

REPORT NO. F(C) / 0154

**Fire Performance Assessment of  
Multi kilfire Cable Fire Barrier  
System**

**SPONSORED BY  
M/s Multi Kilfire Pvt. Ltd.  
Vadodara - 390 016**



Note: Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

### REPORT SUMMARY

1. **Date of Evaluation** : March 27, 2006
2. **Room Temperature** : 32°C
3. **Specimen Evaluated** : Multi Kilfire Cable Firestop KF-604
4. **Construction** : As per figure – 1
5. **Evaluation Procedure** : Fire Resistance
6. **Standard Followed** : UL-1479 and IS:12458
7. **Fire Resisting Rating** : 180 minutes .



Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

#### DISCLAIMER

The responsibility of the Central Building Research Institute, Roorkee is limited only to the technical evaluation of Cable Firestop -KF- 604 (Vertical) specimen submitted by M/s Multi Kilfire Pvt. Ltd. 4, Amin Industrial Estate, Gorwa Road, Vadodara - 390 016

All procedural, legal or operational matters will be the responsibility of the sponsor only. The C.B.R.I, Roorkee is in no way responsible for any of these either directly or indirectly.



Ote: Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

**Fire Performance Assessment of  
Multi kilfire Cable Fire Barrier System**

**PROJECT NO. CNP - 0154**

**PROJECT TEAM**

Dr. T.P. Sharma	Project Leader
Mr. Suvir Singh	Member
Mr. A.S. Srivastava	Member
Mr. Surqesh Kumar	Member
Mr. Sushil Kumar	Member



ote: Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

## CONTENTS

	Page No.
REPORT SUMMARY	1
DISCLAIMER	2
PROJECT TEAM	3
LIST OF TABLES	5
LIST OF FIGURES	6
1.0 SUMMARY	7
2.0 OBJECTIVE	7
3.0 CONSTRUCTION	7
4.0 EVALUATION PROCEDURE	8
5.0 PERFORMANCE CRITERIA AS PER UL : 1479	10
6.0 RESULTS	10
7.0 EVALUATION OBSERVATION	11
8.0 CONCLUSIONS	11
TABLES	12-14
FIGURES	15-17



Ote: Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

### LIST OF TABLE

- TABLE 1:** UNEXPOSED FACE TEMPERATURE MEASURED DURING EVALUATION OF CABLE FIRESTOP-KF-604 (VERTICAL) SPECIMEN CARRIED OUT ON 27.03.2006 FOR FIRE RESISTANCE.
- TABLE 2:** POSITION OF THERMOCOUPLES ON UNEXPOSED FACE OF CABLE FIRESTOP-KF-604 (VERTICAL) SPECIMEN CARRIED OUT ON 27.03.2006 FOR FIRE RESISTANCE.
- TABLE 3:** OBSERVATIONS MADE DURING FIRE RESISTANCE EVALUATION OF CABLE FIRESTOP-KF-604 (VERTICAL) SPECIMEN CARRIED OUT ON 27.03.2006 FOR FIRE RESISTANCE.



Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

**LIST OF FIGURES**

- FIGURE 1:** CONSTRUCTION DETAILS OF CABLE FIRESTOP-KF-604 (VERTICAL) SPECIMEN CARRIED OUT ON 27.03.2006 FOR FIRE RESISTANCE.
- FIGURE 2:** STANDARD AND AVERAGE FURNACE TIME-TEMPERATURE CURVES MAINTAINED DURING EVALUATION OF CABLE FIRESTOP-KF-604 (VERTICAL) SPECIMEN CARRIED OUT ON 27.03.2006 FOR FIRE RESISTANCE.
- FIGURE 3:** UNEXPOSED FACE TIME-TEMPERATURE CURVES OBTAINED DURING THE EVALUATION OF CABLE FIRESTOP-KF-604 (VERTICAL) SPECIMEN CARRIED OUT ON 27.03.2006 FOR FIRE RESISTANCE.



Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

## 1.0 SUMMARY

Special fire investigations was carried out on Cable Firestop KF-604 (vertical) specimen at the request of M/s Multi Kilfire Pvt. Ltd. 4, Amin Industrial Estate, Gorwa Road, Vadodara.

The Cable Firestop KF-604 (vertical) specimen was placed in the floor furnace for fire resistance evaluation, adapting the furnace standard heating conditions and appropriate procedure and criteria as specified in UL : 1479 and IS:12458.

Temperatures were measured on the unexposed face of the Cable Firestop KF-604 (vertical) specimen and observations made during the evaluations were used for assessing the fire resistance performance of Cable Firestop KF-604 (vertical) specimen.

## 2.0 OBJECTIVES

The fire resistance evaluation of Cable Firestop KF-604 (vertical) specimen was subjected to the standard heating conditions as specified in different National & International Standards.

## 3.0 CONSTRUCTIONS

### 3.1 MULTI KILFIRE CABLE FIRESTOP SYSTEM KF-604 (VERTICAL) EVALUATED ON 27.03.2006 FOR FIRE RESISTANCE

Cable Firestop sealing system (Vertical) consisting of RCC Slab of size 1000 mm x 1000 mm x 200 mm thick with a clear opening of 600 mm x 600 mm. The two numbers. cable trays with PVC insulated, PVC sheathed, Aluminum /Copper Conductor, Armoured Power Cables of different dia were installed by penetrating through the opening of the concrete slab as shown in Fig.1. The cables were clamped with cable tray by G.I. wire. The cable trays were projecting 250 mm on the exposed side and 1050 mm on the unexposed side.

The opening of the cable fire barrier system was filled with castable type material having density of 1353 kg/m<sup>3</sup>.

Other construction details and dimensions are given in Fig. 1.





Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

#### 4.0 EVALUATION PROCEDURE

#### 4.1 MULTI KILFIRE CABLE FIRESTOP SYSTEM KF-604 (VERTICAL) EVALUATED ON 27.03.2006 FOR FIRE RESISTANCE.

##### (A) Impact Test

An impact test was conducted on the specimen of Cable Firestop KF-604 (vertical) on 19.12.2005. A 2.5 Kg. MS hammer with semi-spherical bottom was released from the height of 1000 mm on the unexposed face of the firestop system specimen. After the impact a very light impression of bottom of the hammer was observed on unexposed face of the filling material.

##### (B) Accelerated Ageing

The accelerated ageing test on Multi kilfire Cable Firestop System (Vertical) Specimen was carried out from 20-12-2005 to 26-12-2005 for 07 days (168 hours). During the accelerated ageing test the specimen was placed in the furnace where the temperature was maintained at 85°C. The specimen was taken out from the furnace after 07 days for water absorption test.

##### (C) Water Absorption Test

The water absorption test of the Multi kilfire Cable Firestop System (Vertical) Specimen was carried out on 27.12.05 to 28.12.05 for 24 hours. During the water absorption the specimen was immersed in fresh clean water at 20°C ± 2°C.

##### (D) Vibration Test

The vibration test on Multi kilfire Cable Firestop System (Vertical) Specimen was carried out on 02.01.2006 for a period of four hours. During the vibration test, the specimen was subjected to vibration of 100 Hz frequency and 0.5 mm amplitude.

##### (E) Fire Resistance Evaluation

- (i) The fire resistance evaluation of the Multi kilfire Cable Firestop System KF- 604 (Vertical) Specimen- was carried out on 27.03.2005 using floor furnace. During the fire resistance evaluation the furnace was regulated according to the standard heating conditions as specified in UL:1479 and IS:12458..



Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

**(D) Hose Stream Evaluation**

Hose Stream Evaluation was carried out within five minutes after the furnace was shut off. After the hose stream evaluation no water stream beyond the unexposed face of the firestop was observed

**4.3 Furnace Control**

The specimen was subjected to the standard heating conditions in a furnace which can be run on positive pressure.

The temperature of the furnace shall be controlled to vary with time as closely as possible in accordance with the following relationship :

$$T - T_0 = 345 \log (8t + 1)$$

Where  $t$  = time in minutes,  
 $T$  = furnace temperature in °C  
and  $T_0$  = initial furnace temperature in °C

The relationship is illustrated by the following points calculated by means of the above formula to give the standard time-temperature curve :

Time (min.)	Temperature rise in furnace (T-T <sub>0</sub> ) (°C)
5	569
10	659
15	718
30	821
60	925
90	986
120	1029
180	1090

- (a) During the first ten minutes the area under the curve of mean furnace temperature does not vary by more than ± 15% of the area under the standard curve.
- (b) During the first half-hour the area under the curve of mean furnace temperature does not vary by more than ± 10% of the area under the standard curve.
- (c) For any period after the first half-hour the area under the curve of mean furnace temperature does not vary by more than ± 5% of the area under the standard curve.



Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

- (c) At any time after the first ten minutes the mean furnace temperature does not differ from the standard temperature by more than  $\pm 100^{\circ}\text{C}$ .

## 5.0 PERFORMANCE CRITERIA AS PER UL : 1479 - 1983

### 5.1 F-Rating

Firestop shall be considered as meeting the requirements of F-Rating as per UL : 1479 when it remains in the aperture during the fire and hose stream evaluation within the following limitations:

- (a) The firestop shall have withstood the fire test for the rating period without permitting the passage of flames through openings or the occurrence of flaming on any element of the unexposed side of the firestop.
- (b) During the hose stream test, firestop shall not develop any opening that would permit a projection of the water stream beyond the unexposed side.

### 5.2 T-Rating

Firestop shall be considered as meeting the requirements for T-Rating as per UL : 1479-1983 when it remains intact in the opening during the fire test and hose stream test within the following limitations :

- (a) The transmission of heat through the firestop during the rated period shall not raise the temperature, measured by any thermocouple on the unexposed surface of the firestop or on any penetrating item by more than  $163^{\circ}\text{C}$  above its initial temperature. Also, the firestop shall withstand the fire test during the rating period without permitting the passage of flames through openings or the occurrence of flaming of any element to the unexposed side of the firestop.
- (b) During the hose stream test, the firestop shall not develop any opening that would permit a projection of water from the stream beyond the unexposed side.

## 6.0 RESULTS

### 6.1 Temperature Measurements

Temperatures were measured at eight different points on the unexposed side of Cable Firestop System at three points on cable, at two points on cable trays and at three points on filling material as shown in Figure 1. The temperature variation at these points are given in Table 2 and the positions of thermocouples are given in Table 1.



Note: Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

## 7.0 EVALUATION OBSERVATION

7.1 Observations made during the evaluation of Cable Firestop System KF-604 (Vertical) evaluated on 24.08.2002 are given in Table 3.

## 8.0 CONCLUSIONS

8.1 The results of evaluation reveal that the Cable Firestop System KF-604 (Vertical) evaluated on 27. 03.2006 has successfully withstood the criteria for three hours fire resistance rating as per UL : 1479 and IS:12458..



Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

**Table1: Positions of thermocouples on Multi kilfire Cable Firestop System KF-604(Vertical) Specimen evaluated on 27-03-2006 for fire resistance**

Thermocouples Number	Positions of Thermocouples
T1	25 mm away from unexposed face on cable tray number 2
T2	On the unexposed face of filling material.
T3	25 away from cable bunch on the unexposed face of filling material.
T4	25 away from unexposed face on cable tray no. 1
T5	On the unexposed face of filling material.
T6	25 away from unexposed face on cable in cable tray no. 2
T7	25 away from unexposed face on cable in cable tray no. 1.
T8	25 away from unexposed face on cable in cable tray no. 1.



Note: Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

**Table2: Unexposed face temperature measured during the evaluation of Multi kilfire Cable Firestop System KF-604(Vertical) evaluated on 27-03-2006 for fire resistance**

Time (Min)	Unexposed Face Temperature (°C)							
	T1	T2	T3	T4	T5	T6	T7	T8
00	23	23	23	23	23	23	23	23
20	29	26	25	29	25	40	35	34
40	50	27	30	49	29	76	78	71
60	70	30	49	67	35	86	86	82
80	77	47	64	81	47	105	100	97
100	84	65	77	88	63	98	89	88
120	85	69	85	94	72	87	80	84
140	97	71	90	102	84	91	74	81
160	98	73	92	109	92	94	83	86
180	103	73	92	112	94	97	82	84

Note: All figures are rounded off to their nearest integer.



Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

**Table 3: Observations made during the fire resistance evaluation of Cable Firestop System KF-604(Vertical) Specimen evaluated on 27- 03-2006 for fire resistance**

Time Min.	Observations
00	Furnace started at a pressure of $-2.0$ mm Wg.
15	No smoke on unexposed face. Furnace pressure was normal.
30	No smoke on unexposed face. Furnace pressure was normal.
45	No smoke on unexposed face. Furnace pressure was normal.
60	No smoke on unexposed face. Furnace pressure was normal.
75	No smoke on unexposed face. Furnace pressure was normal.
80	Hair cracks was observed on the unexposed face of the filling material.
90	Smoke started to come out from the gap between cable bunch on the unexposed face. Cotton pad was conducted, but no change on cotton pad was observed. Furnace pressure was normal.
110	Smoke continued to come out from the gap between cable bunch on the unexposed face.
120	Smoke continued to come out from the gap between cable bunch on the unexposed face. Cotton pad was conducted, but no change on cotton pad was observed. Furnace pressure was normal.
150	Smoke continued to come out from the gap between cable bunch on the unexposed face.
165	Smoke continued to come out from the gap between cable bunch on the unexposed face.
180	Smoke continued to come out from the gap between cable bunch on the unexposed face. Cotton pad was conducted but no change on cotton pad was observed. Furnace pressure was normal.  Furnace stopped.



Note: Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

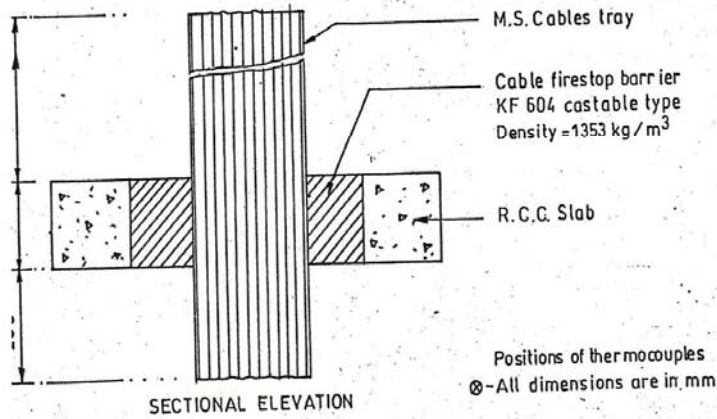
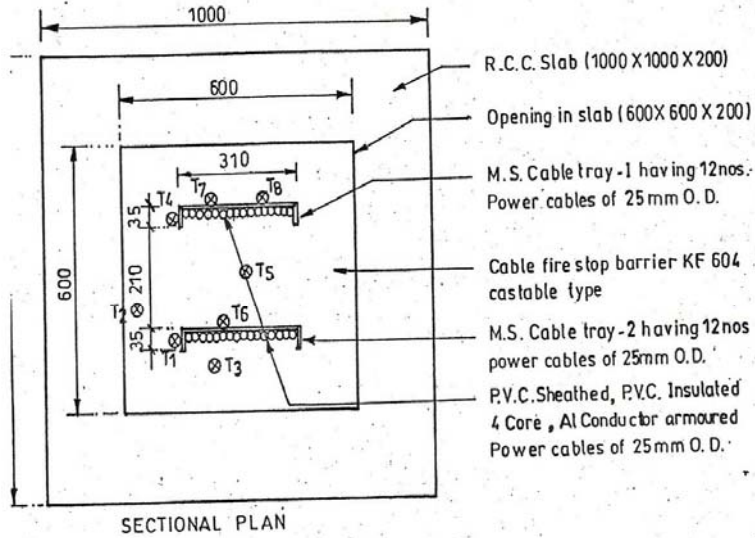


FIGURE 1: CONSTRUCTION DETAILS OF CABLE FIRESTOP-KF-604 (VERTICAL) SPECIMEN CARRIED OUT ON 27.03.2006 FOR FIRE RESISTANCE.

Drg. no	60327 A
Prepared by	(Rajeev Bansal)
Checked by	(Suvir Singh)





Note: Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

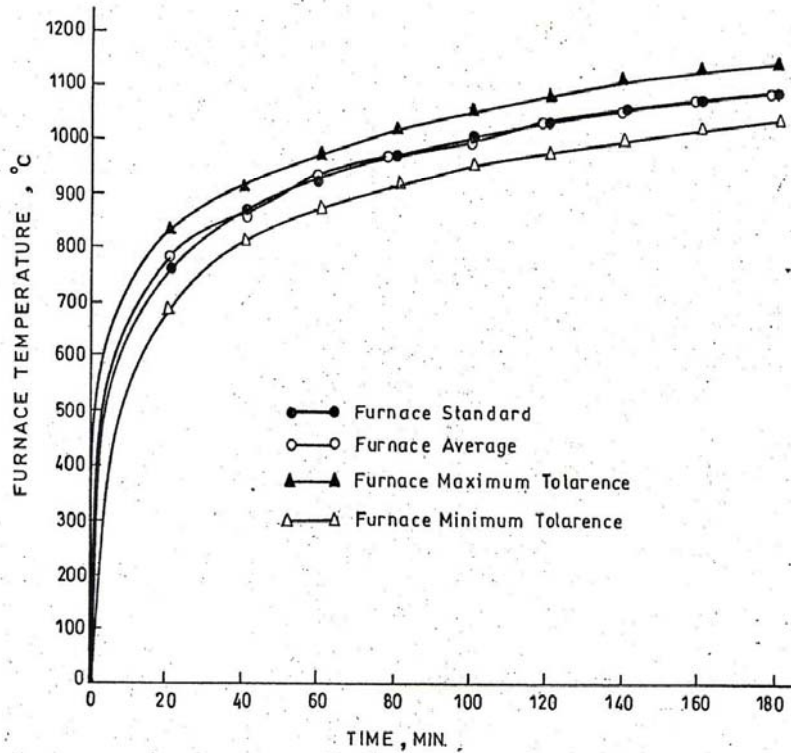


FIGURE 2: STANDARD AND AVERAGE FURNACE TIME-TEMPERATURE CURVES MAINTAINED DURING EVALUATION OF CABLE FIRESTOP-KF-604 (VERTICAL) SPECIMEN CARRIED OUT ON 27.03.2006 FOR FIRE RESISTANCE.



Note: Note: This original only is valid. Third parties who are using copies are doing so at their own risk.

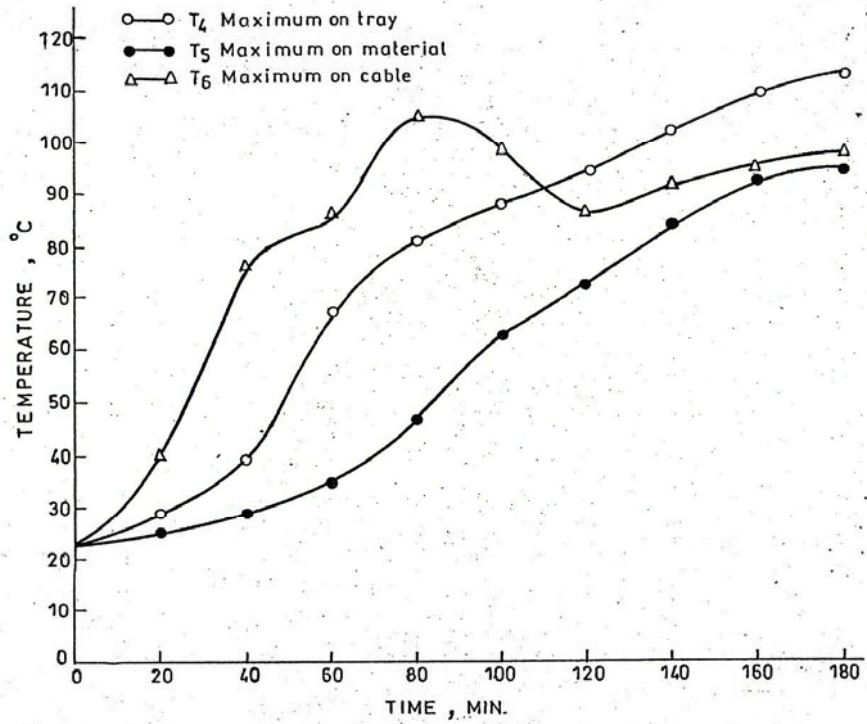


FIGURE 3: UNEXPOSED FACE TIME-TEMPERATURE CURVES OBTAINED DURING THE EVALUATION OF CABLE FIRESTOP-KF-604 (VERTICAL) SPECIMEN CARRIED OUT ON 27.03.2006 FOR FIRE RESISTANCE.

