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Testing laboratory No. 041/S-159 accredited by  
Slovak national accreditation service

# TEST REPORT

Test report number: **FIRES-FR-012-08-AUNE**  
Tested property: Function in fire  
Test method: DIN 4102 – 12:1998-11

Date of issue: **07. 02. 2008**

Name of the product: Cables with integrity function FE180 PH30/E30, FE180 PH90/E90  
Type – (N)HXH, (N)HXCH, HTKSH, HTKSHekw, JE-H(St)H

Manufacturer: **TECHNOKABEL S.A.**, Nasielska 55,  
04-343 Warszawa, Poland – producer of cables

**BAKS Kazimierz Sielski**, Jagodne 5,  
05-480 Karczew, Poland - producer of construction

Sponsor: **TECHNOKABEL S.A.**, Nasielska 55, 04-343 Warszawa, Poland

Task No.: PR-07-0492  
Specimen received: 14. 01. 2008  
Date of the fire test: 17. 01. 2008  
Technician responsible for the technical side of this report: Miroslav Hudák

Number of pages: 7  
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Number of appendices: **36**  
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## 1. INTRODUCTION

This test report contains the results of the test carried out at the testing laboratory of FIRES s.r.o. in Batizovce. The purpose of the test was product classification. The test specimen was power and communication non-halogen cables with circuit integrity maintenance. Persons witnessing the test:

Representatives of the sponsor: Mr. Mariusz Kwiatkowski (TECHNOKABEL)  
Mr. Jacek Kliczek (BAKS)

Test directed by: Mr. Štefan Rástocký  
Test carried out by: Mr. Miroslav Hudák  
Operator: Mr. Ján Hurajt

## 2. MEASURING EQUIPMENT

Identification number	Measuring equipment	Note
F 90 002	Horizontal test furnace for fire testing	-
F 69 005	PLC system for data acquisition and control TECOMAT NS 950	-
F 40 008	Software Control Web 2000	
F 40 009	Control and communication software to PLC TECOMAT NS 950	
F 40 010	Visual and calculating software to PLC TECOMAT NS 950	-
F 40 011	Driver Tecomat – CW 2000 (software)	-
F 71 008, F 71 009	Transducer of differential pressure (from -50 to +150) Pa	pressure inside the test furnace
F 06 501, F 06 502, F 06 503, F 06 504 F 06 505, F 06 506, F 06 507, F 06 508	Plate thermometers	temperature inside the test furnace, according to EN 1363-1 a DIN 4102-2
F 06 701	Sheathed thermocouple type K $\phi$ 3 mm	ambient temperature
F 69 009	PLC system for data acquisition and climate control TECOMAT TC 604	climatic conditions
F 60 001 – F 60 009	Temperature and relative air humidity sensors	climatic conditions
F 54 057	Racking meter	-
F 57 007	Digital stop-watch	-
F 96 015	Test signal panel	-

## 3. PREPARATION OF THE SPECIMEN

Testing laboratory didn't take off individual components of the specimen. Components take-off and its delivering to the testing laboratory were carried out by the test sponsor. Assembling of the supporting system into the test furnace was carried out by workers of company BAKS according to requirements of the sponsor. Mounting of cables and weights into the supporting system was carried out by workers businesses BAKS and TECHNOKABEL.

## 4. PREPARATION OF THE TEST

### 4.1 DESCRIPTION OF THE SPECIMEN STRUCTURE

Test specimen comprised from power and communication non-halogen cables and supporting systems BAKS with accessories – cable trays, cable ladders, basket cable trays, ceiling ledges SDOC with clips UKO1, clips UEF, UDF and sleeves OZO, OZMO.

Cables:	(N)HXH 4x1,5 RE FE180 PH30/E30-E60	( 2 x )
	(N)HXH 4x50 RM FE180 PH30/E30-E60	( 12 x )
	(N)HXCH 4x1,5/1,5 RE FE180 PH30/E30-E60	( 4 x )
	(N)HXCH 4x50/25 RM FE180 PH30/E30-E60	( 8 x )
	(N)HXH 4x1,5 RE FE180 PH90/E90	( 18 x )
	(N)HXH 4x50 RM FE180 PH90/E90	( 8 x )
	(N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	( 14 x )
	(N)HXCH 4x50/25 RM FE180 PH90/E90	( 6 x )
	HTKSH 1x2x0,8 FE180 PH90/E30-E90	( 12 x )
	HTKSHekw 1x2x0,8 FE180 PH90/E30-E90	( 8 x )
	JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	( 22 x )

Ceiling installation: was made by ceiling ledges (type SDOC 600), sleeves OZO, OZMO and cable clips (type UEF, UDF). Ceiling ledges were fixed to ceiling by three dowels (type PRSO M8x75) in spacing of 600 mm. Cables were fixed to ledges by clips (type UKO1) in spacing of 600 mm. Sleeves OZO, OZMO and cable clips (type UEF, UDF) depending on the diameter of cable were fixed to ceiling by dowels (type SRO M6x30) in spacing of 600 mm.

Suspension track No. 1: was made of three consoles combined of two horizontal supports (type CWOP40H40/05 rustless) and two threaded bar M8x600 (rustless) with washers and nuts M8 and two hangers (type USOV rustless) which were fixed to ceiling by dowels (type PRSO M10x80) in spacing of 1200 mm. Basket cable trays (type KDSO400H60 rustless) were fixed to horizontal supports. Load-bearing system was loaded with 20 kg/m.

Suspension track No. 2: was made of three consoles combined of horizontal support (type CWOP40H40/05) and two threaded bar M8x500 with washers and nuts M8 which were fixed to ceiling by dowels (type TRSO M8) in spacing of 1200 mm. Basket cable trays (type KDSO400H60) were fixed to horizontal supports. Load-bearing system was loaded with 20 kg/m.

Suspension track No. 3A: was made of four consoles (type WKS060 rustless) and four threaded bar M6x500 (rustless) with washers and nuts M6 which were fixed to ceiling by dowels (type TRSO M6) in spacing of 1200 mm. Basket cable trays (type KDSO60H60 rustless) were fixed to consoles. Load-bearing system was loaded with 1,5 kg/m.

Suspension track No. 3B: was made of four consoles (type WKS060 ) and four threaded bar M6x500 with washers and nuts M6 which were fixed to ceiling by dowels (type TRSO M6) in spacing of 1200 mm. Basket cable trays (type KDSO60H60) were fixed to consoles.

Suspension track No. 4: was made of three consoles combined of two horizontal supports (type CWOP40H40/05 rustless) and two threaded bar M8x600 (rustless) with washers and nuts M8 and two hangers (type USOV rustless) which were fixed to ceiling by dowels (type PRSO M10x80) in spacing of 1500 mm. Cable trays (type KCOJ400H60 rustless) and ladders (type DGOP 400H60/3 rustless) were fixed to horizontal supports. Trays were loaded with 10 kg/m and ladders were loaded with 20 kg/m.

Suspension track No. 5: was made by three hangers (type WPCO 800) which were fixed to ceiling by four dowels (type PSRO M10x80) in spacing of 1500 mm. Two booms (type WMCO 400) were fixed by screws (type SM M10 x 20) at each hanger. Holders (type UPWO) were fixed at the end of booms. Booms were fixed through these holders by threaded bar M10 with washers and nuts M10 to ceiling holder (type USOV) which was fixed to ceiling by dowel (type PSRO M10x80).

Trays (type **KCOP** 400H60/3) were fixed at upper booms and jointed together by two junctions (type LPOPH60N) and by sheet (type BLO400N) with screws M6 (type SGN M6x12). Trays were fixed to booms by screws M6 (type SGN M6x12).

Ladders (type **DGOP** 400H60N) were fixed at bottom booms and jointed together by junction (type LDOCH60N) with screws M8 (type SGN M8x14). Ladders were fixed to booms by clips (type ZMO) with screws M8 (type SGN M8x14). Trays were loaded with 10 kg/m and ladders were loaded with 20 kg/m.

Types of individual components are from catalogue BAKS 8/2006.

Cable penetration through the wall of test furnace was sealed by mineral wool Rockwool. Loading with steel chain were used as the equivalent load.

More detailed information about specimen construction is shown in the drawings which form the appendix of this test report. Drawings were delivered by the sponsor of the test.

All the information about technical specifications of used materials and semi-products, information about their type sign and their producers were delivered by sponsor. This information was not subject of the specimen inspection. Parameters which were checked are quoted in paragraph 4.3 SPECIMEN INSPECTION.

#### 4.2 DESCRIPTION OF THE SPECIMEN FIXATION

The test specimen was fixed on the ceiling of the test furnace which was created from concrete panels made of common shocked concrete of class B 20, 150 mm thick.

The type of specimen fixation into the test furnace is visible in drawing documentation and it was selected by the sponsor.

#### 4.3 SPECIMEN INSPECTION

Before and after the fire testing, conformity of the test specimen with drawing was checked. The specimen corresponded to the drawing which create appendix of this report.

Specimen inspection consisted of visual review of the test specimen as well as size verification (number and cross sections of conductors, thickness, measurements of cables and trays).

#### 4.4 CLIMATIC CONDITIONING

Test specimens were stored in the climatic hall and conditioned according to EN 1363-1 under the following climatic conditions:

Relative air humidity [%]		Ambient air temperature [°C]	
mean	standard deviation	mean	standard deviation
47,2	2,1	22,7	0,5

The equilibrium state of test specimen humidity was not determined. The test specimen did not comprise hygroscopic material.

## 5. CARRYING OUT THE TEST

### 5.1 TEST CONDITIONS

Conditions in the test furnace (temperature, pressure, content O<sub>2</sub> content) as well as conditions in the testing room (ambient temperature) corresponded to EN 1363-1 and DIN 4102-2 during the whole test. Detailed information is shown in appendices of this report or in quality records of the testing laboratory.

Values characterising environment in the testing room directly before the test:

Date of fire test	Relative air humidity [%]	Ambient air temperature [°C]
17. 01. 2008	57,1	10,7

### 5.2 TEST RESULTS

The measured values are shown in tables that form an integral part of this test report.

### 5.3 EVALUATION OF THE TEST

SPECIMENS	Time to first failure/interruption of conductor
Specimen 1: cables (N)HXCH 4x50/25 RM FE180 PH90/E90	90 minutes no failure/interruption
Specimen 2: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	90 minutes no failure/interruption
Specimen 3: cables (N)HXH 4x1,5 RE FE180 PH90/E90	90 minutes no failure/interruption
Specimen 4: cables (N)HXCH 4x50/25 RM FE180 PH30/E30-E60	55 minutes
Specimen 5: cables (N)HXH 4x50 RM FE180 PH90/E90	90 minutes no failure/interruption
Specimen 6: cables (N)HXCH 4x50/25 RM FE180 PH30/E30-E60	84 minutes
Specimen 7: cables (N)HXH 4x50 RM FE180 PH30/E30-E60	32 minutes
Specimen 8: cables (N)HXH 4x50 RM FE180 PH30/E30-E60	48 minutes
Specimen 9: cables (N)HXCH 4x1,5/1,5 RE FE180 PH30/E30-E60	90 minutes no failure/interruption
Specimen 10: cables (N)HXH 4x1,5 RE FE180 PH90/E90	90 minutes no failure/interruption
Specimen 11: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	90 minutes no failure/interruption
Specimen 12: cables (N)HXH 4x1,5 RE FE180 PH90/E90	90 minutes no failure/interruption
Specimen 13: cables (N)HXCH 4x50/25 RM FE180 PH30/E30-E60	90 minutes no failure/interruption
Specimen 14: cables (N)HXH 4x50 RM FE180 PH30/E30-E60	90 minutes no failure/interruption
Specimen 15: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	90 minutes no failure/interruption
Specimen 16: cables (N)HXH 4x1,5 RE FE180 PH90/E90	90 minutes no failure/interruption
Specimen 17: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	90 minutes no failure/interruption
Specimen 18: cables (N)HXH 4x1,5 RE FE180 PH90/E90	90 minutes no failure/interruption
Specimens 19, 20: cables (N)HXH 4x1,5 RE FE180 PH90/E90	90 minutes no failure/interruption
Specimens 21, 22: cables (N)HXH 4x50 RM FE180 PH90/E90	90 minutes no failure/interruption
Specimen 23: cable (N)HXH 4x50 RM FE180 PH30/E30-E60	31 minutes
Specimen 24: cable (N)HXH 4x50 RM FE180 PH30/E30-E60	15 minutes
Specimens 25, 26: cables (N)HXH 4x1,5 RE FE180 PH30/E30-E60	90 minutes no failure/interruption
Specimen 27: cable (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	90 minutes no failure/interruption
Specimen 28: cable (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	41 minutes
Specimen 29: cable (N)HXCH 4x50/25 RM FE180 PH90/E90	90 minutes no failure/interruption
Specimen 30: cable (N)HXCH 4x50/25 RM FE180 PH90/E90	86 minutes
Specimen 31: cables (N)HXCH 4x50/25 RM FE180 PH30/E30-E60	59 minutes
Specimen 32: cables (N)HXCH 4x1,5/1,5 RE FE180 PH30/E30-E60	25 minutes
Specimens 33, 34: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	90 minutes no failure/interruption
Specimens 35, 36: cables (N)HXH 4x50 RM FE180 PH30/E30-E60	90 minutes no failure/interruption
Specimen 37: cable (N)HXCH 4x50/25 RM FE180 PH90/E90	15 minutes
Specimen 38: cable (N)HXCH 4x50/25 RM FE180 PH90/E90	9 minutes
Specimen 39: cables (N)HXH 4x1,5 RE FE180 PH90/E90	90 minutes no failure/interruption
Specimens 40, 41: cables (N)HXH 4x50 RM FE180 PH90/E90	90 minutes no failure/interruption



<b>SPECIMENS</b>	<b>Time to first failure/interruption of conductor</b>
Specimens 42, 43: cables (N)HXH 4x1,5 RE FE180 PH90/E90	<b>90 minutes no failure/interruption</b>
Specimens 44, 45: cables (N)HXH 4x50 RM FE180 PH90/E90	<b>90 minutes no failure/interruption</b>
Specimens 46, 47: cables (N)HXH 4x1,5 RE FE180 PH90/E90	<b>90 minutes no failure/interruption</b>
Specimen 48: cable (N)HXH 4x50 RM FE180 PH30/E30-E60	<b>49 minutes</b>
Specimen 49: cable (N)HXH 4x50 RM FE180 PH30/E30-E60	<b>52 minutes</b>
Specimens 50, 51: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	<b>90 minutes no failure/interruption</b>
Specimens 52A,B: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>90 minutes no failure/interruption</b>
Specimen 53A: cable HTKSHekw 1x2x0,8 FE180 PH90/E30-E90	<b>27 minutes</b>
Specimen 53B: cable HTKSHekw 1x2x0,8 FE180 PH90/E30-E90	<b>25 minutes</b>
Specimens 54A,B: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>90 minutes no failure/interruption</b>
Specimen 55A: cable HTKSHekw 1x2x0,8 FE180 PH90/E30-E90	<b>81 minutes</b>
Specimen 55B: cable HTKSHekw 1x2x0,8 FE180 PH90/E30-E90	<b>60 minutes</b>
Specimens 56A,B: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90	<b>90 minutes no failure/interruption</b>
Specimen 57A: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>90 minutes no failure/interruption</b>
Specimen 57B: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>76 minutes</b>
Specimens 58A,B: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90	<b>90 minutes no failure/interruption</b>
Specimen 59A: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>76 minutes</b>
Specimen 59B: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>79 minutes</b>
Specimen 60A: cable HTKSHekw 1x2x0,8 FE180 PH90/E30-E90	<b>75 minutes</b>
Specimen 60B: cable HTKSHekw 1x2x0,8 FE180 PH90/E30-E90	<b>90 minutes no failure/interruption</b>
Specimens 61A,B: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90	<b>90 minutes no failure/interruption</b>
Specimen 62A: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>71 minutes</b>
Specimen 62B: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>57 minutes</b>
Specimen 63A: cable HTKSHekw 1x2x0,8 FE180 PH90/E30-E90	<b>9 minutes</b>
Specimen 63B: cable HTKSHekw 1x2x0,8 FE180 PH90/E30-E90	<b>74 minutes</b>
Specimen 64A: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>85 minutes</b>
Specimen 64B: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>83 minutes</b>
Specimen 65A: cable HTKSH 1x2x0,8 FE180 PH90/E30-E90	<b>26 minutes</b>
Specimen 65B: cable HTKSH 1x2x0,8 FE180 PH90/E30-E90	<b>27 minutes</b>
Specimen 66A: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>65 minutes</b>
Specimen 66B: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>80 minutes</b>
Specimens 67A,B: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90	<b>90 minutes no failure/interruption</b>
Specimen 68A: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>90 minutes no failure/interruption</b>
Specimen 68B: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>80 minutes</b>
Specimens 69A,B: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>90 minutes no failure/interruption</b>
Specimen 70A: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>33 minutes</b>
Specimen 70B: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>84 minutes</b>
Specimens 71A,B: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90	<b>90 minutes no failure/interruption</b>
Specimen 72A: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>86 minutes</b>
Specimen 72B: cable JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	<b>78 minutes</b>

The fire test was discontinued in 93<sup>rd</sup> minute at the request of sponsor.

Specimens S1 – S51 were tested by three-phase voltage supply 3 x 230/400V with bulbs 240V / 60 W.  
Specimens S52 – S72 were tested by one-phase voltage supply 1 x 110V with LED diodes 3V /0,03W.

## 6. CLOSING

- This report details the method of construction, the test conditions and results obtained when the specific element of construction described herein was following the procedure outlined in EN 1363-1 and DIN 4102 – 12:1998-11. Any significant deviation with respect to size, constructional details, loads, stresses, edges or end conditions other than those allowed under the field of direct application in the relevant test method is not covered by this report.
- Because of the nature of the fire resistance testing and consequent difficulty in quantifying the uncertainty of measurement of fire resistance, it is not possible to provide a stated degree of accuracy of the result.
- The test results refer only to the tested subjects. This test report is not an approval of the tested product by the test laboratory or the accreditation body overseeing the laboratory's activities. The test was carried out on testing equipment that is the property of FIRES Ltd. Without the written permission of the test laboratory this test report may be copied and/or distributed only as the whole. Any modifications of the test report can be made only by the fire resistance test laboratory FIRES Ltd. Batizovce.

**Report checked by:** Ing. Štefan Rástocký

**Translated by:** Ing. Marek Rusnák

**Issued by:**

**Responsible for the technical side of this report:**

Ing. Štefan Rástocký  
leader of the testing laboratory

Miroslav Hudák  
technician of the testing laboratory

## 7. NORMATIVE REFERENCES

DIN 4102 – 2:1977-09	Fire behaviour of building materials and elements - requirements and testing
DIN 4102 – 12:1998-11	Fire resistance of electric cable systems required to maintain circuit integrity
STN EN 1363-1:2001	Fire resistance tests – Part 1: General requirements

## 8. LIST OF APPENDICES

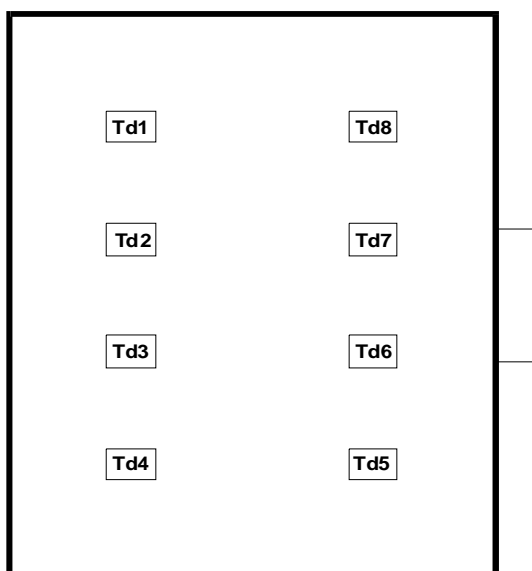
Appendix 1	Measured values inside the test furnace
Appendix 2	Measured values inside the test furnace / graph
Appendix 3	Measured times of tested specimens from S1 to S8
Appendix 4	Measured times of tested specimens from S9 to S16
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**Measured values inside the test furnace**

Time t [min]	Temperature [°C]											Deviation d <sub>e</sub> [%]	Pressure p [Pa]
	Td1	Td2	Td3	Td4	Td5	Td6	Td7	Td8	Tave	Tn	To		
0	31,7	50,5	25,0	26,5	48,2	40,6	34,2	38,9	37,0	20,0	10,5	0,0	0,0
5	643,7	648,7	530,4	499,3	673,4	662,0	527,1	550,5	591,9	576,2	13,4	-11,7	14,9
10	747,4	742,7	621,8	605,8	767,5	773,4	597,5	650,6	688,3	678,3	12,2	-3,9	15,8
15	730,3	797,0	663,3	665,6	752,8	829,0	665,9	737,6	730,2	738,5	11,7	-2,5	14,3
20	775,5	855,6	721,0	729,4	783,4	878,0	736,0	805,1	785,5	781,3	11,7	-1,8	17,2
25	777,2	877,2	780,2	818,5	817,1	891,0	782,8	865,3	826,2	814,6	11,7	-1,1	14,1
30	794,6	843,7	802,7	814,7	817,2	861,3	811,2	839,9	823,2	841,8	11,8	-0,8	16,3
35	844,0	876,8	821,9	854,3	856,0	918,1	829,0	897,6	862,2	864,8	11,6	-1,1	15,7
40	864,3	874,9	820,8	848,3	878,3	904,0	836,0	880,4	863,4	884,7	11,7	-1,1	14,9
45	878,5	890,9	827,7	838,6	895,1	921,6	838,1	872,5	870,4	902,3	11,5	-1,4	14,1
50	890,1	912,6	861,2	877,4	905,2	952,4	865,8	914,0	897,3	918,1	11,5	-1,5	16,8
55	895,1	944,8	902,9	915,6	917,7	985,3	911,7	953,6	928,3	932,3	11,6	-1,5	15,8
60	912,2	962,1	928,1	943,5	934,4	1003,0	944,1	978,8	950,8	945,3	11,3	-1,4	16,4
65	930,9	977,5	946,3	962,5	949,5	1012,0	961,7	999,4	967,6	957,3	11,6	-1,2	13,5
70	949,5	974,6	924,7	952,2	956,5	997,1	943,4	1005,0	963,0	968,4	11,4	-1,1	14,2
75	964,4	981,8	933,6	961,0	969,6	1004,0	948,7	1013,0	972,0	978,7	11,6	-1,0	15,4
80	977,8	987,9	950,7	996,9	984,1	1013,0	962,0	1031,0	988,0	988,4	11,6	-1,0	14,5
85	991,9	1005,0	967,8	1008,0	997,0	1027,0	984,7	1042,0	1003,0	997,4	11,7	-0,9	13,4
90	1003,0	1013,0	981,9	1018,0	1009,0	1038,0	988,5	1055,0	1013,7	1005,9	11,4	-0,8	13,7
91	1004,0	1016,0	982,7	1022,0	1010,0	1042,0	989,9	1058,0	1015,9	1007,6	11,5	-0,8	15,1
92	1007,0	1016,0	983,9	1025,0	1011,0	1042,0	991,7	1060,0	1017,4	1009,2	11,4	-0,8	15,7

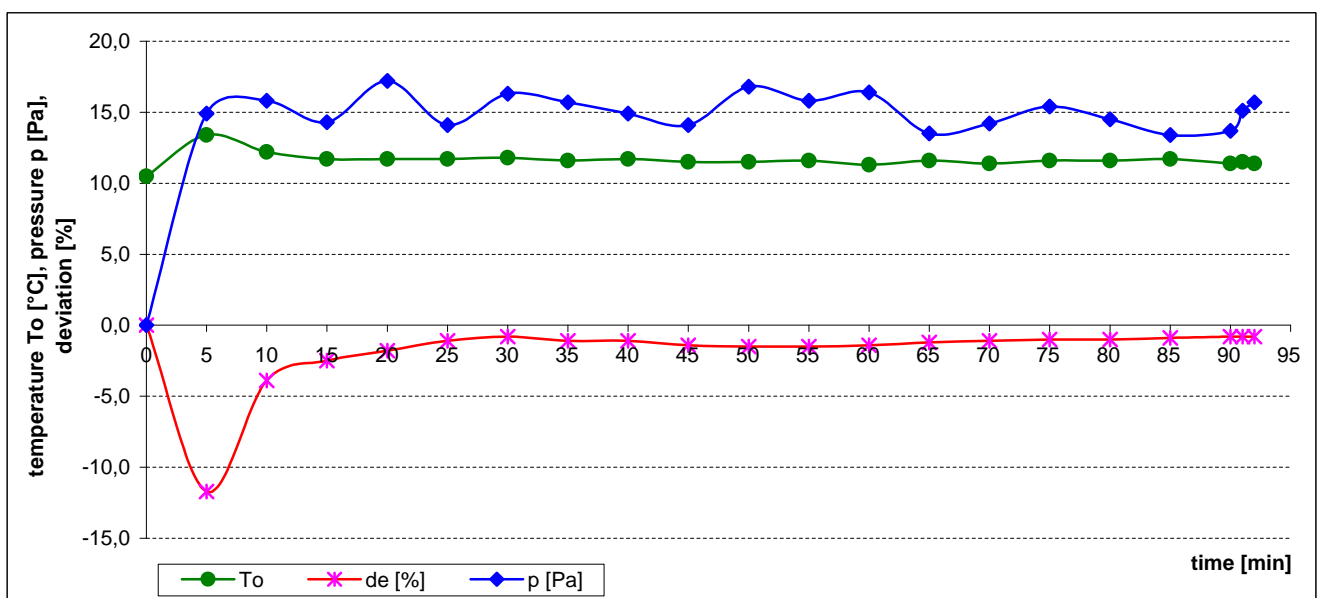
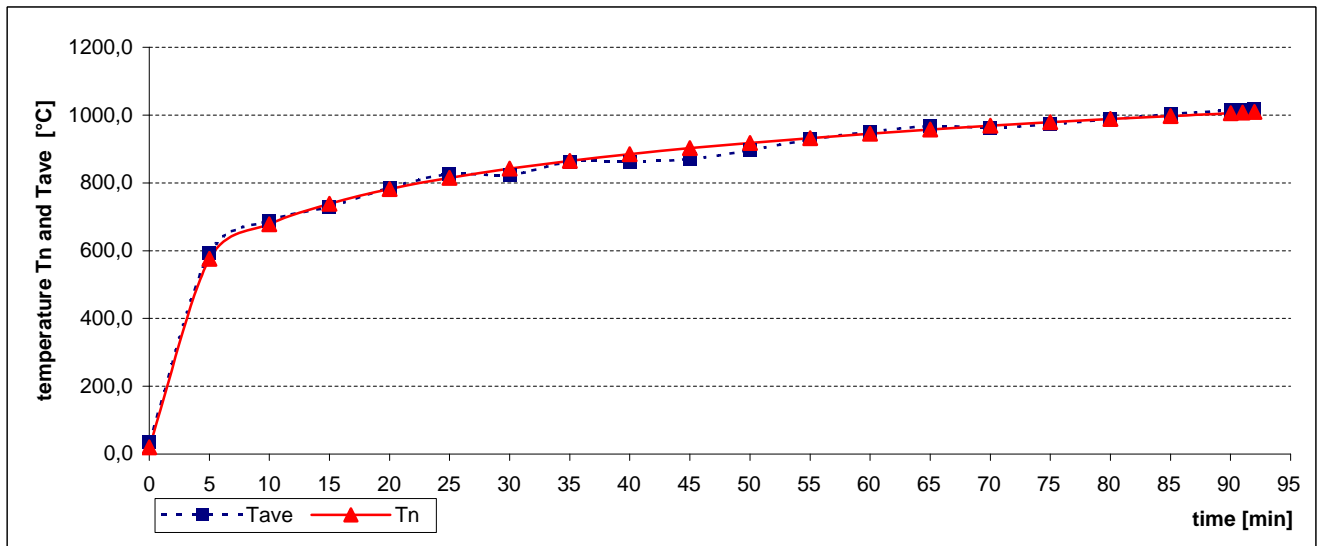
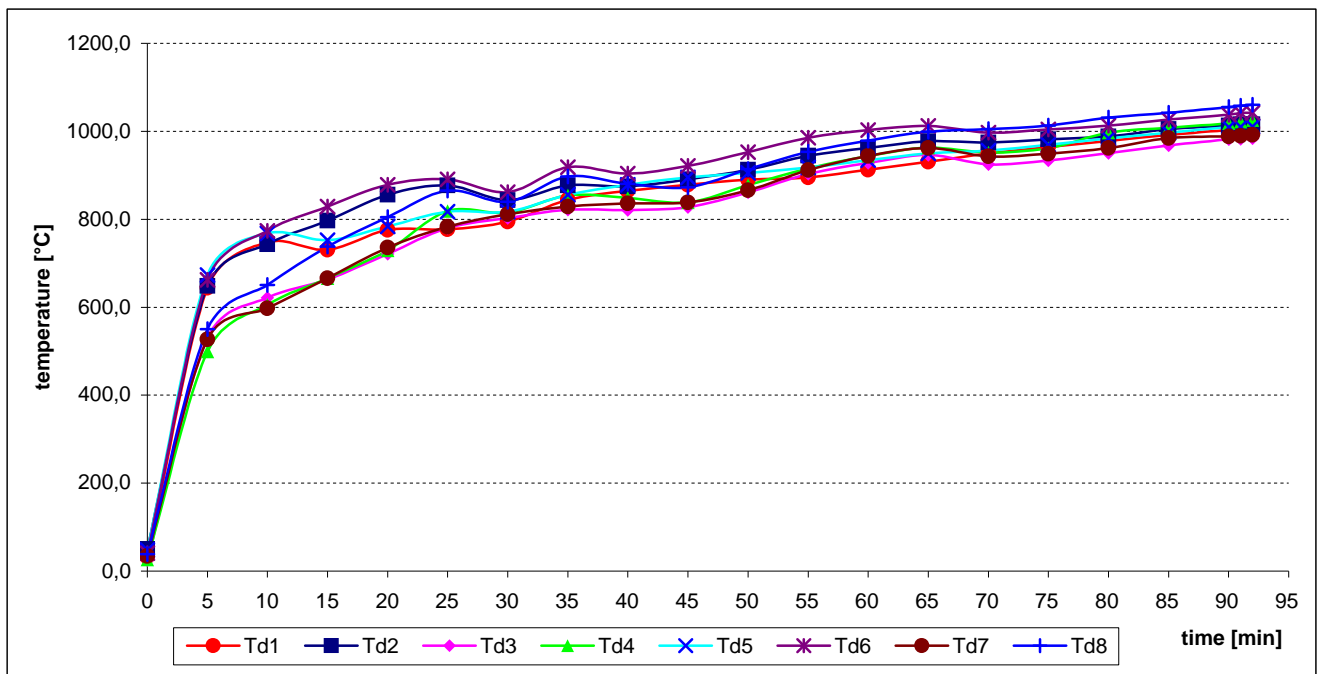
- Tave** Average temperature in the test furnace calculated from plate thermometers
- Tn** Standard temperature in the test furnace laid down to test guideline
- To** Ambient temperature
- d<sub>e</sub>** Deviation of the average temperature from the standard temperature calculated according to test guideline
- p** Pressure inside the test furnace measured under the ceiling of the test furnace

**Layout of measuring points in the test furnace:**





Measured values inside the test furnace / graph



**Measured time of tested specimens from S1 to S8**

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
S1	1-L1	no failure / interruption
	2-L2	no failure / interruption
	3-L3	no failure / interruption
	4-PEN	no failure / interruption
S2	5-L1	no failure / interruption
	6-L2	no failure / interruption
	7-L3	no failure / interruption
	8-PEN	no failure / interruption
S3	9-L1	no failure / interruption
	10-L2	no failure / interruption
	11-L3	no failure / interruption
	12-PEN	no failure / interruption
S4	13-L1	x
	14-L2	55:13
	15-L3	x
	16-PEN	x
S5	17-L1	no failure / interruption
	18-L2	no failure / interruption
	19-L3	no failure / interruption
	20-PEN	no failure / interruption
S6	21-L1	84:10
	22-L2	x
	23-L3	x
	24-PEN	x
S7	25-L1	x
	26-L2	32:29
	27-L3	32:29
	28-PEN	x
S8	29-L1	48:32
	30-L2	x
	31-L3	x
	32-PEN	x

Specimen 1: cables (N)HXCH 4x50/25 RM FE180 PH90/E90
Specimen 2: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90
Specimen 3: cables (N)HXH 4x1,5 RE FE180 PH90/E90
Specimens 4, 6: cables (N)HXCH 4x50/25 RM FE180 PH30/E30-E60
Specimen 5: cables (N)HXH 4x50 RM FE180 PH90/E90
Specimens 7, 8: cables (N)HXH 4x50 RM FE180 PH30/E30-E60

x conductor was turned off manually after permanent interruption / failure of other conductors in the cable

Power cables were tested by three-phase voltage supply 3 x 230/400V with bulbs 240V / 60 W. Circuit breakers with rating 3 A were used.

**Measured time of tested specimens from S9 to S16**

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
S9	33-L1	no failure / interruption
	34-L2	no failure / interruption
	35-L3	no failure / interruption
	36-PEN	no failure / interruption
S10	37-L1	no failure / interruption
	38-L2	no failure / interruption
	39-L3	no failure / interruption
	40-PEN	no failure / interruption
S11	41-L1	no failure / interruption
	42-L2	no failure / interruption
	43-L3	no failure / interruption
	44-PEN	no failure / interruption
S12	45-L1	no failure / interruption
	46-L2	no failure / interruption
	47-L3	no failure / interruption
	48-PEN	no failure / interruption
S13	49-L1	no failure / interruption
	50-L2	no failure / interruption
	51-L3	no failure / interruption
	52-PEN	no failure / interruption
S14	53-L1	no failure / interruption
	54-L2	no failure / interruption
	55-L3	no failure / interruption
	56-PEN	no failure / interruption
S15	57-L1	no failure / interruption
	58-L2	no failure / interruption
	59-L3	no failure / interruption
	60-PEN	no failure / interruption
S16	61-L1	no failure / interruption
	62-L2	no failure / interruption
	63-L3	no failure / interruption
	64-PEN	no failure / interruption

Specimen 9: cables (N)HXCH 4x1,5/1,5 RE FE180 PH30/E30-E60
Specimens 10, 12, 16: cables (N)HXH 4x1,5 RE FE180 PH90/E90
Specimens 11, 15: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90
Specimen 13: cables (N)HXCH 4x50/25 RM FE180 PH30/E30-E60
Specimen 14: cables (N)HXH 4x50 RM FE180 PH30/E30-E60

x conductor was turned off manually after permanent interruption / failure of other conductors in the cable

Power cables were tested by three-phase voltage supply 3 x 230/400V with bulbs 240V / 60 W. Circuit breakers with rating 3 A were used.

**Measured time of tested specimens from S17 to S24**

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
S17	65-L1	no failure / interruption
	66-L2	no failure / interruption
	67-L3	no failure / interruption
	68-PEN	no failure / interruption
S18	69-L1	no failure / interruption
	70-L2	no failure / interruption
	71-L3	no failure / interruption
	72-PEN	no failure / interruption
S19	73-L1	no failure / interruption
	74-L2	no failure / interruption
	75-L3	no failure / interruption
	76-PEN	no failure / interruption
S20	77-L1	no failure / interruption
	78-L2	no failure / interruption
	79-L3	no failure / interruption
	80-PEN	no failure / interruption
S21	81-L1	no failure / interruption
	82-L2	no failure / interruption
	83-L3	no failure / interruption
	84-PEN	no failure / interruption
S22	85-L1	no failure / interruption
	86-L2	no failure / interruption
	87-L3	no failure / interruption
	88-PEN	no failure / interruption
S23	89-L1	x
	90-L2	31:49
	91-L3	x
	92-PEN	x
S24	93-L1	x
	94-L2	15:02
	95-L3	x
	96-PEN	x

Specimen 17: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90
Specimens 18, 19, 20: cables (N)HXH 4x1,5 RE FE180 PH90/E90
Specimens 21, 22: cables (N)HXH 4x50 RM FE180 PH90/E90
Specimens 23, 24: cables (N)HXH 4x50 RM FE180 PH30/E30-E60

x conductor was turned off manually after permanent interruption / failure of other conductors in the cable

Power cables were tested by three-phase voltage supply 3 x 230/400V with bulbs 240V / 60 W. Circuit breakers with rating 3 A were used.

**Measured time of tested specimens from S25 to S32**

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
S25	97-L1	no failure / interruption
	98-L2	no failure / interruption
	99-L3	no failure / interruption
	100-PEN	no failure / interruption
S26	101-L1	no failure / interruption
	102-L2	no failure / interruption
	103-L3	no failure / interruption
	104-PEN	no failure / interruption
S27	105-L1	no failure / interruption
	106-L2	no failure / interruption
	107-L3	no failure / interruption
	108-PEN	no failure / interruption
S28	109-L1	x
	110-L2	x
	111-L3	41:32
	112-PEN	x
S29	113-L1	no failure / interruption
	114-L2	no failure / interruption
	115-	no failure / interruption
	116-PEN	no failure / interruption
S30	117-L1	x
	118-L2	86:38
	119-L3	x
	120-PEN	x
S31	121-L1	59:46
	122-L2	x
	123-L3	x
	124-PEN	x
S32	125-L1	25:03
	126-L2	x
	127-L3	x
	128-PEN	x

Specimens 25, 26: cables (N)HXH 4x1,5 RE FE180 PH30/E30-E60
Specimens 27, 28: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90
Specimens 29, 30: cables (N)HXCH 4x50/25 RM FE180 PH90/E90
Specimen 31: cables (N)HXCH 4x50/25 RM FE180 PH30/E30-E60
Specimen 32: cables (N)HXCH 4x1,5/1,5 RE FE180 PH30/E30-E60

x conductor was turned off manually after permanent interruption / failure of other conductors in the cable

Power cables were tested by three-phase voltage supply 3 x 230/400V with bulbs 240V / 60 W. Circuit breakers with rating 3 A were used.

**Measured time of tested specimens from S33 to S41**

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
S33	129-L1	no failure / interruption
	130-L2	no failure / interruption
	131-L3	no failure / interruption
	132-PEN	no failure / interruption
S34	133-L1	no failure / interruption
	134-L2	no failure / interruption
	135-L3	no failure / interruption
	136-PEN	no failure / interruption
S35	137-L1	no failure / interruption
	138-L2	no failure / interruption
	139-L3	no failure / interruption
	140-PEN	no failure / interruption
S36	141-L1	no failure / interruption
	142-L2	no failure / interruption
	143-L3	no failure / interruption
	144-PEN	no failure / interruption
S37	145-L1	x
	146-L2	15:31
	147-L3	x
	148-PEN	x
S38	149-L1	x
	150-L2	x
	151-L3	9:59
	152-PEN	x
S39	153-L1	no failure / interruption
	154-L2	no failure / interruption
	155-L3	no failure / interruption
	156-PEN	no failure / interruption
S40	157-L1	no failure / interruption
	158-L2	no failure / interruption
	159-L3	no failure / interruption
	160-PEN	no failure / interruption
S41	161-L1	no failure / interruption
	162-L2	no failure / interruption
	163-L3	no failure / interruption
	164-PEN	no failure / interruption

Specimens 33, 34: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90
Specimens 35, 36: cables (N)HXH 4x50 RM FE180 PH30/E30-E60
Specimens 37, 38: cables (N)HXCH 4x50/25 RM FE180 PH90/E90
Specimen 39: cables (N)HXH 4x1,5 RE FE180 PH90/E90
Specimens 40, 41: cables (N)HXH 4x50 RM FE180 PH90/E90

x conductor was turned off manually after permanent interruption / failure of other conductors in the cable

Power cables were tested by three-phase voltage supply 3 x 230/400V with bulbs 240V / 60 W. Circuit breakers with rating 3 A were used.



### Measured time of tested specimens from S42 to S51

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
S42	165-L1	no failure / interruption
	166-L2	no failure / interruption
	167-L3	no failure / interruption
	168-PEN	no failure / interruption
S43	169-L1	no failure / interruption
	170-L2	no failure / interruption
	171-L3	no failure / interruption
	172-PEN	no failure / interruption
S44	173-L1	no failure / interruption
	174-L2	no failure / interruption
	175-L3	no failure / interruption
	176-PEN	no failure / interruption
S45	177-L1	no failure / interruption
	178-L2	no failure / interruption
	179-L3	no failure / interruption
	180-PEN	no failure / interruption
S46	181-L1	no failure / interruption
	182-L2	no failure / interruption
	183-L3	no failure / interruption
	184-PEN	no failure / interruption
S47	185-L1	no failure / interruption
	186-L2	no failure / interruption
	187-L3	no failure / interruption
	188-PEN	no failure / interruption
S48	189-L1	49:27
	190-L2	x
	191-L3	x
	192-PEN	x
S49	193-L1	52:36
	194-L2	x
	195-L3	x
	196-PEN	x
S50	197-L1	no failure / interruption
	198-L2	no failure / interruption
	199-L3	no failure / interruption
	200-PEN	no failure / interruption
S51	201-L1	no failure / interruption
	202-L2	no failure / interruption
	203-L3	no failure / interruption
	204-PEN	no failure / interruption

Specimens 42, 43, 46, 47: cables (N)HXH 4x1,5 RE FE180 PH90/E90
Specimens 44, 45: cables (N)HXH 4x50 RM FE180 PH90/E90
Specimens 48, 49: cables (N)HXH 4x50 RM FE180 PH30/E30-E60
Specimens 50, 51: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90

**x** conductor was turned off manually after permanent interruption / failure of other conductors in the cable

Power cables were tested by three-phase voltage supply 3 x 230/400V with bulbs 240V / 60 W. Circuit breakers with rating 3 A were used.

### Measured time of tested specimens from S52 to S59

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
S52A	209-L	no failure / interruption
	210-PEN	no failure / interruption
S52B	211-L	no failure / interruption
	212-PEN	no failure / interruption
S53A	213-L	27:04
	214-PEN	x
S53B	215-L	25:19
	216-PEN	x
S54A	217-L	no failure / interruption
	218-PEN	no failure / interruption
S54B	219-L	no failure / interruption
	220-PEN	no failure / interruption
S55A	221-L	81:07
	222-PEN	x
S55B	223-L	60:11
	224-PEN	x
S56A	225-L	no failure / interruption
	226-PEN	no failure / interruption
S56B	227-L	no failure / interruption
	228-PEN	no failure / interruption
S57A	229-L	no failure / interruption
	230-PEN	no failure / interruption
S57B	231-L	76:18
	232-PEN	x
S58A	233-L	no failure / interruption
	234-PEN	no failure / interruption
S58B	235-L	no failure / interruption
	236-PEN	no failure / interruption
S59A	237-L	76:58
	238-PEN	x
S59B	239-L	79:24
	240-PEN	x

Specimens 52, 54, 57, 59: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90
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Specimens 53, 55: cables HTKSHekw 1x2x0,8 FE180 PH90/E30-E90
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Specimens 56, 58: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90
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- x conductor was turned off manually after permanent interruption / failure of other conductors in the cable

Signal cables were tested by three-phase voltage supply 1 x 110V with LED diods 3V / 0,3W.  
Circuit breakers with rating 3 A were used.

**Measured time of tested specimens from S60 to S67**

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
S60A	241-L	75:20
	242-PEN	x
S60B	243-L	no failure / interruption
	244-PEN	no failure / interruption
S61A	245-L	no failure / interruption
	246-PEN	no failure / interruption
S61B	247-L	no failure / interruption
	248-PEN	no failure / interruption
S62A	249-L	71:55
	250-PEN	x
S62B	251-L	57:24
	252-PEN	x
S63A	253-L	9:06
	254-PEN	x
S63B	255-L	74:48
	256-PEN	x
S64A	257-L	85:12
	258-PEN	x
S64B	259-L	83:44
	260-PEN	x
S65A	261-L	26:17
	262-PEN	x
S65B	263-L	27:40
	264-PEN	x
S66A	265-L	65:08
	266-PEN	x
S66B	267-L	80:58
	268-PEN	x
S67A	269-L	no failure / interruption
	270-PEN	no failure / interruption
S67B	271-L	no failure / interruption
	272-PEN	no failure / interruption

Specimens 62, 64, 66: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90
Specimens 60, 63: cables HTKSHekw 1x2x0,8 FE180 PH90/E30-E90
Specimens 61, 65, 67: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90

x conductor was turned off manually after permanent interruption / failure of other conductors in the cable

Signal cables were tested by three-phase voltage supply 1 x 110V with LED diods 3V / 0,3W. Circuit breakers with rating 3 A were used.

**Measured time of tested specimens from S68 to S72**

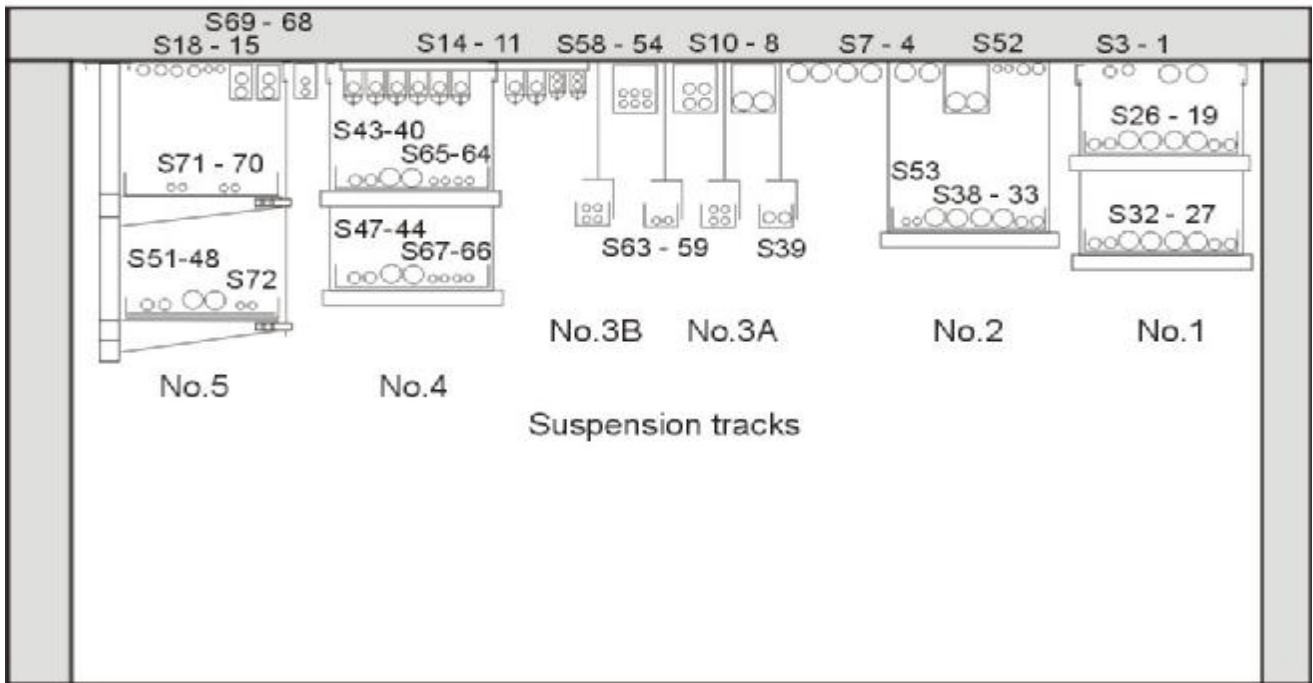
Specimen	Bulbs	Time to permanent failure / interruption [min:s]
S68A	273-L	no failure / interruption
	274-PEN	no failure / interruption
S68B	275-L	80:18
	276-PEN	x
S69A	277-L	no failure / interruption
	278-PEN	no failure / interruption
S69B	279-L	no failure / interruption
	280-PEN	no failure / interruption
S70A	281-L	33:42
	282-PEN	x
S70B	283-L	84:17
	284-PEN	x
S71A	285-L	no failure / interruption
	286-PEN	no failure / interruption
S71B	287-L	no failure / interruption
	288-PEN	no failure / interruption
S72A	289-L	86:40
	290-PEN	x
S72B	291-L	78:08
	292-PEN	x

Specimens 68, 69, 70, 72: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90
Specimens 71: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90

- x conductor was turned off manually after permanent interruption / failure of other conductors in the cable

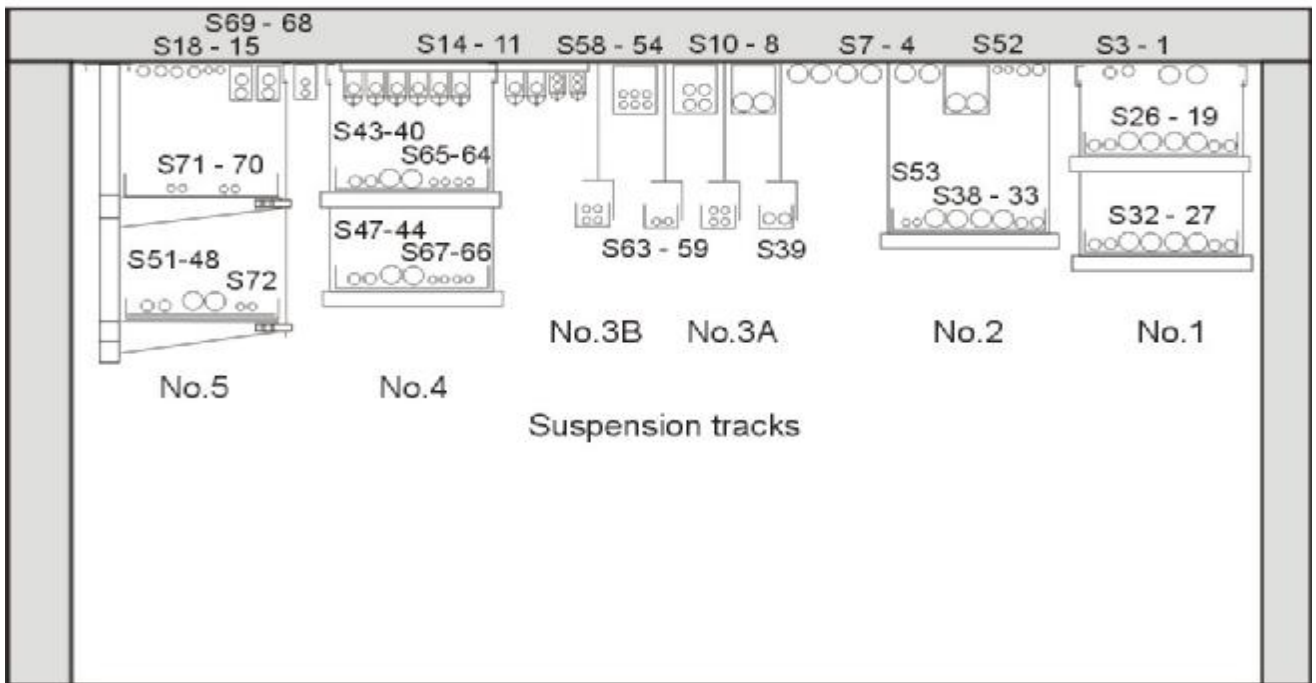
Signal cables were tested by three-phase voltage supply 1 x 110V with LED diods 3V / 0,3W. Circuit breakers with rating 3 A were used.

**Layout of cables in the test furnace**



Specimen 1: cables (N)HXCH 4x50/25 RM FE180 PH90/E90	Specimens placed in ceiling clips UDF (BAKS) in spacing of 600 mm
Specimen 2: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	
Specimen 3: cables (N)HXH 4x1,5 RE FE180 PH90/E90	
Specimen 5: cables (N)HXH 4x50 RM FE180 PH90/E90	
Specimen 6: cables (N)HXCH 4x50/25 RM FE180 PH30/E30-E60	
Specimen 7: cables (N)HXH 4x50 RM FE180 PH30/E30-E60	Specimens placed in sleeves OZO (BAKS) in spacing of 600 mm
Specimen 4: cables (N)HXCH 4x50/25 RM FE180 PH30/E30-E60	
Specimen 8: cables (N)HXH 4x50 RM FE180 PH30/E30-E60	
Specimen 9: cables (N)HXCH 4x1,5/1,5 RE FE180 PH30/E30-E60	
Specimen 10: cables (N)HXH 4x1,5 RE FE180 PH90/E90	
Specimen 11: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	Specimen placed in ceiling profile ledges with clips UKO (BAKS) in spacing of 600 mm
Specimen 12: cables (N)HXH 4x1,5 RE FE180 PH90/E90	
Specimen 13: cables (N)HXCH 4x50/25 RM FE180 PH30/E30-E60	
Specimen 14: cables (N)HXH 4x50 RM FE180 PH30/E30-E60	
Specimen 15: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	Specimens placed in sleeves OZMO (BAKS) in spacing of 600 mm
Specimen 16: cables (N)HXH 4x1,5 RE FE180 PH90/E90	
Specimen 17: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	Specimens placed in ceiling clips UEF (BAKS) in spacing of 600 mm
Specimen 18: cables (N)HXH 4x1,5 RE FE180 PH90/E90	
Specimens 19, 20: cables (N)HXH 4x1,5 RE FE180 PH90/E90	
Specimens 21, 22: cables (N)HXH 4x50 RM FE180 PH90/E90	Specimens placed in the upper basket cable tray (BAKS) Suspension track No.1
Specimens 23, 24: cables (N)HXH 4x50 RM FE180 PH30/E30-E60	
Specimens 25, 26: cables (N)HXH 4x1,5 RE FE180 PH30/E30-E60	
Specimens 27, 28: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	Specimens placed in the under basket cable tray (BAKS) Suspension track No.1
Specimens 29, 30: cables (N)HXCH 4x50/25 RM FE180 PH90/E90	
Specimen 31: cables (N)HXCH 4x50/25 RM FE180 PH30/E30-E60	
Specimen 32: cables (N)HXCH 4x1,5/1,5 RE FE180 PH30/E30-E60	
Specimens 33, 34: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	Specimens placed in the basket cable tray (BAKS) Suspension track No.2
Specimens 35, 36: cables (N)HXH 4x50 RM FE180 PH30/E30-E60	
Specimens 37, 38: cables (N)HXCH 4x50/25 RM FE180 PH90/E90	
Specimen 39: cables (N)HXH 4x1,5 RE FE180 PH90/E90	Specimens placed in the basket cable tray (BAKS) Suspension track No.3A
Specimens 40, 41: cables (N)HXH 4x50 RM FE180 PH90/E90	Specimens placed in the cable tray (BAKS) Suspension track No.4
Specimens 42, 43: cables (N)HXH 4x1,5 RE FE180 PH90/E90	
Specimens 44, 45: cables (N)HXH 4x50 RM FE180 PH90/E90	Specimens placed in the ladder (BAKS) Suspension track No.4
Specimens 46, 47: cables (N)HXH 4x1,5 RE FE180 PH90/E90	
Specimens 48, 49: cables (N)HXH 4x50 RM FE180 PH30/E30-E60	Specimens placed in the ladder (BAKS) Suspension track No.5
Specimens 50, 51: cables (N)HXCH 4x1,5/1,5 RE FE180 PH90/E90	

**Layout of cables in the test furnace**



Specimens 52: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	Specimens placed in ceiling clips UDF (BAKS) in spacing of 600 mm
Specimens 53: cables HTKSHekw 1x2x0,8 FE180 PH90/E30-E90	Specimens placed in the basket cable tray (BAKS) Suspension track No.2
Specimens 54: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	Specimens placed in sleeves OZO (BAKS) in spacing of 600 mm
Specimens 55: cables HTKSHekw 1x2x0,8 FE180 PH90/E30-E90	
Specimens 56: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90	
Specimens 57: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	
Specimens 58: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90	Specimen placed in ceiling profile ledges with clips UKO (BAKS) in spacing of 600 mm
Specimens 59: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	Specimens placed in the basket cable tray (BAKS) Suspension track No.3A
Specimens 60: cables HTKSHekw 1x2x0,8 FE180 PH90/E30-E90	
Specimens 61: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90	
Specimens 62: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	Specimens placed in the basket cable tray (BAKS) Suspension track No.3B
Specimens 63: cables HTKSHekw 1x2x0,8 FE180 PH90/E30-E90	
Specimens 64: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	Specimens placed in the cable tray (BAKS) Suspension track No.4
Specimens 65: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90	
Specimens 66: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	Specimens placed in the ladder (BAKS) Suspension track No.4
Specimens 67: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90	
Specimens 68: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	Specimens placed in sleeves OZMO (BAKS) in spacing of 600 mm
Specimens 69: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	Specimens placed in ceiling clips UEF (BAKS) in spacing of 600 mm
Specimens 70: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	Specimens placed in the cable tray (BAKS) Suspension track No.5
Specimens 71: cables HTKSH 1x2x0,8 FE180 PH90/E30-E90	
Specimens 72: cables JE-H(St)H 1x2x0,8 FE180 PH90/E30-E90	Specimens placed in the ladder (BAKS) Suspension track No.5



**Photos taken before the test**





**Photos taken after the termination of the test**

