

# BRE Global Client Report

## Gripple Fire Testing November 2016

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## Executive Summary

BRE Global has undertaken six fire experiments to investigate the performance of an innovative hanger system used to support mechanical and electrical installations, services etc. Two different systems have been assessed under load and exposed to a heating curve corresponding to 30, 60 or 120 minutes standard fire exposure<sup>1,2</sup>. 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 120 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 S/S No. 2 unit with loop end fixing stainless steel wire 1x19 construction & zinc plated copper ferrule	15	76.1	Fire exposure terminated at 30 minutes
2.	Gripple S/S No. 2 unit with loop end fixing stainless steel wire 1x19 construction & zinc plated copper ferrule	7.5	148	Fire exposure terminated at 60 minutes
3.	Gripple S/S No. 2 unit with loop end fixing stainless steel wire 1x19 construction & zinc plated copper ferrule	2.5	87.6	Fire exposure terminated at 120 minutes
4	Gripple S/S No. 3 unit with loop end fixing stainless steel wire 7x7 construction & zinc plated copper ferrule	45	69.4	Fire exposure terminated at 30 minutes
5.	Gripple S/S No. 3 unit with loop end fixing stainless steel wire 7x7 construction & zinc plated copper ferrule	20	89.4	Fire exposure terminated at 60 minutes
6.	Gripple S/S No. 3 unit with loop end fixing stainless steel wire 7x7 construction & zinc plated copper ferrule	10	78.0	Fire exposure terminated at 120 minutes

<sup>1</sup> 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

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

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



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## Introduction

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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 120 minutes of the standard time-temperature fire curve<sup>1</sup>.



## 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 when under an applied load. The experimental programme, as agreed with the client is summarised in **Table 1** below.

**Table 1 - Experimental programme**

Test No.	Description	Applied load (kg)	Standard fire exposure (min)
1	Gripple S/S No. 2 unit with loop end fixing	15	30
2	Gripple S/S No. 2 unit with loop end fixing	7.5	60
3	Gripple S/S No. 2 unit with loop end fixing	2.5	120
4	Gripple S/S No. 3 unit with loop end fixing	45	30
5	Gripple S/S No. 3 unit with loop end fixing	20	60
6	Gripple S/S No. 3 unit with loop end fixing	10	120

In each case the load was applied by hanging a weight to a looped length of the cable by means of a "Gripple" fixing (**Figure 1**). The fixing to the other end was attached to a bolt connected to a threaded bar suspended above the furnace (**Figure 2**). In each case the Gripple fixing was entirely contained within the furnace and exposed to fire.



**Figure 1 - Gripple (No. 2) cable connector, before fire exposure**



**Figure 2 - Looped cable end suspended via threaded bar above the furnace**

### 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. The performance criterion is considered unsatisfied when the cable with the Gripple fixing can no longer take the loading.

### Furnace description

The furnace used is a gas fired furnace used to undertake non-standard fire testing. The furnace heating curve is described by the following equation:

$$\theta_g = 345 \log_{10}(8 \cdot t + 1) + \theta_0 \quad \text{Equation 1}$$

Where,

$\theta_g$  – represents the gas temperature (°C);

t – represents the time (min);

$\theta_0$  – represents the initial temperature (°C).

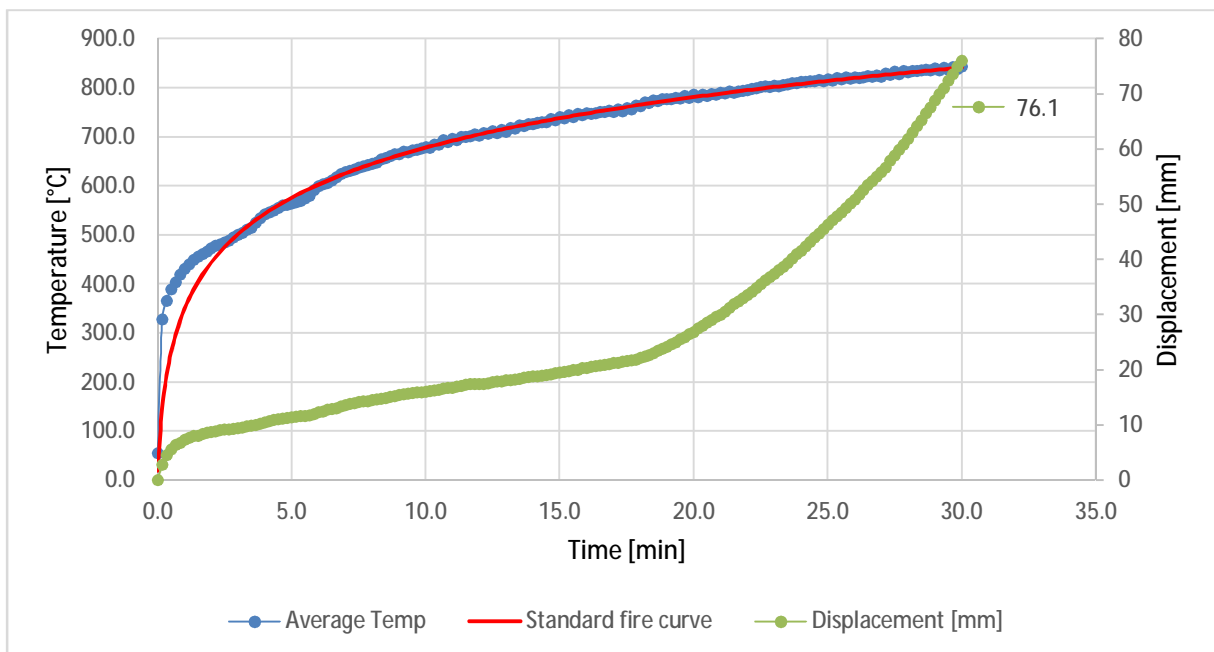
### Methodology

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 S/S No. 2 unit with loop end fixing 15kg load and 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 fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum extension was approximately 76 mm after 30 minutes of fire exposure. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in **Figure 4**.



**Figure 3 - Results from sample reference 1**



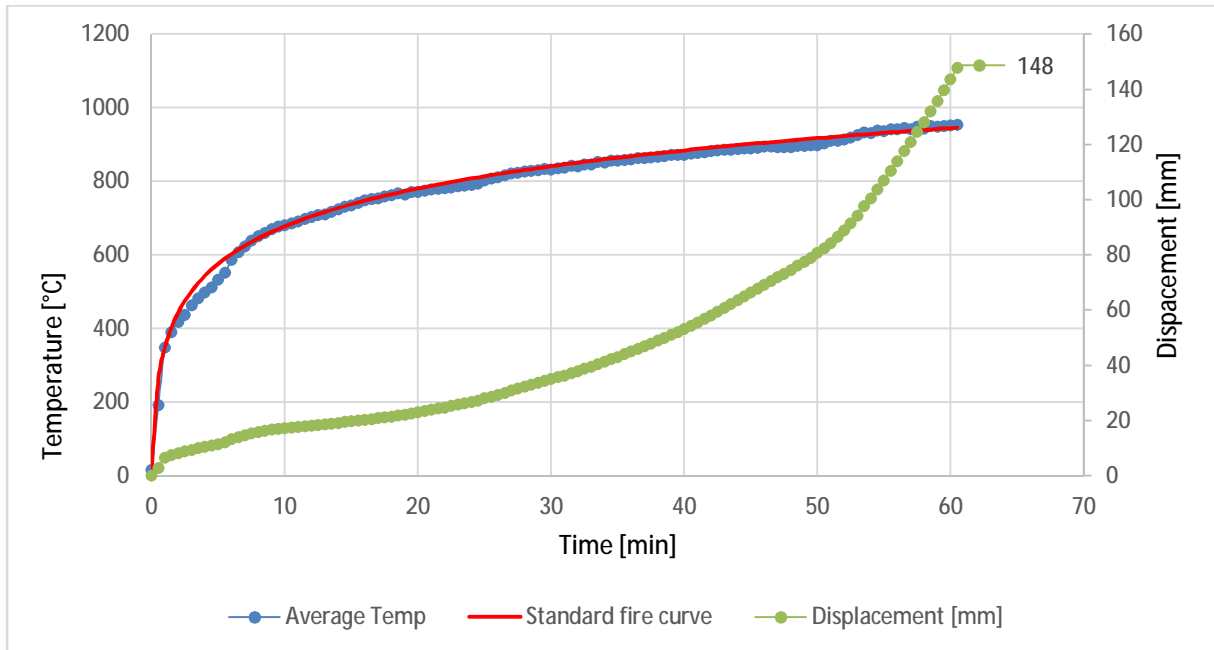
**Figure 4 - Gripple S/S No. 2 unit after fire exposure for 30 minutes**





### Sample reference 2: Gripple S/S No. 2 unit with loop end fixing 7.5kg load and 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 fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum extension was approximately 148 mm after 60 minutes of fire exposure. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in **Figure 6**.



**Figure 5 - Results from sample reference 2**

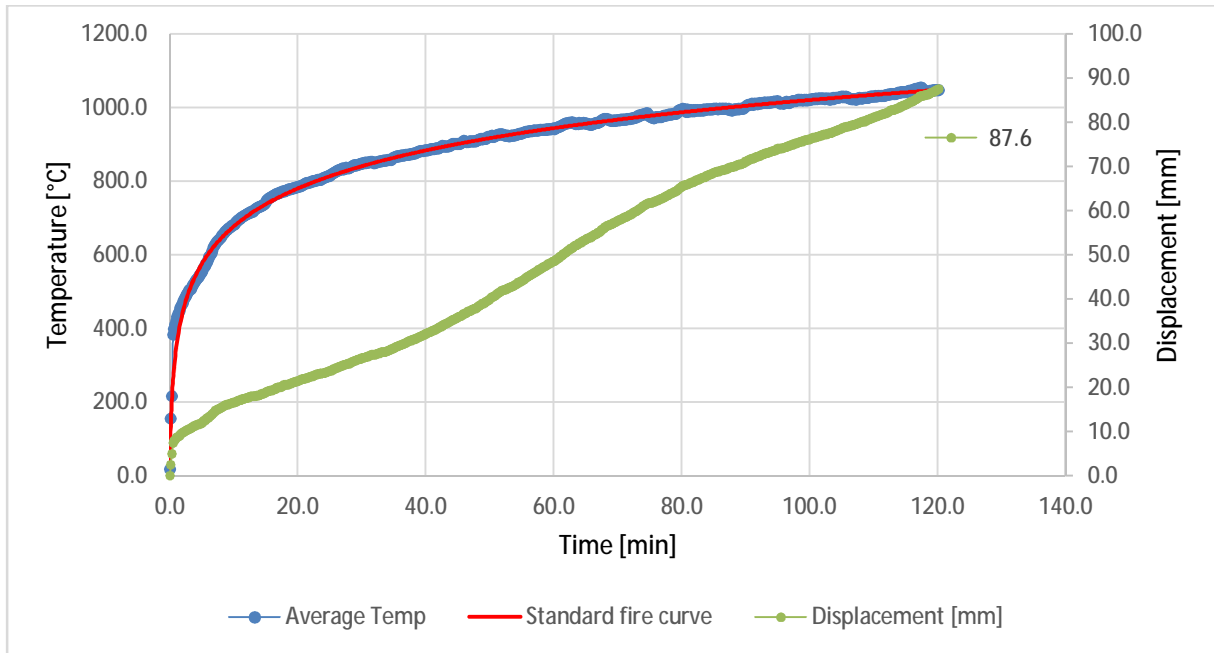


**Figure 6 - Gripple S/S No. 2 unit after fire exposure for 60 minutes**

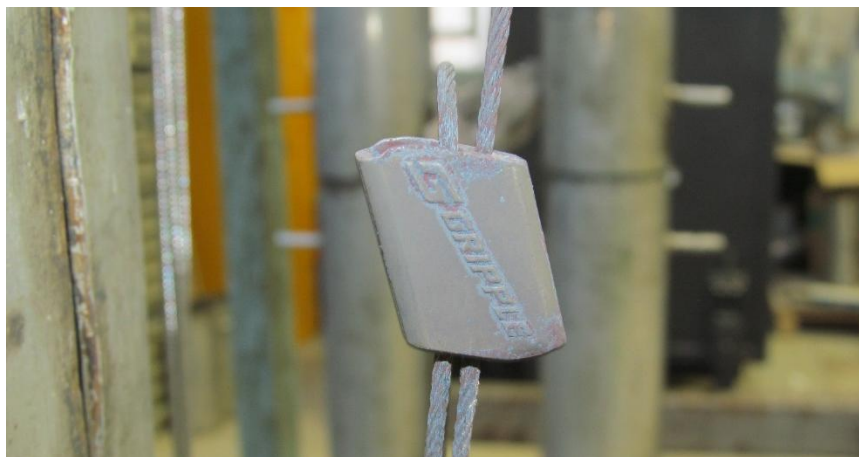


**Sample reference 3: Gripple S/S No. 2 unit with loop end fixing 2.5kg load and 120 minutes fire exposure**

The results from the third fire experiment are shown in **Figure 7** below. The measured temperature within the furnace is shown alongside the standard fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum extension was approximately 87 mm after 120 minutes of fire exposure. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in **Figure 8**.



**Figure 7 - Results from sample reference 3**

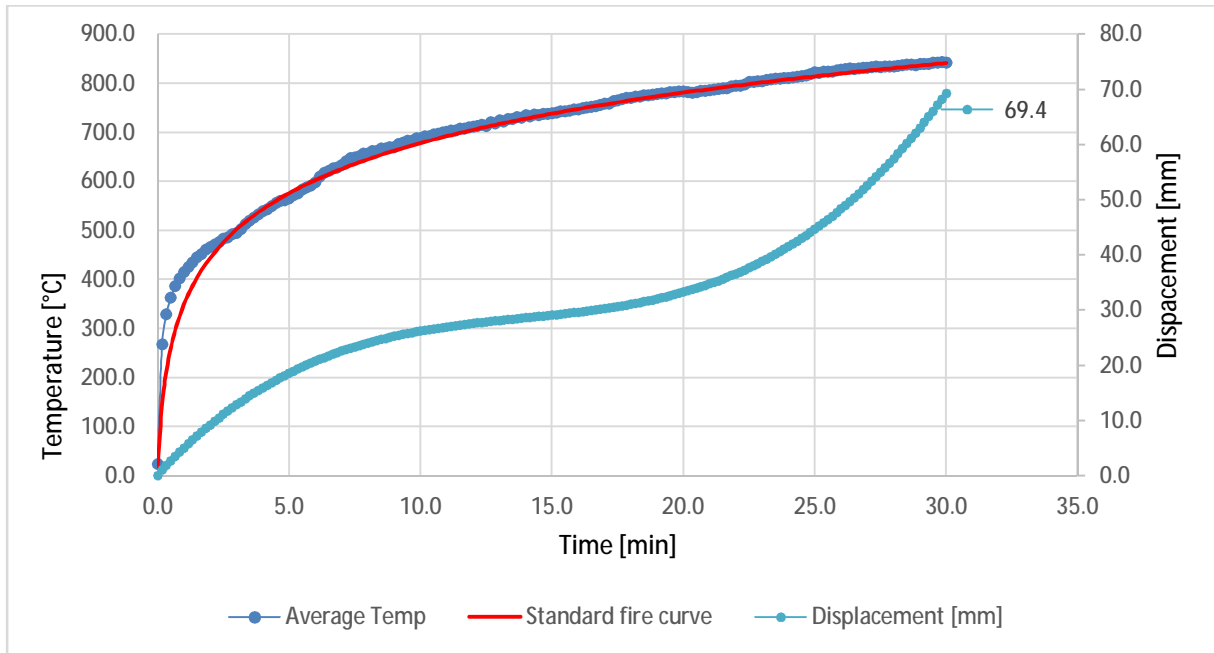


**Figure 8 - Gripple S/S No. 2 unit after fire exposure for 120 minutes**

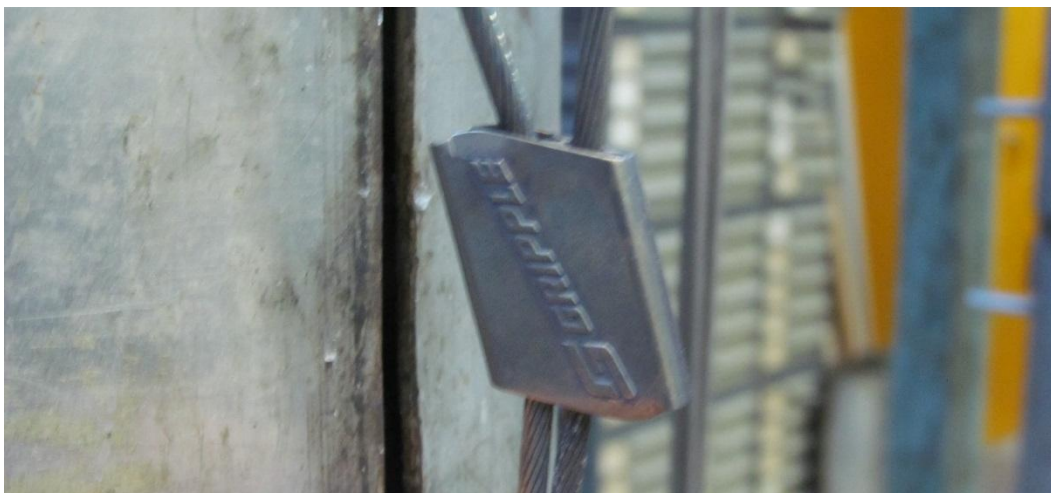


**Sample reference 4: Gripple S/S No. 3 unit with loop end fixing 45kg load and 30 minutes fire exposure**

The results from the fourth fire experiment are shown in **Figure 9** below. The measured temperature within the furnace is shown alongside the standard fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum extension was approximately 69 mm after 30 minutes of fire exposure. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in **Figure 10**.



**Figure 9 - Results from sample reference 4**

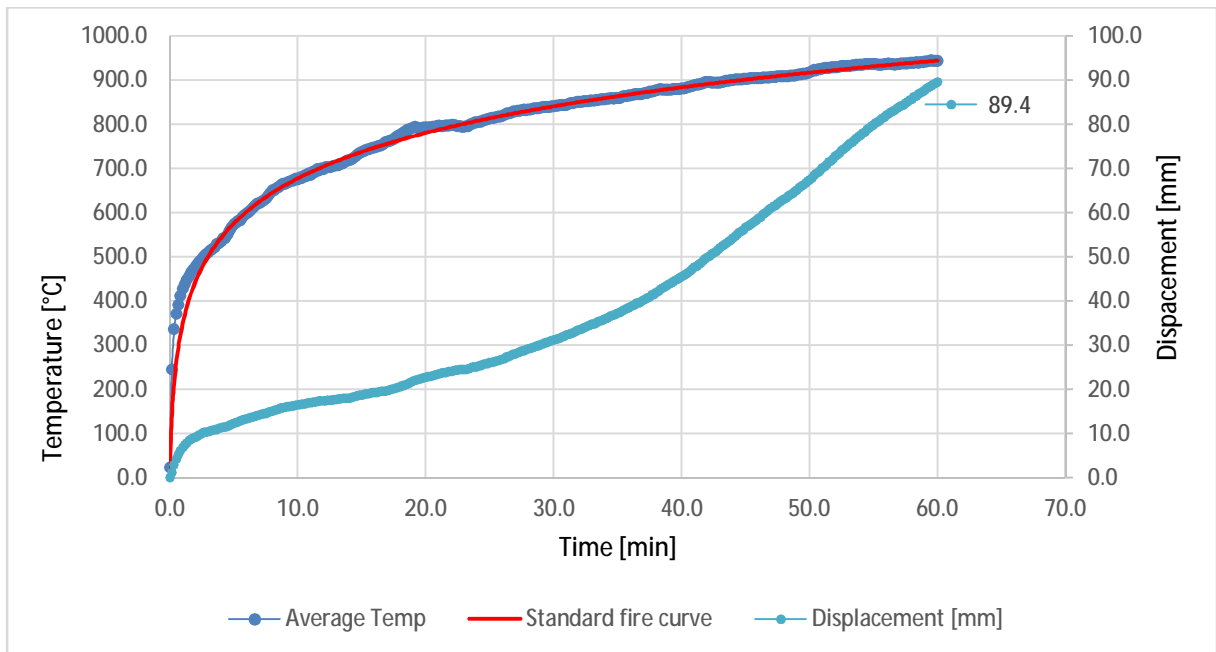


**Figure 10 - Gripple S/S No. 3 unit after fire exposure for 30 minutes**

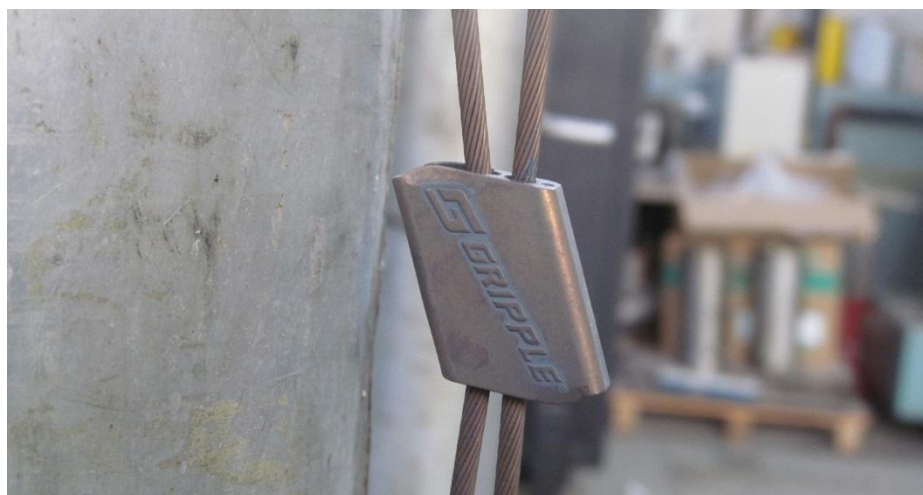


**Sample reference 5: Gripple S/S No. 3 unit with loop end fixing 20kg load and 60 minutes fire exposure**

The results from the fifth fire experiment are shown in **Figure 11** below. The measured temperature within the furnace is shown alongside the standard fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum extension was approximately 89 mm after 60 minutes of fire exposure. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in **Figure 12**.



**Figure 11 - Results from sample reference 5**

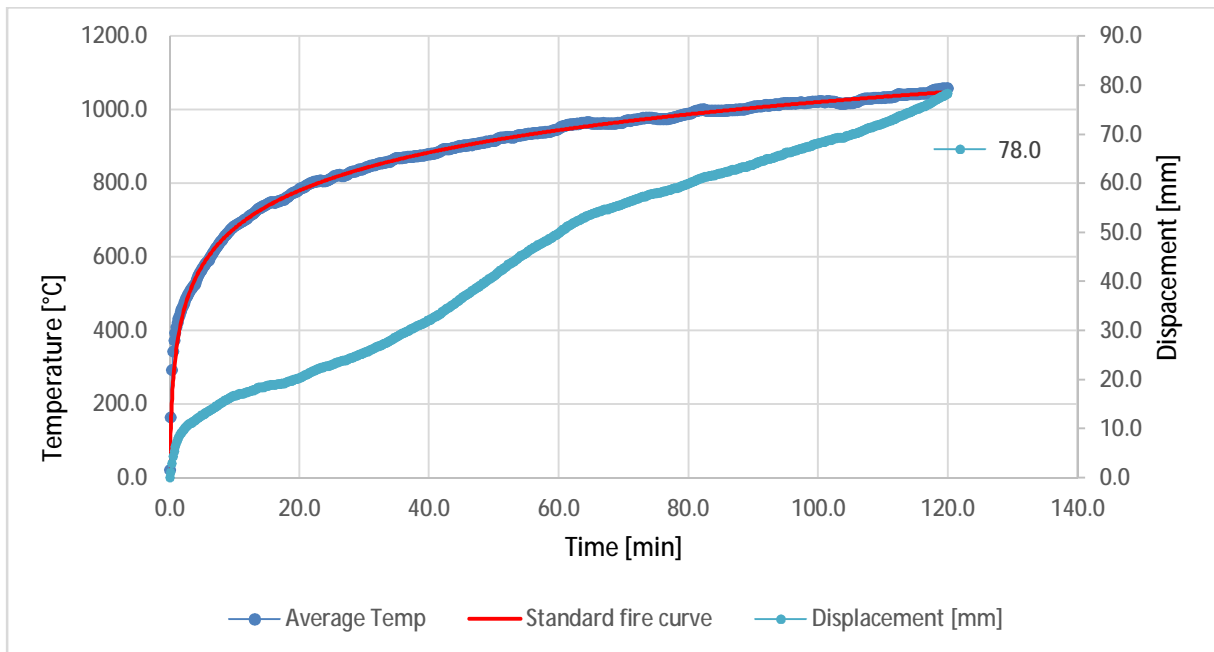


**Figure 12 - Gripple S/S No. 3 unit after fire exposure for 60 minutes**

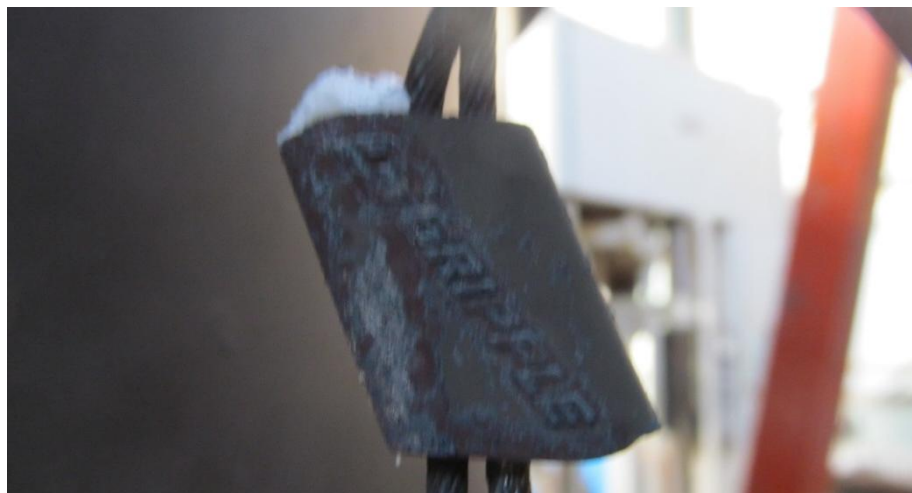


### Sample reference 6: Gripple S/S No. 3 unit with loop end fixing 10kg load and 120 minutes fire exposure

The results from the sixth fire experiment are shown in **Figure 13** below. The measured temperature within the furnace is shown alongside the standard fire curve. The results show good agreement between the measured temperature and the standard curve. The maximum extension was approximately 78 mm after 120 minutes of fire exposure. The system continued to support the applied load for the experimental period. The sample is shown on removal from the furnace in **Figure 14**.



**Figure 13 - Results from sample reference 6**

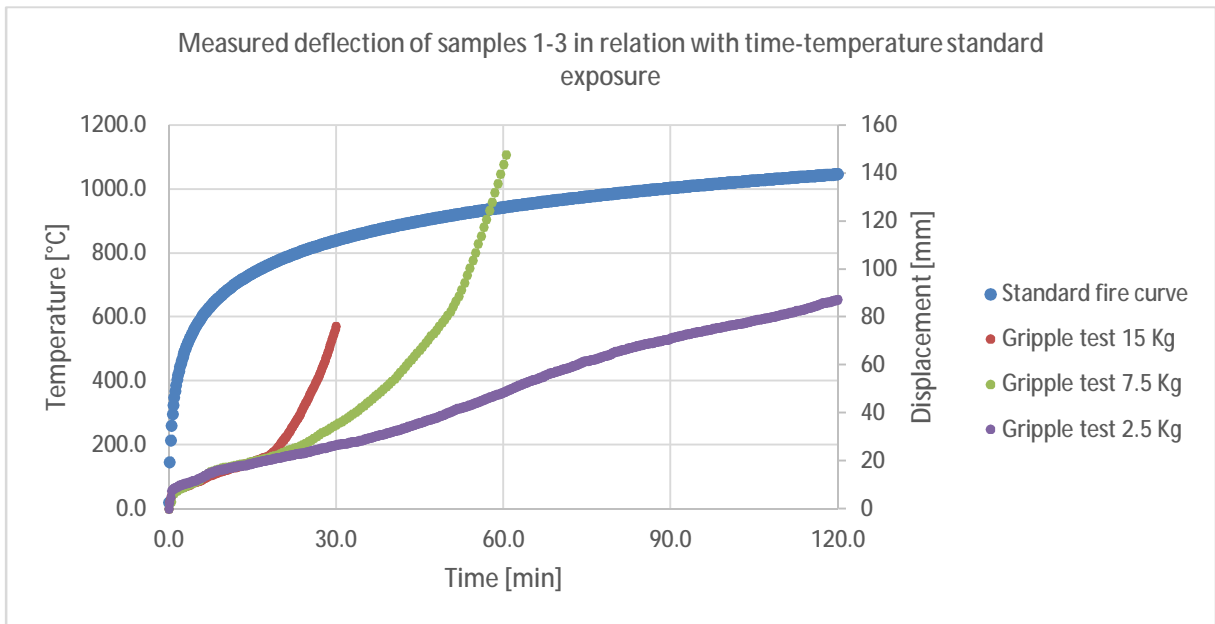


**Figure 14 - Gripple S/S No. 3 unit after fire exposure for 120 minutes**

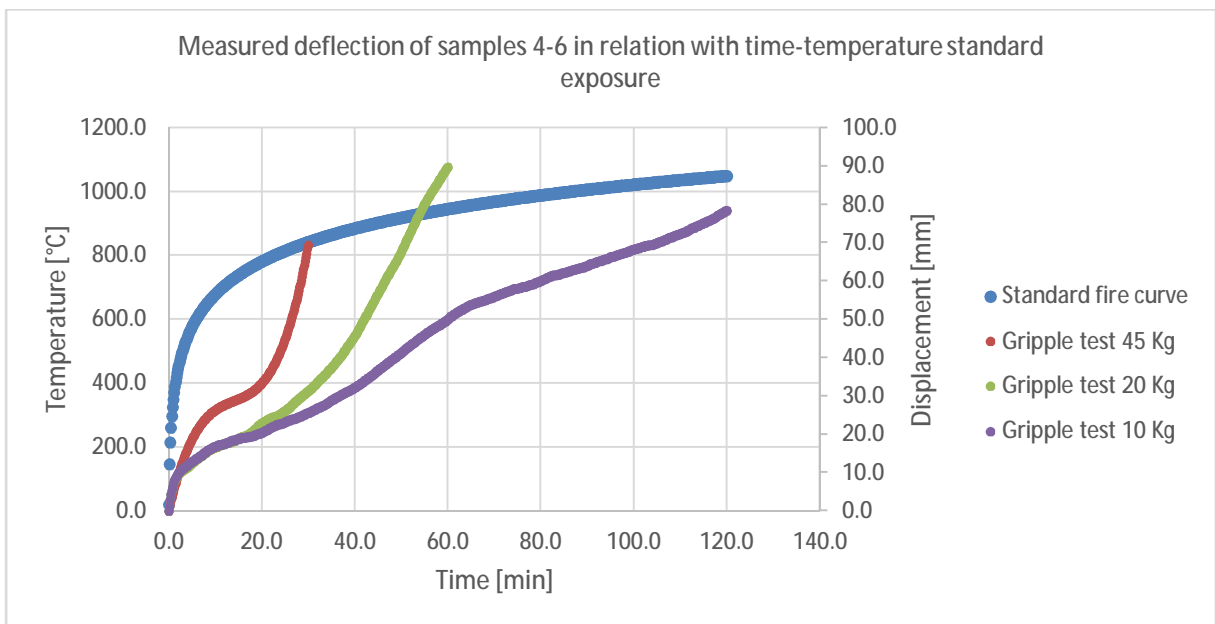


## Results summary

A summary of the test results are presented in **Figure 15**, **Figure 16** and **Table 2** below:



**Figure 15 - Measured deflection for Gripple S/S No. 2 in relation with standardized time-temperature fire exposure**



**Figure 16 - Measured deflection for Gripple S/S No. 3 in relation with standardized time-temperature fire exposure**



**Table 2 - Summary of test result for Gripple fixing elements**

Test no.	Applied load (kg)	Standard fire exposure (min)	Max deflection (mm)	Comment
1.	15	30	76.1	Fire exposure terminated at 30 minutes
2.	7.5	60	148.0	Fire exposure terminated at 60 minutes
3.	2.5	120	87.6	Fire exposure terminated at 120 minutes
4.	45	30	69.4	Fire exposure terminated at 30 minutes
5.	20	60	89.4	Fire exposure terminated at 60 minutes
6.	10	120	78.0	Fire exposure terminated at 120 minutes

A total of six fire tests have been undertaken on a wire rope suspension system incorporating a “gripple” connector at one end and a loop at the other end. In each case the fixings, incorporating a length of wire rope (either stainless steel 1x19 construction for test reference 1-3 or stainless steel 7x7 construction for test reference 4-6), 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.

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



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## References

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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.