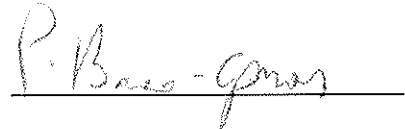


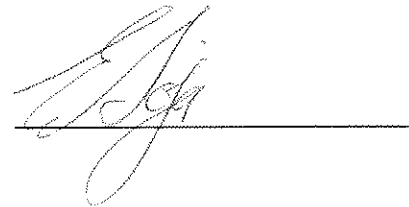
# **FAR 3324**

## **FIRE RESISTANCE OF ABESCO SERIES 2 PIPE WRAPS WITH uPVC PIPES**

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# FIRE RESISTANCE OF ABESCO SERIES 2 PIPE WRAPS WITH uPVC PIPES

## 1. CLIENT

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## 2. INTRODUCTION

This report gives BRANZ's assessment of the fire resistance in accordance with AS 1530.4-2005 of Abesco G type intumescent series 2 pipe wraps with various uPVC pipes in a normal weight concrete floor.

## 3. BACKGROUND

In BRANZ fire resistance test FR 3402 a number of penetration systems were tested in a nominal 170 mm thick concrete floor slab. Three series 2 pipe wraps with G type intumescent and a fibre glass mesh were tested as follows:

Pipe	Intumescent layers	Intumescent thickness	Wrap height	FRL
50 mm uPVC	2x	1.8 mm thick	50 mm	-/245/245
100 mm uPVC	2x	1.8 mm thick	50 mm	-/92/35
100 mm uPVC	3x	1.8mm thick	50 mm	-/205/202

In BRANZ fire resistance test FR 3981 a number of penetration systems were tested in a nominal 120 mm thick concrete floor slab, specifically series 2 pipe wraps with nominal 40 mm, 65 mm and 100 mm uPVC pipes. The wraps achieved the following results in accordance with AS 1530.4:

Pipe	Intumescent layers	Intumescent thickness	Wrap height	FRL
40 mm uPVC*	2x	1.8 mm thick	50 mm	-/220/208
65 mm uPVC*	2x	1.8 mm thick	50 mm	-/241/241
80 mm uPVC	2x	1.8mm thick	50 mm	-/241/21

\* - installed into nominal 90 mm thick Maxilite calcium silicate board.

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In GERBAM fire resistance test report RE GM 710/05/A/NP/R 102, a number of Abesco penetration systems were reported including three cast-in pipe wraps. The wraps consisted of G type intumescent tested with uPVC pipes in accordance with NF EN 1363-1 and NF EN 1366-3. The specimen details are as follows and all achieved Integrity and Insulation of 240 minutes without failure in a 150 mm thick light weight concrete slab:

AS Nominal Pipe (mm)	Pipe (actual)	Intumescent layers	Intumescent thickness	Wrap height	Integrity/Insulation
50 mm	55mm uPVC	2x	1.8 mm thick	50 mm	240/240
100 mm	110mm uPVC	3x	1.8 mm thick	50 mm	240/240
150 mm	160mm uPVC	6x	1.8 mm thick	75 mm	240/240

## 4. DISCUSSION

### 4.1 AS1530.4-2005 vs EN 1366.3

NF EN 1366.3 defines the test method for testing penetrations which also references EN 1363.1 "General requirements". EN 1363.1 defines the furnace equipment and conditions whereas EN 1366.3 is specific to seals.

The furnace conditions and pressure requirements in EN 1363.1 is similar to AS 1530.4-2005 as they both use the same time/temperature curve and similar have pressure requirements. The main difference is EN 1363.1 specifies plate thermometers to measure the furnace temperature whereas AS 1530.4 specifies 3 mm mineral insulated metal sheathed thermocouples, but also allows for the use of plate thermometers. In terms of furnace conditions the plate thermometers take a bit longer to heat up and are therefore more severe at the start of the test when compared to AS 1530.4. Therefore based on this it is expected the furnace exposure of the specimens tested in RE GM 710/05/A/NP/R 102 would be at least as severe if tested in to AS 1530.4-2005 furnace conditions.

With regards to the instrumentation and specimen configuration the requirements of EN 1363.1 and AS 1530.4-2005 are slightly different. The position of specimen thermocouples are considered to be sufficiently similar between standards, however the specimen configuration is different. EN 1366.1 defines plastic pipes to be 500 mm in length and can be capped or uncapped depending on the end use requirements. Whereas AS 1530.4-2005 define the pipes to be capped on the fire side and extend at least 2,000 mm to the unexposed face. From the test report it is unclear if the pipes were capped or uncapped. Based on this the information from this report is used as background supporting evidence and the assessment is restricted to 180 minutes.

  
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## 4.2 Nominal 32 mm, 40 mm, 50 mm and 65 mm uPVC

Based on the available test evidence it is proposed to assess the Series 2, G Type, intumescent wraps in concrete floor slabs for up to an FRL of -/180/180 on 32mm, 40 mm, 50 mm, 65 mm, 80 mm and 100 mm nominal diameter uPVC pipes.

In fire resistance test FR 3981 three series 2 wraps were tested. A nominal 80 mm uPVC pipe was mounted into the floor slab with two layers of G type intumescent nominally 1.8 mm thick x 50 mm high. The specimen achieved an FRL of -/241/21. The other two wraps were installed into three layers of 30 mm thick calcium silicate board (90 mm total). The uPVC pipes tested were nominally 40 mm and 65 mm, installed with two layers of the same G type intumescent and achieved an FRL of -/220/208 and -/241/241 respectively.

An analysis of the temperature data collect on the three test specimens and of the concrete and calcium silicate board indicate that the temperatures on the unexposed face of the elements are similar. With regards to pipe penetration systems it is considered that a result in an element can also be applied to a thicker building element without detriment to the fire performance. Therefore it is considered that if the nominal 40 mm and 65 mm pipes were tested in the 120 mm thick concrete slab the test results would be similar.

Based on the test results of the 65 mm and 40 mm pipes it is considered that a nominal 50 mm and 32 mm diameter pipe with a similar wrap configuration would also achieve a similar test result. To be conservative this is limited to the lower performing test specimen and therefore limited to an FRL of -/180/180.

Further to this it is considered a 40 mm wrap can be used with a nominal 32 mm diameter pipe on the condition the hole is back filled with mortar/concrete or Abesco fire rated sealant.


## 4.3 Nominal 80 mm and 100 mm uPVC

In FR 3981 the nominal 80 mm wrap achieved Integrity of 241 minutes and Insulation of 21 minutes. In fire resistance test FR 3402 two nominal 100 mm uPVC pipes were tested with G type intumescent of similar dimensions with a fibreglass mesh. The difference between the two pipes was one had two layers of intumescent and the other had three layers. The test results achieved were -/92/35 and -/205/202 respectively. Other than pipe size the only difference between the wrap of the 80 mm pipe tested in FR 3981 and the lesser performing 100 mm pipe tested in FR 3402 was the absence of a fibreglass mesh in the 80 mm wrap. From the difference between the two 100 mm pipes is clear there is a significant improvement in performance in terms of Integrity and Insulation with three layers of intumescent.

In addition to this test data has been supplied of a nominal 50 mm and 100 mm uPVC pipe tested in a light weight concrete slab where the G type intumescent did not have any mesh. The nominal 50 mm wrap consisted of two layers of the G type intumescent and the 100 mm wrap had 3 layers. Both test specimens achieved an Integrity and Insulation of 240 minutes in accordance with NF EN 1366.3. This result shows the ability of the 100 mm wrap to remain in place for up to 240 minutes without failure with three layers of intumescent. Based on the available test evidence it is considered an 80 mm uPVC pipe with three layers of G type intumescent would achieve an FRL or at least -/180/180. Further to this, based on the available evidence on the 100 mm wraps it is considered with three layers of G type intumescent would achieve at least an FRL of up to -/180/180 without a fibre glass mesh.

  
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## 4.4 Nominal 150 mm uPVC

In fire resistance test RE GM 710/05/A/NP/R 102 a nominal 150 mm uPVC pipe with a series 2 wrap consisting of 6 layers of 1.8 mm thick x 75 mm high G type intumescent was tested in accordance with NF EN 1366.3 and maintained the Insulation and Integrity criteria for at least 240 minutes in a light weight floor slab. In fire resistance test FR 3981 a similar pipe and wrap was tested except 50 mm in height. The specimen achieved an FRL -/61/57.

Although the RE GM 710/05/A/NP/R 102 test was under different test conditions it does demonstrate the ability of the wrap to remain in place and maintain the test criteria for 240 minutes when 75 mm high. FR 3981 demonstrated the ability of the wrap to close the pipe off at the start of the test. To be conservative it is considered if the wrap tested in FR 3981 had been at least 75 mm in height it would achieve at least 180 minutes insulation and Integrity if tested in accordance with AS 1530.4-2005.

## 5. CONCLUSION

Based on the available test data it is considered that the Abesco series 2 wraps with G type intumescent would achieve at least an FRL of -/180/180 or up to the FRL of the element it is installed into, if tested in accordance with AS 1530.4-2005, with the following uPVC pipe configurations in a normal weight concrete floor slab:

Pipe (nom)	Intumescent layers G type	Intumescent thickness	Height	FRL
32 mm 40 mm	2x	1.8 mm	50 mm	-/180/180
50 mm	2x	1.8 mm	50 mm	-/180/180
65 mm	2x	1.8 mm	50 mm	-/180/180
80 mm	3x	1.8 mm	50 mm	-/180/180
100 mm	3x	1.8 mm	50 mm	-/180/180
150 mm	6x	1.8 mm	75 mm	-/180/180

## 6. LIMITATIONS

This assessment is subject to the completeness and accuracy of the information supplied.

BRANZ reserves the right to amend or withdraw this assessment should additional information become available regarding the fire performance of the items assessed in this report.

  
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