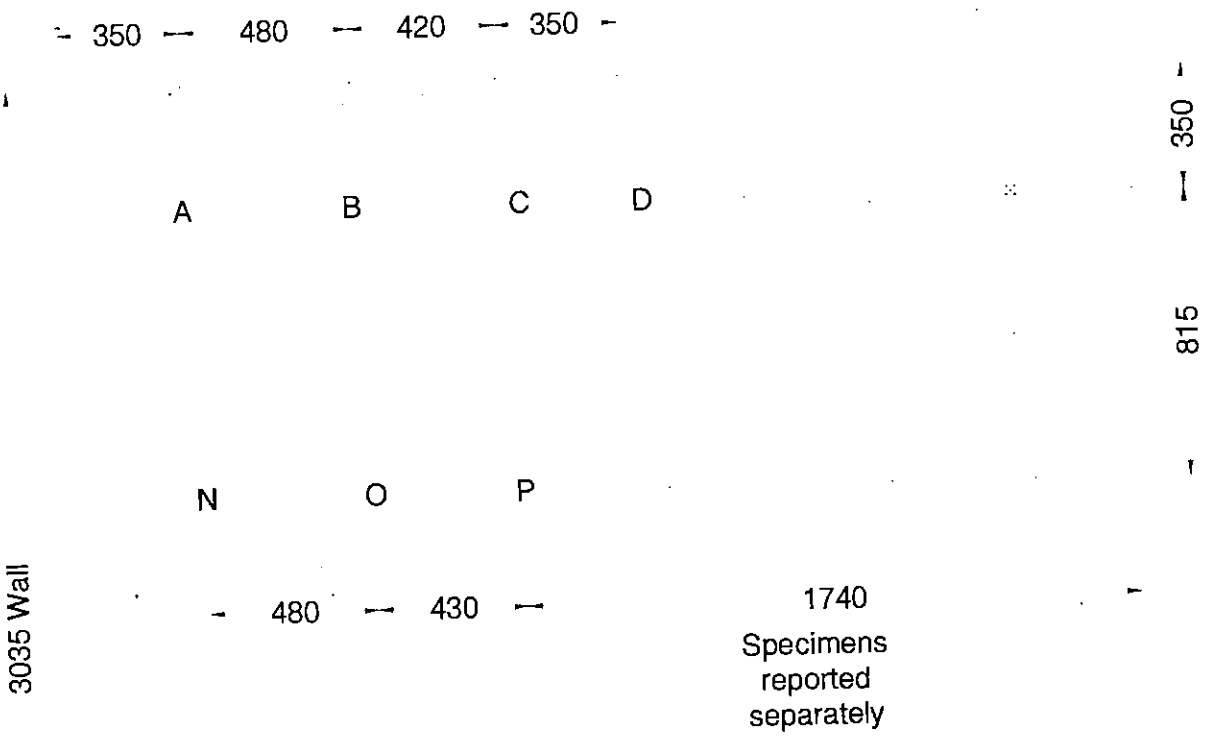
Item		Description
Specimen B		
Pipe material	:	Polyvinyl chloride (PVC)
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	250 mm diameter x 11.9 mm wall thickness
iii. actual size	:	250 mm diameter x 11.9 mm wall thickness
Fixing method	:	Fitted through the blockwork wall and sealed with sand and cement mortar infill
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/250
iii. material	:	1 mm steel casing with 1 layer of 15 mm thick graphite based intumescent
iv. fitting method	:	2 off fitted around service pipe on both the exposed and unexposed faces so that they were butted up to the wall and were through bolted to each other via 9 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 295 mm and at 475 mm centres from the blockwork wall on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation
Specimen C		
Pipe material	:	PE
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	50 mm diameter x 2.9 mm wall thickness
iii. actual size	:	50 mm diameter x 2.9 mm wall thickness
Fixing method	:	Fitted through the blockwork wall and sealed with sand and cement mortar infill
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/50
iii. material	:	1 mm steel casing with 1 layer of 6 mm thick graphite based intumescent
iv. fitting method	:	2 off fitted around service pipe on both the exposed and unexposed faces so that they were butted up to the wall and were through bolted to each other via 2 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 295 mm and at 475 mm centres from the blockwork wall on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation

Annex A (Continued)

Item		Description
Specimen D		
Pipe material	:	PVC
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	50 mm diameter x 1.8 mm wall thickness
iii. actual size	:	50 mm diameter x 2.0 mm wall thickness
Fixing method	:	Fitted through the blockwork wall and sealed with sand and cement mortar infill
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/50
iii. material	:	1 mm steel casing with 1 layer of 6 mm thick graphite based intumescent
iv. fitting method	:	2 off fitted around service pipe on both the exposed and unexposed faces so that they were butted up to the wall and were through bolted to each other via 2 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 295 mm and at 475 mm centres from the blockwork wall on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation
Specimen N		
Pipe material	:	PE
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	250 mm diameter x 22.8 mm wall thickness
iii. actual size	:	250 mm diameter x 24.0 mm wall thickness
Fixing method	:	Fitted through the blockwork wall and sealed with sand and cement mortar infill
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/250
iii. material	:	1 mm steel casing with 1 layer of 15 mm thick graphite based intumescent
iv. fitting method	:	2 off fitted around service pipe on both the exposed and unexposed faces so that they were butted up to the wall and were through bolted to each other via 9 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 295 mm and at 475 mm centres from the blockwork wall on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation

Annex A (Continued)

Item		Description
Specimen O	:	PVC
Pipe material		
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	250 mm diameter x 4.9 mm wall thickness
iii. actual size	:	250 mm diameter x 5.9 mm wall thickness
Fixing method	:	Fitted through the blockwork wall and sealed with sand and cement mortar infill
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/250
iii. material	:	1 mm steel casing with 1 layer of 15 mm thick graphite based intumescent
iv. fitting method	:	2 off fitted around service pipe on both the exposed and unexposed faces so that they were butted up to the wall and were through bolted to each other via 9 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 295 mm and at 475 mm centres from the blockwork wall on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation
Specimen P	:	Acrylonitrile butadiene styrene (ABS)
Pipe material		
Overall sizes		
i. length	:	1250 mm long, extending at least 500 mm into the furnace
ii. serial size	:	160 mm diameter x 10.45 mm wall thickness
iii. actual size	:	160 mm diameter x 10.5 mm wall thickness
Fixing method	:	Fitted through the blockwork wall and sealed with sand and cement mortar infill
Collar		
i. manufacturer	:	Hilti
ii. reference	:	Hilti CP 644/160
iii. material	:	1 mm steel casing with 2 layers of 15 mm thick graphite based intumescent
iv. fitting method	:	2 off fitted around service pipe on both the exposed and unexposed faces so that they were butted up to the wall and were through bolted to each other via 6 off fixing lugs
Support	:	Support framework was constructed from 'Hilti' MQ41 channels, supporting the service item via 'Hilti' support rings at 295 mm and at 475 mm centres from the blockwork wall on the unexposed face only
Capping	:	The end of the service pipe was plugged on the unexposed face with ceramic fibre insulation



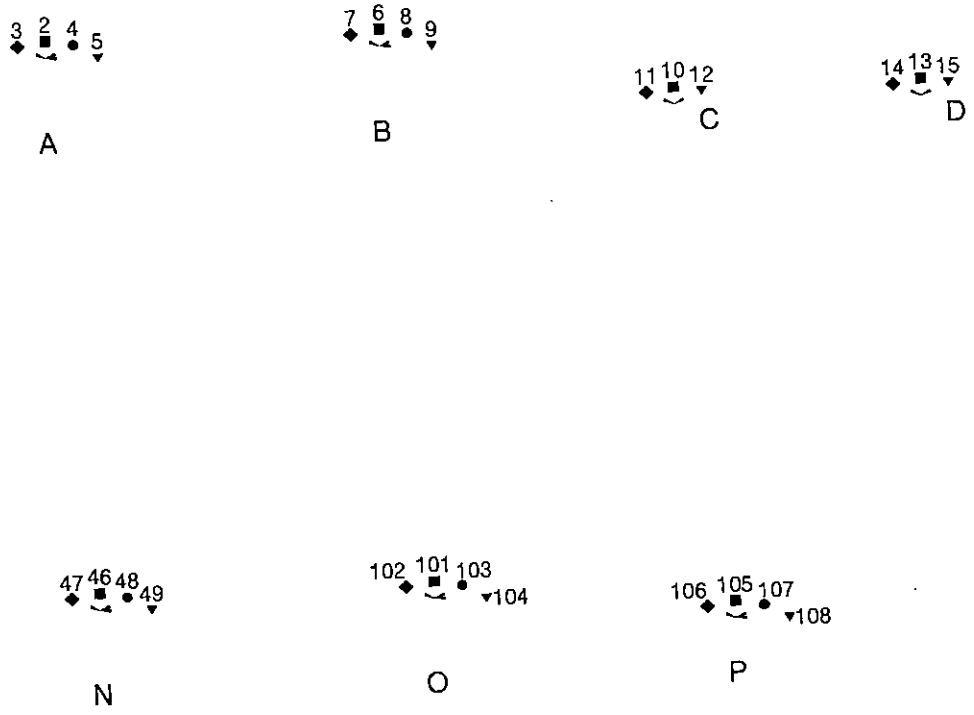
GENERAL ELEVATION
OF UNEXPOSED FACE

Do not scale

See Annex A for schedule
All dimensions are in mm

Warrington FIRE research

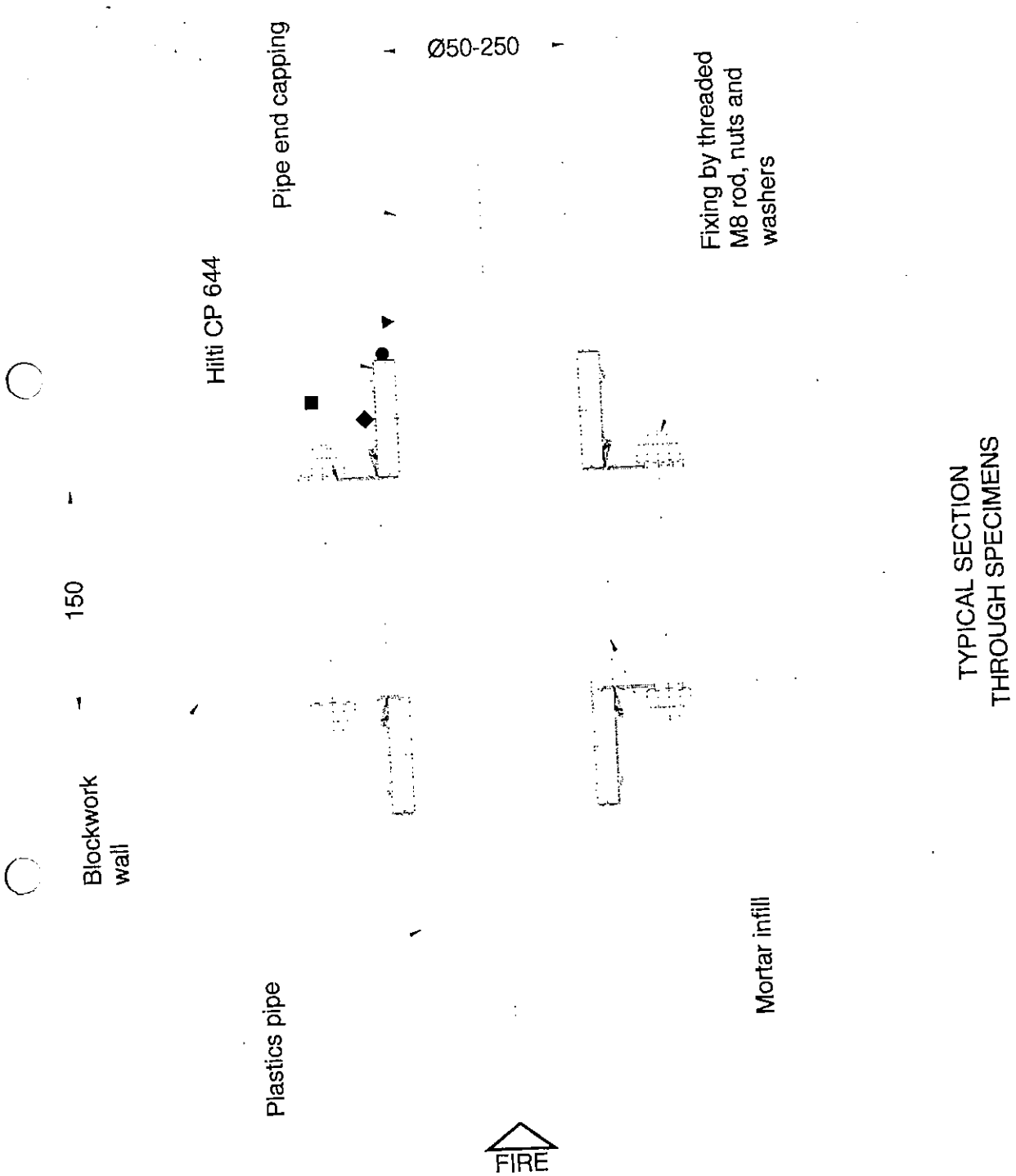
FIGURE 1



THERMOCOUPLE POSITIONS

■◆●▼ Positions of thermocouples, also refer to Figure 3

FIGURE 2



TYPICAL SECTION THROUGH SPECIMENS

■◆●▼ Positions of thermocouples relating to Figure 2

Do not scale

See Annex A for schedule
All dimensions are in mm

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FIGURE 3

Annex B

Data Recorded During The Test

Table 1

Specified and Actual Furnace Temperatures

Time Mins	Specified Furnace Temperature Deg. C	Actual Furnace Temperature Deg. C
0	20	24
10	678	703
20	781	805
30	842	839
40	885	865
50	918	913
60	945	932
70	968	966
80	988	982
90	1006	998
100	1022	1028
110	1036	1031
120	1049	1045
130	1061	1057
140	1072	1063
150	1082	1096
160	1092	1114
170	1101	1125
180	1110	1122
190	1118	1123
200	1126	1127
210	1133	1130
220	1140	1136
230	1146	1141
240	1153	1146
245	1156	1147

Annex B (Continued)

Table 2

Individual Temperatures Recorded on
the Unexposed Surface of Specimen A

Time Mins	T/C Number 2 Deg. C	T/C Number 3 Deg. C	T/C Number 4 Deg. C	T/C Number 5 Deg. C
0	16	14	14	17
10	16	18	21	44
20	17	26	29	61
30	19	39	33	62
40	23	54	36	61
50	28	62	39	62
60	36	61	40	63
70	46	61	42	64
80	59	70	44	65
90	68	74	45	65
100	73	75	45	64
110	74	76	46	62
120	77	76	46	62
130	77	76	46	61
140	77	76	46	60
150	78	76	46	59
160	78	77	47	60
170	80	77	48	61
180	80	77	48	62
190	81	77	49	63
200	82	77	50	64
210	82	78	51	66
220	83	79	52	69
230	84	80	54	71
240	86	85	56	74
245	87	101	58	76

Annex B (Continued)

Table 3

Individual Temperatures Recorded on
the Unexposed Surface of Specimen B

Time Mins	T/C Number 6 Deg. C	T/C Number 7 Deg. C	T/C Number 8 Deg. C	T/C Number 9 Deg. C
0	15	15	15	16
10	17	17	23	45
20	21	23	31	57
30	28	30	37	64
40	34	36	40	65
50	47	42	42	62
60	57	50	43	59
70	56	55	44	60
80	89	60	50	77
90	96	65	62	99
100	98	70	70	109
110	99	75	75	113
120	100	81	77	113
130	75	97	80	113
140	87	149	90	115
150	95	169	91	118
160	109	188	88	117
170	127	210	89	116
180	147	221	90	114
190	165	237	90	111
200	172	244	91	107
210	183	252	91	103
220	189	259	90	98
230	197	263	89	96
240	208	268	89	95
245	211	269	89	94

Annex B (Continued)

Table 4

Individual Temperatures Recorded on the Unexposed Surface of Specimen C

Time Mins	T/C Number 10 Deg. C	T/C Number 11 Deg. C	T/C Number 12 Deg. C
0	16	11	16
10	17	10	18
20	18	17	20
30	19	21	24
40	25	27	28
50	44	36	32
60	61	44	36
70	71	47	40
80	76	48	43
90	79	49	45
100	80	48	47
110	80	46	48
120	80	45	51
130	81	40	54
140	81	45	52
150	80	46	51
160	80	43	52
170	80	43	54
180	80	44	58
190	81	46	59
200	82	47	60
210	83	48	60
220	84	47	61
230	84	49	63
240	85	50	64
245	85	51	64

Annex B (Continued)

Table 5

Individual Temperatures Recorded on the Unexposed Surface of Specimen D

Time Mins	T/C Number 13 Deg. C	T/C Number 14 Deg. C	T/C Number 15 Deg. C
0	17	16	12
10	17	18	15
20	19	23	22
30	21	28	29
40	26	34	34
50	37	41	38
60	64	52	41
70	82	62	47
80	86	67	47
90	87	70	55
100	88	71	52
110	88	71	55
120	88	72	57
130	88	72	56
140	87	72	56
150	87	72	54
160	87	73	54
170	87	75	54
180	87	75	56
190	86	76	56
200	85	77	56
210	84	79	58
220	84	80	59
230	84	82	60
240	85	85	62
245	85	86	62

Annex B (Continued)

Table 6

Individual Temperatures Recorded on
the Unexposed Surface of Specimen N

Time Mins	T/C Number 46 Deg. C	T/C Number 47 Deg. C	T/C Number 48 Deg. C	T/C Number 49 Deg. C
0	11	10	11	12
10	12	15	13	21
20	13	23	20	35
30	17	29	25	41
40	46	38	32	52
50	64	56	41	64
60	81	115	73	75
70	90	160	119	86
80	96	173	152	123
90	97	186	147	119
100	99	199	138	112
110	103	215	130	107
120	114	241	122	101
130	129	271	117	97
140	146	289	114	95
150	161	303	113	92
160	182	323	114	91
170	198	338	114	88
180	212	347	115	86
190	225	353	116	85
200	225	359	116	83
210	229	363	116	82
220	247	368	116	81
230	251	373	117	80
240	272	379	117	79
245	277	382	117	78

Annex B (Continued)

Table 7

Individual Temperatures Recorded on
the Unexposed Surface of Specimen O

Time Mins	T/C Number 101 Deg. C	T/C Number 102 Deg. C	T/C Number 103 Deg. C	T/C Number 104 Deg. C
0	12	12	12	13
10	13	17	20	40
20	17	25	29	62
30	22	33	34	67
40	30	40	39	77
50	56	51	44	82
60	73	63	47	82
70	79	68	52	84
80	84	71	54	83
90	86	73	56	83
100	87	74	57	83
110	87	74	57	83
120	86	75	57	85
130	87	77	58	88
140	87	78	59	89
150	88	80	60	92
160	89	82	63	96
170	90	86	65	98
180	90	88	67	100
190	92	91	69	103
200	92	94	71	107
210	94	97	73	109
220	96	101	75	106
230	101	105	75	108
240	108	112	77	111
245	113	117	78	111

Annex B (Continued)

Table 8

Individual Temperatures Recorded on
the Unexposed Surface of Specimen P

Time Mins	T/C Number 105 Deg. C	T/C Number 106 Deg. C	T/C Number 107 Deg. C	T/C Number 108 Deg. C
0	14	14	14	14
10	14	15	17	31
20	15	17	19	31
30	16	20	21	30
40	18	22	23	33
50	22	26	28	51
60	29	33	36	68
70	42	44	48	93
80	60	58	63	108
90	74	71	77	116
100	79	78	85	119
110	80	82	90	121
120	82	78	96	209
130	*	*	*	*
140				
150				
160				
170				
180				
190				
200				
210				
220				
230				
240				
245				

* Integrity Failure Occurred at 120 Minutes

Annex B (Continued)

Table 9

Individual and Mean Temperatures Recorded by the 1.5 Mineral Insulated Thermocouples Within the Furnace Chamber

Time	T/C Number 119	T/C Number 120	T/C Number 121	T/C Number 122	T/C Number 123	T/C Number 124	T/C Number 125	T/C Number 126	T/C Number 127	Mean Temp
Mins	Deg. C	Deg. C	Deg. C	Deg. C	Deg. C	Deg. C	Deg. C	Deg. C	Deg. C	Deg. C
0	16	15	17	18	16	18	17	17	17	16
10	717	670	737	715	691	764	692	641	677	700
20	844	819	766	869	802	771	825	818	803	813
30	882	845	843	908	859	829	979	857	824	869
40	891	860	830	911	854	832	1035	876	851	882
50	944	919	883	959	915	921	1005	920	892	930
60	962	934	904	975	936	938	992	936	913	943
70	963	963	943	987	984	990	993	976	989	976
80	975	977	959	998	1007	1006	1011	995	995	991
90	986	987	972	1016	1021	1021	1005	1004	1020	1003
100	1009	1014	999	1038	1044	1031	1065	1035	1043	1030
110	1009	1013	1017	1059	1063	1042	1039	1034	1045	1035
120	1027	1022	1025	1057	1077	1052	1059	1046	1049	1046
130	1034	1034	1042	1054	1096	1068	1085	1057	1051	1057
140	1043	1041	1039	1071	1084	1069	1091	1060	1059	1062
150	1077	1076	1073	1099	1122	1103	1146	1098	1085	1097
160	1098	1092	1092	1116	1148	1132	1146	1107	1097	1113
170	1111	1102	1102	1126	1157	1146	1160	1122	1101	1126
180	1105	1102	1100	1140	1139	1125	1164	1118	1104	1121
190	1103	1101	1103	1158	1146	1136	1164	1118	1103	1123
200	1107	1106	1105	1152	1155	1144	1154	1121	1110	1125
210	1111	1106	1106	1149	1155	1138	1151	1127	1115	1131
220	1118	1114	1115	1151	1162	1166	1154	1129	1124	1137
230	1120	1116	1121	1147	1166	1168	1145	1138	1128	1138
240	1126	1119	1136	1158	1175	1178	1140	1139	1134	1144
245	1125	1121	1125	1169	1174	1175	1139	1139	1138	1145

Annex B (Continued)

Table 10

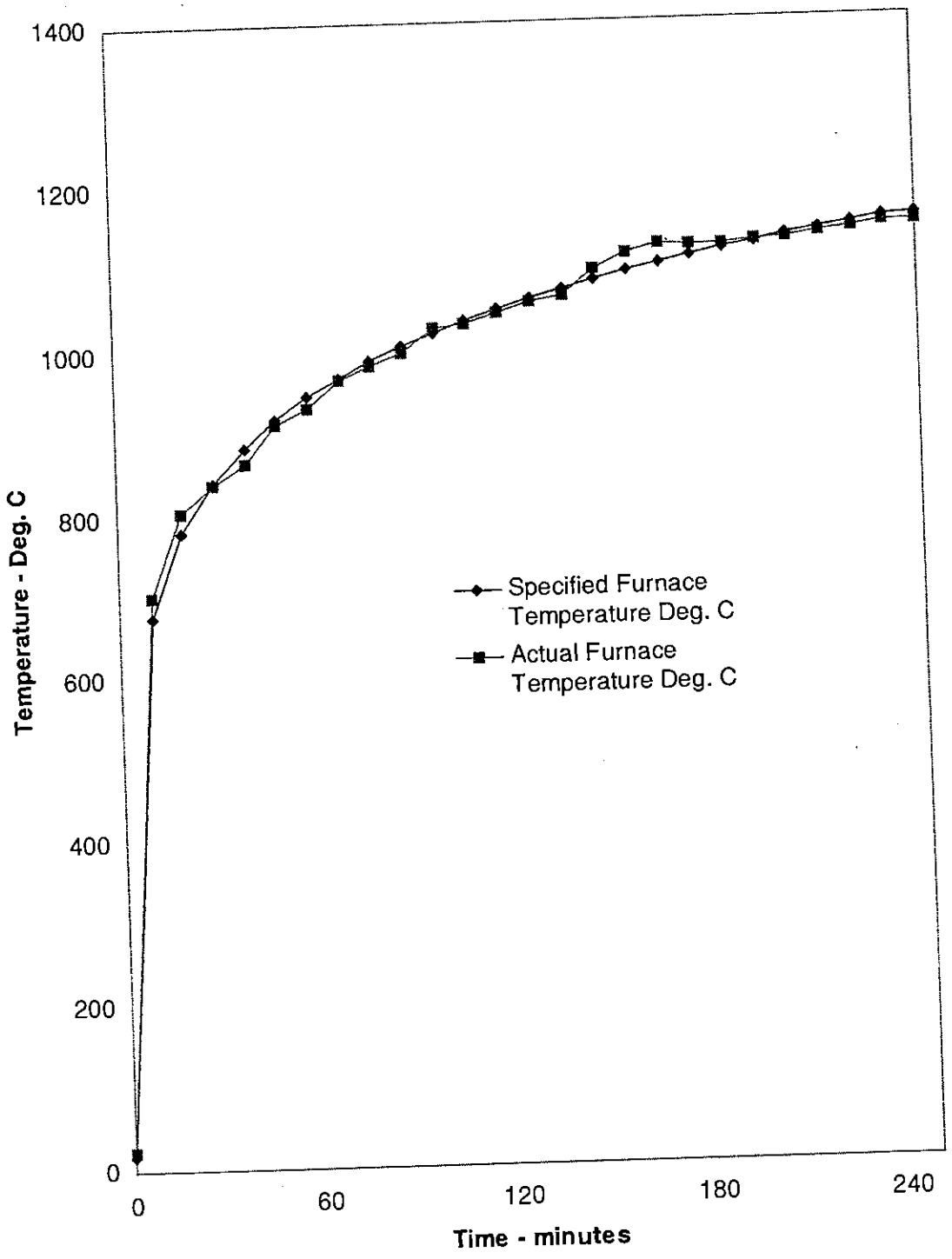
Pressure Measured at Position 300 mm
Below the Top of the Assembly

Time Mins	Pressure Pa
0	0
10	17.9
20	17.6
30	17.7
40	17.3
50	16.9
60	16.7
70	16.3
80	16.7
90	16.9
100	18
110	17.5
120	17.8
130	17.6
140	17.4
150	17.2
160	17.5
170	18.3
180	17
190	16.5
200	18.3
210	17.4
220	17.3
230	17.1
240	16.8
245	16.3

Annex B (Continued)

Graph 1

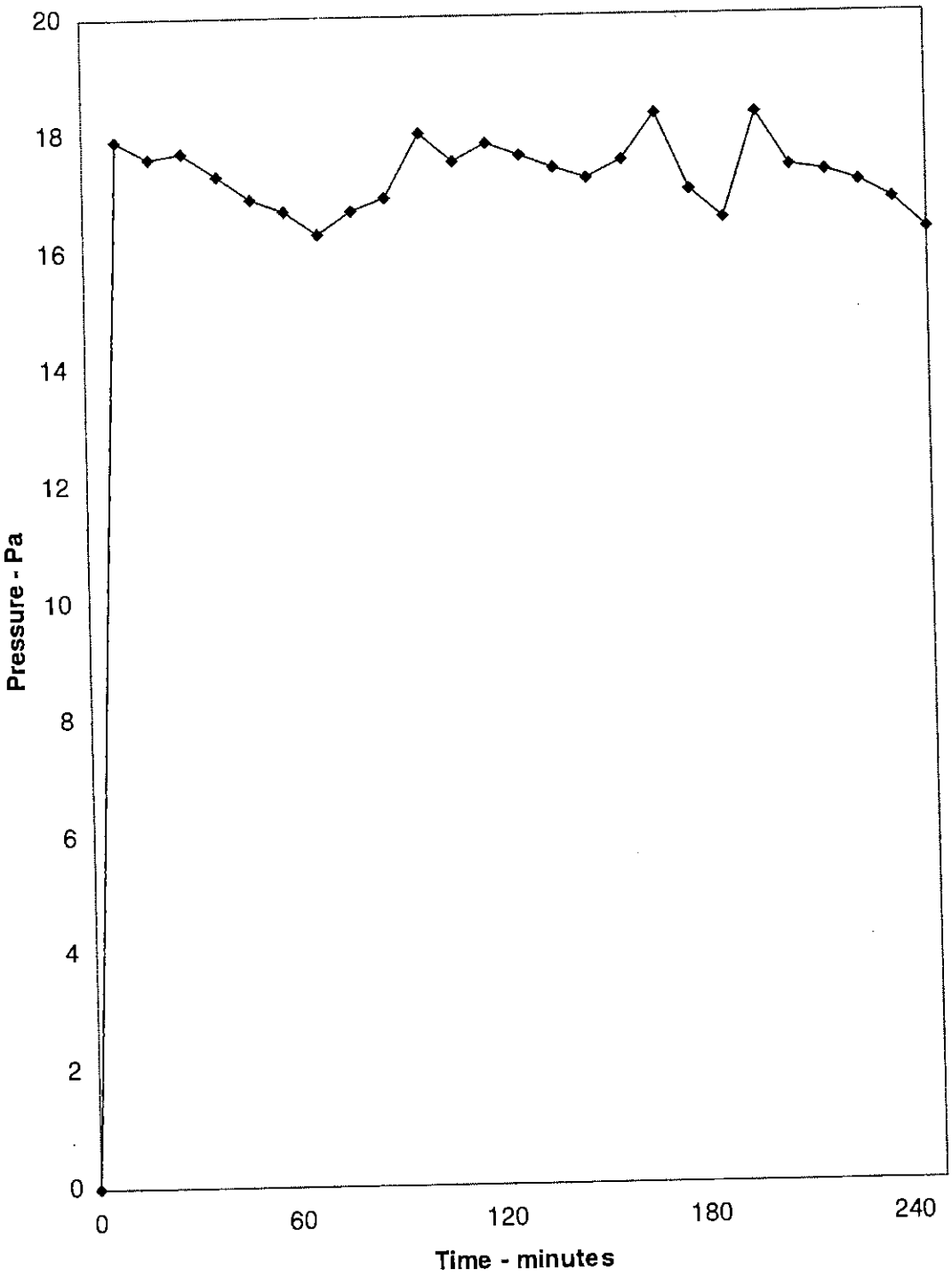
Specified and Actual Furnace Temperatures



Annex B (Continued)

Graph 2

Pressure Recorded within the Furnace Chamber



Annex C

Observations Made by the Responsible Officer

U – Observations made from unexposed side
E – Observations made from exposed side

Time			
Mins	**Secs**		
00	00		**The Test Commences.**
01	20	U	Small amounts of smoke release are evident from the collar of Specimen B.
06	15	E	All specimens are flaming and melting.
07	50	U	Smoke release is evident from the collars of all specimens.
08	30	U	Increased smoke release is evident from the collar of Specimen O.
14	20	E	All specimens continue to flame.
16	20	U	A cracking noise is heard from Specimen O.
17	50	U	Smoke release continues increases from the collar of Specimen O.
20	20	E	Reacted intumescent is visible at the collar areas where the pipes have fallen away.
32	20	U	Smoke release has begun to subside from all pipes.
37	30	E	The exposed face collar to Specimen N has fallen away.
43	45	U	Smoke release begins to increase from Specimen B.
53	40	U	Smoke release begins to increase from Specimen N.
56	00	U	Smoke release continues to increase from the collar of Specimen N.
62	00	U	Specimen N begins to melt and drip. Smoke release increases from this specimen.
69	00	U	Smoke release continues to increases from Specimen N.
73	00	U	Discolouration is evident at various positions along the pipe of N.
77	00	U	The pipe of N begins to collapse at the position where it exits the collar.

Annex C (Continued)

Time Mins	Secs		
87	00	U	A hole is evident in the pipe to Specimen N, but no through gap in to the furnace is evident.
93	00	U	A temperature rise in excess of 180°C is recorded on Specimen N. **Insulation failure of Specimen N is deemed to occur.**
102	00	U	The hole increases in size to Specimen N and reacted intumescent is clearly visible.
118	00	U	Smoke release increases from the collar of Specimen P. The pipe begins to collapse at the position where it exits the collar.
119	00	U	Glowing is evident at the collar of Specimen P. A cotton pad is applied, but fails to ignite. A temperature rise in excess of 180°C is recorded on Specimen P. **Insulation failure of Specimen P is deemed to occur.**
120	30	U	Sustained flames issue from the collar of Specimen P. **Integrity failure of Specimen P is deemed to occur.**
128	00	U	Smoke release increases from Specimen B.
140	00	U	Smoke release continues to increase from the collar of Specimen B.
161	00	U	A temperature rise in excess of 180°C is recorded on Specimen B. **Insulation failure of Specimen B is deemed to occur.**
180	00	U	No further significant changes.
245	00		**The test is discontinued at the request of the sponsor.**

Post Test Observations

No visible through gaps are evident into the furnace chamber for specimens A, B, C, D, N and O.

Annex D

Photographs

Plate 1	:	The exposed face of the assembly prior to the test
Plate 2	:	The unexposed face of the assembly prior to the test
Plate 3	:	Showing the unexposed face of the assembly during the test
Plate 4	:	Showing the unexposed face of the assembly during the test
Plate 5	:	Showing the unexposed face of the assembly during the test
Plate 6	:	Showing the unexposed face of the assembly during the test
Plate 7	:	Showing the unexposed face of the assembly during the test
Plate 8	:	Showing the unexposed face of the assembly during the test
Plate 9	:	Showing the unexposed face of the assembly during the test
Plate 10	:	Showing the exposed face of the assembly directly after the test

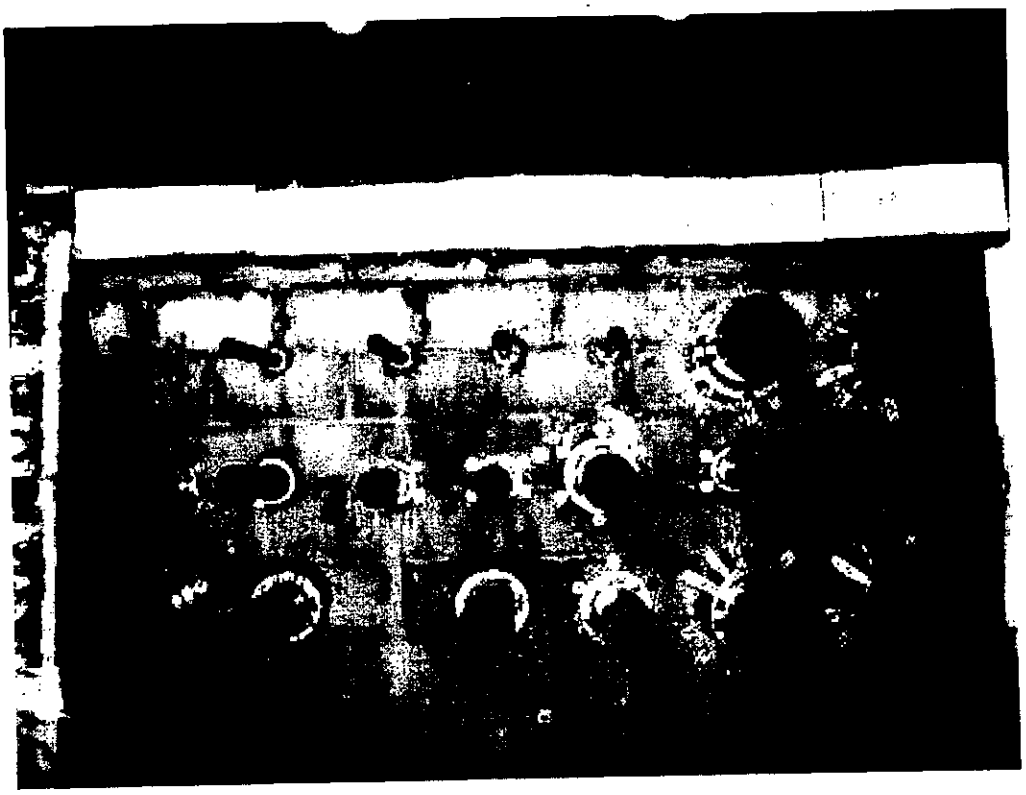


Plate 1

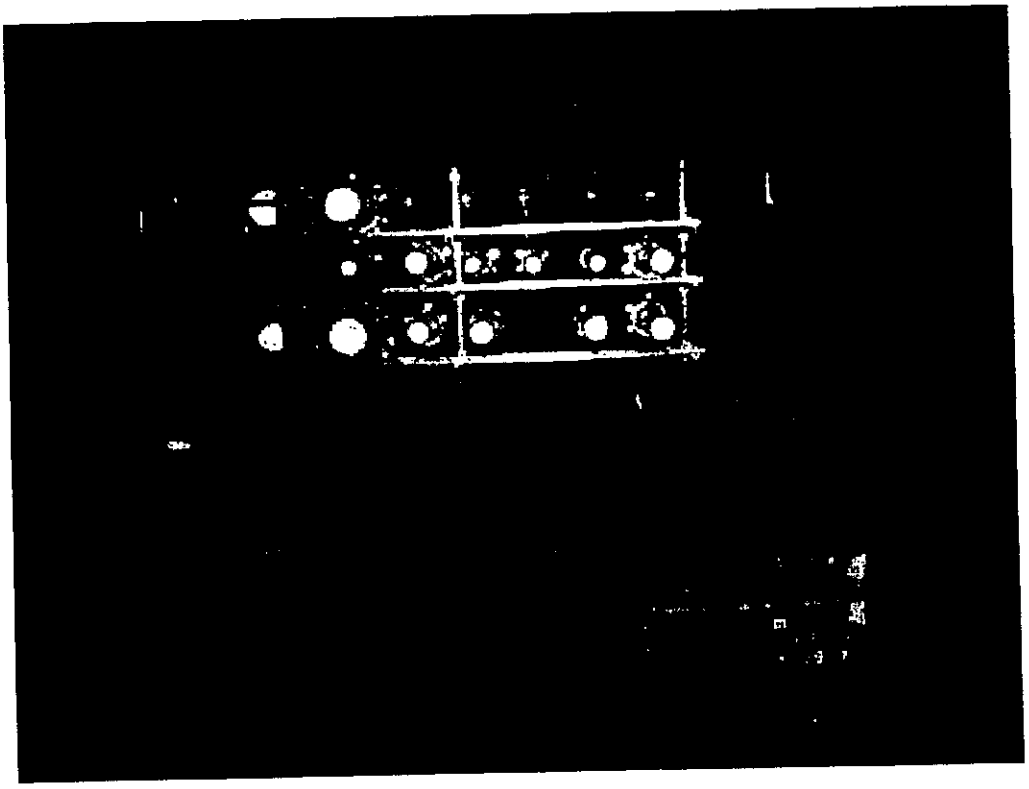


Plate 2

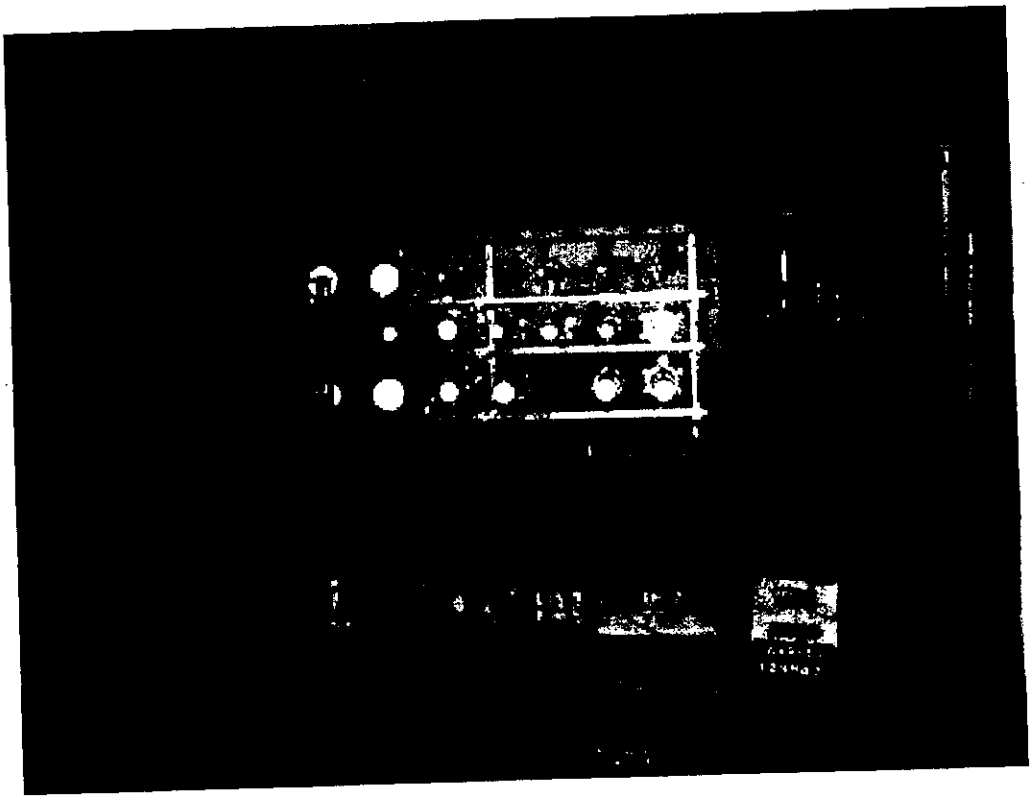


Plate 3

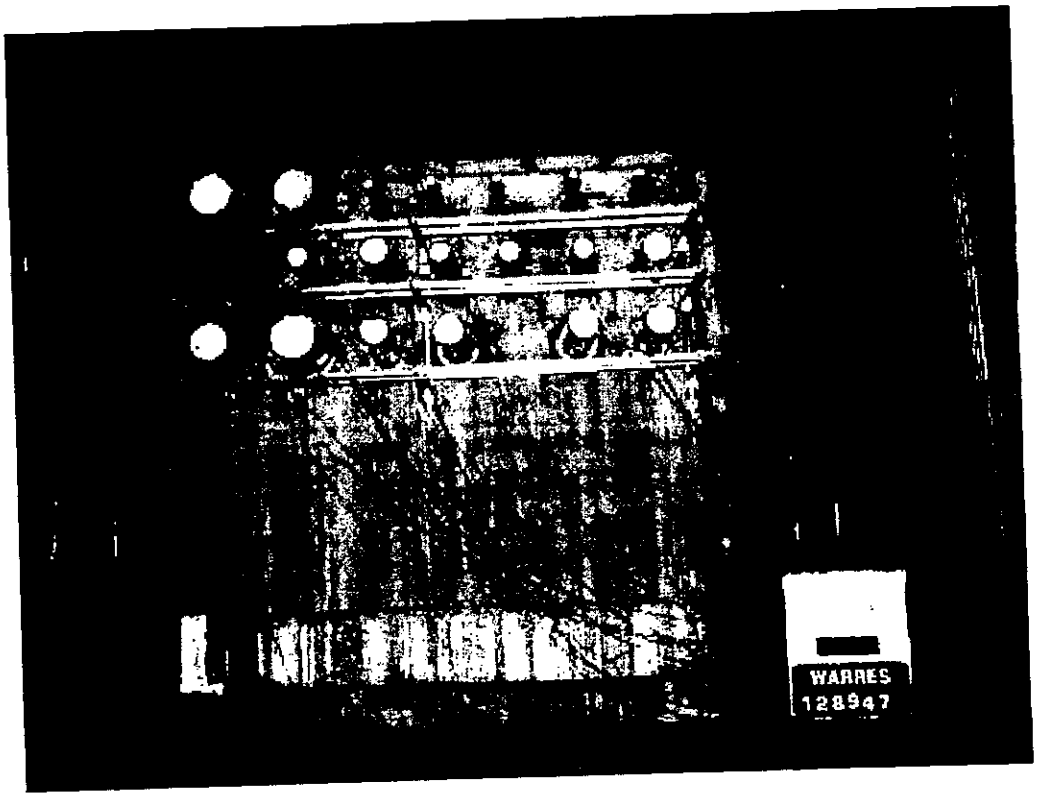


Plate 4

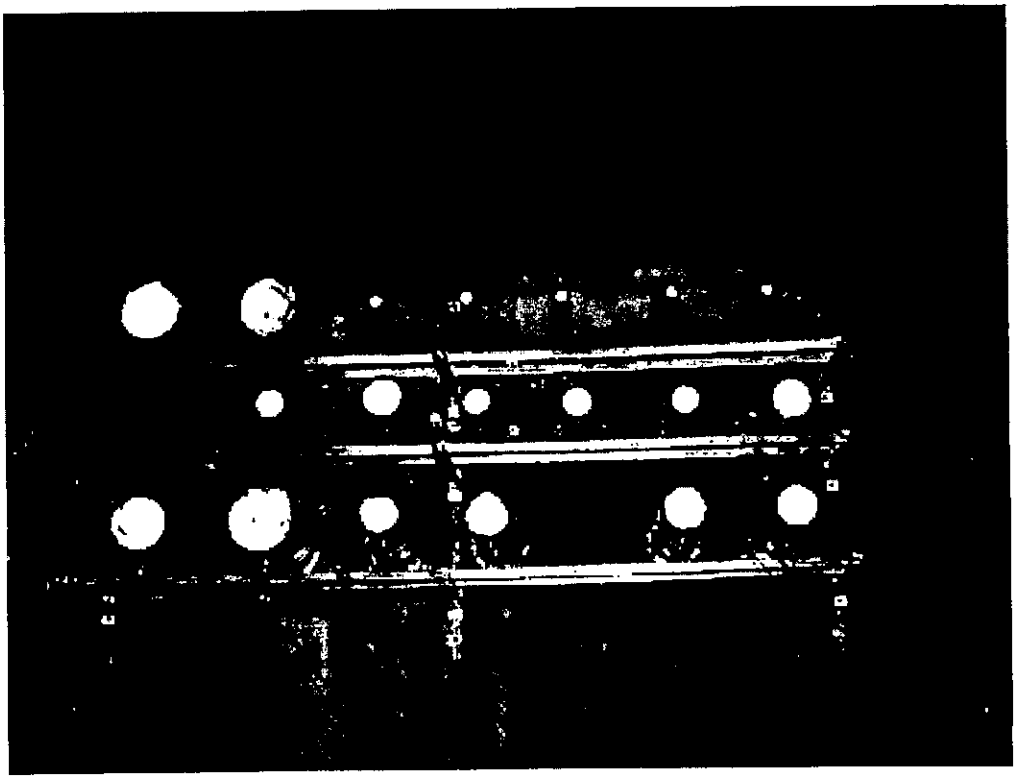


Plate 5

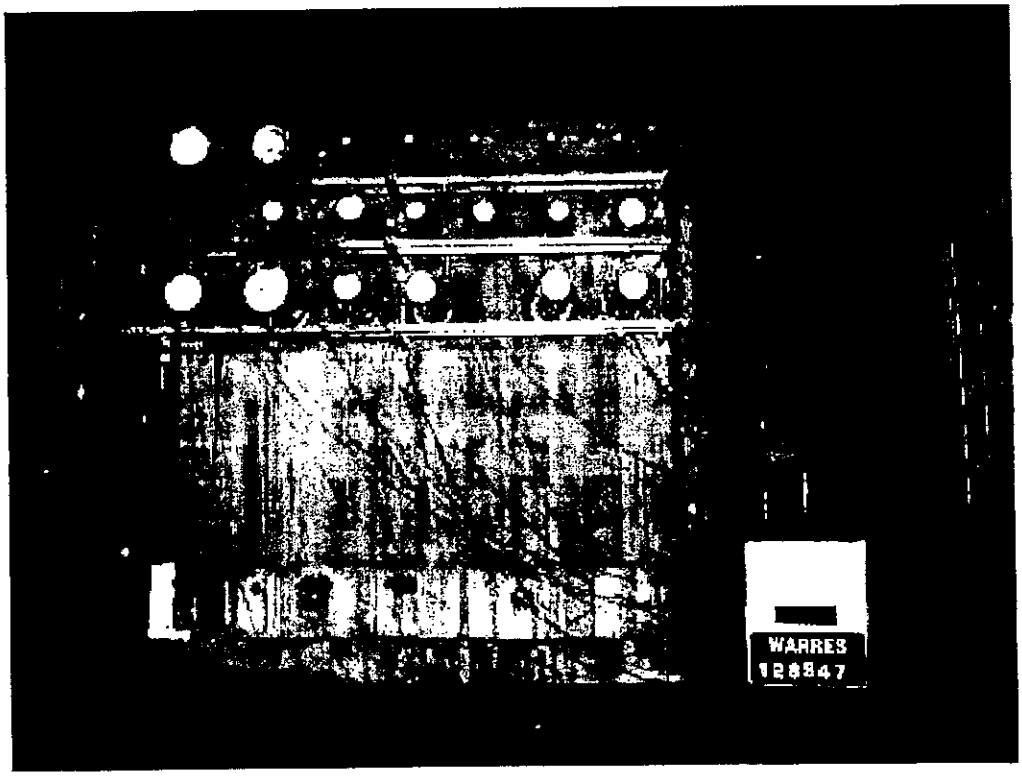


Plate 6

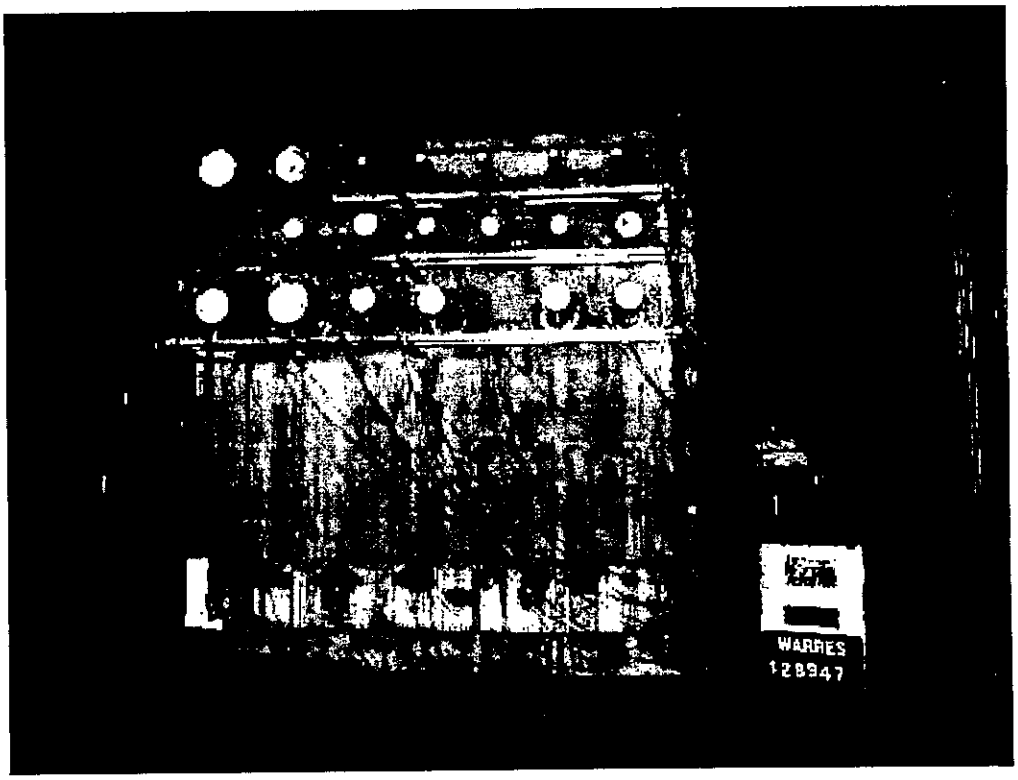


Plate 7

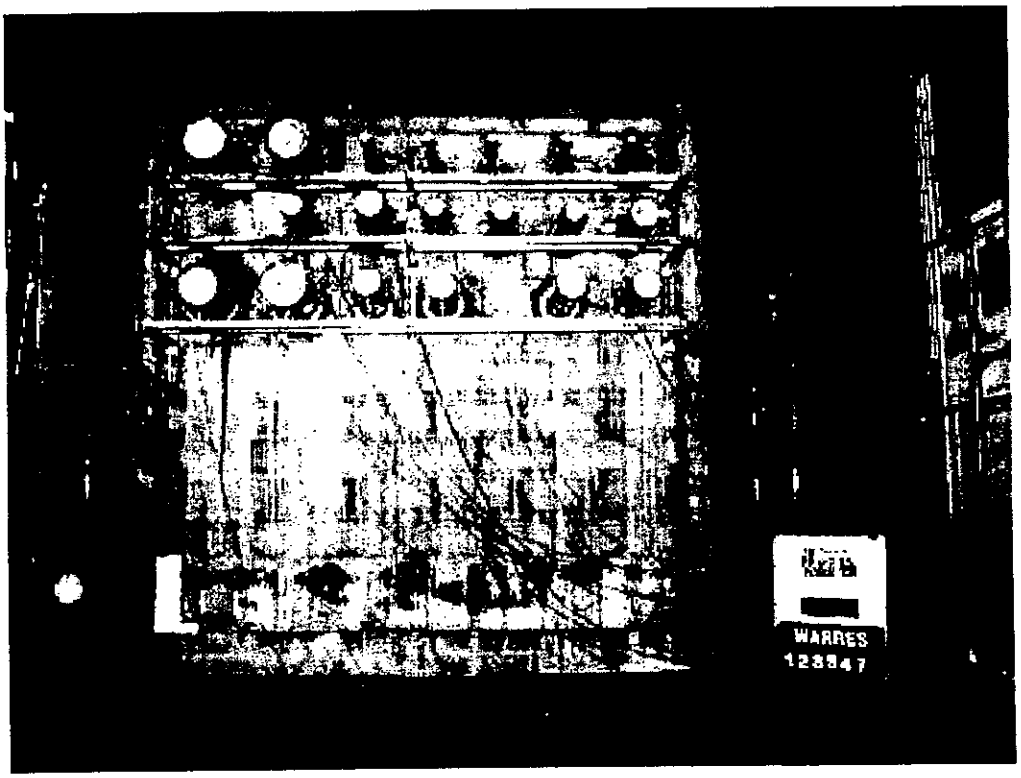


Plate 8

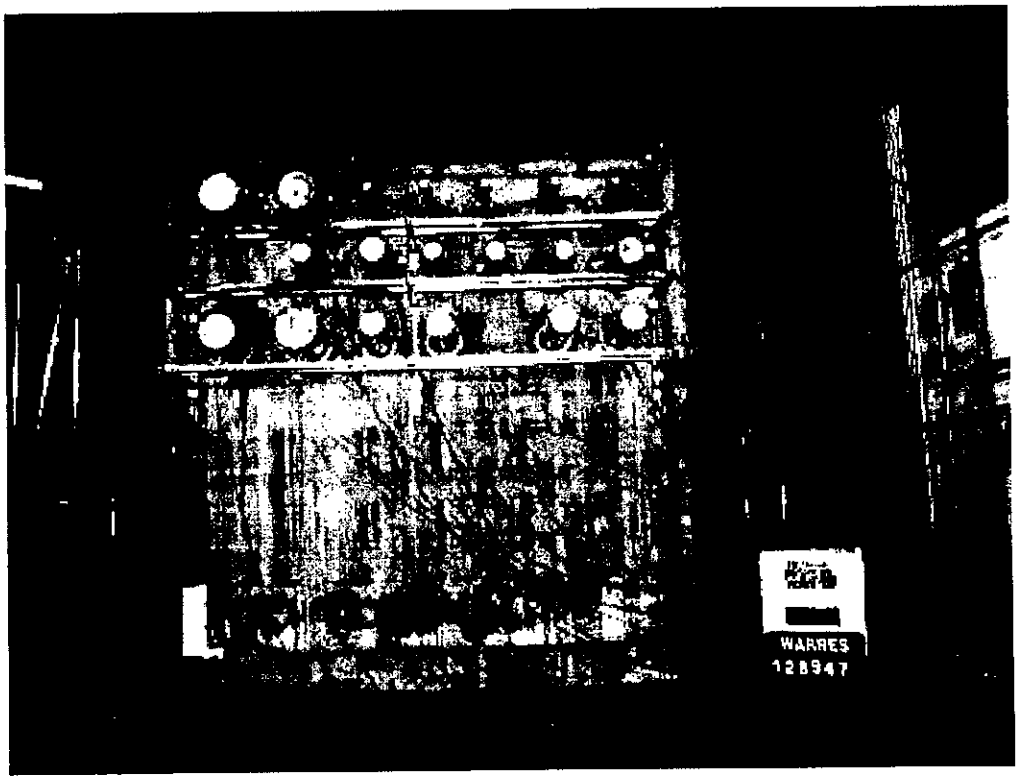


Plate 9

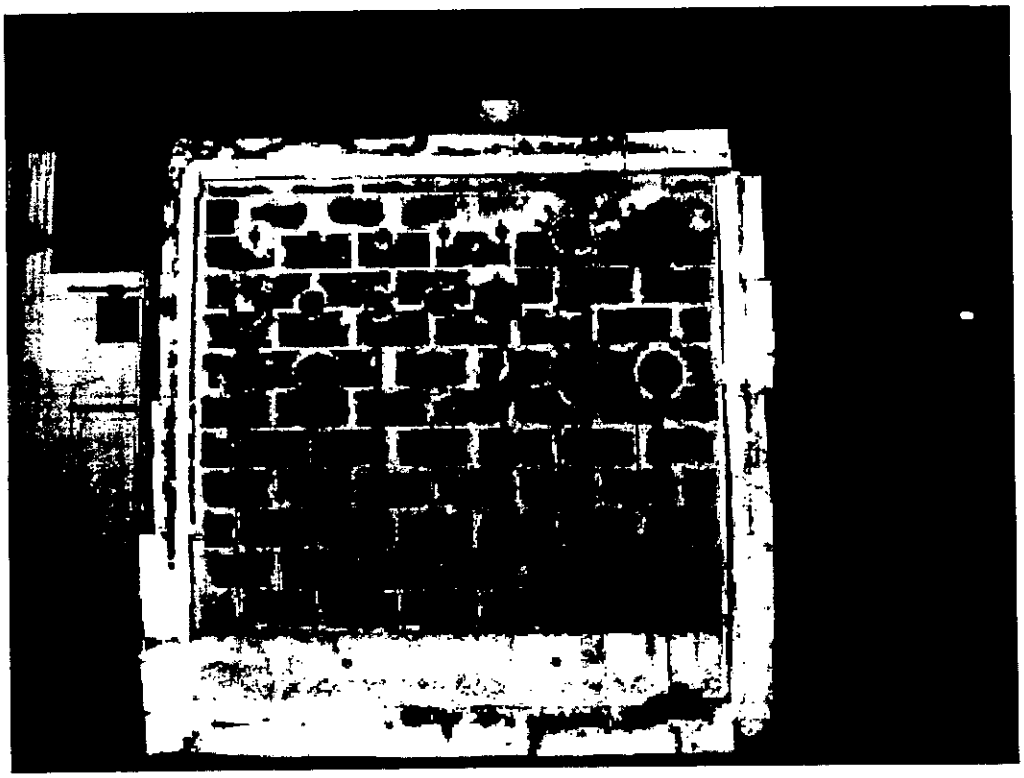


Plate 10

warringtonfire
Proud to be part of element

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24th May 2019

Mr Uwe Bohn
Hilti Entwicklungsgesellschaft mbH
86916 Kaufering
Hiltistr. 6
Germany

Review of Fire Test Report Referenced WARRES No. 128947/B

1 Introduction

The report referenced WARRES No. 128947/B relates to a fire resistance test conducted to evaluate the ability of seven specimens of pipe penetration sealing system mounted within a blockwork wall assembly, to reinstate the integrity and insulation performance (as defined in BS 476: Part 20: 1987) of the wall construction where it has been provided with apertures to allow for the penetration of various diameters of pipe services. Since no standardised test for this purpose yet exists, an ad-hoc fire resistance test was performed utilising the heating conditions specified in BS EN 1363-1: 1999, together with the performance criteria of BS 476: Part 20: 1987 'Methods of determination of the fire resistance of elements of construction (general principles)', in conjunction with additional guidelines taken from prEN 1366-3: 2002.

The test assembly comprised a blockwork wall assembly formed from lightweight concrete blocks with overall dimensions of 3035 mm high by 3050 mm wide by 150 mm thick. The wall was provided with seven circular apertures of various diameters, through which the pipes were passed. Each pipe was fitted with an intumescent collar on each face of the wall which was referenced 'CP644'. The specimens were referenced as A, B, C, D, N, O and P and are detailed in the table below:

The results were as follows:

Item Ref.	Integrity	Insulation
A	245 minutes	245 minutes
B	245 minutes	161 minutes
C	245 minutes	245 minutes
D	245 minutes	245 minutes
N	245 minutes	93 minutes
O	245 minutes	245 minutes
P	120 minutes	119 minutes

Warringtonfire Testing and Certification Limited
Registered in England and Wales
Registered Office: 10 Lower Grosvenor Place, London, United Kingdom, SW1W 0EN
Company Registration No: 11371436

2 Confirmation of Specification

It has been confirmed by Hilti Entwicklungsgesellschaft mbH that there have been no changes to the specification or the construction given in the original report referenced WARRES No. 128947/B

3 Considerations

While there is now a published European Standard (EN 1366-3: 2009) relating to the fire resistance testing of penetration sealing systems, this standard was not available when the test was conducted and therefore, as the fire resistance of the floor or wall construction into which the seal would be installed, is determined by test procedures detailed within BS 476: Part 20: 1987, 'Method for determination of the fire resistance of elements of construction (general principles)' or BS EN 1363-1: 1999, it was deemed appropriate to use this as the basis for a test for evaluating the penetration sealing systems themselves.

The current test methodology with respect to the fire resistance testing of penetration sealing systems, i.e. utilising the heating conditions and performance criteria for integrity and insulation given in BS 476: Part 20: 1987 or EN 1363-1, has not been amended and would, therefore, still be utilised for this purpose.

At present there are no existing Resolutions adopted by the Fire Test Study Group since the original test was performed, which would affect the manner in which the test would be conducted, or the interpretation of the test results.

4 Conclusions

At present there are no additional resolutions adopted by the Fire Test Study Group since the original test was performed which would affect the manner in which the test would be conducted or the interpretation of the test results.

The procedures adopted for the original test have been re-examined and are similar to those currently in use.

Therefore, with respect to the fire resistance test report referenced WARRES No. 128947/B its contents should remain valid until 1st June 2024.

5 Validity

This review is based on information used to formulate the original test report. No other information or data has been submitted by Hilti Entwicklungsgesellschaft mbH, which could affect this review.

Performed by:

C. Abbott
Principal Certification Engineer
Warringtonfire

Reviewed By:

D. Hankinson
Principal Certification Engineer
Warringtonfire

Buildings Department

屋宇署

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

26 May 1994

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

Dear Sirs,

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

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

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

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

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

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

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

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

Yours faithfully,

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

PT/rcy/ac

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

消 防 處
防 火 組
香港九龍尖沙咀東部廣華道1號
消防總部大廈

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

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

29 April 1992

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

Dear Sirs,

"HILTI" Fire Prevention System

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

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

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

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

Yours faithfully,

(TSE Yu-hing)
for Director of Fire Services

TYH/jt

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. : 108/FP/DY/23

Subject : Country of Origin- Hilti CP644 Firestop Collar

Dear Sir / Madam,

Enclosed please find the information of Hilti CP644 Firestop Collar. .

Brand Name : Hilti

Model Name : Hilti CP644 Firestop Collar

Manufacturer : Hilti Corporation

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

Manufacturer Contact Person : Dennis Yeung

Supplier : Hilti (Hong Kong) Ltd

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

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

Country of Origin : Germany

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

Yours faithfully,

Dennis Yeung
Head of Product Leadership Strategy, F&P

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

Date: 23 June 2021

Ref.: 041/FP/BL/21

Subject: Hilti CP644 Firestop Collars – LEED Information

To Whom It May Concern:

- The Hilti CP644 Firestop Collar is manufactured in Germany.
- The metal portions of the collars are recyclable.
- There is no recycled content in the Hilti CP644 Firestop Collar and it cannot be recycled.
- The Hilti CP644 Firestop Collars does not share any rapidly renewable materials.
- The VOC content of the Hilti CP617 Firestop Putty Pad is 7.6 g/l.

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

Yours faithfully,

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

To whom it may concern

Date: 22nd April 2016

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, CP644 Firestop Jacket 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,

Andrew Lau
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 CP 644 Firestop Collar Job Reference

Year	Project Name	Customer Name	Project type
2020	TUEN MUN AREA 56 (500),KWUN CHUI RD	WING SHING ENGINEERING	Residential
2020	Unspecified - Infrastructure - Tai Po Water Treatment Works, Tai Po	ATAL ENGINEERING LIMITED	Infrastructure
2020	New - Residential - (Tai Po Town Lot 214) 7 Fo Yin Road, Pak Shek K	AQUASCAPE LIMITED	Residential
2023	KAI TAK AREA 4B, SITE 1, NKIL 6576	AQUASCAPE LIMITED	Residential
2023	ORGANIC RESOURCES RECOVERY CENTRE PH2 (WASTE TREA	JEC - AGRIVERT IJV	Utilities