



Regulatory information report




The fire resistance performance of various Service Penetrations protected with Hilti CP 680 P/PX Cast in Collar

Client: Hilti Australia Pty Ltd

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Quality Management

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Executive summary

This report contains the minimum information sufficient for regulatory compliance and refers to the Assessment report FAS190023 R2.4.

The referenced assessment report presents an assessment of the fire resistance performance of metal pipes, uPVC, uPVC-SC, HDPE and PP-MD plastic pipes through 150 mm and 120 mm thick concrete floor fire separating elements (with variations addressing thicker concrete floor separating elements) protected by Hilti CP 680 P/PX fire collars, if tested in accordance with AS 1530.4: 2014, and assessed in accordance with AS 4072.1-2005.

Table 1 presents a summary of the assessment outcomes for various service penetrations through concrete floor separating elements with a thickness not less than 150 mm. Refer Section 3.5 for collar configuration details CC1 and CC2 (CC2 requires the fire collar to remain uncut during installation).

Table 1 Summary of assessment outcomes for plastic pipe penetrations through minimum 150 mm thick concrete floor separating element (Assessment 1)

| Pipe configuration | Pipe material | Hilti collar CP 680 P/PX size | Pipe nominal size, DN (mm) | Nominal total pipe wall thickness (mm) | Hilti collar CP 680 P/PX configuration | FRL (min) $t_{b,min} = 150$ mm |
|---------------------|---------------|-------------------------------|----------------------------|--|--|--------------------------------|
| Stack/straight pipe | uPVC | 2" | 40 | 2 | CC1 | -/240/240 |
| | | 2" | 50 | 2.2 | | |
| | | 2" | 65 | 2.7 | | |
| | | 3" | 80 | 2.9 | | |
| | | 4" | 100 | 3.5 | | |
| | | 6" | 150 | 5 | CC2 | |
| Elbow inside collar | uPVC | 2" | 40 | 2 | CC1 | -/240/240 |
| | | 2" | 50 | 2.2 | | |
| | | 2" | 65 | 2.7 | | |
| | | 3" | 80 | 2.9 | | |
| | | 4" | 100 | 3.5 | | |
| | | 6" | 150 | 5 | CC2 | |
| Stack/straight pipe | uPVC-SC | 4" | 100 | 3.5 | CC1 | -/240/240 |
| | | 6" | 150 | 5 | CC2 | |

| | | | | | | |
|--|---------------------|------------|-----------------------------------|-----------|-----|-----------|
| Elbow inside collar | uPVC-SC | 4" | 100 | 3.5 | CC1 | -/240/240 |
| | | 6" | 150 | 5 | CC2 | |
| Stack/straight pipe | HDPE | 2" | 40 - 60 | 3 | CC1 | -/240/240 |
| | | 3" | 70 | 3 | | |
| | | 4" | 90, 100 | 3.5, 4.3 | | |
| | | 6" | 125 - 150 | 4.9 - 6.2 | CC2 | |
| Elbow inside collar | HDPE | 2" | 40 - 60 | 3 | CC1 | -/240/240 |
| | | 3" | 70 | 3 | | |
| | | 4" | 90, 100 | 3.5, 4.3 | | |
| | | 6" | 125 - 150 | 4.9 - 6.2 | | |
| stack/straight pipe | PP-MD+ | 2" | 40 | 1.8 | CC1 | -/120/120 |
| | | 2" | 50 | 1.8 | | |
| | | 3" | 75 | 1.9 | | |
| | | 4" | 110 | 2.7 | | |
| Multiple collars (max: 3) connected in a row | UPVC, UPVC-SC, HDPE | 2", 3", 4" | all approved systems up to DN 110 | As tested | CC1 | -/240/240 |
| | | 6" | all approved systems up to DN160 | As tested | CC2 | -/240/240 |
| | PP-MD+ | 2", 3", 4" | all approved systems up to DN 110 | As tested | CC1 | -120/120 |

+ Due to the lack of baseline test results for PP-MD pipes through 150 mm concrete slab, a reduced FRL based on test results for 120 mm concrete slab separating element has been assigned.

An assessment was also conducted for similar service penetrations through concrete floor separating elements with a thickness not less than 120 mm (Assessment 2). An FRL of -/120/120 is deemed attainable for all pipe configurations described in Table 2 for this case, provided that either the Hilti collar CP 680 P/PX is left uncut, or local aperture beading is provided using 13 mm or 16 mm plasterboard such that the overall thickness of the separating floor element is not less than 150 mm. However, for pipes with diameters greater than Ø100 through concrete floor separating element with a thickness not less than 120 mm intended to achieve FRL -/120/120, collar sleeve shall remain uncut (local aperture building alone is insufficient).

Table 2 Summary of assessment outcomes for plastic pipe penetrations through minimum 120 mm thick concrete floor separating element (Assessment 2)

| Pipe configuration | pipe material | Hilti collar CP 680P size | Pipe nominal size, DN (mm) | Nominal total pipe wall thickness (mm) | FRL (min) t _{b,min} = 120 mm |
|---------------------|---------------|---------------------------|----------------------------|--|---------------------------------------|
| stack/straight pipe | uPVC | 2" | 40 | 2 | -/120/120 |
| | | 2" | 50 | 2.2 | |
| | | 2" | 65 | 2.7 | |
| | | 3" | 80 | 2.9 | |
| | | 4" | 100 | 3.5 | |
| | | 6" | 150* | 5 | |
| Elbow inside collar | uPVC | 2" | 40 | 2 | -/120/120 |
| | | 2" | 50 | 2.2 | |
| | | 2" | 65 | 2.7 | |
| | | 3" | 80 | 2.9 | |
| | | 4" | 100 | 3.5 | |
| | | 6" | 150* | 5 | |
| stack/straight pipe | UPVC-SC | 4" | 100 | 3.5 | -/120/120 |
| | | 6" | 150* | 5 | -/120/120 |
| Elbow inside collar | uPVC-SC | 4" | 100 | 3.5 | -/120/120 |
| | | 6" | 150* | 5 | |
| stack/straight pipe | HDPE | 2" | 40 - 60 | 3 | -/120/120 |
| | | 3" | 70 | 3 | |

| Pipe configuration | pipe material | Hilti collar CP 680P size | Pipe nominal size, DN (mm) | Nominal total pipe wall thickness (mm) | FRL (min) $t_{b,min} = 120$ mm |
|-------------------------------------|---------------------|---------------------------|-----------------------------------|--|--------------------------------|
| | | 4" | 90, 100 | 3.5, 4.3 | |
| | | 6" | 125 – 150* | 4.9 - 6.2 | |
| Elbow inside collar | HDPE | 2" | 40 - 60 | 3 | -/120/120 |
| | | 3" | 70 | 3 | |
| | | 4" | 90, 100 | 3.5, 4.3 | |
| | | 6" | 125 – 150* | 4.9 - 6.2 | |
| stack/straight pipe | PP-MD | 2" | 40 | 1.8 | -/120/120 |
| | | 2" | 50 | 1.8 | |
| | | 3" | 75 | 1.9 | |
| | | 4" | 110 | 2.7 | |
| Multiple collars connected in a row | UPVC, UPVC-SC, HDPE | 2", 3", 4" | all approved systems up to DN 110 | As tested | -/120/120 |
| | | 6" | 150* | As tested | -/120/120 |
| | PP-MD | 2", 3", 4" | all approved systems up to DN 110 | As tested | -/120/120 |

*Sleeve shall remain uncut during installation

Table 3 Summary of assessment outcomes for insulated metal pipe penetrations through minimum 120 mm thick concrete floor separating element (Assessment 3)

| Metal pipe material | Hilti collar CP 680P/PX size* | Pipe nominal diameter, DN (mm) | Minimum pipe wall thickness (mm) | Allowable annual seal width (mm) | Sealant depth (mm) | Backing configuration | Pipe insulation configuration* | Insulation length | FRL |
|----------------------------------|-------------------------------|--------------------------------|----------------------------------|--|--------------------|---|--|-------------------|-----------|
| Copper, ferrous or brass | 2" or 3" | 23 to 65 | 0.91 | 25 mm, or up to 60 mm with mineral wool infill | 30 | PEF backing rod, CF 116, CF-F 750 GV, CF 126 or mineral rock wool | Mineral stone/rock wool insulation or performed mineral stone/rock wool insulation installed on top side of the floor only | 365 | -/240/120 |
| | 3", 4" or 6" | 80-100 | 1.22 | | | | | 500 | |
| | | 100-125 | 1.42 | | | | | 600 | |
| Copper, ferrous (steel and iron) | 6" | 125-150 | 1.63 | | | | | 725 | -/120/120 |

*Note1: where there are two or more options for Hilti collar CP 680P/PX size, the max annular gap of 25 mm must be taken into consideration

*Note 2: Insulation used by Hilti in fire test FRT 180461b is 38 mm rockwool with density of 140 kg/m³. A 38 mm or 50 mm thick Bradford Fibertex 450 insulation with a minimum density of 80 kg/m³ can be optionally used as per test EWFA 2683500. Moreover, any equivalent mineral fibre insulation with a minimum density of 80 kg/m³ and a minimum thickness of 38 mm can optionally be used.

Table 4 Summary of assessment outcomes for non-insulated metal pipe penetrations through minimum 120 mm thick concrete floor separating element (Assessment 3)

| Metal pipe material | Hilti collar CP 680P/PX size* | Pipe nominal diameter, DN (mm) | Minimum pipe wall thickness (mm) | Allowable annual seal width (mm) | Sealant depth (mm) | Backing configuration | Pipe insulation configuration | FRL |
|----------------------------------|-------------------------------|--------------------------------|----------------------------------|--|--------------------|---|-------------------------------|---------|
| Copper, ferrous or brass | 2" or 3" | 23 to 65 | 0.91 | 25 mm, or up to 60 mm with mineral wool infill | 30 | PEF backing rod, CF 116, CF-F 750 GV, CF 126 or mineral rock wool | None | -/240/- |
| | 3", 4" or 6" | 80-100 | 1.22 | | | | | -/120/- |
| | | 100-125 | 1.42 | | | | | -/120/- |
| Copper, ferrous (steel and iron) | 6" | 125-150 | 1.63 | | | | | -/120/- |

*Note: where there are two or more options for Hilti collar CP 680P/PX size, the max annular gap of 25 mm must be taken into consideration

Table 5 Summary of assessment outcomes for non-insulated metal pipe penetrations through minimum 150 mm thick rigid wall separating element (Assessment 4)

| Metal pipe material | Hilti collar CP 680P/PX size* | Pipe nominal diameter, DN (mm) | Minimum pipe wall thickness (mm) | Allowable annular seal width (mm) | Sealant depth (mm) | Additional protection | Pipe insulation configuration | FRL |
|----------------------------------|-------------------------------|--------------------------------|----------------------------------|---|--------------------|---------------------------|-------------------------------|---------|
| Copper, ferrous or brass | 2" or 3" | 23 to 65 | 0.91 | 25, or up to 60 mm with mineral wool infill | 30 | CP 680p/PX cast in collar | None | -/240/- |
| | 3", 4" or 6" | 80-100 | 1.22 | | | | | -/120/- |
| | | 100-125 | 1.42 | | | | | -/120/- |
| Copper, ferrous (steel and iron) | 6" | 125-150 | 1.63 | | | | | -/120/- |

*Note: where there are two or more options for Hilti collar CP 680P/PX size, the max annular gap of 25 mm must be taken into consideration.

Table 6 Summary of assessment outcomes for insulated metal pipe penetrations through minimum 150 mm thick rigid wall separating element (Assessment 4)

| Metal pipe material | Hilti collar CP 680P/PX size* | Pipe nominal diameter, DN (mm) | Minimum pipe wall thickness (mm) | Allowable annular seal width (mm) | Sealant depth (mm) | Additional protection | Pipe insulation configuration* | Insulation length | FRL |
|----------------------------------|-------------------------------|--------------------------------|----------------------------------|--|--------------------|---------------------------|--|-------------------|-----------|
| Copper, ferrous or brass | 2" or 3" | 23 to 65 | 0.91 | 25 mm, or up to 60 mm with mineral wool infill | 30 | CP 680p/PX cast in collar | Mineral stone/rock wool insulation or performed mineral stone/rock wool insulation installed on top side of the floor only | 365 | -/240/120 |
| | 3", 4" or 6" | 80-100 | 1.22 | | | | | 500 | |
| | | 100-125 | 1.42 | | | | | 600 | -/120/120 |
| Copper, ferrous (steel and iron) | 6" | 125-150 | 1.63 | | | | | 725 | |

*Note: where there are two or more options for Hilti collar CP 680P/PX size, the max annular gap of 25 mm must be taken into consideration.

Limitations of assessment

The drawings included in this report were provided by Hilti Australia Pty Ltd.

The deemed-to-satisfy condition for the fire resistance period of a 150mm thick concrete slab is stated as -/180/180 in Table 5.5.1 in AS 3600:2018. An FRL of -/240/240 is attainable with a 175mm thick concrete slab as per this standard. The tests sponsored by the client, however, have shown that a majority of the tested systems with 150mm thick concrete floor separating element achieved FRL -/240/240 under controlled laboratory conditions. The outcomes of the referenced assessment report, which are based on these test results, shall not be interpreted as universally applicable for the assessed products in all practical applications. It is acknowledged that with reduced safety margins arising from thinner concrete floor separating elements, the influence of other factors such as defects in products, faults in installation and workmanship now bear greater influence on the performance of the systems.

The deemed-to-satisfy condition for the fire resistance period of a 150 mm thick concrete wall is stated as -/180/180 in Table 5.7.1 in AS 3600:2018. An FRL of -/240/240 is attainable with a 175 mm thick concrete wall as per this standard. As a result, the FRL given to the metal pipes assessed in 150 mm thick rigid walls are only applicable for 150 mm rigid walls tested to achieve a minimum FRL of -/240/120 in accordance to AS 1530.4:2014 or equivalent standard.

Additionally, the variations and outcome of the referenced assessment report are subject to the limitations and requirements described in Sections 2, 4 and 5 of this report. The results of this report are valid until 31 July 2024.

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1. Introduction

This report contains the minimum information sufficient for regulatory compliance and refers to the Assessment report FAS190023 R2.4.

The referenced assessment report documents the findings of the assessment undertaken to determine the likely fire resistance level (FRL) of various service penetrations installed through Hilti cast-in devices if tested in accordance with AS1530.4: 2014. This assessment was carried out at the request of Hilti Australia Pty Ltd. The sponsor details are included in Table 7.

Table 7 Sponsor details

| Client | Address |
|-------------------------|--|
| Hilti Australia Pty Ltd | 1G Homebush Bay Dr Rhodes NSW 2138 |

2. Framework for the assessment

2.1 Assessment approach

An assessment is an opinion about the likely performance of a component or element of structure if it was subject to a standard fire test.

No specific framework, methodology, standard or guidance documents exists in Australia for doing these assessments. We have therefore followed the 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' prepared by the Passive Fire Protection Forum (PFPF) in the UK in 2019¹.

This guide provides a framework for undertaking assessments in the absence of specific fire test results. Some areas where assessments may be offered are:

- Where a modification is made to a construction which has already been tested
- The interpolation or extrapolation of results of a series of fire resistance tests, or utilisation of a series of fire test results to evaluate a range of variables in a construction design or a product
- Where, for various reasons – e.g. size or configuration – it is not possible to subject a construction or a product to a fire test.

Assessments will vary from relatively simple judgements on small changes to a product or construction through to detailed and often complex engineering assessments of large or sophisticated constructions.

The referenced assessment uses established empirical methods and our experience of fire testing similar products to extend the scope of application by determining the limits for the design based on the tested constructions and performances obtained. The assessment is an evaluation of the potential fire resistance performance if the elements were to be tested in accordance with AS 1530.4:2014.

The referenced assessment has been written using appropriate test evidence generated at accredited laboratories to the relevant test standard. The supporting test evidence has been deemed appropriate to support the manufacturer's stated design.

¹ Passive Fire Protection Forum (PFPF) 2019, Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence, Passive Fire Protection Forum (PFPF), UK.

2.2 Compliance with the National Construction Code

This assessment report has been prepared to meet the evidence of suitability requirements of the National Construction Code Volumes One and Two – Building Code of Australia (NCC) 2019 including amendments² under A5.2 (1) (d).

This report and the referenced assessment has been written in accordance with the general principles outlined in EN 15725:2010³ for extended application reports on the fire performance of construction products and building elements. It also references test evidence for meeting a performance requirement or deemed to satisfy (DTS) provisions of the NCC under A5.4 for fire resistance levels, as applicable to the assessed systems.

2.3 Declaration

The guide to undertaking assessments in lieu of fire tests prepared by the PFPF in the UK requires a declaration from the client. By accepting our fee proposal dated 27 June 2019, Hilti Australia Pty Ltd confirmed that:

- To their knowledge the component or element of structure, which is the subject of the referenced assessment report, has not been subjected to a fire test to the standard against which the referenced assessment report is being made.
- They agree to withdraw this report and the referenced assessment report from circulation if the component or element of structure is the subject of a fire test by a test authority in accordance with the standard against which the referenced assessment is being made and the results are not in agreement with the referenced assessment.
- They are not aware of any information that could adversely affect the conclusions of the referenced assessment report and – if they subsequently become aware of any such information, they agree to ask the assessing authority to withdraw the assessment.

² National Construction Code Volumes One and Two - Building Code of Australia 2019 including Amendments, Australian Building Codes Board, Australia

³ European Committee for Standardization, EN 15725:2010: Extended application reports on the fire performance of construction products and building elements, European Committee for Standardization, Brussels, Belgium.

3. Description of the specimen and variations

3.1 System description

The tested systems included uPVC, uPVC-SC, HDPE and PP-MD pipes of various diameters through 150 mm and 120 mm thick concrete slabs. In addition to insulated and uninsulated metal pipes with various sizes penetrating 150 mm thick rigid wall systems.

3.2 Referenced test data

The assessment of the variation to the tested system and the determination of the likely performance is based on the results of the fire resistance tests of service penetrations documented in the reports summarised in Table 8. Further details of the tested system are described in the referenced assessment report.

Table 8 Referenced test data

| Report number | Test sponsor | Test date | Testing authority |
|-----------------|------------------------------|-----------------|--------------------------|
| FRT180461.1 | Hilti Australia Pty Ltd | 04 March 2019 | Warringtonfire Australia |
| FRT180462.1 | Hilti Australia Pty Ltd | 05 March 2019 | Warringtonfire Australia |
| FRT180463.1 | Hilti Australia Pty Ltd | 06 March 2019 | Warringtonfire Australia |
| FRT180322.2 | Hilti Australia Pty Ltd | 24 October 2018 | Warringtonfire Australia |
| FRT190095.1 | Hilti Australia Pty Ltd | 30 May 2019 | Warringtonfire Australia |
| FRT190130 | Hilti Australia Pty Ltd | 11 July 2019 | Warringtonfire Australia |
| NR. 8730/12 NR. | HILTI AG, Feldkircherstrasse | 05/06/2012. | AFITI LICOF |
| EWFA 53390600.1 | Hilti Australia Pty Ltd | 19 July 2018 | Warringtonfire Australia |

A summary of the tested service penetrations and the results from these fire tests are presented in Table 9. All the tested system contained Hilti Firestop Acrylic sealant CP606.

Table 9 Reference test details and results

| Reference test | Pipe type | Pipe diameter (mm) | Measured pipe thickness (mm) | Separating element | Local fire stopping protection | Aperture size (mm) | FRL (min) | | |
|----------------|-----------|--------------------|------------------------------|--------------------|--------------------------------|--------------------|-----------|-----|-----------|
| FRT 180463.1 | uPVC | Stack | 40 | 2.5 | 150 mm concrete slab | Hilti CP 680 P/PX | 2" | 160 | -/240/240 |
| | | | 50 | 2 | | | 2" | 160 | -/240/240 |
| | | | 65 | 2.5 | | | 2" | 160 | -/240/240 |
| | | | 80 | 3 | | | 3" | 200 | -/240/240 |
| | uPVC-SC | Stack | 100 | 3.5 | | | 4" | 250 | -/240/240 |
| | | | 150 | 5 | | | 6" | 350 | -/240/0 |
| FRT 180462.1 | uPVC | PVC Elbow | 40 | 2 | 150 mm concrete slab | Hilti CP 680 P/PX | 2" | 160 | -/240/240 |
| | | | 150-SC | 5 | | | 6" | 350 | -/240/240 |
| | HDPE | Stack | 50 | 3.5 | | | 2" | 160 | -/240/240 |
| | | | 160 | 7 | | | 6" | 350 | -/240/240 |
| | | HDPE Elbow | 50 | 3.5 | | | 2" | 160 | -/240/240 |
| | PP-MD | Stack | 40 | 2.5 | | | 2" | 160 | -/240/240 |

| Reference test | Pipe type | | Pipe diameter (mm) | Measured pipe thickness (mm) | Separating element | Local fire stopping protection | | Aperture size (mm) | FRL (min) |
|----------------|-----------|------------|--------------------|------------------------------|----------------------|--------------------------------|----|---------------------------|-----------|
| FRT 180461.1 | HDPE | HDPE Elbow | 110 | 5 | 150 mm concrete slab | Hilti CP 680 P/PX | 4" | 350 | -/240/240 |
| FRT 180322.2 | HDPE | Stack | 100 | 4.1 | 120 mm concrete slab | Hilti CP 680 P/PX | 6" | 250 | -/120/120 |
| | PP-MD | Stack | 100 | 3 | | | 6" | 250 | -/120/120 |
| FRT 190095.1 | HDPE | 3 x Stack | 160 | 5 | 150 mm concrete slab | Hilti CP 680 P/PX | 6" | 800 mm long x 350 mm wide | -/240/15 |

3.3 Purpose of the test method

AS 1530.4:2014 Section 10 sets out procedures for the fire resistance testing of service penetrations according to assess:

- The effects of the penetration on the integrity and insulation of the separating element; and
- Insulation and integrity failure of the penetrating service

The standard is to be read in conjunction with AS 4072.1:2005 to determine any provisions dealing with orientation and mounding of test specimens. It covers the construction and installation of service penetrations. Furthermore, AS 4072.1-2005 specifies the requirements for pre-qualification for assessment of variations of PVC-U DWV (uPVC) pipes as follows.

All the following tested plastic pipe sizes shall achieve the required FRL.

- 40 mm
- 50 mm
- 65 mm
- 80 mm
- 100 mm
- 150 mm

For plastic pipes other than PVC-U DWV, an opinion may be given provided that the following criteria are met.

- The maximum and minimum sizes of the assessed pipes have been tested and achieved the required FRL in the subject separating element
- The outside diameter of the largest pipe does not exceed 120 mm
 - For all pipes with outside diameters greater than 120mm, testing in accordance with AS 1530.4:2014 is recommended.
- The outside diameter of the smallest pipe is not less than 40 mm
- The five pipe sizes specified earlier have been tested and all achieved the required FRL

For metal pipes, an opinion may be given provided that the following criteria are met.

- The maximum and minimum sizes of the assessed pipes have been tested and achieved the required FRL in the subject separating element
- The outside diameter of the largest pipe does not exceed 150 mm

- For all pipes with outside diameters greater than 120mm, testing in accordance with AS 1530.4:2014 is recommended.
- The outside diameter of the smallest pipe is not less than 25 mm
- Inclusion of two CFS-PL firestop plugs to seal bank CP 680/PX cast-in collars.

3.4 Variations to tested systems

3.4.1 Variation 1 – Fire resistance performance of uPVC, HDPE and PP-MD service penetrations (Variation 1)

The first variation considered in the assessment is the fire resistance performance of uPVC, HDPE and PP-MD service penetrations of different pipe diameter to the tested systems.

3.4.2 Variation 2 – Collar installation methods

In all the tested service penetration systems, the top end of the fire collar was cut to be flush with the top level of the separating element. Hilti CP 606 sealant was then applied in the annular space between the separating element and the service to a depth of 10 mm from the unexposed surface of the separating element, as shown in Figure 1. As shown here, a sleeve coupler may be used if the concrete separating floor thickness is greater than 200 mm.

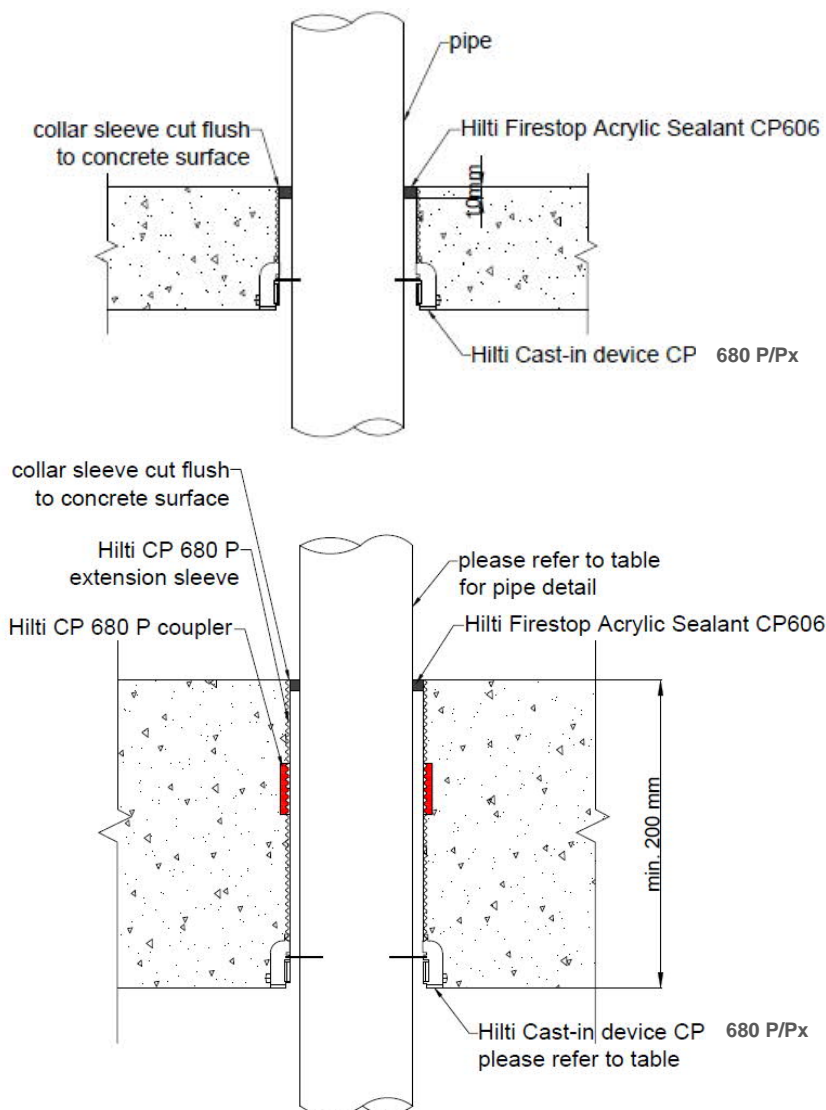


Figure 1 Section view, CP 680 P/PX with or without coupler, sleeve cut flush

Another option available is leaving this fire collar top uncut, leaving it to extend over the floor slab top level, applying the sealant to a depth of 10mm from the top end of the collar, as shown in Figure 2. This would effectively alter the testing arrangement such that the thermocouples on the service pipe are moved further away from the fire source. Therefore, they are likely to record lower temperatures. Similar to the previous case, if the thickness of the concrete separating floor is greater than 200 mm, a sleeve coupler may be used.

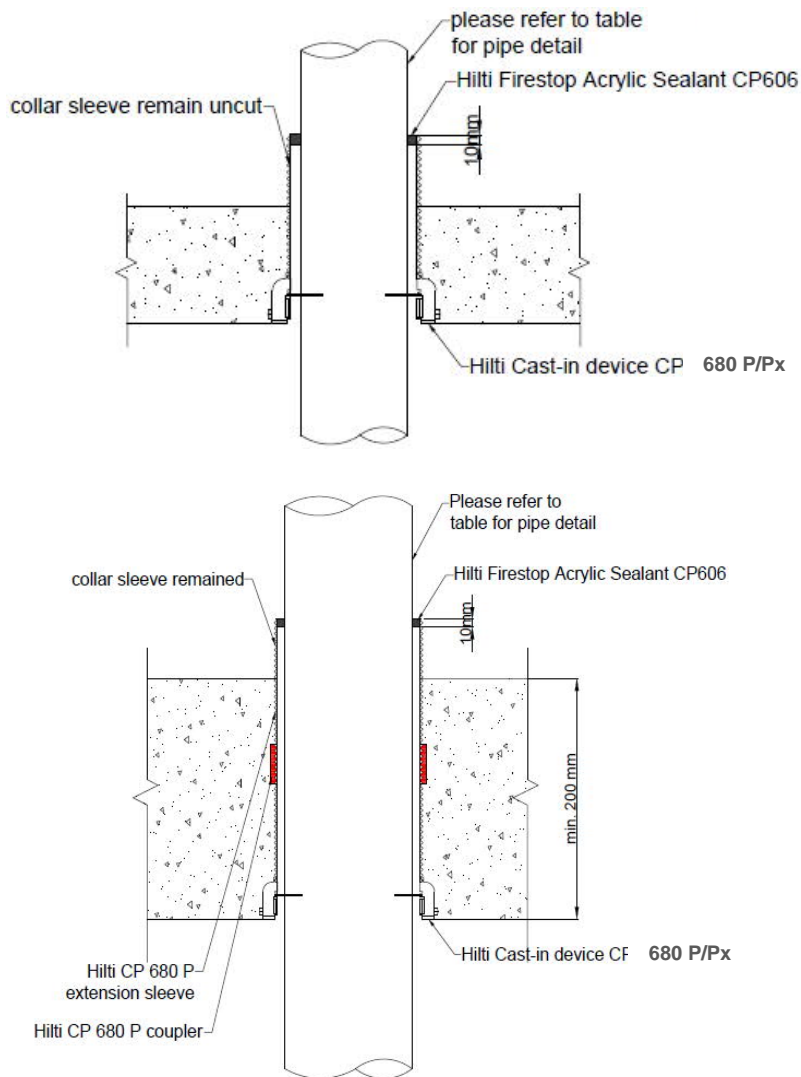


Figure 2 Section view, CP 680 P/PX with or without coupler, sleeve uncut

3.4.3 Variation 3 – Increase of floor slab thickness

It is proposed that for pipes with nominal diameter greater than 110mm, the thickness of the separating floor slab is increased to 200mm, in conjunction with the available test results to achieve FRL -/240/240. The additional thickness of the floor increases the distance between the thermocouples on the service pipe and the fire source. This variation is to be used as an alternative to Variation 2 where the sleeve collar is cut flush with the slab top level.

3.4.4 Variation 4 – Fire rated plasterboard build up

It is proposed that to achieve a 150mm thickness in the separating floor element for the purpose of improving the performance of a service penetration, 120mm thick concrete slabs are fitted locally with a combination of 13mm and 16mm plasterboard covers, as shown in Figures 3 and 4. It is proposed that with this arrangement, the assessed pipes can achieve FRL -/120/120. Under this condition, the insulation criterion is generally qualified by Design Table 5.5.1 of AS3600: 2018 which states that the fire resistance period (FRP) for insulation for slabs of thickness 120 mm is 120 min. However, due to the requirement for delaying temperature readings on service pipes, either local aperture beading shall be used as described above, or the sleeve shall be left uncut to achieve FRL -/120/120 for penetrations through 120 mm concrete floor separating elements.

Effects on the structural adequacy of the separating element induced by this variation do not form part of the referenced assessment. They are to be determined by the structural engineer.

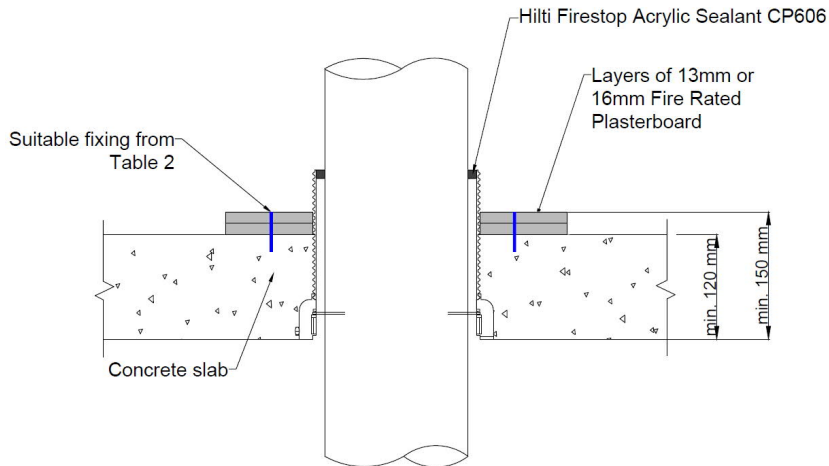


Figure 3 Concrete build up/aperture beading detail – section view

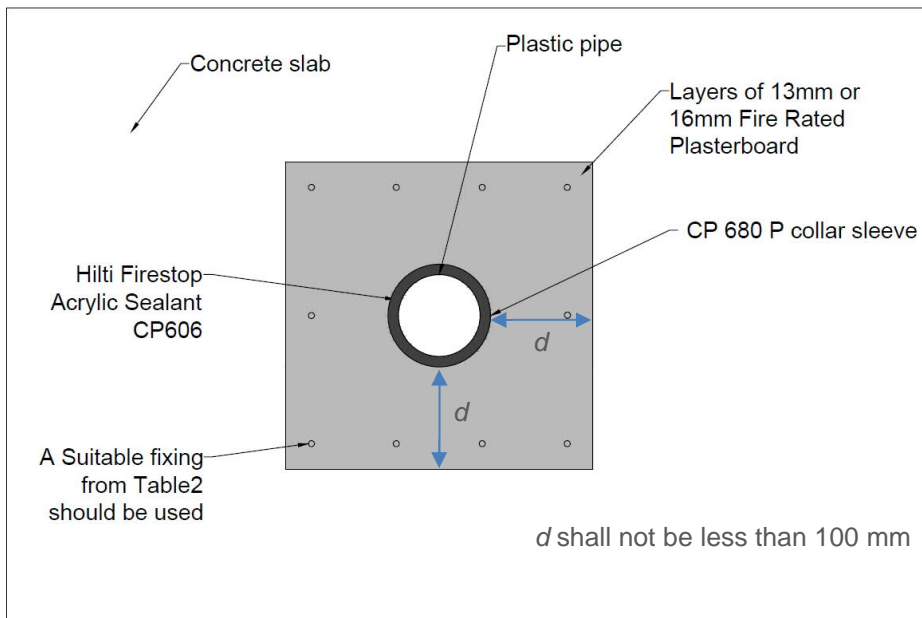


Figure 4 Concrete build up/aperture beading detail – front view

The minimum distance from the outer surface of the service pipe to the edge of the plasterboard beading (d – in Figure 4) shall not be less than 100 mm. The fixing anchor details are as shown in Table 10. The maximum spacing between anchors shall not exceed 150 mm.

Table 10 Anchor fixing types

| Anchoring System | | Minimum Size | Solid Concrete Floor |
|--------------------|--------|--------------|----------------------|
| Hilti Screw Anchor | HUS3-P | M6 | ✓ |
| | HUS3-H | | ✓ |
| | HUS | | ✓ |

3.4.5 Variation 5 – Metal pipes protected with Hilti CP 606 in rigid floors

Metal pipe protected with Hilti CP 606

The floor must have a minimum bare concrete separating element thickness of 120 mm. Aperture framing/beading shall be applied to achieve necessary thickness of 150 mm locally. Build up is not required for floors with thicknesses equal to or greater than 150mm.

The metal pipe must be positioned in the core hole such that the annular gap on all sides is maximum of 25 mm. The gap must be filled with Hilti CP 606 to a minimum depth of 30 mm backed with PE backing rod or mineral stone/rock wool. Annular gaps beyond 25 mm and up to 60 mm are allowed provided that the gap is sealed with CP 606 to a min depth of 30 mm backed with 33% compressed mineral wool with a minimum density of 60 kg/m³ as shown in Figure 4C. Where the annular gap is inconsistent around the pipe (i.e. less than 25 mm on one side and greater than 25 mm on the other side), 33% compressed mineral wool is only required in those areas where the gap is over 25 mm. The backing rod may be omitted if CP 606 sealant is applied to the full depth of the floor with a maximum annular gap of 25 mm. If the annular gap is zero, Hilti CP 606 can be applied in a 30 mm high x 5 mm thick fillet around the pipe as shown in Figures 5B and 5E.

The FRL assigned applies to the installation configuration where PVC pipe section or Hilti cast in collar CP680/CP680P/CP680PX/CP680M casted in floor remains in the concrete floor.

PEF backing rod can be open or closed, sealant can be filled to full depth of the floor with a maximum annular gap of 25 mm, so that the use of backing rod can be ignored

The metal pipe shall be copper, brass and ferrous (steel and iron) pipes specified in the assessment table, stainless and galvanised pipes are also included.

Pipe insulation can either be mineral stone/rock wool with greater density and thickness, or 38 mm and 50 mm thick Bradford Fibertex 450. Moreover, any equivalent mineral fibre insulation with a minimum density of 80 kg/m³ and a minimum thickness of 38 mm can optionally be used. Mineral stone/rock wool insulation must be overlapped by a minimum length equivalent to the pipe diameter. Such overlap is not required for preformed mineral stone/rock wool section.

If concrete slab thickness is greater than 200 mm, a sleeve coupler of a PVC pipe of appropriate size shall be used to extend the overall collar height up to at least the slab thickness.

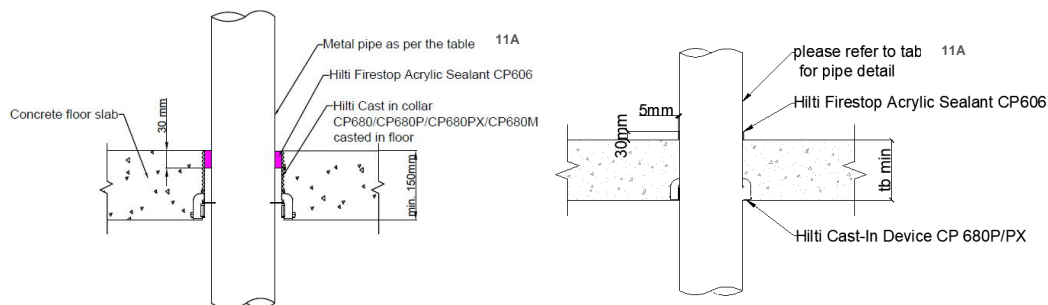


Figure 4A (Left): Section view – CP 680P/PX cast-in collar in 150 mm concrete slab detail

Figure 4B (Right) : Section view – CP 680P/PX cast-in collar in 150 mm concrete slab detail with zero annular gap

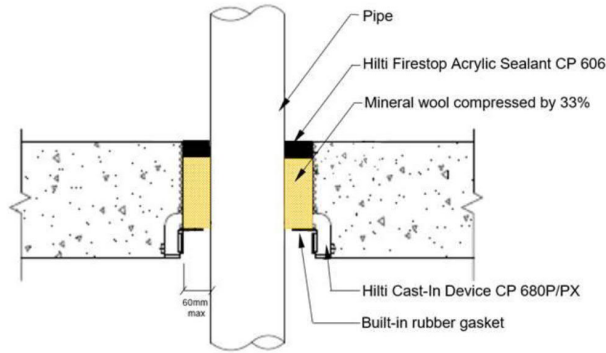


Figure 4C: Section view – CP 680P/PX cast-in collar in 150 mm concrete slab detail with up to 60 mm annular gap filled with mineral wool with min density of 60 kg/m³ compressed by min 33%

Table 11A: Assessment summary of metal pipe configuration as per Figure 4A

| Metal pipe material | Hilti collar CP 680P/PX size* | Pipe nominal diameter, DN (mm) | Minimum pipe wall thickness (mm) | Allowable annual seal width (mm) | Sealant depth (mm) | Backing configuration | Pipe insulation configuration | FRL |
|----------------------------------|-------------------------------|--------------------------------|----------------------------------|---|--------------------|---|-------------------------------|---------|
| Copper, ferrous or brass | 2" or 3" | 23 to 65 | 0.91 | 25, or up to 60 mm with mineral wool infill (Figure 4C) | 30 | PEF backing rod, CF 116, CF-F 750 GV, CF 126 or mineral rock wool | None | -/240/- |
| | 3", 4" or 6" | 80-100 | 1.22 | | | | | -/120/- |
| 100-125 | | 1.42 | -/120/- | | | | | |
| Copper, ferrous (steel and iron) | 6" | 125-150 | 1.63 | | | | | |

Note: Where there are two or more options for Hilti collar CP 680P/PX size, the max annular gap of 25mm must be taken into consideration.

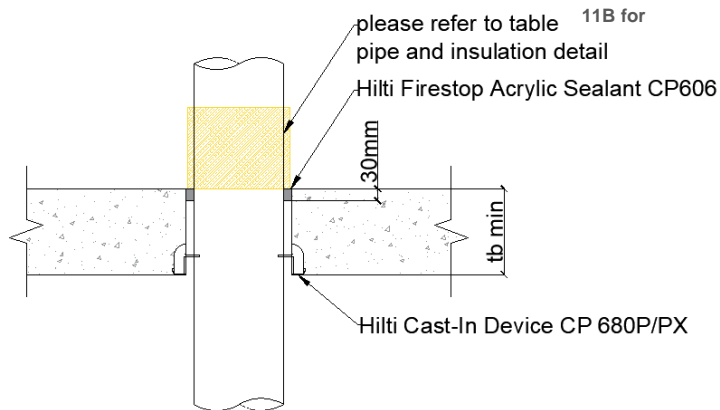


Figure 4D: Section view – CP 680P/PX cast-in collar in 150 mm concrete slab detail with mineral wool insulation

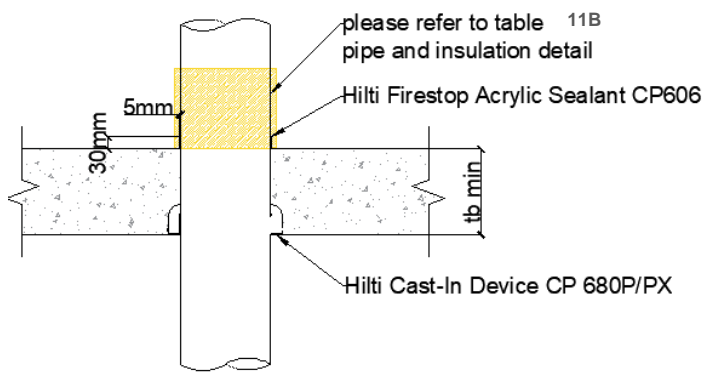


Figure 4E: Section view – CP 680P/PX cast-in collar in 150 mm concrete slab detail with mineral wool insulation and zero annular gap

Table 11B Assessment summary of metal pipe configuration as per Figure 4C

| Metal pipe material | Hilti collar CP 680P/PX size* | Pipe nominal diameter, DN (mm) | Minimum pipe wall thickness (mm) | Allowable annual seal width (mm) | Sealant depth (mm) | Backing configuration | Pipe insulation configuration* | Insulation length | FRL |
|----------------------------------|-------------------------------|--------------------------------|----------------------------------|---|--------------------|---|--|-------------------|-----------|
| Copper, ferrous or brass | 2" or 3" | 23 to 65 | 0.91 | 25, or up to 60 mm with mineral wool infill (Figure 4C) | 30 | PEF backing rod, CF 116, CF-F 750 GV, CF 126 or mineral rock wool | Mineral stone/rock wool insulation or performed mineral stone/rock wool insulation installed on top side of the floor only | 365 | -/240/120 |
| | 3", 4" or 6" | 80-100 | 1.22 | | | | | 500 | |
| | | 100-125 | 1.42 | | | | | 600 | |
| Copper, ferrous (steel and iron) | 6" | 125-150 | 1.63 | | | | | 725 | -/120/120 |

*Note: Insulation used by Hilti in fire test FRT 180461b is 38 mm rockwool with density of 140 kg/m³. 38 mm or 50 mm thick Bradford Fibertex 450 insulation can be optionally used as per test EWFA 2683500. Moreover, any equivalent mineral fibre insulation with a minimum density of 80 kg/m³ and a minimum thickness of 38 mm can optionally be used.

3.4.6 Variation 6 – Performance of blank cast-in collars seals

The proposed penetration seal construction is comprised of a minimum of 2 Hilti CFS-PL Firestop Plugs to seal blank cast-in collars up to 202mm in diameter. The minimum total seal thickness must be 150mm.

The proposed floor construction shall be made from concrete with a minimum thickness of 120mm. Layers of 13mm or 16mm thick and 100mm wide fire rated plasterboard strips are applied around the aperture and make the seal thickness to be minimum 150mm thick.

The proposed construction comprises Hilti Firestop Plug as tested in Nr 8688/12 filled within apertures in a 150mm thick concrete floor slab. The Hilti Firestop Plugs reached to the depth of 60mm on every side on the supporting construction leaving an air space between themselves of 30mm approximately. The specimen 8688G comprised an aperture with size of Ø250mm in diameter and filled with Hilti Firestop Plugs each side and the plug was placed directly into the gap of the support construction.

With reference to the temperature measured in Nr 8688/12 remote from the services, it is confirmed that these temperatures did not rise in excess of 100°C before 120 minutes and there was no integrity failure or collapse of the plugs in this time.

As concluded previously, it is considered that the integrity and insulation behaviour of the sealing systems tested in Nr 8688/12 can be used to indicate the likely behaviour of similar specimen tested in accordance with AS 1530.4:2014 for up to 120 minutes.

The proposed construction is 120mm thick concrete floor. With reference to AS 3600, for normal weight, simply supported solid reinforced slabs, the 120mm thick concrete slab will likely achieve an FRL of 120/120/120.

Based on the above discussion, it is confirmed that the proposed construction will likely achieve an insulation and integrity performance of 120 minutes respectively if tested in accordance with AS 1530.4:2014.

Table 11C Schedule of compounds for CFS-PL projected floor systems

| Item | Description | Item | Description |
|-------|---|---------------|-----------------------------------|
| A | Hilti Firestop Plug CFS-PL Hilti Firestop Plug CP 658 | t_E | Thickness of the building element |
| E | Building element (rigid or flexible wall construction, floor) | \varnothing | Diameter of the seal |
| E_1 | Aperture beading, 13mm or 16mm fire grade plasterboard | w_A | Width of the frame |
| E_2 | Aperture beading, 75mm Hebel panel from one side only | t_A | Thickness of the seal, min. 150mm |

Floor penetrations

The floors must be tested in accordance with AS 1530.4:2014 for the required fire resistance period.

Blank floor seal, no services, Figure 4C

Maximum opening size 202mm,. Seal thickness (t_A) \geq 150 mm.

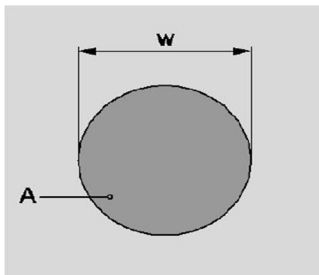


Figure 4F Blank Floor Seal, No Services protected with Hilti CFS-PL Firestop Plug

Table 11D assessment results for bank seals services

| Description of Services | FRL |
|---|-----------|
| Blank cast-in collars up to 202mm sealed with 2 Hilti CFS-PL Firestop Plugs to achieve an overall minimum seal thickness of 150mm | -/120/120 |

3.4.7 Variation 7 – Metal pipes in 150 mm thick rigid walls

It is proposed to assess various metal pipes in minimum 150 mm thick rigid wall systems. It is also proposed that CP 680P/PX cast in collar can optionally be used instead of the PVC cast in sleeve inside the rigid wall systems as shown in Figure 5 and Figure 6.

A summary of the assessment outcomes for metal pipes service penetrations through a minimum 150 mm thick rigid wall separating element with and without insulation and zero annular gaps are shown in below tables.



Figure 5 uninsulated metal pipes in minimum 150 mm thick rigid walls with CP 680P/PX cast-in collar.

Table 11 Uninsulated metal pipe penetrations through minimum 150 mm thick rigid wall separating element

| Metal pipe material | Hilti collar CP 680P/PX size* | Pipe nominal diameter, DN (mm) | Minimum pipe wall thickness (mm) | Allowable annular seal width (mm) | Sealant depth (mm) | Additional protection | Pipe insulation configuration | FRL |
|----------------------------------|-------------------------------|--------------------------------|----------------------------------|---|--------------------|---------------------------|-------------------------------|---------|
| Copper, ferrous or brass | 2" or 3" | 23 to 65 | 0.91 | 25, or up to 60 mm with mineral wool infill | 30 | CP 680p/PX cast in collar | None | -/240/- |
| | 3", 4" or 6" | 80-100 | 1.22 | | | | | -/120/- |
| | | 100-125 | 1.42 | | | | | |
| Copper, ferrous (steel and iron) | 6" | 125-150 | 1.63 | | | | | -/120- |

*Note: where there are two or more options for Hilti collar CP 680P/PX size, the max annular gap of 25 mm must be taken into consideration

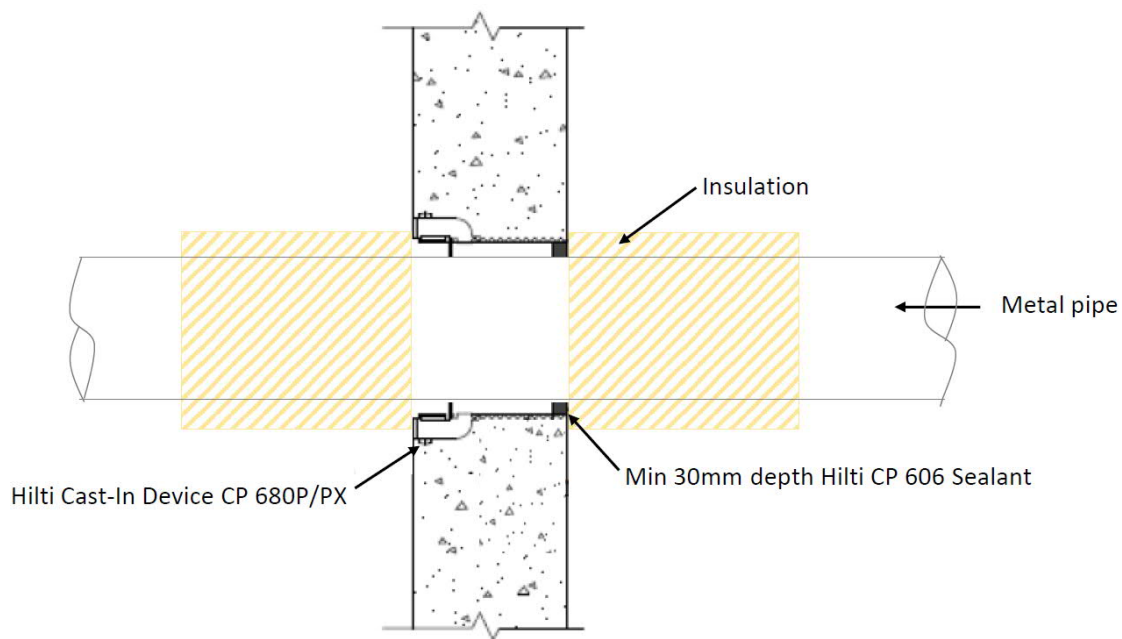


Figure 6 Insulated metal pipes in minimum 150 mm thick rigid walls with CP 680P/PX cast-in collar.

Table 12 Insulated metal pipe penetrations through minimum 150 mm thick rigid wall separating element (Assessment 4)

| Metal pipe material | Hilti collar CP 680P/PX size* | Pipe nominal diameter, DN (mm) | Minimum pipe wall thickness (mm) | Allowable annular seal width (mm) | Sealant depth (mm) | Additional protection | Pipe insulation configuration* | Insulation length | FRL |
|----------------------------------|-------------------------------|--------------------------------|----------------------------------|--|--------------------|---------------------------|--|-------------------|-----------|
| Copper, ferrous or brass | 2" or 3" | 23 to 65 | 0.91 | 25 mm, or up to 60 mm with mineral wool infill | 30 | CP 680p/PX cast in collar | Mineral stone/rock wool insulation or performed mineral stone/rock wool insulation installed on top side of the floor only | 365 | -/240/120 |
| | 3", 4" or 6" | 80-100 | 1.22 | | | | | 500 | |
| | | 100-125 | 1.42 | | | | | 600 | |
| Copper, ferrous (steel and iron) | 6" | 125-150 | 1.63 | | | | | 725 | -/120/120 |

*Note: where there are two or more options for Hilti collar CP 680P/PX size, the max annular gap of 25 mm must be taken into consideration.

3.5 Schedule of components for proposed penetration systems

3.5.1 uPVC stack pipe protected with Hilti CP 680 P/PX cast in collar through concrete floor fire separating element (1/2)

Overview

For an FRL of -/120/120, the bare concrete floor separating element thickness (t_b , min) shall have a minimum thickness of 120 mm. For -/240/240 FRL, the bare concrete floor separating element thickness (t_b , min) shall have a minimum thickness of 150 mm. The FRL of the concrete floor separating element governs the FRL of the penetration system.

CP 680 P/PX must be left uncut for all Ø150mm pipe penetrations.

FRL -/120/120 solution, t_b , min = 120 mm

To achieve an FRL of -/120/120 on a 120mm bare concrete floor, leave the CP 680 P/PX uncut. No build up is required.

If the CP 680 P/PX collar is to be cut flush, a minimum concrete floor separating element thickness (including Local aperture beading/build-up) required is 150 mm. Local aperture beading/build-up is allowed using layers of 13 mm or 16mm thick fire grade plasterboard to increase the concrete floor thickness to minimum 150 mm. Please refer to Section 3.4.4 for aperture beading/build-up details.

FRL -/240/240 solution, t_b , min = 150 mm

Hilti collar CP 680P/PX configuration 1 (CC1): HILTI cast in collar CP 680P/PX collar sleeve can remain uncut or cut flush during the installation.

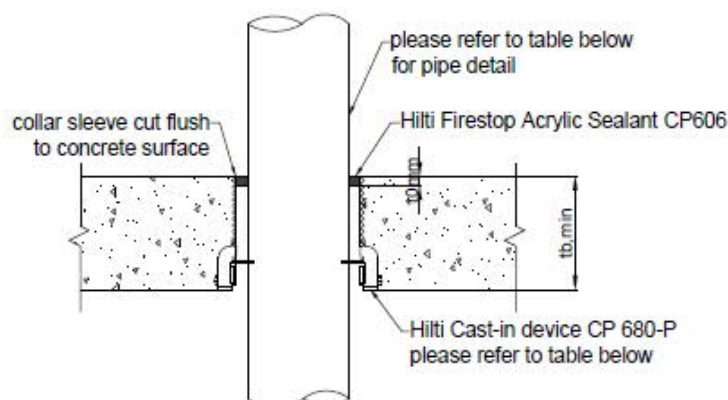
Hilti collar CP 680P/PX configuration 2 (CC2): HILTI cast in collar CP 680P/PX collar sleeve shall remain uncut during the installation, for this collar configuration.

Other considerations

In all pipe configurations, the annular gap between the service pipe and the collar or the sleeve extension shall be filled with Hilti Firestop Acrylic Sealant CP606 to a depth not less than 10 mm as shown in Figures 5 and 6.

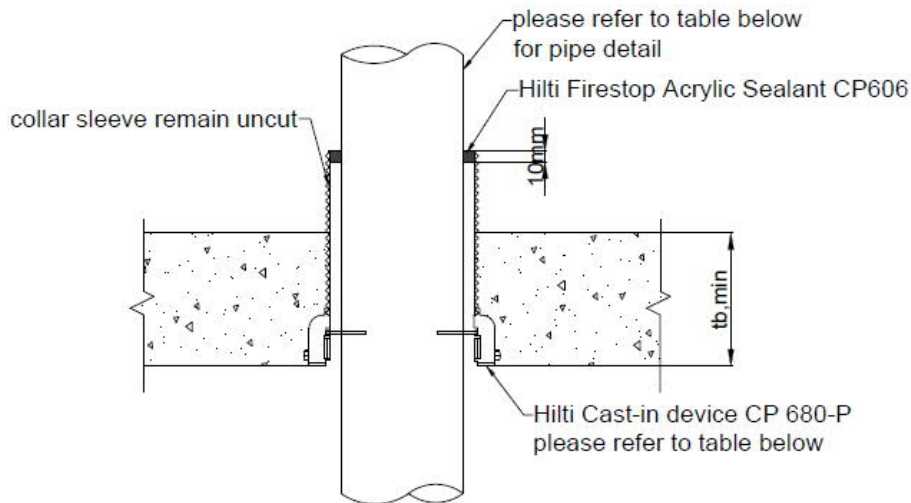
If concrete slab thickness is greater than 200mm, a sleeve coupler or a PVC pipe of appropriate size shall be used to extend the overall collar height up to the at least the slab thickness. The sleeve can be flush with the slab top level or remain uncut. Refer to Figures 1 and 2 for installation configurations. The approval also covers uPVC pipe in the collar before the concrete pour.

Pipe details are taken from AS 1260 and actual test specimen.



Local aperture/beading is required for slabs less than 150 mm thick to achieve FRL - /120/120 if the collar sleeve is cut flush to the surface of the slab.

Figure 7 uPVC stack pipe with sleeve cut flush



Local aperture/beading is not required for slabs less than 150 mm thick to achieve FRL -/120/120 if the collar sleeve is left uncut.

Figure 8 uPVC stack pipe with sleeve uncut

The schedule of components for the uPVC stack pipes through 150mm thick concrete floor fire separating element is as shown in Table 13.

Table 13 uPVC stack pipe through 150 mm concrete floor

| Pipe configuration | pipe material | Hilti collar CP 680P size | Pipe nominal size, DN (mm) | Nominal total pipe wall thickness (mm) | Hilti collar CP 680P configuration | Sealant configuration | FRL $t_b, \min = 150\text{mm}$ |
|----------------------|---------------|---------------------------|----------------------------|--|------------------------------------|---|--------------------------------|
| Stack/ straight pipe | UPVC | 2" | 40 | 2 | CC1 | 10 mm depth of CP 606 applied in the annular gap between the pipe and the collar sleeve | -/240/240 |
| | | 2" | 50 | 2.2 | | | |
| | | 2" | 65 | 2.7 | | | |
| | | 3" | 80 | 2.9 | | | |
| | | 4" | 100 | 3.5 | | | |
| | | 6" | 150* | 5 | CC2 | | |

*Collar sleeve shall remain uncut at all times.

3.5.2 uPVC pipe with elbow inside collar protected with Hilti CP 680 P/PX cast in collar through concrete floor fire separating element (2/2)

Overview

The application refers to elbow or 4-way riser socket inside the collar through concrete floor.

For an FRL of -/120/120, the bare concrete floor separating element thickness (t_b, \min) shall have a minimum thickness of 120 mm. For an FRL of -/240/240, the bare concrete floor separating element thickness (t_b, \min) shall have a minimum thickness of 150 mm. The FRL of the concrete floor separating element governs the FRL of the penetration system.

FRL -/120/120 solution, $t_b, \min = 120 \text{ mm}$

To achieve an FRL of -/120/120 on a 120mm bare concrete floor, leave the CP 680 P/PX uncut. No build up is required.

If the CP 680 P/PX collar is to be cut flush, a minimum concrete floor separating element thickness (including Local aperture beading/build-up) required is 150 mm. Local aperture beading/build-up is allowed using layers of 13 mm or 16mm thick fire grade plasterboard to increase the concrete floor thickness to minimum 150 mm. Please refer to Section 3.4.4 for the aperture beading/build-up details.

FRL -/240/240 solution, t_b , min = 150 mm

Hilti collar CP 680P/PX configuration 1 (CC1): HILTI cast in collar CP 680P/PX collar sleeve can remain uncut or cut flush during the installation.

Other considerations

In all pipe configurations, the annular gap between the service pipe and the collar or the sleeve extension shall be filled with Hilti Firestop Acrylic Sealant CP606 to a depth not less than 10 mm as shown in Figures 7 and 8.

If concrete slab thickness is greater than 200mm, a sleeve coupler or a PVC pipe of appropriate size shall be used to extend the overall collar height up to the at least the slab thickness. The sleeve can be flush with the slab top level or remain uncut. Refer to Figures 1 and 2 for installation configurations. The approval also covers uPVC pipe in the collar before the concrete pour.

Pipe details are taken from AS 1260 and actual test specimen.

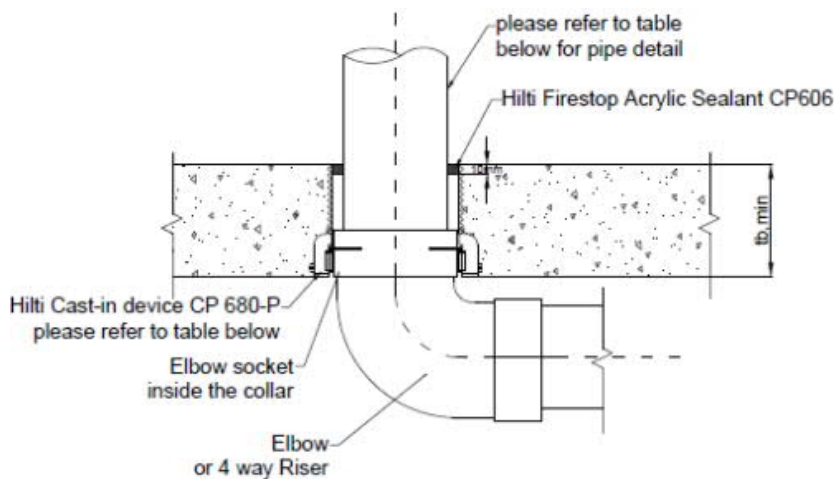


Figure 9 uPVC pipe with elbow inside with sleeve cut flush

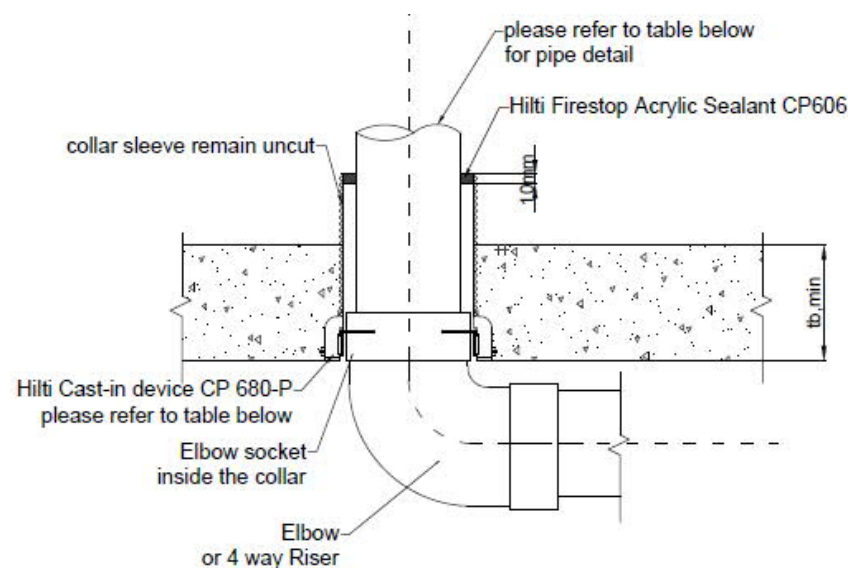


Figure 10 uPVC pipe with elbow inside with sleeve uncut

The schedule of components for the uPVC pipes with elbows or 4-way risers through 150mm thick concrete floor fire separating element is as shown in Table 14.

Table 14 uPVC pipe with elbow or 4-way riser socket inside the collar through 150 mm concrete floor

| Pipe configuration | pipe material | Hilti collar CP 680P size | Pipe nominal size, DN (mm) | Nominal total pipe wall thickness (mm) | Hilti collar CP 680P configuration | Sealant configuration | FRL $t_b, \text{min} = 150\text{mm}$ |
|---------------------|---------------|---------------------------|----------------------------|--|------------------------------------|---|--------------------------------------|
| Elbow inside collar | uPVC | 2" | 40 | 2 | CC1 | 10 mm depth of CP 606 applied in the annular gap between the pipe and the collar sleeve | - /240/240 |
| | | 2" | 50 | 2.2 | | | |
| | | 2" | 65 | 2.7 | | | |
| | | 3" | 80 | 2.9 | | | |
| | | 4" | 100 | 3.5 | | | |
| | | 6" | 150 | 5 | | | |

3.5.3 uPVC-SC stack pipe protected with Hilti CP 680 P/PX cast in collar through concrete floor fire separating element (1/2)

Overview

For an FRL of -/120/120, the bare concrete floor separating element thickness (t_b, min) shall have a minimum thickness of 120 mm. For an FRL of -/240/240, the bare concrete floor separating element thickness (t_b, min) shall have a minimum thickness of 150 mm. The FRL of the concrete floor separating element governs the FRL of the penetration system.

CP 680 P/PX must be left uncut for all $\varnothing 150\text{mm}$ pipe penetrations.

FRL -/120/120 solution, $t_b, \text{min} = 120 \text{ mm}$

To achieve an FRL of -/120/120 on a 120mm bare concrete floor, leave the CP 680 P/PX uncut. No build up is required.

If the CP 680 P/PX collar is to be cut flush, a minimum concrete floor separating element thickness (including Local aperture beading/build-up) required is 150 mm. Local aperture beading/build-up is allowed using layers of 13 mm or 16mm thick fire grade plasterboard to increase the concrete floor thickness to minimum 150 mm. Please refer to Section 3.4.4 for aperture beading/build-up details.

FRL -/240/240 solution, $t_b, \text{min} = 150 \text{ mm}$

Hilti collar CP 680P/PX configuration 1 (CC1): HILTI cast in collar CP 680P/PX collar sleeve can remain uncut or cut flush during the installation.

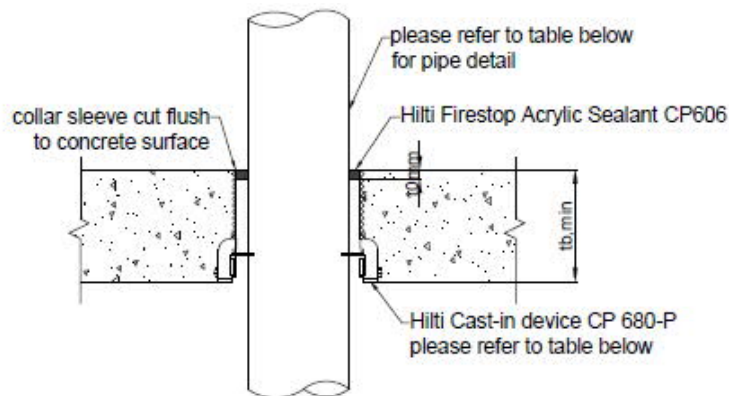
Hilti collar CP 680P/PX configuration 2 (CC2): HILTI cast in collar CP 680P/PX collar sleeve must remain uncut during the installation, for this collar configuration.

Other considerations

In all pipe configurations, the annular gap between the service pipe and the collar or the sleeve extension shall be filled with Hilti Firestop Acrylic Sealant CP606 to a depth not less than 10 mm as shown in Figures 9 and 10.

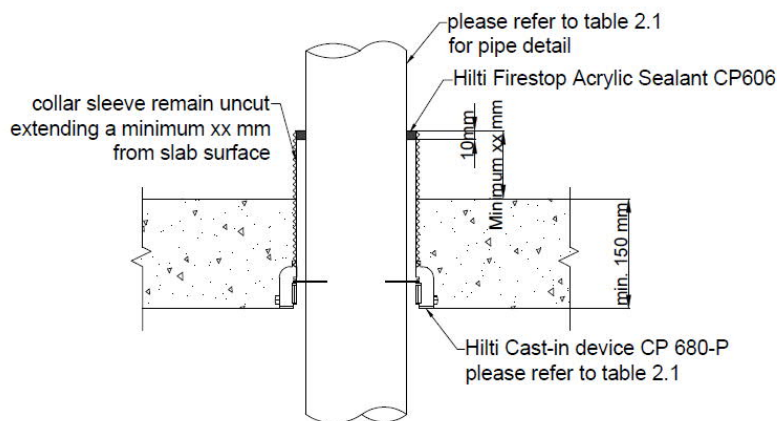
If concrete slab thickness is greater than 200mm, a sleeve coupler or a PVC pipe of appropriate size shall be used to extend the overall collar height up to the at least the slab thickness. The sleeve can be flush with the slab top level or remain uncut. Refer to Figures 1 and 2 for installation configurations. The approval also covers uPVC-SC pipe in the collar before the concrete pour.

Pipe details are taken from AS 1260 and actual test specimen.



Local aperture/beading is required for slabs less than 150 mm thick to achieve FRL - /120/120 if the collar sleeve is cut flush to the surface of the slab.

Figure 11 uPVC-SC stack pipe with sleeve cut flush



Local aperture/beading is not required for slabs less than 150 mm thick to achieve FRL -/120/120 if the collar sleeve is left uncut.

Figure 12 uPVC-SC stack pipe with sleeve uncut

The schedule of components for the uPVC-SC stack pipes through 150mm thick concrete floor fire separating element is as shown in Table 15.

Table 15 uPVC-SC stack pipe through 150 mm concrete floor

| Pipe configuration | pipe material | Hilti collar CP 680P size | Pipe nominal size, DN (mm) | Nominal pipe wall thickness (mm) | Hilti collar CP 680P configuration | Sealant configuration | FRL $t_{b,min} = 150mm$ |
|---------------------|---------------|---------------------------|----------------------------|----------------------------------|------------------------------------|---|-------------------------|
| Stack/straight pipe | UPVC-SC | 4" | 100 | 3.5 | CC1 | 10 mm depth of CP 606 applied in the annular gap between the pipe and the collar sleeve | -/240/240 |
| | UPVC-SC | 6" | 150* | 5 | CC2 | | -/240/240 |

* Collar sleeve shall remain uncut at all times.

3.5.4 uPVC-SC pipe with elbow inside the collar protected with Hilti CP 680 P/PX cast in collar through concrete floor fire separating element (2/2)

Overview

The application refers to elbow or 4-way riser socket inside the collar through concrete floor.

For an FRL of -/120/120, the bare concrete floor separating element thickness (t_b , min) shall have a minimum thickness of 120 mm. For an FRL of -/240/240, the bare concrete floor separating element thickness (t_b , min) shall have a minimum thickness of 150 mm. The FRL of the concrete floor separating element governs the FRL of the penetration system.

FRL -/120/120 solution, t_b , min = 120 mm

To achieve an FRL of -/120/120 on a 120mm bare concrete floor, leave the CP 680 P/PX uncut. No build up is required.

If the CP 680 P/PX collar is to be cut flush, a minimum concrete floor separating element thickness (including Local aperture beading/build-up) required is 150 mm. Local aperture beading/build-up is allowed using layers of 13 mm or 16mm thick fire grade plasterboard to increase the concrete floor thickness to minimum 150 mm. Please refer to Section 3.4.4 for aperture beading/build-up details.

FRL -/240/240 solution, t_b , min = 150 mm

Hilti collar CP 680P/PX configuration 1 (CC1): HILTI cast in collar CP 680P/PX collar sleeve can remain uncut or cut flush during the installation.

Other considerations

In all pipe configurations, the annular gap between the service pipe and the collar or the sleeve extension shall be filled with Hilti Firestop Acrylic Sealant CP606 to a depth not less than 10 mm as shown in Figures 11 and 12.

If concrete slab thickness is greater than 200mm, a sleeve coupler or a PVC pipe of appropriate size shall be used to extend the overall collar height up to the at least the slab thickness. The sleeve can be flush with the slab top level or remain uncut. Refer to Figures 1 and 2 for installation configurations. The approval also covers uPVC-SC pipe in the collar before the concrete pour.

Pipe details are taken from AS 1260 and actual test specimen.

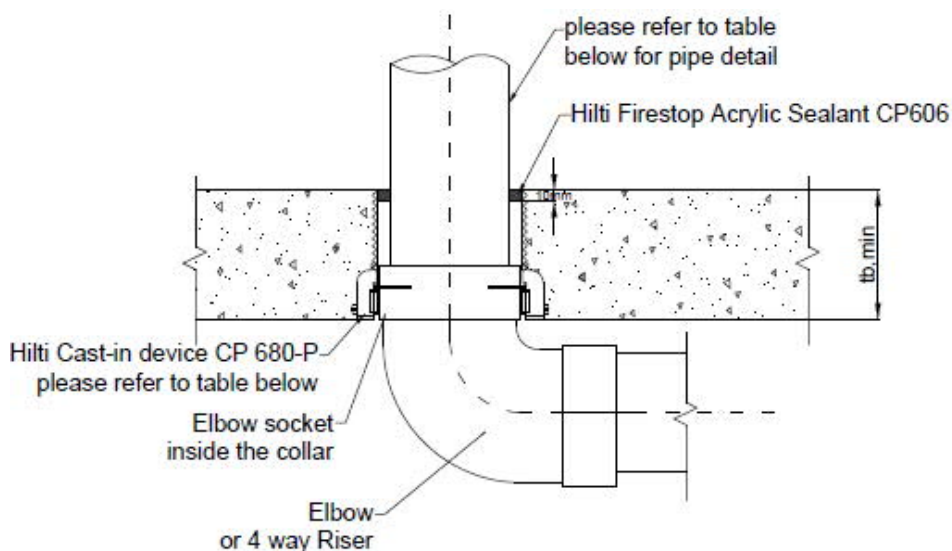


Figure 13 uPVC-SC pipe with elbow inside with sleeve cut flush

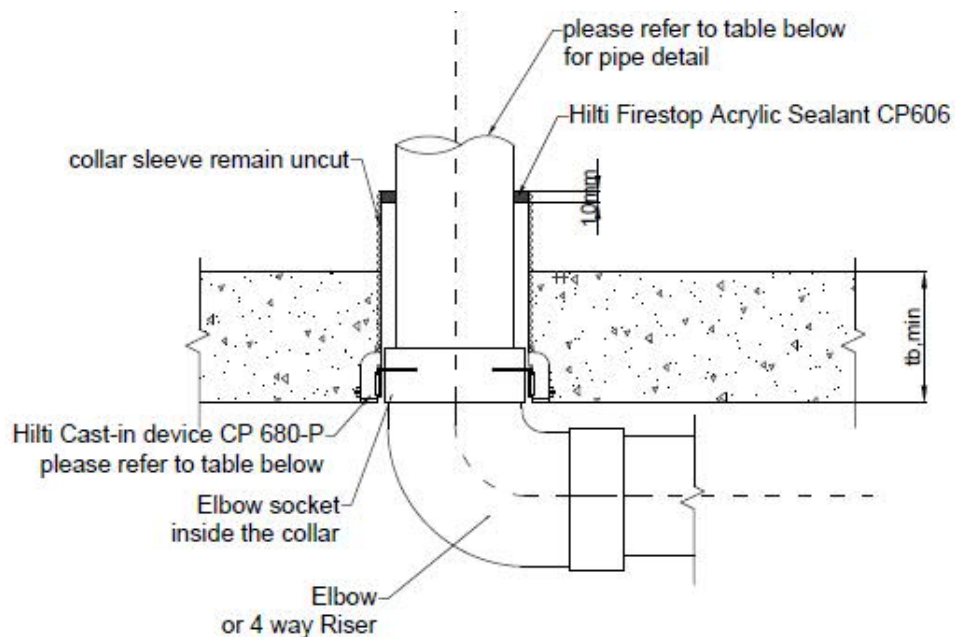


Figure 14 uPVC-SC pipe with elbow inside with sleeve uncut

The schedule of components for the uPVC pipes with elbows or 4-way risers through 150mm thick concrete floor fire separating element is as shown in Table 16.

Table 16 uPVC-SC pipe with elbow or 4-way riser socket inside the collar through 150 mm concrete floor

| Pipe configuration | pipe material | Hilti collar CP 680P size | Pipe nominal size, DN (mm) | Nominal total pipe wall thickness (mm) | Hilti collar CP 680P configuration | Sealant configuration | FRL $t_{b, min} = 150mm$ |
|---------------------|---------------|---------------------------|----------------------------|--|------------------------------------|---|--------------------------|
| Elbow inside collar | uPVC-SC | 4" | 100 | 3.5 | CC1 | 10 mm depth of CP 606 applied in the annular gap between the pipe and the collar sleeve | -/240/240 |
| | | 6" | 150 | 5 | CC2 | | |

3.5.5 HDPE pipe protected with Hilti CP 680 P/PX cast in collar through concrete floor fire separating element (1/2)

Overview

For an FRL of -/120/120, the bare concrete floor separating element thickness (t_b , min) shall have a minimum thickness of 120 mm. For an FRL of -/240/240, the bare concrete floor separating element thickness (t_b , min) shall have a minimum thickness of 150 mm. The FRL of the concrete floor separating element governs the FRL of the penetration system.

CP 680 P/PX must be left uncut for all Ø150mm pipe penetrations.

FRL -/120/120 solution, t_b , min = 120 mm

To achieve FRL -/120/120 on a 120mm bare concrete floor, leave the CP 680 P/PX uncut. No build up is required.

If the CP 680 P/PX collar is to be cut flush, a minimum concrete floor separating element thickness (including Local aperture beading/build-up) required is 150 mm. Local aperture beading/build-up is allowed using layers of 13 mm or 16mm thick fire grade plasterboard to increase the concrete floor thickness to minimum 150 mm. Please refer to Section 3.4.4 for aperture beading/build-up details.

FRL -/240/240 solution, t_b , min = 150 mm

Hilti collar CP 680P/PX configuration 1 (CC1): HILTI cast in collar CP 680P/PX collar sleeve can remain uncut or cut flush during the installation.

Hilti collar CP 680P/PX configuration 2 (CC2): HILTI cast in collar CP 680P/PX collar sleeve must remain uncut during the installation, for this collar configuration.

Other considerations

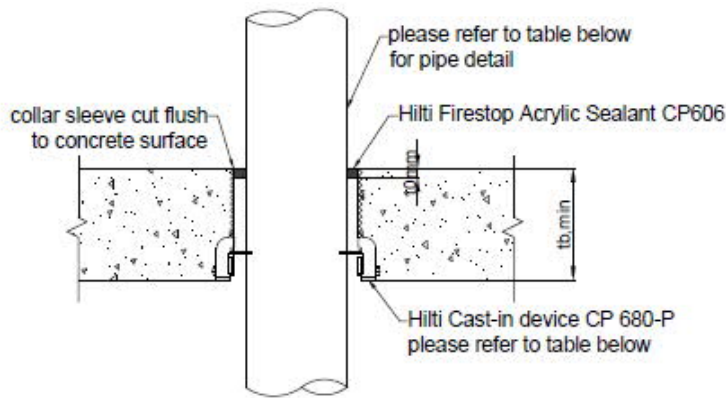
In all pipe configurations, the annular gap between the service pipe and the collar or the sleeve extension shall be filled with Hilti Firestop Acrylic Sealant CP606 to a depth not less than 10 mm as shown in Figures 13 and 14.

If concrete slab thickness is greater than 200mm, a sleeve coupler of appropriate size shall be used to extend the overall collar height up to the at least the slab thickness. The sleeve can be flush with the slab top level or remain uncut. Refer to Figures 1 and 2 for installation configurations. The approval also covers HDPE pipe in the collar before the concrete pour.

It is allowed to use HDPE pipes and fittings with grooves on the surface of the pipe as long as the pipe material composition, thickness and diameter are similar to the tested and assessed HDPE pipes in this assessment.

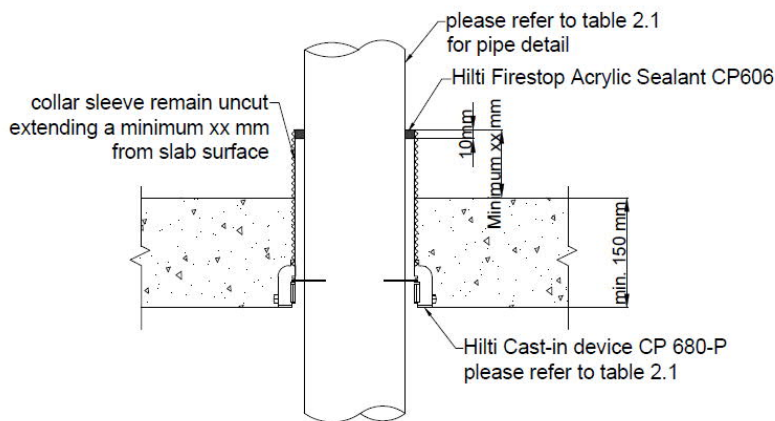
Any pipe fittings used must be tested and have an established minimum FRL of -/240/240 in accordance to AS 1530.4:2014.

Pipe details are taken from AS 1260 and actual test specimen.



Local aperture/beading is required for slabs less than 150 mm thick to achieve FRL - /120/120 if the collar sleeve is cut flush to the surface of the slab.

Figure 15 HDPE stack pipe with sleeve cut flush



Local aperture/beading is not required for slabs less than 150 mm thick to achieve FRL -/120/120 if the collar sleeve is left uncut.

Figure 16 HDPE stack pipe with sleeve uncut

The schedule of components for the HDPE stack pipes through 150mm thick concrete floor fire separating element is as shown in Table 17.

Table 17 HDPE pipe through 150 mm thick concrete floor

| Pipe configuration | pipe material | Hilti collar CP 680P size | Pipe nominal size, DN (mm) | Nominal total pipe wall thickness (mm) | Hilti collar CP 680P configuration | Sealant configuration | FRL $t_b, \text{min} = 150\text{mm}$ |
|---------------------|---------------|---------------------------|----------------------------|--|------------------------------------|---|--------------------------------------|
| Stack/straight pipe | HDPE | 2" | 40 - 60 | 3 | CC1 | 10 mm depth of CP 606 applied in the annular gap between the pipe and the collar sleeve | -/240/240 |
| | | 3" | 70 | 3 | | | |
| | | 4" | 90, 100 | 3.5, 4.3 | | | |
| | | 6" | 125 - 150 | 4.9 - 6.2 | CC1 | | |

3.5.6 HDPE pipe with elbow inside the collar protected with Hilti CP 680 P/PX cast in collar through concrete floor fire separating element (2/2)

Overview

The application refers to elbow or 4-way riser socket inside the collar through concrete floor.

For an FRL of -/120/120, the bare concrete floor separating element thickness (t_b , min) shall have a minimum thickness of 120 mm. For an FRL of -/240/240, the bare concrete floor separating element thickness (t_b , min) shall have a minimum thickness of 150 mm. The FRL of the concrete floor separating element governs the FRL of the penetration system.

FRL -/120/120 solution, t_b , min = 120 mm

To achieve an FRL of -/120/120 on a 120mm bare concrete floor, leave the CP 680 P/PX uncut. No build up is required.

If the CP 680 P/PX collar is to be cut flush, a minimum concrete floor separating element thickness (including Local aperture beading/build-up) required is 150 mm. Local aperture beading/build-up is allowed using layers of 13 mm or 16mm thick fire grade plasterboard to increase the concrete floor thickness to minimum 150 mm. Please refer to Section 3.4.4 for aperture beading/build-up details.

FRL -/240/240 solution, t_b , min = 150 mm

Hilti collar CP 680P/PX configuration 1 (CC1): HILTI cast in collar CP 680P/PX collar sleeve can remain uncut or cut flush during the installation.

Other considerations

In all pipe configurations, the annular gap between the service pipe and the collar or the sleeve extension shall be filled with Hilti Firestop Acrylic Sealant CP606 to a depth not less than 10 mm as shown in Figures 15 and 16.

If concrete slab thickness is greater than 200mm, a sleeve coupler of appropriate size shall be used to extend the overall collar height up to the at least the slab thickness. The sleeve can be flush with the slab top level or remain uncut. Refer to Figures 1 and 2 for installation configurations. The approval also covers HDPE pipe in the collar before the concrete pour.

It is allowed to use HDPE pipes and fittings with grooves on the surface of the pipe as long as the pipe material composition, thickness and diameter are similar to the tested and assessed HDPE pipes in this assessment.

Any pipe fittings used must be tested and have an established minimum FRL of -/240/240 in accordance to AS 1530.4:2014.

Pipe details are taken from AS 1260 and actual test specimen.

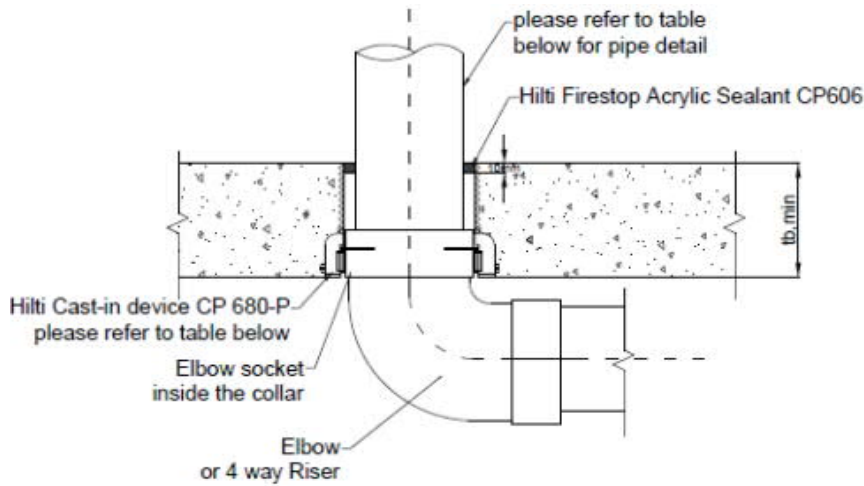


Figure 17 HDPE pipe with elbow inside with sleeve cut flush

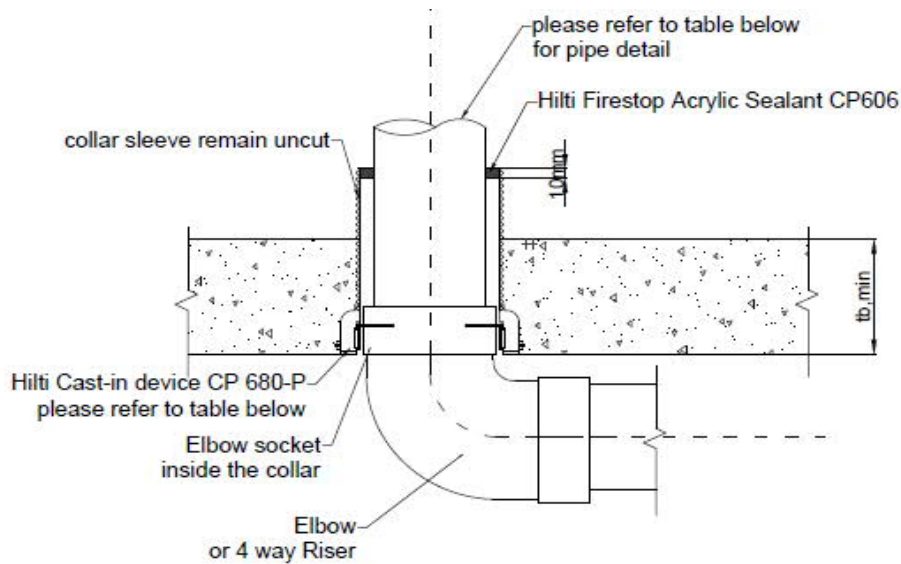


Figure 18 HDPE pipe with elbow inside with sleeve uncut

The schedule of components for the HDPE pipes with elbows or 4-way risers through 150mm thick concrete floor fire separating element is as shown in Table 18.

Table 18 HDPE pipe with embow or 4-way riser through 150mm concrete floor

| Pipe configuration | Pipe material | Hilti collar CP 680P size | Pipe nominal diameter, DN (mm) | Nominal total pipe wall thickness (mm) | Hilti collar CP 680P configuration | Sealant configuration | FRL $t_b, min = 150mm$ |
|---------------------|---------------|---------------------------|--------------------------------|--|------------------------------------|---|---------------------------|
| Elbow inside collar | HDPE | 2" | 40 - 60 | 3 | CC1 | 10 mm depth of CP 606 applied in the annular gap between the pipe and the collar sleeve | -/240/240 |
| | | 3" | 70 | 3 | | | |
| | | 4" | 90, 100 | 3.5, 4.3 | | | |
| | | 6" | 125 - 150 | 4.9 - 6.2 | | | |

3.5.7 PP-MD stack pipe protected with Hilti CP 680 P/PX cast in collar through concrete floor fire separating element (1/1)

Overview

For an FRL of -/120/120, the bare concrete floor separating element thickness (t_b , min) shall have a minimum thickness of 120 mm.

Due to the lack of baseline test results, an assessment for an FRL of -/240/240 is not conducted for PP-MD pipes.

FRL -/120/120 solution, t_b , min = 120 mm

To achieve an FRL of -/120/120 on a 120mm bare concrete floor, leave the CP 680 P/PX uncut. No build up is required.

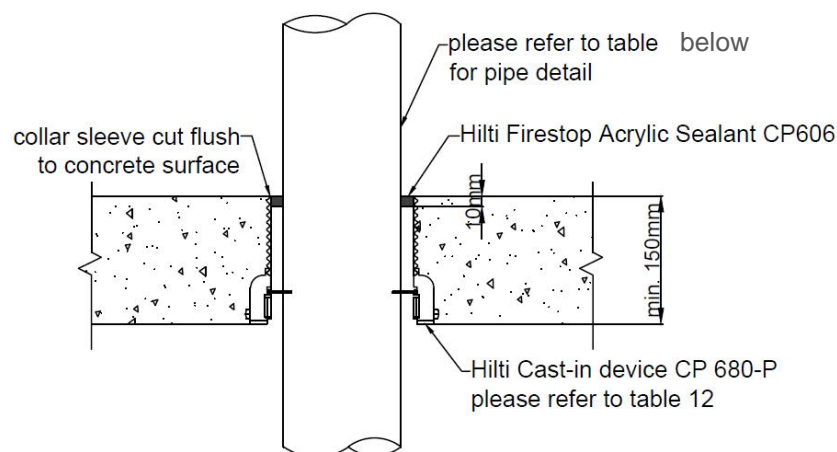
If the CP 680 P/PX collar is to be cut flush, a minimum concrete floor separating element thickness (including Local aperture beading/build-up) required is 150 mm. Local aperture beading/build-up is allowed using layers of 13 mm or 16mm thick fire grade plasterboard to increase the concrete floor thickness to minimum 150 mm. Please refer to Section 3.4.4 for aperture beading/build-up details.

Other considerations

In all pipe configurations, the annular gap between the service pipe and the collar or the sleeve extension shall be filled with Hilti Firestop Acrylic Sealant CP606 to a depth not less than 10 mm as shown in Figures 17 and 18.

If concrete slab thickness is greater than 200mm, a sleeve coupler of appropriate size shall be used to extend the overall collar height up to the at least the slab thickness. The sleeve can be flush with the slab top level or remain uncut.

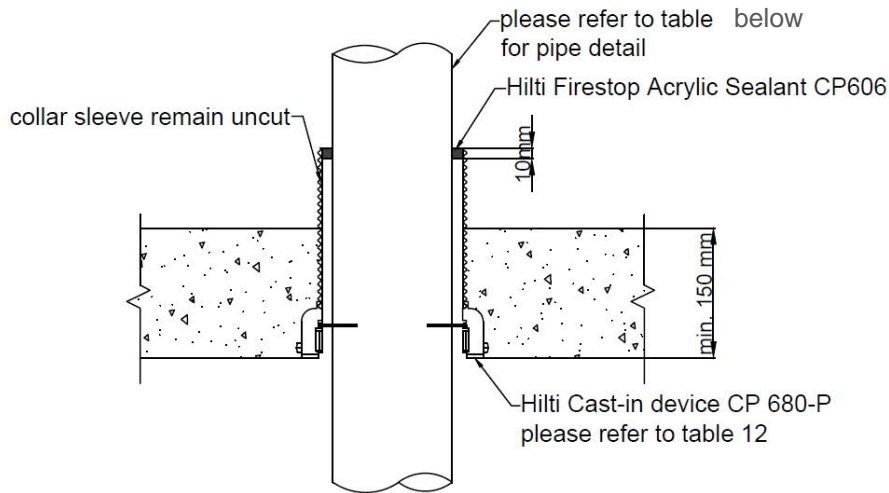
The assessment generally addresses Rehau Raupiano Plus, Valsir Triplus and Marley dBlue and other mineral reinforced PP pipes, provided the pipe construction is PP-MD as per AS/NZS 7671:2010⁴. However, it is noted that pipe thickness has a significant impact on the performance of the system when exposed to fire. If the pipe thickness varies notably between PP-MD pipes from different manufacturers for the same nominal diameter, such cases should be assessed separately. Specific assessment of such alternative pipes of different thicknesses to the PP-MD pipes described in this report are not covered by this assessment.



Local aperture/beading is required for slabs less than 150 mm thick to achieve FRL -/120/120 if the collar sleeve is cut flush to the surface of the slab.

Figure 19 PP-MD stack pipe with sleeve cut flush

⁴ Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings - Polypropylene (PP)(ISO 7671:2003, MOD)



Local aperture/beading is not required for slabs less than 150 mm thick to achieve FRL -/120/120 if the collar sleeve is left uncut.

Figure 20 PP-MD stack pipe with sleeve uncut

The schedule of components for the PP-MD stack pipes through 120mm thick concrete floor fire separating element is as shown in Table 19.

Table 19 PP-MD pipe through 120 mm concrete floor

| Pipe configuration | pipe material | Hilti collar CP 680P size | Pipe nominal size, DN (mm) | Nominal total pipe wall thickness (mm) | Hilti collar CP 680P configuration | Sealant configuration | FRL $t_{b, min} = 120mm$ |
|---------------------|---------------|---------------------------|----------------------------|--|------------------------------------|---|--------------------------|
| Stack/straight pipe | PP-MD | 2" | 40 | 1.8 | CC1 | 10 mm depth of CP 606 applied in the annular gap between the pipe and the collar sleeve | -/120/120 |
| | | 2" | 50 | 1.8 | | | |
| | | 3" | 75 | 1.9 | | | |
| | | 4" | 110 | 2.7 | | | |

3.5.8 Multiple stack pipe penetrations protected with Hilti CP 680 P/PX cast in collar through concrete floor fire separating element (1/1)

Overview

For -/120/120 FRL, the bare concrete floor separating element thickness (t_b , min) shall have a minimum thickness of 120 mm. For -/240/240 FRL, the bare concrete floor separating element thickness (t_b , min) shall have a minimum thickness of 150 mm. The FRL of the concrete floor separating element governs the FRL of the penetration system.

CP 680 P/PX must be left uncut for all Ø150mm pipe penetrations.

The assessment does not cover PP-MD pipes with diameter greater than Ø110.

FRL -/120/120 solution, t_b , min = 120 mm

To achieve FRL -/120/120 on a 120mm bare concrete floor, leave the CP 680 P/PX uncut. No build up is required.

If the CP 680 P/PX collar is to be cut flush, a minimum concrete floor separating element thickness (including Local aperture beading/build-up) required is 150 mm. Local aperture beading/build-up is allowed using layers of 13 mm or 16mm thick fire grade plasterboard to increase the concrete floor thickness to minimum 150 mm. Please refer to Section 3.4.4 for the aperture beading/build-up details.

FRL -/240/240 solution, t_b , min = 150 mm

Hilti collar CP 680P/PX configuration 1 (CC1): HILTI cast in collar CP 680P/PX collar sleeve can remain uncut or cut flush during the installation.

Hilti collar CP 680P/PX configuration 2 (CC2): HILTI cast in collar CP 680P/PX collar sleeve must remain uncut during the installation, for this collar configuration.

Other considerations

In all pipe configurations, the annular gap between the service pipe and the collar or the sleeve extension shall be filled with Hilti Firestop Acrylic Sealant CP606 to a depth not less than 10 mm as shown in Figures 19 and 20.

If concrete slab thickness is greater than 200mm, a sleeve coupler of appropriate size shall be used to extend the overall collar height up to the at least the slab thickness. The sleeve can be flush with the slab top level or remain uncut. Refer to Figures 1 and 2 for installation configurations. The approval also covers pipes in the collar before the concrete pour.

Pipes with different material and sizes can be put into a multiple pipe configuration. However, the installation shall comply with this Section 3.5.8.

Pipe details are taken from AS 1260 and actual test specimen.

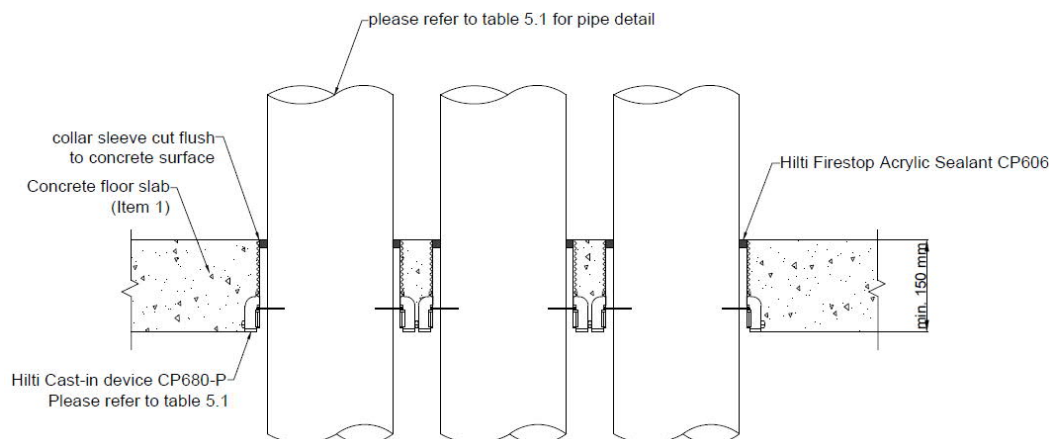


Figure 21 Multiple stack pipe with sleeve cut flush

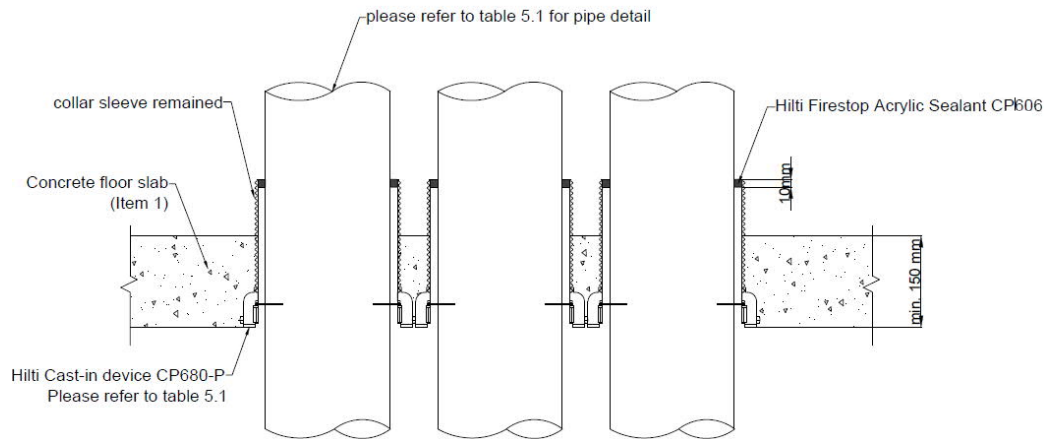


Figure 22 Multiple stack pipe with sleeve uncut

The schedule of components for the UPVC, UPVC-SC and HDPE stack pipes through 150mm thick concrete floor fire separating element is as shown Table 20.

Table 20 Multiple penetrations through 150 mm concrete floor

| Pipe configuration | pipe material | Hilti collar CP 680P size | Pipe nominal size, DN (mm) | Nominal total pipe wall thickness (mm) | Hilti collar CP 680P configuration | Sealant configuration | FRL $t_{b,min} = 150mm$ |
|-------------------------------------|---------------------------------|---------------------------|-----------------------------------|--|------------------------------------|---|-------------------------|
| Multiple collars connected in a row | UPVC, UPVC-SC, HDPE | 2", 3", 4" | all approved systems up to DN 110 | As tested | CC1 | 10 mm depth of CP 606 applied in the annular gap between the pipe and the collar sleeve | -/240/240 |
| | | 6" | all approved systems up to DN160 | | CC2 | | -/240/240 |
| | PP-MD* | 2", 3", 4" | all approved systems up to DN 110 | | CC1 | | -/120/120 |
| | Copper, ferrous or brass | 2", 3", 4", 6" | All approved system up to DN 125 | | CC1 with insulation | 30 mm depth of CP 606 applied in the annular gap or in a fillet around the pipe | -/240/120 |
| | Copper, ferrous (Steel or Iron) | 6" | All approved system up to DN 150 | | | | -/120/120 |
| | Copper, ferrous or brass | 2", 3", 4", 6" | All approved system up to DN 125 | | | | CC1 without insulation |

| Pipe configuration | pipe material | Hilti collar CP 680P size | Pipe nominal size, DN (mm) | Nominal total pipe wall thickness (mm) | Hilti collar CP 680P configuration | Sealant configuration | FRL $t_{b,min} = 150mm$ |
|--------------------|---------------------------------|---------------------------|----------------------------------|--|------------------------------------|-----------------------|-------------------------|
| | Copper, ferrous (Steel or Iron) | 6" | All approved system up to DN 150 | | | | -/120/0 |

*Only PP-MD less than 110 mm is included as per Table 20, if PP-MD is present in a multiple collar configuration with other type of pipes, the FRL of the whole system is limited to -/120/120.

4. Scope, objective and assumptions

- The scope of this report is limited to an assessment of the variations to the tested systems described in section 3.4.
- This report details the methods of construction, test conditions and assessed results that would have been expected if the specific elements of construction described here had been tested in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.
- The application of the results of the referenced assessment is to floor elements exposed to fire from the underside as tested with the service supported as tested.
- This report is only valid for the assessed system/s. Any changes with respect to size, construction details, loads, stresses, edge or end conditions, other than those identified in this report, may invalidate the findings of the referenced assessment report. If there are changes to the system, a reassessment will be needed to verify consistency with the assessment in this report.
- The data, methodologies, calculations and conclusions documented in this report specifically relate to the assessed system/s and must not be used for any other purpose.
- The drawings included in this report were provide by Hilti Australia Pty Ltd.
- This report has been prepared based on information provided by others. Warringtonfire has not verified the accuracy and/or completeness of that information and will not be responsible for any errors or omissions that may be incorporated into this report as a result.

5. Validity

Warringtonfire Australia does not endorse the tested or assessed product in any way. The conclusions of the referenced assessment report may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all conditions.

Due to the nature of fire testing and the consequent difficulty in quantifying the uncertainty of measurement, it is not possible to provide a stated degree of accuracy. The inherent variability in test procedures, materials and methods of construction, and installation may lead to variations in performance between elements of similar construction.

The referenced assessment report is based on information and experience available at the time of preparation. The published procedures for the conduct of tests and the assessment of test results are subject to constant review and improvement. It is therefore recommended that this report be reviewed on or, before, the stated expiry date.

The referenced assessment report represents our opinion about the performance likely to be demonstrated on a test in accordance with AS 1530.4:2014, based on the evidence referred to in the referenced assessment report.

The referenced assessment report is provided to the Hilti Australia Pty Ltd for its own purposes and we cannot express an opinion on whether it will be accepted by building certifiers or any other third parties for any purpose.