

BRE Global Client Report

Fire performance of Gripple hanger system

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Executive Summary

BRE Global has undertaken fifteen fire experiments to investigate the performance of an innovative hanger system used to support mechanical and electrical installations, services etc. Three different systems have been assessed under load with different types of end fixing and exposed to a heating curve corresponding to 30, 60 or 90 minutes standard fire exposure^{1,2}. This report contains all relevant results and observations.

The performance of the product was assessed in terms of the ability to continue to support the applied load when subject to a heating curve corresponding to 30, 60 or 90 minutes standard fire exposure as agreed with the client. In terms of the performance criteria set out in this report the performance of the specimens is as follows:

Ref. No.	Description	Applied load (kg)	Maximum extension (mm)	Comment
1	Gripple Trapeze Plus No.2 unit with M8 stud end fixing (with cable basket adaptor)	15	142	Fire exposure terminated at 30 minutes
2	Gripple Trapeze Plus No.2 unit with M8 stud end fixing (with cable basket adaptor)	4	77	Fire exposure terminated at 60 minutes
3	Gripple Trapeze Plus No.2 unit with M8 stud end fixing (with cable basket adaptor)	2.5	101	Fire exposure terminated at 120 minutes
4	Gripple Trapeze Plus No.2 unit with 90 degree eyelet end fixing (with cable basket adaptor)	15	143	Fire exposure terminated at 30 minutes
5	Gripple Trapeze Plus No.2 unit with 90 degree eyelet end fixing (with cable basket adaptor)	7.5	275	Fire exposure terminated at 60 minutes
6	Gripple Trapeze Plus No.2 unit with 90 degree eyelet end fixing (with cable basket adaptor)	2.5	155	Fire exposure terminated at 120 minutes
7	Gripple Trapeze Plus No.2 unit with straight eyelet end fixing (with cable basket adaptor)	15	139	Fire exposure terminated at 30 minutes



8	Gripple Trapeze Plus No.2 unit with straight eyelet end fixing	7.5	165	Fire exposure terminated at 60 minutes
9	Gripple Trapeze Plus No.2 unit with straight eyelet end fixing	2.5	61	Fire exposure terminated at 120 minutes
10	Gripple Trapeze Plus No.4 unit with M10 stud end fixing	100	62	Fire exposure terminated at 30 minutes
11	Gripple Trapeze Plus No.4 unit with M10 stud end fixing	50	184	Fire exposure terminated at 60 minutes
12	Gripple Trapeze Plus No.4 unit with M10 stud end fixing	25	110	Fire exposure terminated at 120 minutes
13	Gripple Pipe Bracket 640mm (PB640) suspended using M10 threaded rod	30	48	Fire exposure terminated at 30 minutes
14	Gripple Pipe Bracket 640mm (PB640) suspended using M10 threaded rod	15	74	Fire exposure terminated at 60 minutes
15	Gripple Pipe Bracket 640mm (PB640) suspended using M10 threaded rod	5	80	Fire exposure terminated at 120 minutes

¹ British Standards Institution, BS 476-20:1987, Fire tests on building materials and structures – Part 20: Method for the determination of the fire resistance of elements of construction (general principles), BSI, London, 1987

²DIN 4102 Part 2, Fire Behaviour of Building Materials and Components, Building components, Definitions, Requirements and Tests, Deutsche Normen, Berlin, September 1977

The work does not constitute any form of product approval or certification.



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Introduction

BRE Global have undertaken a series of fire experiments to investigate the performance of a number of stainless steel wire rope connecting systems when under load and subject to a thermal exposure corresponding to 30, 60 or 90 minutes of the standard fire curve¹.



Description of the project

The client required information on the performance of a number of steel wire rope suspension systems subject to a standard fire exposure from a furnace. The experimental programme, as agreed with the client is summarised in Table 1 below.

Ref No.	Duration of exposure to the standard fire curve (min)	Description	Applied load to the cable system (kg)
1	30	Gripper Trapeze Plus No.2 unit with M8 stud end fixing (with cable basket adaptor)	15
2	60	Gripper Trapeze Plus No.2 unit with M8 stud end fixing (with cable basket adaptor)	4
3	120	Gripper Trapeze Plus No.2 unit with M8 stud end fixing (with cable basket adaptor)	2.5
4	30	Gripper Trapeze Plus No.2 unit with 90 degree eyelet end fixing (with cable basket adaptor)	15
5	60	Gripper Trapeze Plus No.2 unit with 90 degree eyelet end fixing (with cable basket adaptor)	7.5
6	120	Gripper Trapeze Plus No.2 unit with 90 degree eyelet end fixing (with cable basket adaptor)	2.5
7	30	Gripper Trapeze Plus No.2 unit with straight eyelet end fixing (with cable basket adaptor)	15
8	60	Gripper Trapeze Plus No.2 unit with straight eyelet end fixing	7.5
9	120	Gripper Trapeze Plus No.2 unit with straight eyelet end fixing	2.5
10	30	Gripper Trapeze Plus No.4 unit with M10 stud end fixing	100
11	60	Gripper Trapeze Plus No.4 unit with M10 stud end fixing	50
12	120	Gripper Trapeze Plus No.4 unit with M10 stud end fixing	20



Ref No.	Duration of exposure to the standard fire curve (min)	Description	Applied load to the cable system (kg)
13	30	Gripple Pipe Bracket 640mm (PB640) suspended using M10 threaded rod	30
14	60	Gripple Pipe Bracket 640mm (PB640) suspended using M10 threaded rod	15
15	120	Gripple Pipe Bracket 640mm (PB640) suspended using M10 threaded rod	5

Table 1 Experimental programme

In each case the load was applied by hanging a weight to a length of channel fixed to the cable by means of a “Gripple” fixing (Ref. No. 1-12) (Figure 1) or a Gripple pipe bracket (Ref. No. 13-15) (Figure 2). The fixing to the other end was attached to a threaded bar suspended above the furnace and varied for each test in accordance with the description in the table above. In each case both fixings were entirely contained within the furnace.



Figure 1 “Gripple” fixing (Ref. No. 1)

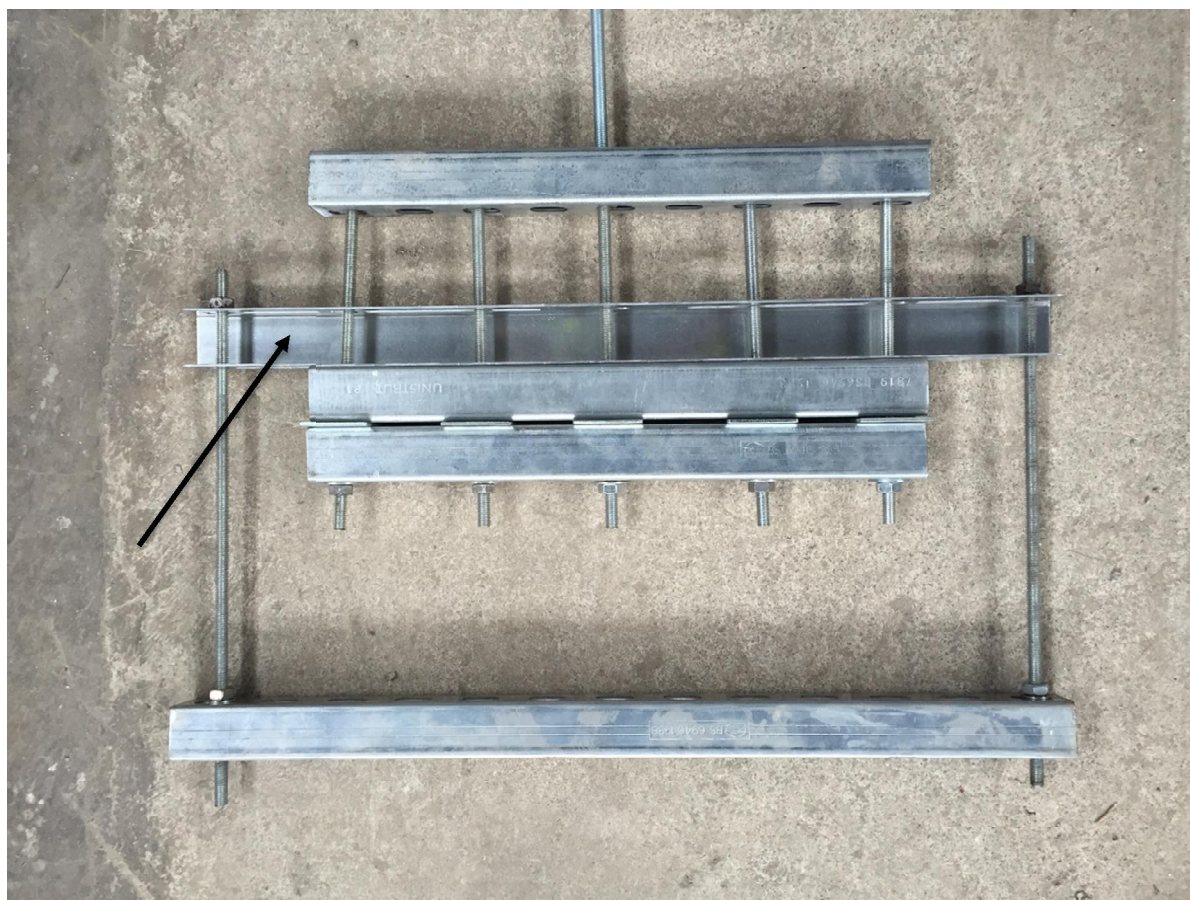


Figure 2 Gripple pipe bracket PB640 indicated by arrow

Performance criterion

The systems were evaluated against a performance requirement to continue to support the applied design load (as specified by the client) for the entire duration of the experiment. In order to provide additional information total elongation of the cable was also measured.

Furnace description

The furnace used is a gas fired furnace used to undertake ad-hoc fire testing.

Methodology

In the absence of any standardised method of test and assessment for the products an agreed experimental methodology was developed and agreed between BRE Global and the Client.



Findings

Sample reference. 1 Gripple Trapeze Plus No. 2 unit with M8 stud end fixing (with cable basket adaptor) 15kg load 30 minutes fire exposure

The results from the first fire experiment are shown in Figure 3 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results indicate a higher temperature in the early stages but show good agreement between the measured temperature and the standard curve thereafter. The maximum extension was approximately 142mm after 30 minutes. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 4. The sample comprised both the Gripple unit and M8 stud end fixing.

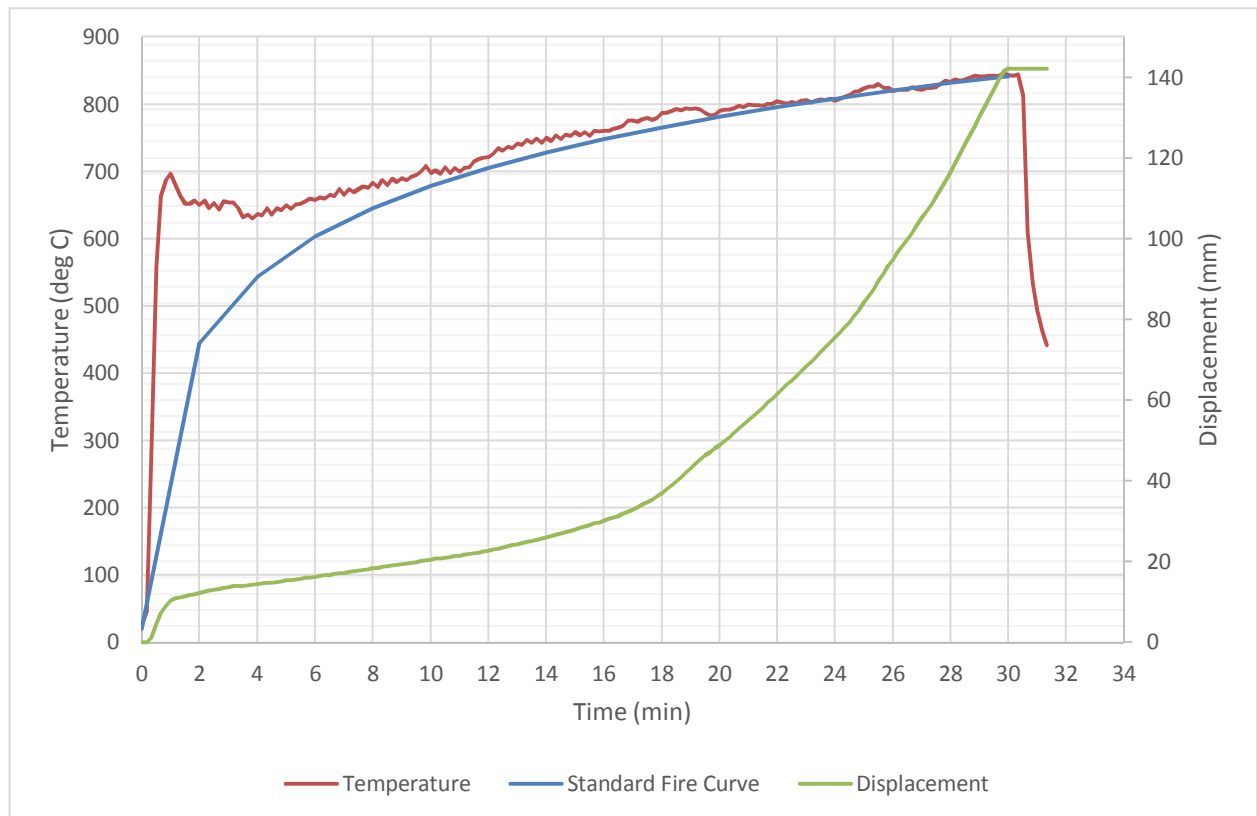


Figure 3 Results from sample reference No. 1

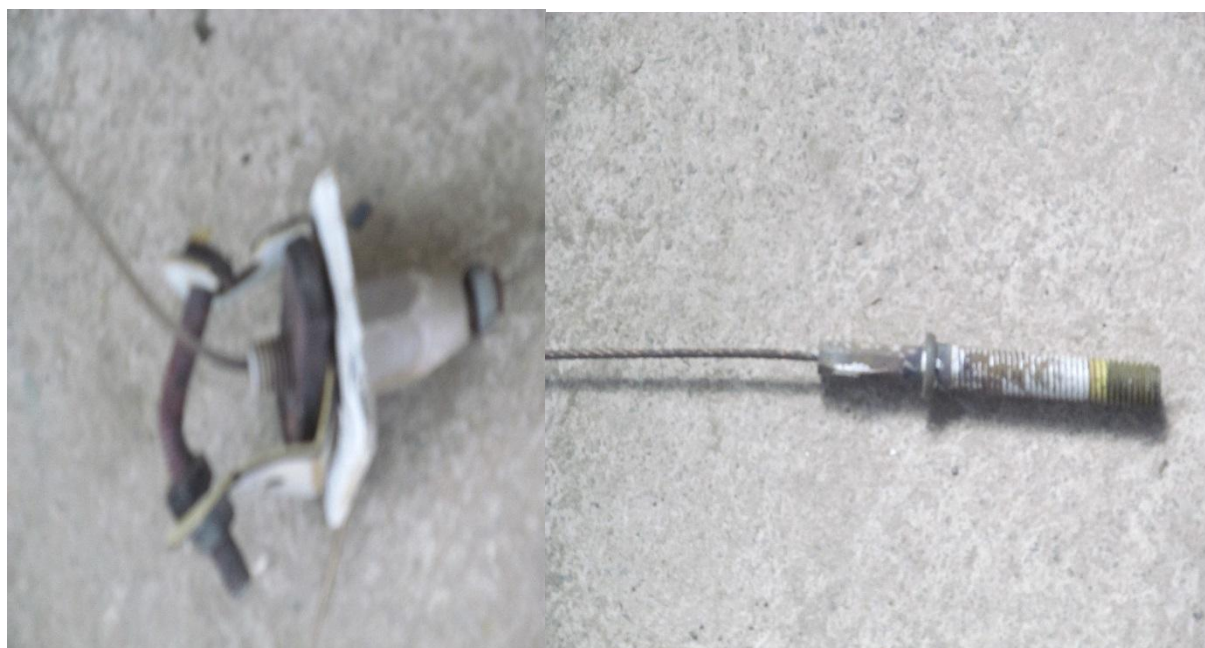


Figure 4 Gripple fixing and threaded connector following fire exposure for 30 minutes

Sample reference 2 Gripple Trapeze Plus No. 2 unit with M8 stud end fixing (with cable basket adaptor) 4kg load 60 minutes fire exposure

The results from the second fire experiment are shown in Figure 5 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 77mm after 60 minutes. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 6. The sample comprised both the Gripple unit and M8 stud end fixing.

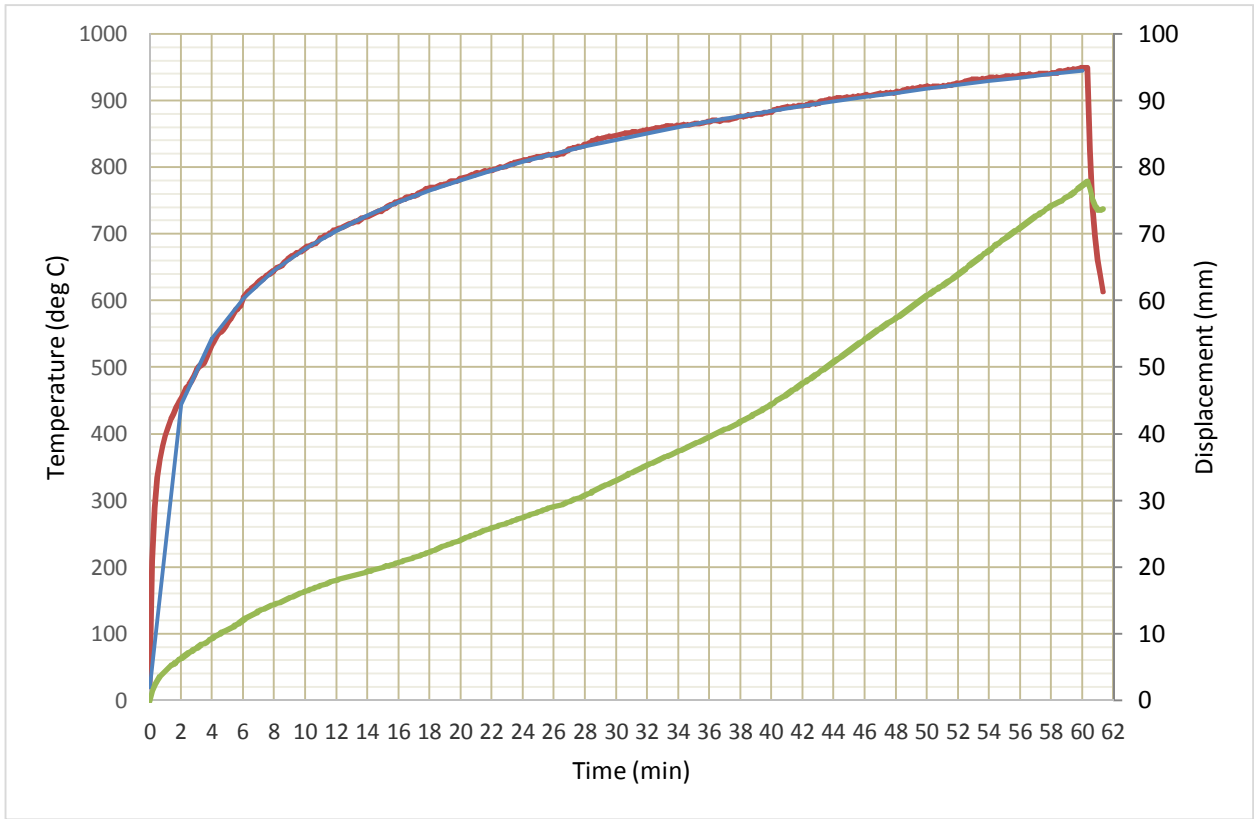


Figure 5 Results from sample reference No. 2



Figure 6 Gripple fixing and threaded connector following fire exposure for 60 minutes



Sample reference 3 Gripple Trapeze Plus No. 2 unit with M8 stud end fixing (with cable basket adaptor) 2.5kg load 120 minutes fire exposure

The results from the third fire experiment are shown in Figure 7 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 101mm after 120 minutes. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 8. The sample comprised both the Gripple unit and M8 stud end fixing.

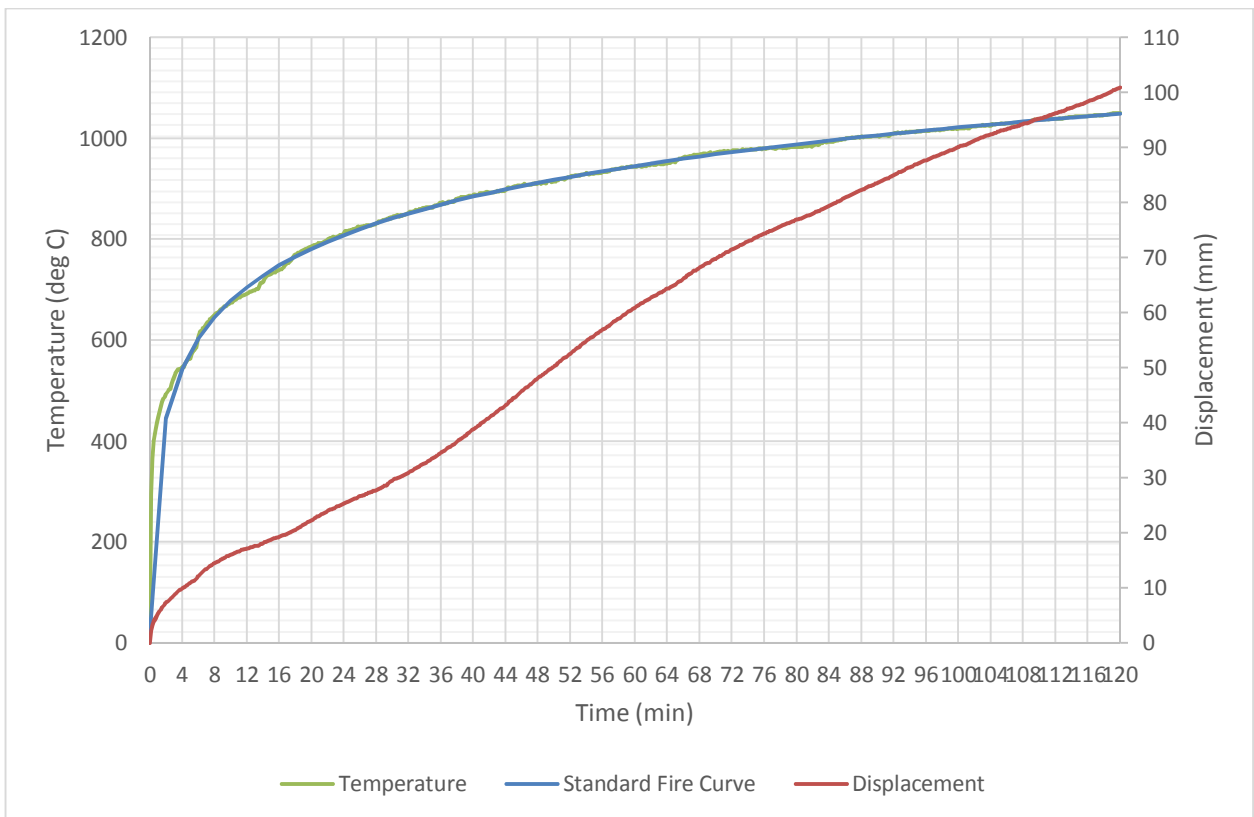


Figure 7 Results from sample reference No. 3



Figure 8 Gripple fixing and threaded connector following fire exposure for 120 minutes

Sample reference 4 Gripple Trapeze Plus No. 2 unit with 90° eyelet end fixing (with cable basket adaptor) 15kg load 30 minutes fire exposure

The results from the fourth fire experiment are shown in Figure 9 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 143mm after 30 minutes. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 10. The sample comprised both the Gripple unit and the 90°eyelet end fixing.

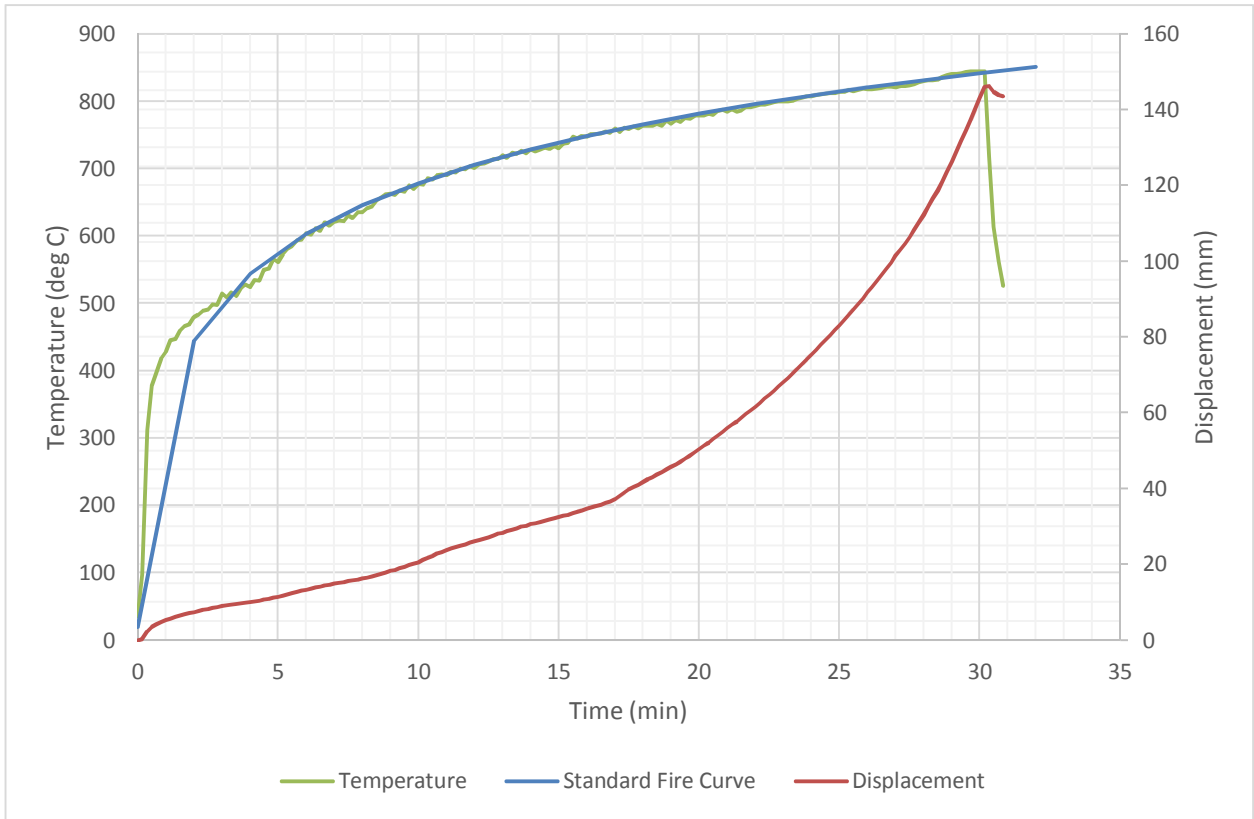


Figure 9 Results from sample reference No. 4



Figure 10 Gripple fixing and 90°eyelet following fire exposure for 30 minutes



Sample reference 5 Gripple Trapeze Plus No. 2 unit with 90° eyelet end fixing (with cable adaptor) 7.5 kg load 60 minutes fire exposure

The results from the fifth fire experiment are shown in Figure 11 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 275mm after 30 minutes. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 12. The sample comprised both the Gripple unit and the 90° eyelet end fixing.

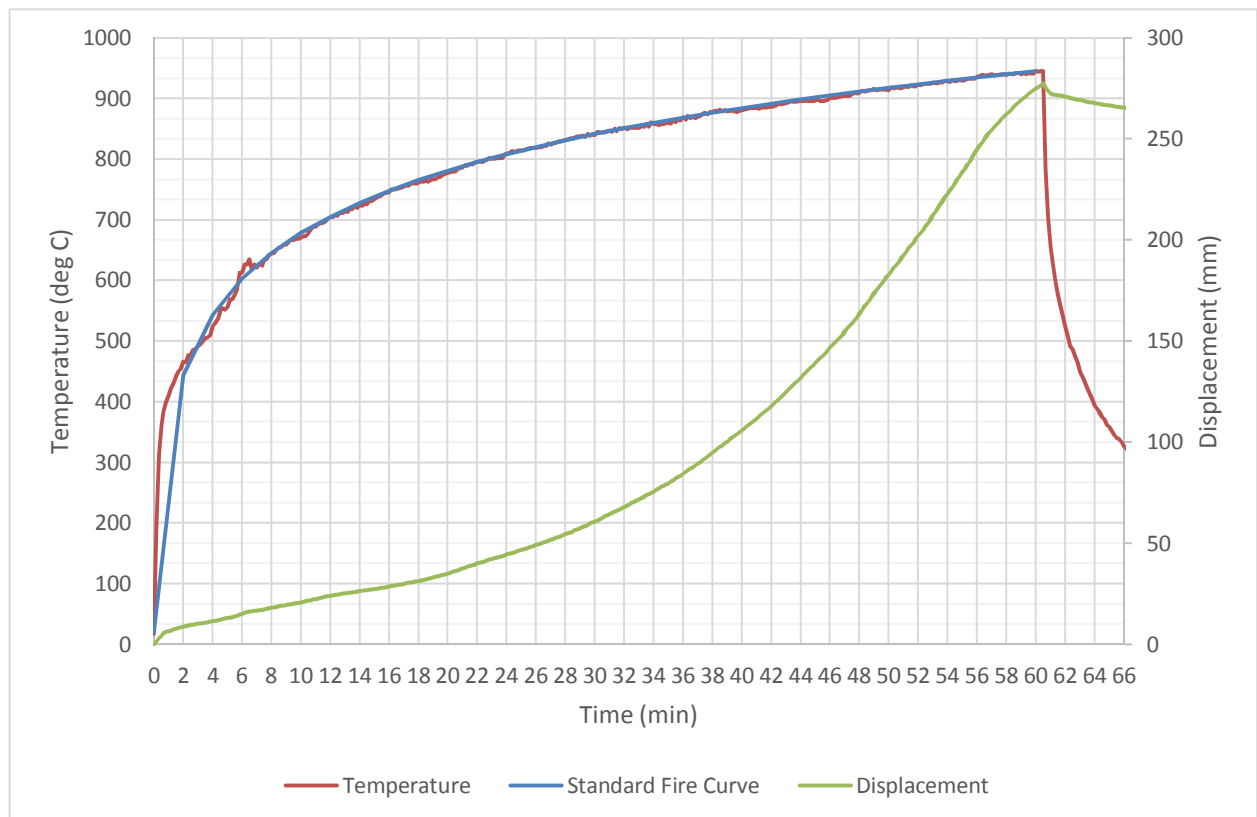


Figure 11 Results from sample reference No. 5

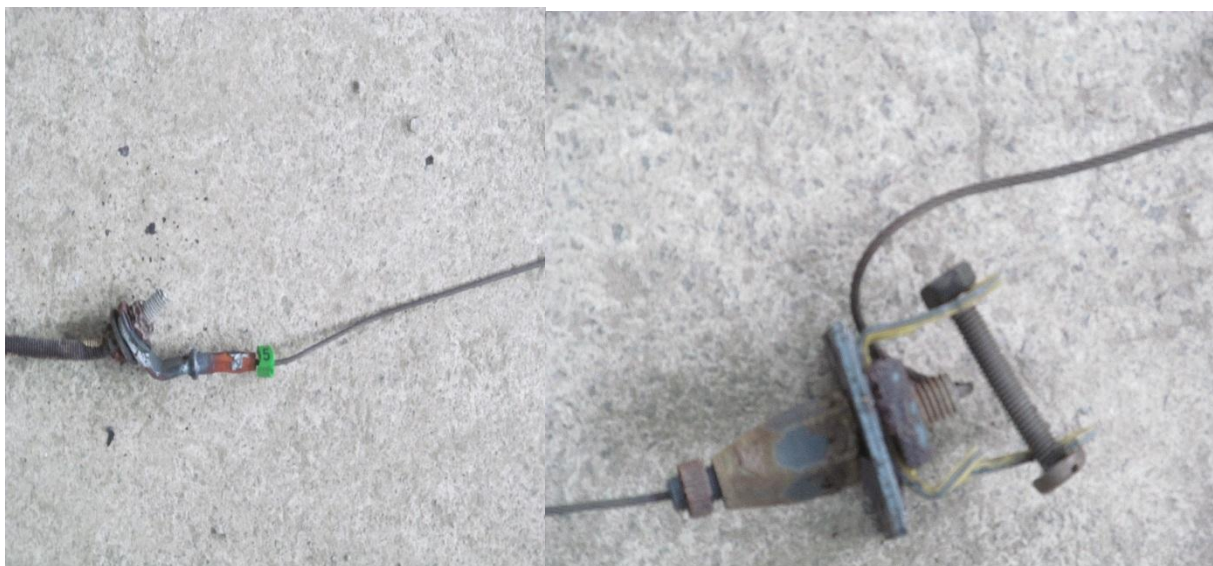


Figure 12 Gripple fixing and 90°eyelet following fire exposure for 60 minutes

Sample reference 6 Gripple Trapeze Plus No. 2 unit with 90° eyelet end fixing (with cable basket adaptor) 2.5kg load 120 minutes fire exposure

The results from the sixth fire experiment are shown in Figure 13 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 155mm after 120 minutes. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 14. The sample comprised both the Gripple unit and the 90°eyelet end fixing.

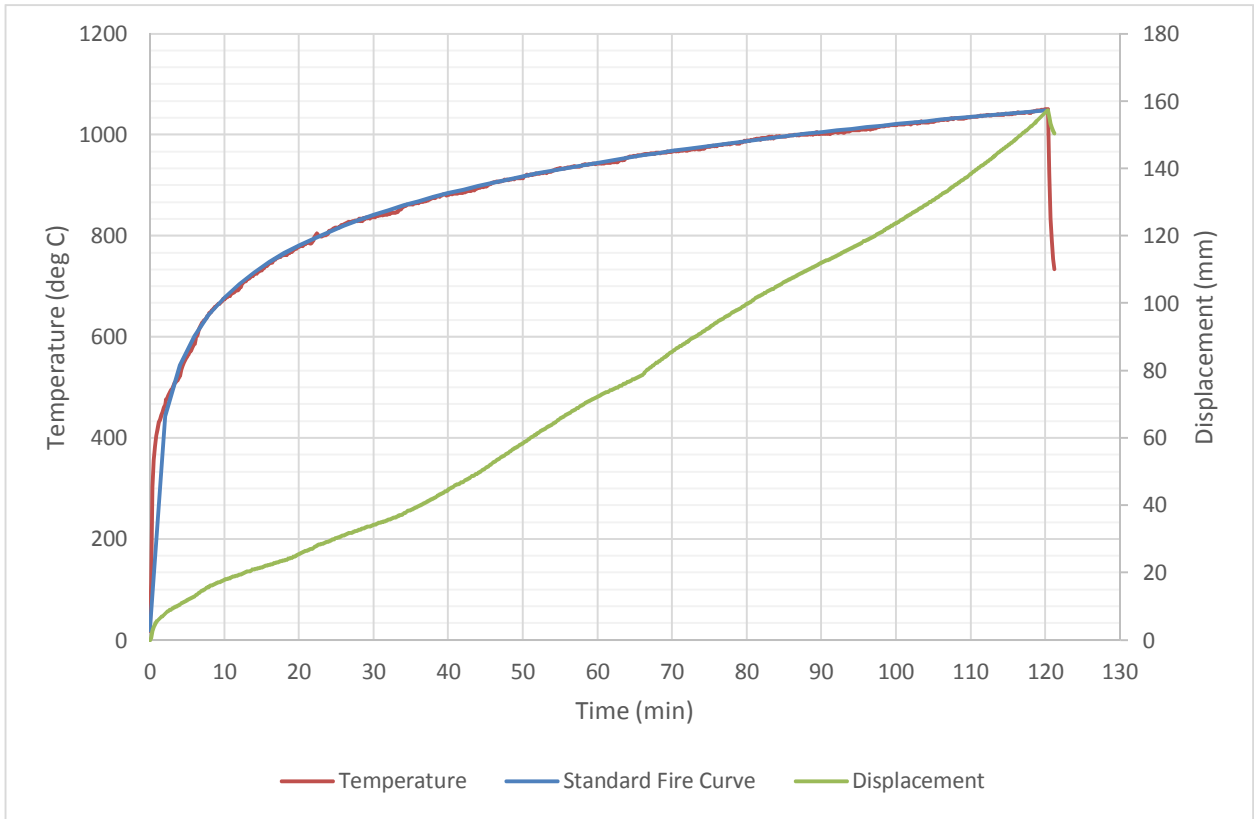


Figure 13 Results from sample reference 6



Figure 14 Gripple fixing and 90° eyelet following fire exposure for 120 minutes



Sample reference 7 Gripple Trapeze Plus No. 2 unit with straight eyelet end fixing (with cable basket adaptor) 15kg load 30 minutes fire exposure

The results from the seventh fire experiment are shown in Figure 15 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 139mm after 30 minutes. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 16. The sample comprised both the Gripple unit and the straight eyelet end fixing.

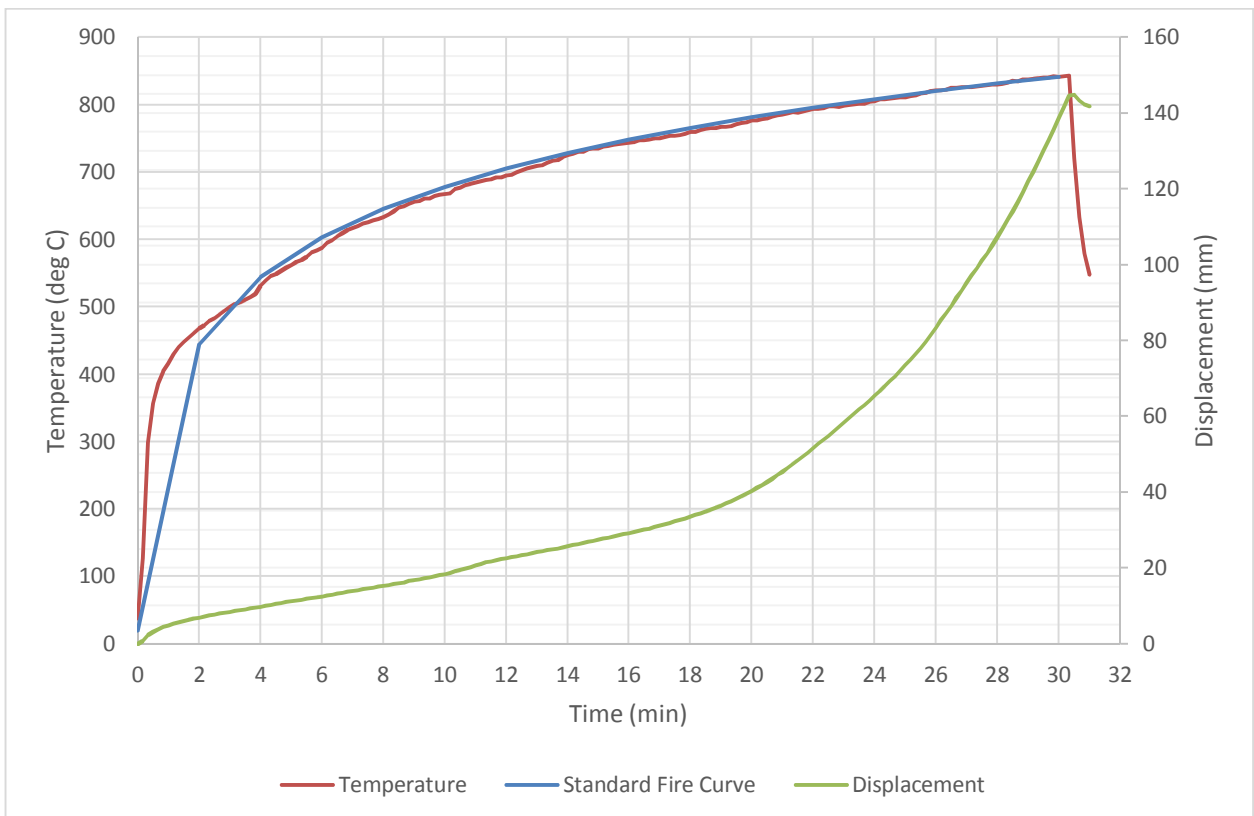


Figure 15 Results from sample reference 7



Figure 16 Gripple fixing and straight eyelet following fire exposure for 30 minutes

Sample reference 8 Gripple Trapeze Plus No. 2 unit with straight eyelet end fixing 7.5kg load 60 minutes fire exposure

The results from the eighth fire experiment are shown in Figure 17 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 165mm after 60 minutes. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 18. The sample comprised both the Gripple unit and the straight eyelet end fixing.

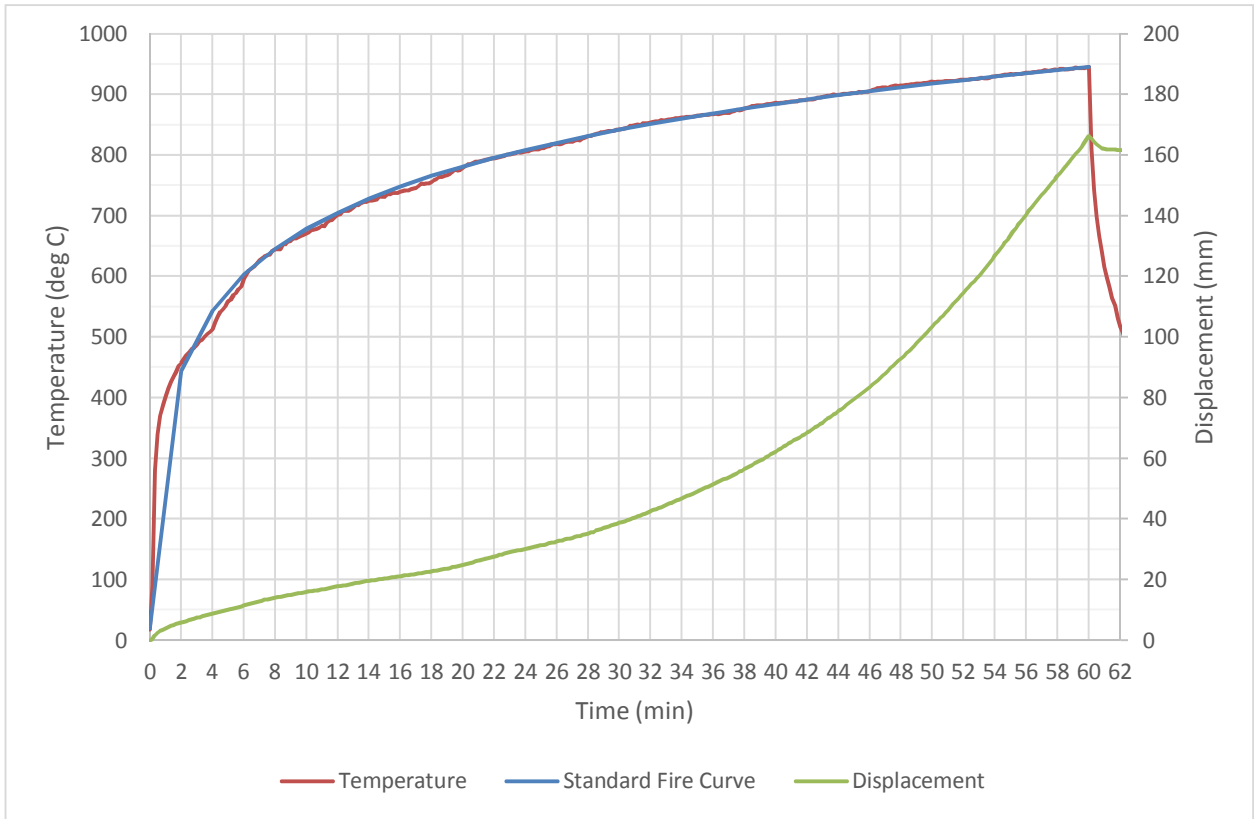


Figure 17 results from sample reference 8



Figure 18 Gripple fixing and straight eyelet following 60 minutes fire exposure



Sample reference 9 Gripple Trapeze No. 2 unit with straight eyelet end fixing 2.5kg load 120 minutes fire exposure

The results from the ninth fire experiment are shown in Figure 19 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 61mm after 120 minutes. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 20. The sample comprised both the Gripple unit and the straight eyelet end fixing.

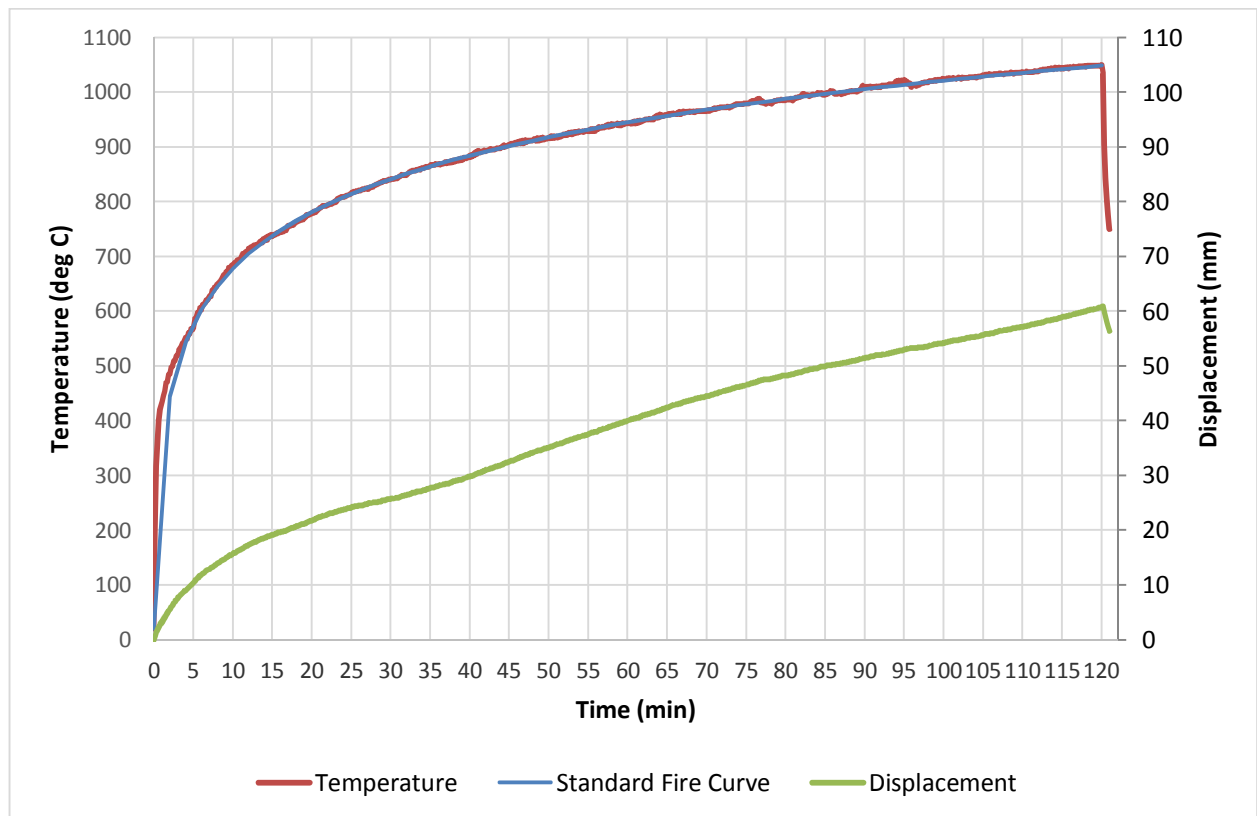


Figure 19 Results from sample reference 9



Figure 20 Gripple fixing and straight eyelet following 120 minutes fire exposure

Sample reference 10 Gripple Trapeze No. 4 unit with M10 stud end fixing 100kg load 30 minutes fire exposure

The results from the tenth fire experiment are shown in Figure 21 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 62mm after 30 minutes. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 22. The sample comprised both the Gripple unit and the M10 stud end fixing.

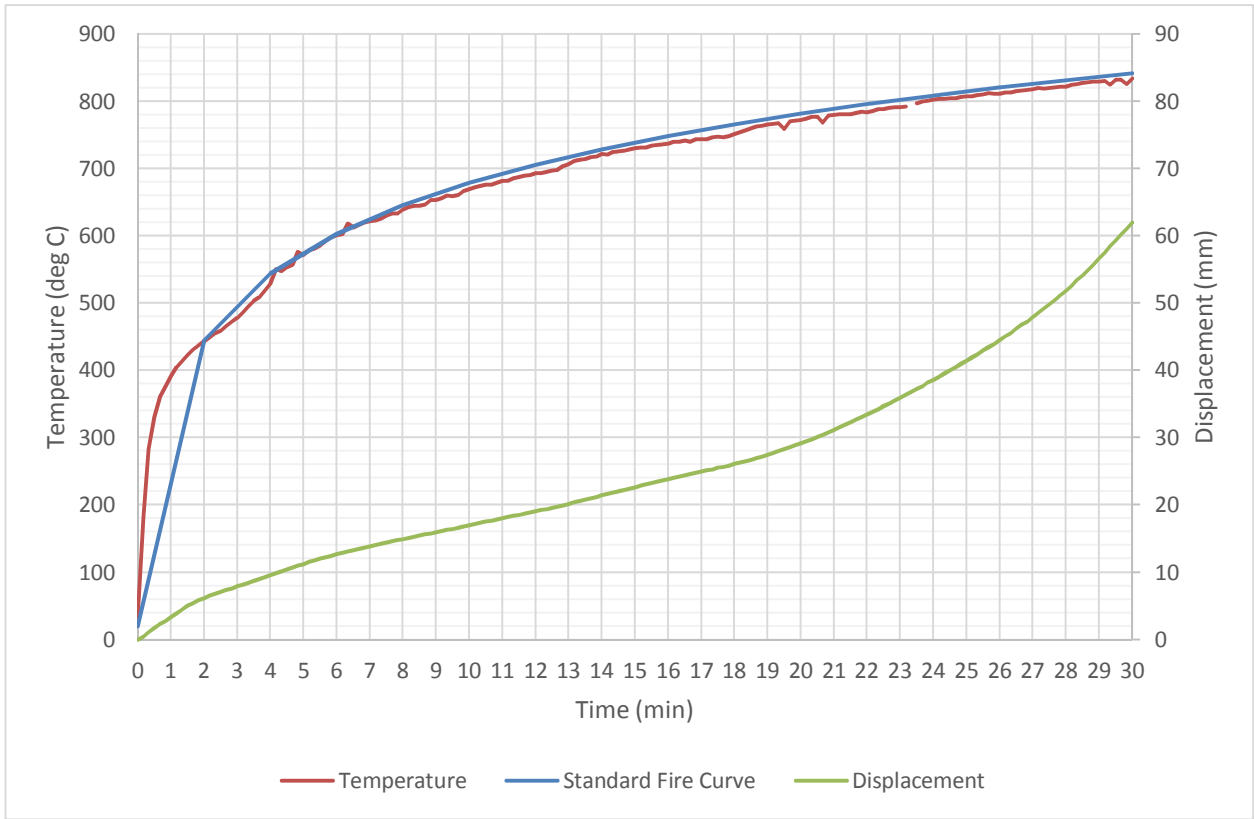


Figure 21 Results from sample reference 10



Figure 22 Gripple fixing and M10 stud end fixing following 30 minutes fire exposure



Sample reference 11 Gripple Trapeze Plus No. 4 unit with M10 stud end fixing 50kg load 60 minutes fire exposure

The results from the eleventh fire experiment are shown in Figure 23 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 184mm after 60 minutes. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 24. The sample comprised both the Gripple unit and the M10 stud end fixing.

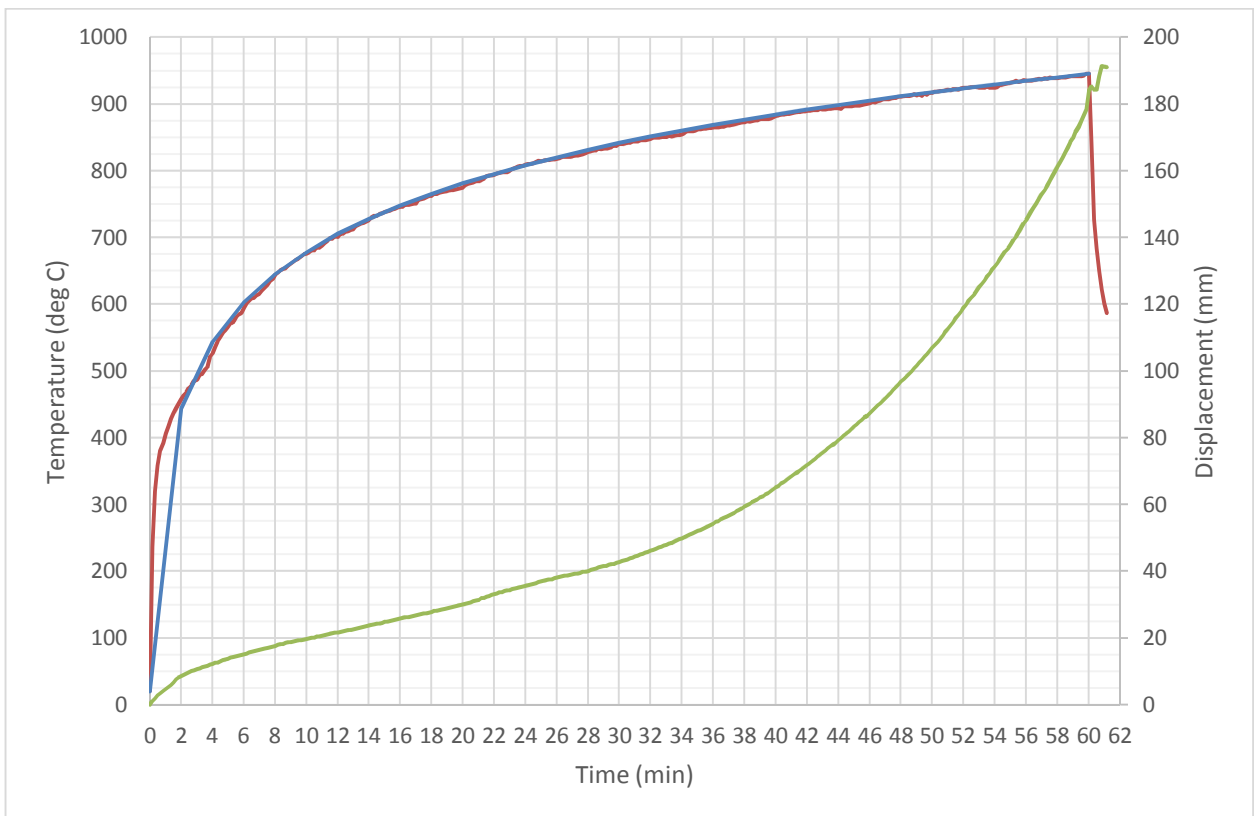


Figure 23 Results from sample ref. 11



Figure 24 Gripple fixing and M10 stud end fixing following 60 minutes fire exposure

Sample reference 12 Gripple Trapeze Plus No. 4 unit with M10 stud end fixing 20kg load 120 minutes fire exposure

The results from the twelfth fire experiment are shown in Figure 25 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 110mm after 120 minutes. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 26. The sample comprised both the Gripple unit and the M10 stud end fixing.

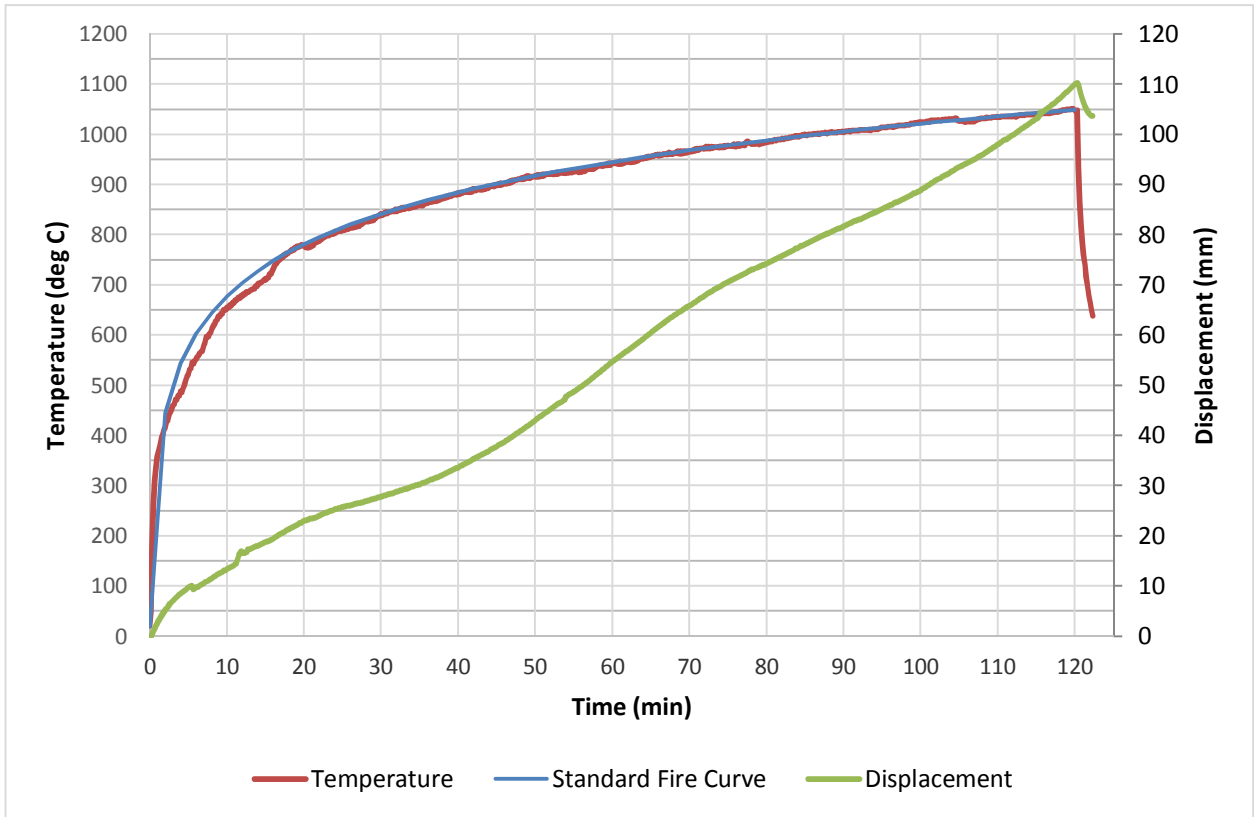


Figure 25 Results from sample ref. 12



Figure 26 Gripple fixing and M10 stud fixing following 120 minutes fire exposure



Sample reference 13 Gripple pipe bracket 640mm (PB640) suspended using M10 threaded rod 30kg load 30 minutes fire exposure

The results from the thirteenth fire experiment are shown in Figure 27 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 48mm after 30 minutes. For some unknown reason the data file was stopped slightly short of the prescribed fire exposure period but the system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 28. The sample comprised both the Gripple pipe bracket and associated loading frame.

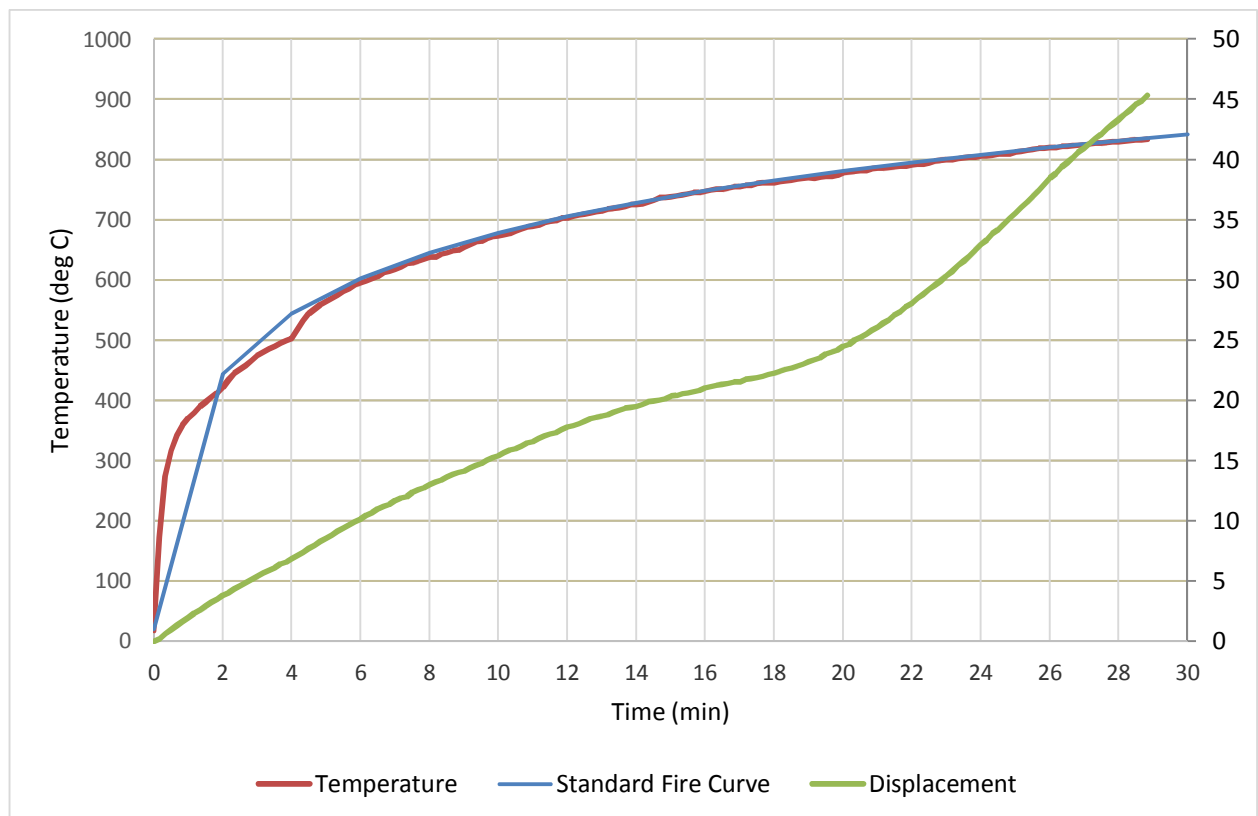


Figure 27 Results from sample ref. 13



Figure 28 Gripple pipe bracket PB640 following 30 minutes fire exposure

Sample reference 14 Gripple pipe bracket 640mm (PB640) suspended using M10 threaded rod 15kg load fire exposure 60 minutes

The results from the fourteenth fire test are shown in Figure 29 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 74mm after 60 minutes. There was a loss of power to the furnace approximately 8 minutes into the test. Power was restored quickly and the furnace temperature was restored after approximately 6 minutes and the test continued. In our opinion the temporary drop in temperature did not have any impact on the result. The system continued to support the applied load for the test period. The sample is shown on removal from the furnace in Figure 30. The sample comprised both the Gripple pipe bracket and associated loading frame.

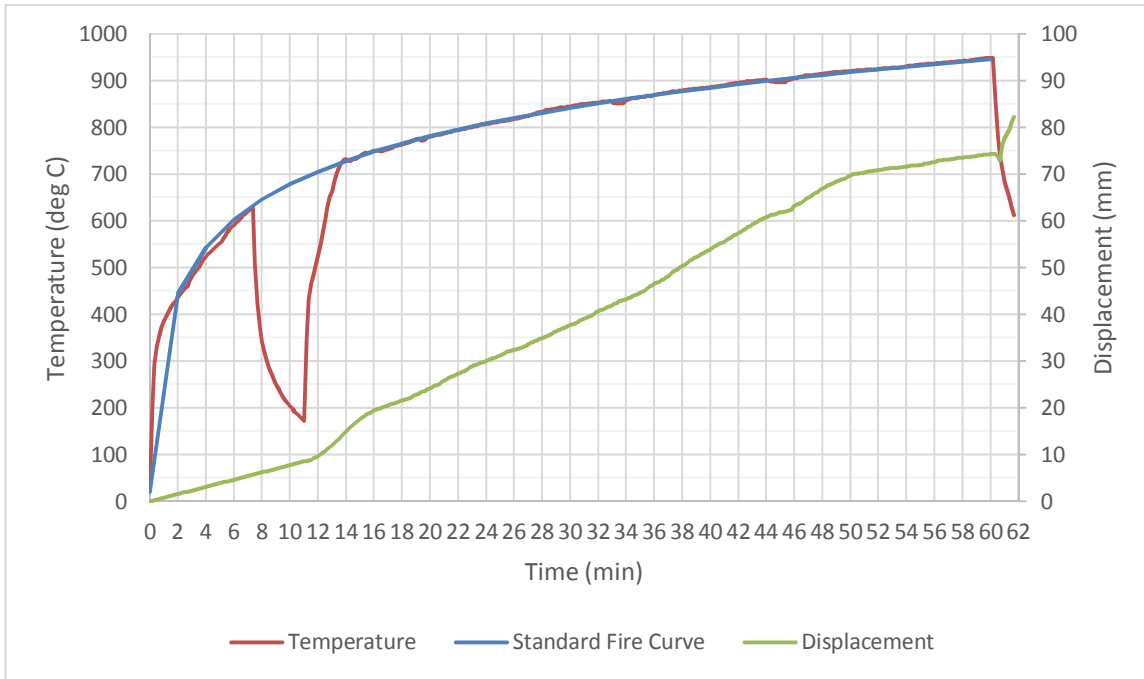


Figure 29 Results from sample ref. 14



Figure 30 Gripple pipe bracket PB640 following 60 minutes fire exposure



Sample reference 15 Gripple pipe bracket 640mm (PB640) suspended using M10 threaded rod 5kg load fire exposure 120 minutes

The results from the fifteenth and final fire experiment are shown in Figure 31 below. The measured temperature within the furnace is shown alongside the standard (BS476) fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum deflection was approximately 80mm after 120 minutes. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in Figure 32. The sample comprised both the Gripple pipe bracket and associated loading frame.

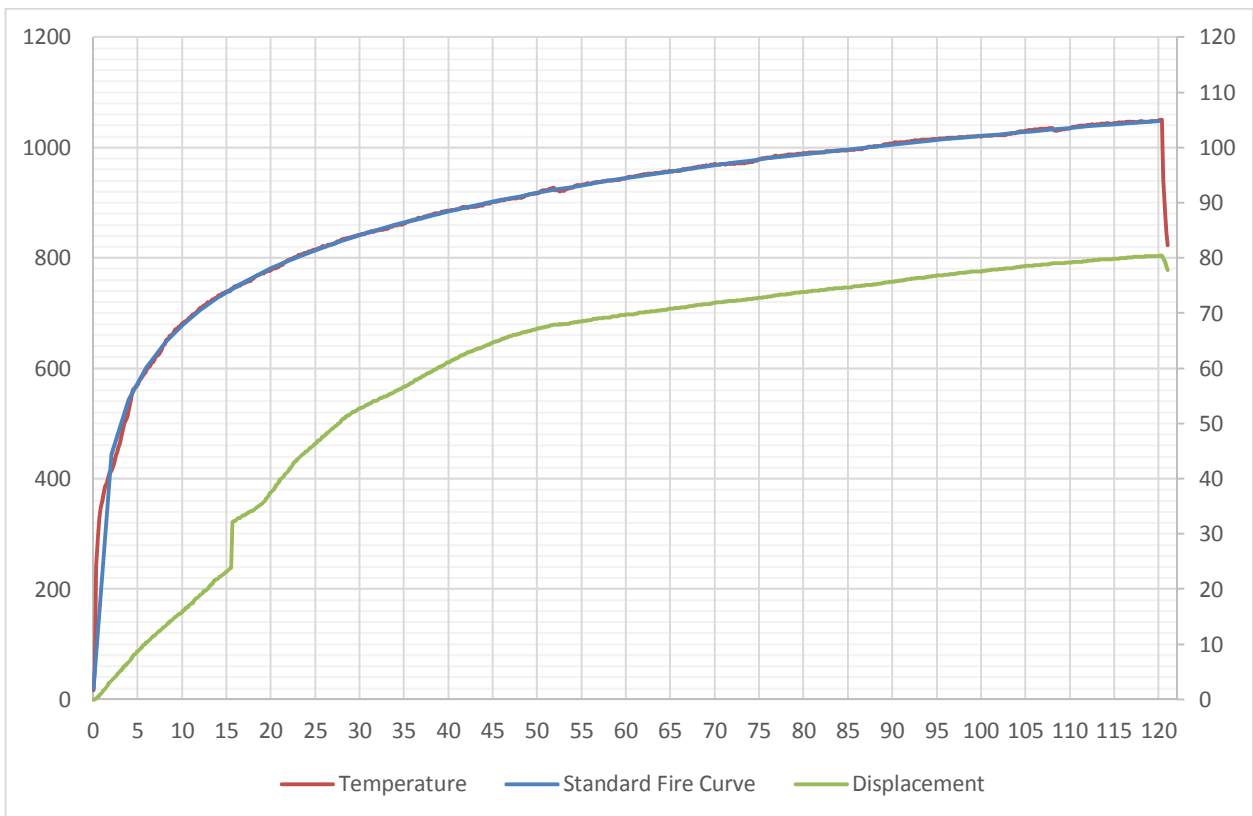


Figure 31 Results from sample ref. 15



Figure 32 Gripper pipe bracket PB640 following 120 minutes fire exposure



Results summary

A total of fifteen fire tests have been undertaken on a wire rope suspension system incorporating a “griple” connector at one end and a variety of different fixing systems at the other end or a pipe bracket support. In each case the fixings, incorporating a length of wire rope where the Gripple fixings were used, were suspended from a supporting frame, put under load and subject to a heating regime corresponding to a specified exposure to the standard fire curve. The results from the experimental programme are summarised in Table 2.

Ref. No.	Description	Applied load (kg)	Maximum extension (mm)	Comment
1	Griple Trapeze Plus No.2 unit with M8 stud end fixing (with cable basket adaptor)	15	142	Fire exposure terminated at 30 minutes
2	Griple Trapeze Plus No.2 unit with M8 stud end fixing (with cable basket adaptor)	4	77	Fire exposure terminated at 60 minutes
3	Griple Trapeze Plus No.2 unit with M8 stud end fixing (with cable basket adaptor)	2.5	101	Fire exposure terminated at 120 minutes
4	Griple Trapeze Plus No.2 unit with 90 degree eyelet end fixing (with cable basket adaptor)	15	143	Fire exposure terminated at 30 minutes
5	Griple Trapeze Plus No.2 unit with 90 degree eyelet end fixing (with cable basket adaptor)	7.5	275	Fire exposure terminated at 60 minutes
6	Griple Trapeze Plus No.2 unit with 90 degree eyelet end fixing (with cable basket adaptor)	2.5	155	Fire exposure terminated at 120 minutes
7	Griple Trapeze Plus No.2 unit with straight eyelet end fixing (with cable basket adaptor)	15	139	Fire exposure terminated at 30 minutes
8	Griple Trapeze Plus No.2 unit with straight eyelet end fixing	7.5	165	Fire exposure terminated at 60 minutes



9	Gripple Trapeze Plus No.2 unit with straight eyelet end fixing	2.5	61	Fire exposure terminated at 120 minutes
10	Gripple Trapeze Plus No.4 unit with M10 stud end fixing	100	62	Fire exposure terminated at 30 minutes
11	Gripple Trapeze Plus No.4 unit with M10 stud end fixing	50	184	Fire exposure terminated at 60 minutes
12	Gripple Trapeze Plus No.4 unit with M10 stud end fixing	25	110	Fire exposure terminated at 120 minutes
13	Gripple Pipe Bracket 640mm (PB640) suspended using M10 threaded rod	30	48	Fire exposure terminated at 30 minutes
14	Gripple Pipe Bracket 640mm (PB640) suspended using M10 threaded rod	15	74	Fire exposure terminated at 60 minutes
15	Gripple Pipe Bracket 640mm (PB640) suspended using M10 threaded rod	5	80	Fire exposure terminated at 120 minutes

Table 2 Summary of test results



References

1. British Standards Institution, BS 476-20:1987, Fire tests on building materials and structures – Part 20: Method for the determination of the fire resistance of elements of construction (general principles), BSI, London, 1987.
2. DIN 4102 Part 2, Fire Behaviour of Building Materials and Components, Building components, Definitions, Requirements and Tests, Deutsche Normen, Berlin, September 1977.