TEST REPORT FIRES-FR-086-07-AUNE

Cables with integrity function FE180/E90
Type – NHXH, NHXCH, JE-H(St)H

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FIRES
The Experts on Fire Safety

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SNAS
Reg. No. 041/S-159

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

TEST REPORT

Test report number:	**FIRES-FR-086-07-AUNE**
Tested property:	Function in fire
Test method:	DIN 4102 – 12:1998-11
Date of issue:	**19. 06. 2007**

Name of the product:	Cables with integrity function FE180/E90 Type – NHXH, NHXCH, JE-H(St)H
Manufacturer:	**Zaklady Kablowe Bitner Celina Bitner,** Friedleina 3/3, 30-009 Kraków, Poland – producer of cables **Baks,** 05-480 Karczew, Jagodne 5, Poland – producer of construction
Sponsor:	**Zaklady Kablowe Bitner Celina Bitner,** Friedleina 3/3, 30-009 Kraków, Poland

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Task No.:	PR-07-0161
Specimen received:	21. 05. 2007
Date of the fire test:	24. 05. 2007

Technician responsible for the technical side of this report: Miroslav Hudák

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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 specimens was power and communication non-halogen cables with circuit integrity maintenance. Persons witnessing the test:

Representatives of the sponsor: Mrs. Alina Rychlik - Paradowska (Zaklady Kablowe Bitner)
Mr. Adam Cichoń (Zaklady Kablowe Bitner)
Mr. Jan Krajewski (Zaklady Kablowe Bitner)
Mr. Jacek Kliczek (BAKS)

Test directed by: Štefan Rástocký
Test carried out by: Miroslav Hudák
Operator: 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 (+50až-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 ϕ 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 54 055	Racking meter	-
F 57 005	Digital stop-watch	-
F 57 002	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 of the test sponsor.

4. PREPARATION OF THE TEST

4.1 DESCRIPTION OF THE SPECIMEN STRUCTURE

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

Cables: (N)HXH - 4x1,5 RE E90 CERAMIC (10 x)
NHXH - 4x1,5 RE E90 MICA (2 x)
NHXH - 4x50 RM E90 MICA (4 x)
(N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC (10 x)
(N)HXCH - 4x10 RE/10 E90 CERAMIC (2 x)
(N)HXCH - 4x50 RM/25 E90 CERAMIC (2 x)
JE-H(St)H - 2x2x0,8 E30 CERAMIC (4 x)
JE-H(St)H - 2x2x0,8 E90 CERAMIC (14 x)

Supporting system: suspension track and ceiling installation were used for specimen test.
Suspension track: was made by three hangers (type WPCO 600) which were fixed to ceiling by four dowels (type PSRO M10x80) in spacing of 1200 mm. Two booms (type WMCO 400) and two booms (type WMCO 300) were fixed by screws (type SM M10 x 60) 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).
Two trays (type KCOP 300H60/3) were fixed at upper booms and jointed together by two junctions (type LPOPH60N) and by sheet (type BLO N) with screws M6 (type SGN M6x12). Trays were fixed to booms by screws M6 (type SGN M6x12).
Two ladders (type DGOP 400H60/3) 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).
Ceiling installation: was made by cable clips UDF, UEF and sleeves OZO, OZMO, which were fixed to ceiling by dowels (type SRO M6x30) in spacing of 300 mm and 600 mm and by ceiling ledges (type SDOC 600) which were fixed to ceiling by three dowels (type PRSO M8x75) in spacing of 300 mm. Cables were fixed to ledges by clips (type UKO1) in spacing of 300 mm.
Types of individual components are from catalogue BAKS 8/2006.

Cable penetration through the wall of test furnace was sealed by mineral wool Rockwool.
Load capacity: bearing system was loaded with maximal tolerance according to the standard:

- trays with 10 kg/m and ladders with 20 kg/m.

Loading with steel chain was 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
53,7	3,1	23,9	1,1

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_2 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]**
24. 05. 2007	60,6	20,6

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: cable (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	**37 minutes**
Specimen 2: cable (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	**52 minutes**
Specimen 3: cable NHXH - 4x50 RM E90 MICA	**48 minutes**
Specimen 4: cable NHXH - 4x50 RM E90 MICA	**66 minutes**
Specimen 5: cable (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	**36 minutes**
Specimen 6: cable (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	**58 minutes**
Specimen 7: cable (N)HXCH - 4x10 RE/10 E90 CERAMIC	**90 minutes no failure**
Specimen 8: cable (N)HXCH - 4x10 RE/10 E90 CERAMIC	**66 minutes**
Specimen 9: cable (N)HXH - 4x1,5 RE E90 CERAMIC	**38 minutes**
Specimen 10: cable (N)HXH - 4x1,5 RE E90 CERAMIC	**61 minutes**
Specimen 11: cable (N)HXH - 4x1,5 RE E90 CERAMIC	**49 minutes**
Specimen 12: cable (N)HXH - 4x1,5 RE E90 CERAMIC	**90 minutes no failure**
Specimen 13: cable (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	**56 minutes**
Specimen 14: cable (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	**59 minutes**
Specimen 15: cable (N)HXH - 4x1,5 RE E90 CERAMIC	**23 minutes**
Specimen 16: cable (N)HXH - 4x1,5 RE E90 CERAMIC	**35 minutes**
Specimens 17,18: cables NHXH - 4x50 RM E90 MICA	**90 minutes no failure**
Specimen 19: cable (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	**42 minutes**
Specimen 20: cable (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	**45 minutes**
Specimen 21: cable (N)HXH - 4x1,5 RE E90 CERAMIC	**49 minutes**
Specimen 22: cable (N)HXH - 4x1,5 RE E90 CERAMIC	**53 minutes**
Specimens 23,24: cables NHXH - 4x1,5 RE E90 MICA	**90 minutes no failure**
Specimens 25,26: cables (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	**90 minutes no failure**
Specimen 27: cable (N)HXH - 4x1,5 RE E90 CERAMIC	**54 minutes**
Specimen 28: cable (N)HXH - 4x1,5 RE E90 CERAMIC	**50 minutes**
Specimens 29,30: cables (N)HXCH - 4x50 RM/25 E90 CERAMIC	**90 minutes no failure**
Specimen 52: cable JE-H(St)H - 2x2x0,8 E90 CERAMIC	**68 minutes**
Specimen 53: cable JE-H(St)H - 2x2x0,8 E90 CERAMIC	**63 minutes**
Specimen 55: cable JE-H(St)H - 2x2x0,8 E90 CERAMIC	**42 minutes**
Specimen 56: cable JE-H(St)H - 2x2x0,8 E90 CERAMIC	**89 minutes**
Specimens 57,58: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC	**90 minutes no failure**
Specimen 59: cable JE-H(St)H - 2x2x0,8 E30 CERAMIC	**90 minutes no failure**
Specimen 60: cable JE-H(St)H - 2x2x0,8 E30 CERAMIC	**57 minutes**
Specimens 61,62: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC	**90 minutes no failure**
Specimen 63: cable JE-H(St)H - 2x2x0,8 E90 CERAMIC	**90 minutes no failure**
Specimen 64: cable JE-H(St)H - 2x2x0,8 E90 CERAMIC	**67 minutes**
Specimens 65,66: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC	**90 minutes no failure**
Specimen 67: cable JE-H(St)H - 2x2x0,8 E30 CERAMIC	**65 minutes**
Specimen 68: cable JE-H(St)H - 2x2x0,8 E30 CERAMIC	**76 minutes**
Specimens 69,70: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC	**90 minutes no failure**

The fire test was discontinued in 92nd minute at the request of sponsor.

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: 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 behavior 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

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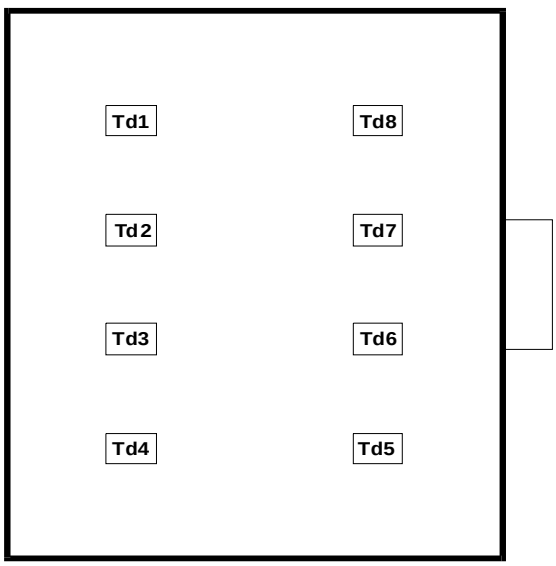
Measured values inside the test furnace

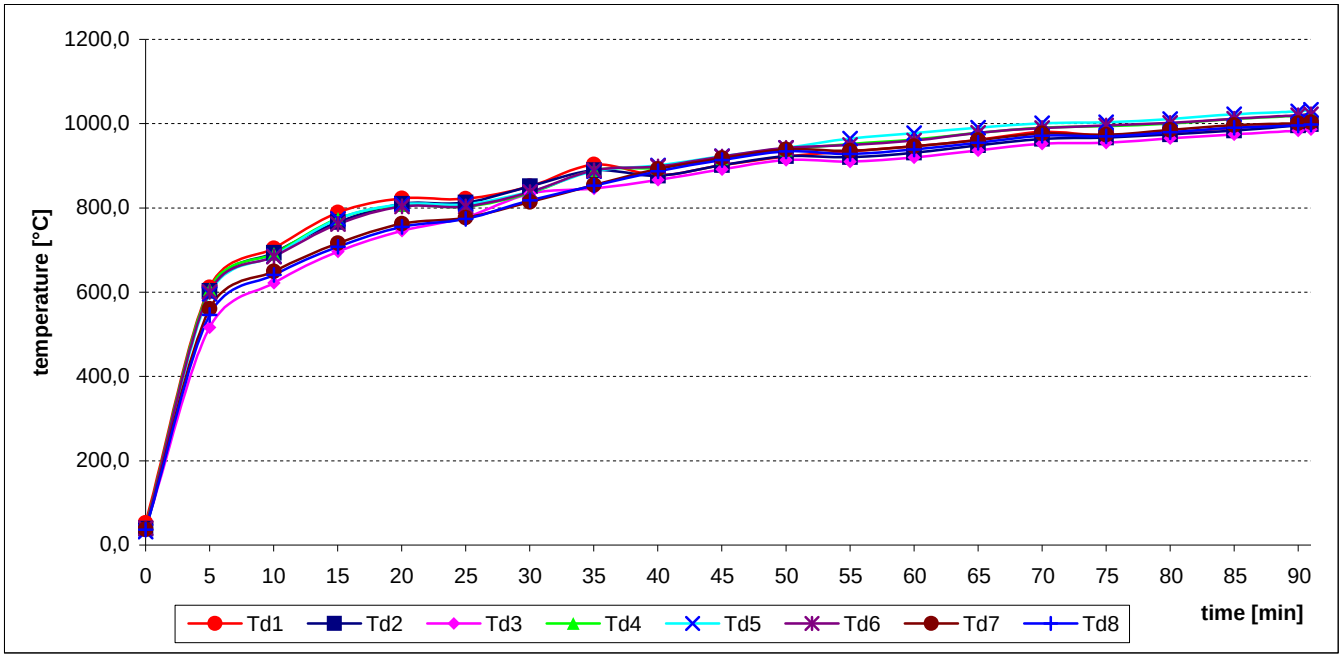
Time	Temperature [°C]											Deviation	Pressure
t [min]	Td1	Td2	Td3	Td4	Td5	Td6	Td7	Td8	Tave	Tn	To	d_e [%]	p [Pa]
0	52,1	39,0	39,7	41,5	31,8	40,4	37,5	36,1	39,8	20,0	24,1	0,0	-0,1
5	611,4	602,9	516,8	606,9	596,0	600,7	560,5	546,0	580,2	576,4	24,9	-7,9	9,4
10	703,9	693,5	622,1	691,0	686,2	684,0	649,2	641,2	671,4	678,4	25,8	-3,6	7,4
15	788,9	766,3	696,3	774,6	774,2	762,0	716,0	707,7	748,3	738,6	26,5	-2,0	10,5
20	822,5	809,5	746,1	806,6	809,0	803,2	762,4	755,3	789,3	781,4	26,6	-1,0	15,1
25	821,4	812,4	778,0	803,0	808,5	803,4	777,2	773,8	797,2	814,6	26,7	-1,1	10,9
30	851,6	851,1	834,2	835,8	838,3	837,9	814,1	817,8	835,1	841,8	27,0	-1,3	9,6
35	903,4	889,7	846,4	889,0	886,9	889,1	854,6	853,1	876,5	864,8	26,3	-1,2	11,5
40	878,3	876,1	866,4	895,7	901,0	898,4	892,2	887,0	886,9	884,7	26,2	-1,0	13,4
45	901,8	901,3	892,0	917,5	922,5	922,3	918,1	913,3	911,1	902,3	25,8	-0,8	10,5
50	922,0	923,0	913,4	937,8	942,6	942,5	938,7	933,8	931,7	918,1	26,5	-0,6	12,5
55	933,9	920,4	909,8	951,4	964,5	949,7	935,6	928,2	936,7	932,3	26,0	-0,4	10,0
60	946,0	931,3	920,1	962,4	977,3	959,7	946,0	938,6	947,7	945,3	25,3	-0,3	12,1
65	961,4	948,4	936,5	978,6	990,1	978,0	961,1	954,5	963,6	957,3	25,9	-0,2	11,2
70	980,2	963,8	952,3	990,3	1001,0	989,6	976,5	971,1	978,1	968,4	25,3	-0,1	11,5
75	972,3	967,2	954,9	994,1	1003,0	995,6	973,7	969,6	978,9	978,7	24,9	-0,1	10,2
80	979,3	974,2	965,1	1000,0	1011,0	1002,0	985,0	979,9	987,2	988,4	24,7	-0,1	10,1
85	989,9	983,8	974,3	1011,0	1022,0	1012,0	996,4	990,2	997,6	997,4	24,4	-0,1	10,6
90	999,3	995,8	983,6	1019,0	1029,0	1020,0	1001,0	995,6	1005,6	1005,9	24,0	-0,1	11,6
91	1001,0	998,4	986,4	1023,0	1033,0	1022,0	1003,0	997,9	1008,4	1007,6	24,2	-0,1	11,0

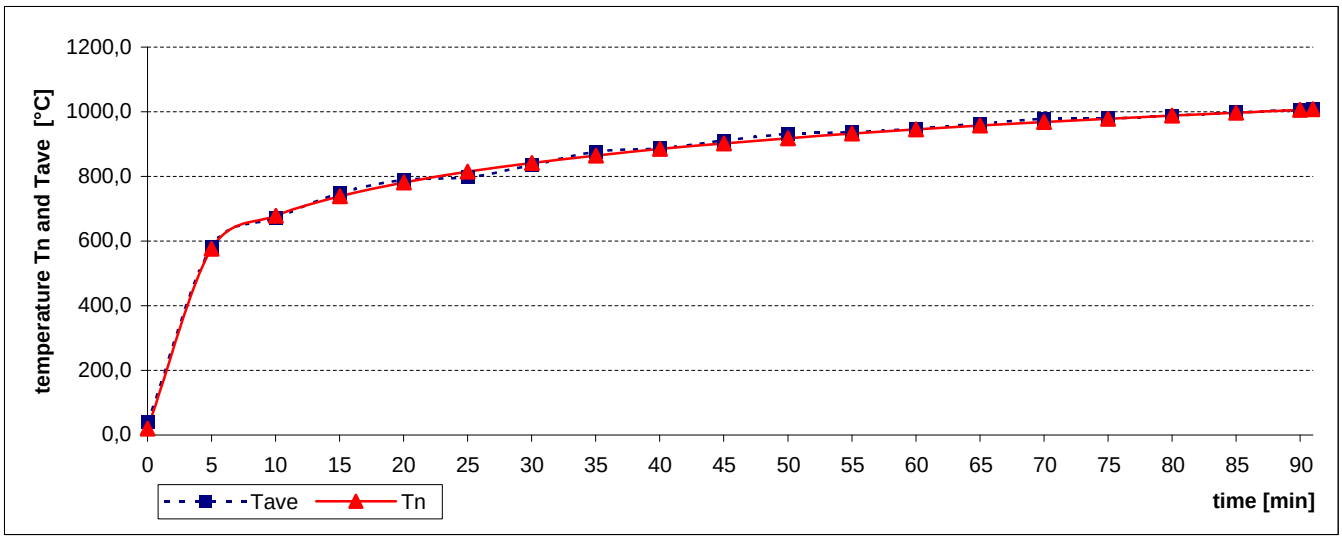
Tave Average temperature in the test furnace calculated from plate thermometers
Tn Standard temperature in the test furnace laid down to test guideline
To Ambient temperature
d_e Deviation of the average temperature from the standard temperature calculated according to test guideline
p Pressure inside the test furnace measured under the ceiling of the test furnace

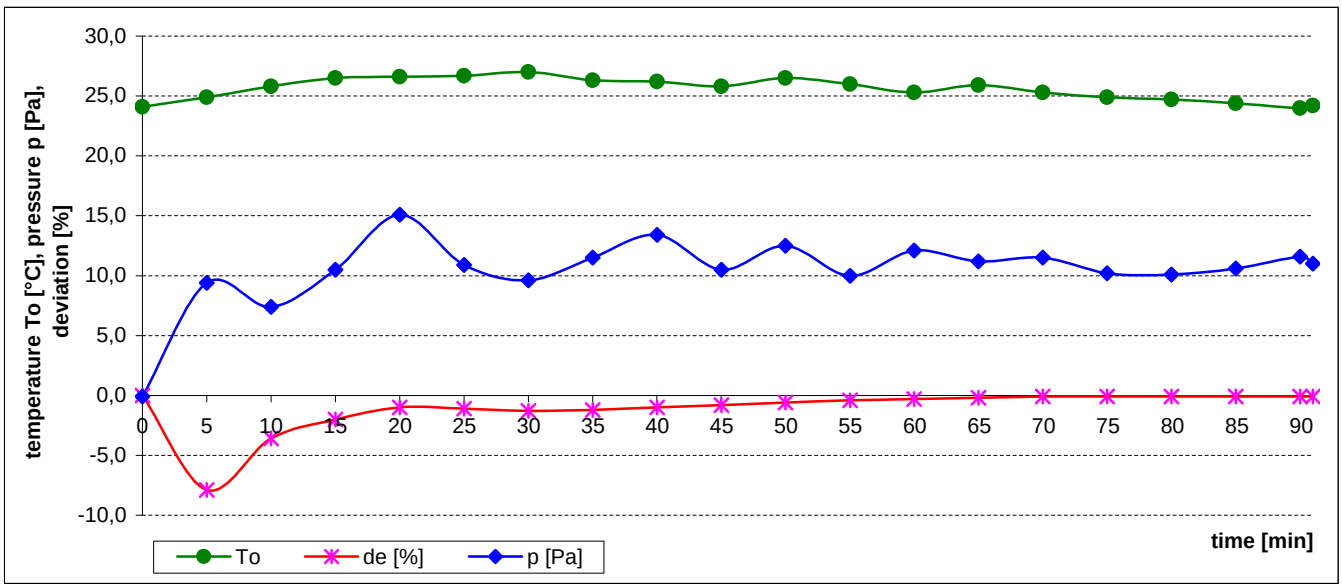
Layout of measuring points in the test furnace:



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	37:29
	2-L2	37:29
	3-L3	x
	4-PEN	x
S2	5-L1	52:41
	6-L2	52:41
	7-L3	52:41
	8-PEN	52:41
S3	9-L1	48:57
	10-L2	48:57
	11-L3	x
	12-PEN	x
S4	13-L1	x
	14-L2	66:25
	15-L3	66:25
	16-PEN	x
S5	17-L1	x
	18-L2	36:23
	19-L3	36:23
	20-PEN	x
S6	21-L1	58:58
	22-L2	x
	23-L3	58:58
	24-PEN	x
S7	25-L1	no failure
	26-L2	no failure
	27-L3	no failure
	28-PEN	no failure
S8	29-L1	x
	30-L2	x
	31-L3	66:08
	32-PEN	x

Specimens 1,2: cables (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC
Specimens 3,4: cables NHXH - 4x50 RM E90 MICA
Specimens 5.6: cables (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC
Specimens 7,8: cables (N)HXCH - 4x10 RE/10 E90 CERAMIC

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	38:01
	34-L2	38:01
	35-L3	x
	36-PEN	x
S10	37-L1	61:44
	38-L2	61:44
	39-L3	x
	40-PEN	x
S11	41-L1	49:18
	42-L2	49:18
	43-L3	49:18
	44-PEN	49:18
S12	45-L1	no failure
	46-L2	no failure
	47-L3	no failure
	48-PEN	no failure
S13	49-L1	x
	50-L2	x
	51-L3	56:29
	52-PEN	x
S14	53-L1	59:28
	54-L2	59:28
	55-L3	59:28
	56-PEN	59:28
S15	57-L1	x
	58-L2	x
	59-L3	23:56
	60-PEN	x
S16	61-L1	35:54
	62-L2	x
	63-L3	35:54
	64-PEN	35:54

Specimens 9,10: cables (N)HXH - 4x1,5 RE E90 CERAMIC
Specimens 11,12: cables (N)HXH - 4x1,5 RE E90 CERAMIC
Specimens 13,14: cables (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC
Specimens 15,16: cables (N)HXH - 4x1,5 RE E90 CERAMIC

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
	66-L2	no failure
	67-L3	no failure
	68-PEN	no failure
S18	69-L1	no failure
	70-L2	no failure
	71-L3	no failure
	72-PEN	no failure
S19	73-L1	42:28
	74-L2	42:28
	75-L3	42:28
	76-PEN	42:28
S20	77-L1	45:41
	78-L2	x
	79-L3	45:41
	80-PEN	x
S21	81-L1	49:43
	82-L2	x
	83-L3	x
	84-PEN	x
S22	85-L1	53:26
	86-L2	no failure
	87-L3	53:26
	88-PEN	53:26
S23	89-L1	no failure
	90-L2	no failure
	91-L3	no failure
	92-PEN	no failure
S24	93-L1	no failure
	94-L2	no failure
	95-L3	no failure
	96-PEN	no failure

Specimens 17,18: cables NHXH - 4x50 RM E90 MICA
Specimens 19,20: cables (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC
Specimens 21,22: cables (N)HXH - 4x1,5 RE E90 CERAMIC
Specimens 23,24: cables NHXH - 4x1,5 RE E90 MICA

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 S30

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
S25	97-L1	no failure
	98-L2	no failure
	99-L3	no failure
	100-PEN	no failure
S26	101-L1	no failure
	102-L2	no failure
	103-L3	no failure
	104-PEN	no failure
S27	105-L1	54:00
	106-L2	x
	107-L3	54:00
	108-PEN	x
S28	109-L1	50:09
	110-L2	50:09
	111-L3	x
	112-PEN	x
S29	113-L1	no failure
	114-L2	no failure
	115-	no failure
	116-PEN	no failure
S30	117-L1	no failure
	118-L2	no failure
	119-L3	no failure
	120-PEN	no failure

Specimens 25,26: cables (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC
Specimens 27,28: cables (N)HXH - 4x1,5 RE E90 CERAMIC
Specimens 29,30: cables (N)HXCH - 4x50 RM/25 E90 CERAMIC

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 S62

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
S52	209-L	68:55
	210-PEN	68:55
	211-L	x
	212-PEN	x
S53	213-L	x
	214-PEN	x
	215-L	63:05
	216-PEN	63:05
S55	221-L	x
	222-PEN	x
	223-L	42:07
	224-PEN	42:07
S56	225-L	89:56
	226-PEN	89:56
	227-L	89:56
	228-PEN	89:56
S57	229-L	no failure
	230-PEN	no failure
	231-L	no failure
	232-PEN	no failure
S58	233-L	no failure
	234-PEN	no failure
	235-L	no failure
	236-PEN	no failure
S59	237-L	no failure
	238-PEN	no failure
	239-L	no failure
	240-PEN	no failure
S60	241-L	57:54
	242-PEN	57:54
	243-L	57:54
	244-PEN	57:54
S61	245-L	no failure
	246-PEN	no failure
	247-L	no failure
	248-PEN	no failure
S62	249-L	no failure
	250-PEN	no failure
	251-L	no failure
	252-PEN	no failure

Specimens 52,53: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC
Specimens 55,56: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC
Specimens 57,58: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC
Specimens 59,60: cables JE-H(St)H - 2x2x0,8 E30 CERAMIC
Specimens 61,62: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC

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 V63 to V70

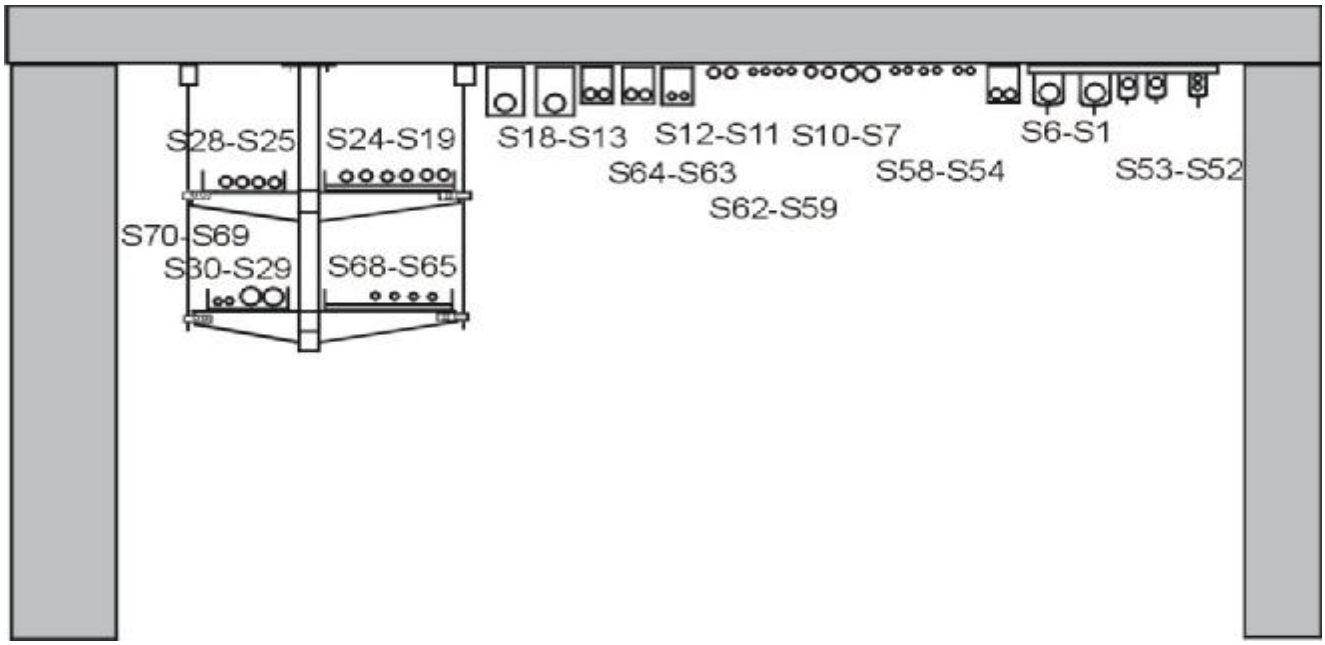
Specimen	Bulbs	Time to permanent failure / interruption [min:s]
S63	253-L	no failure
	254-PEN	no failure
	255-L	no failure
	256-PEN	no failure
S64	257-L	67:18
	258-PEN	67:18
	259-L	x
	260-PEN	x
S65	261-L	no failure
	262-PEN	no failure
	263-L	no failure
	264-PEN	no failure
S66	265-L	no failure
	266-PEN	no failure
	267-L	no failure
	268-PEN	no failure
S67	269-L	x
	270-PEN	x
	271-L	65:50
	272-PEN	65:50
S68	273-L	x
	274-PEN	x
	275-L	76:51
	276-PEN	76:51
S69	277-L	no failure
	278-PEN	no failure
	279-L	no failure
	280-PEN	no failure
S70	281-L	no failure
	282-PEN	no failure
	283-L	no failure
	284-PEN	no failure

Specimens 63,64: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC
Specimens 65,66: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC
Specimens 67,68: cables JE-H(St)H - 2x2x0,8 E30 CERAMIC
Specimens 69,70: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC

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.

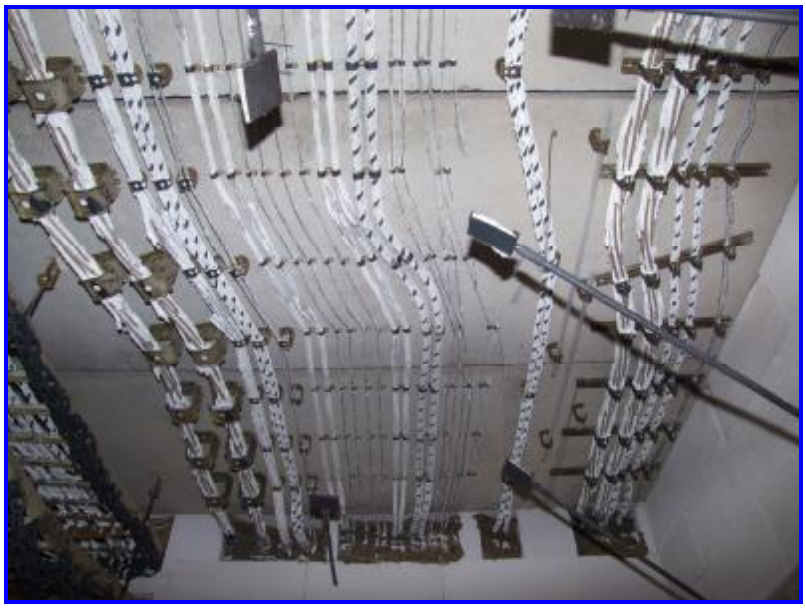
Layout of cables in the test furnace

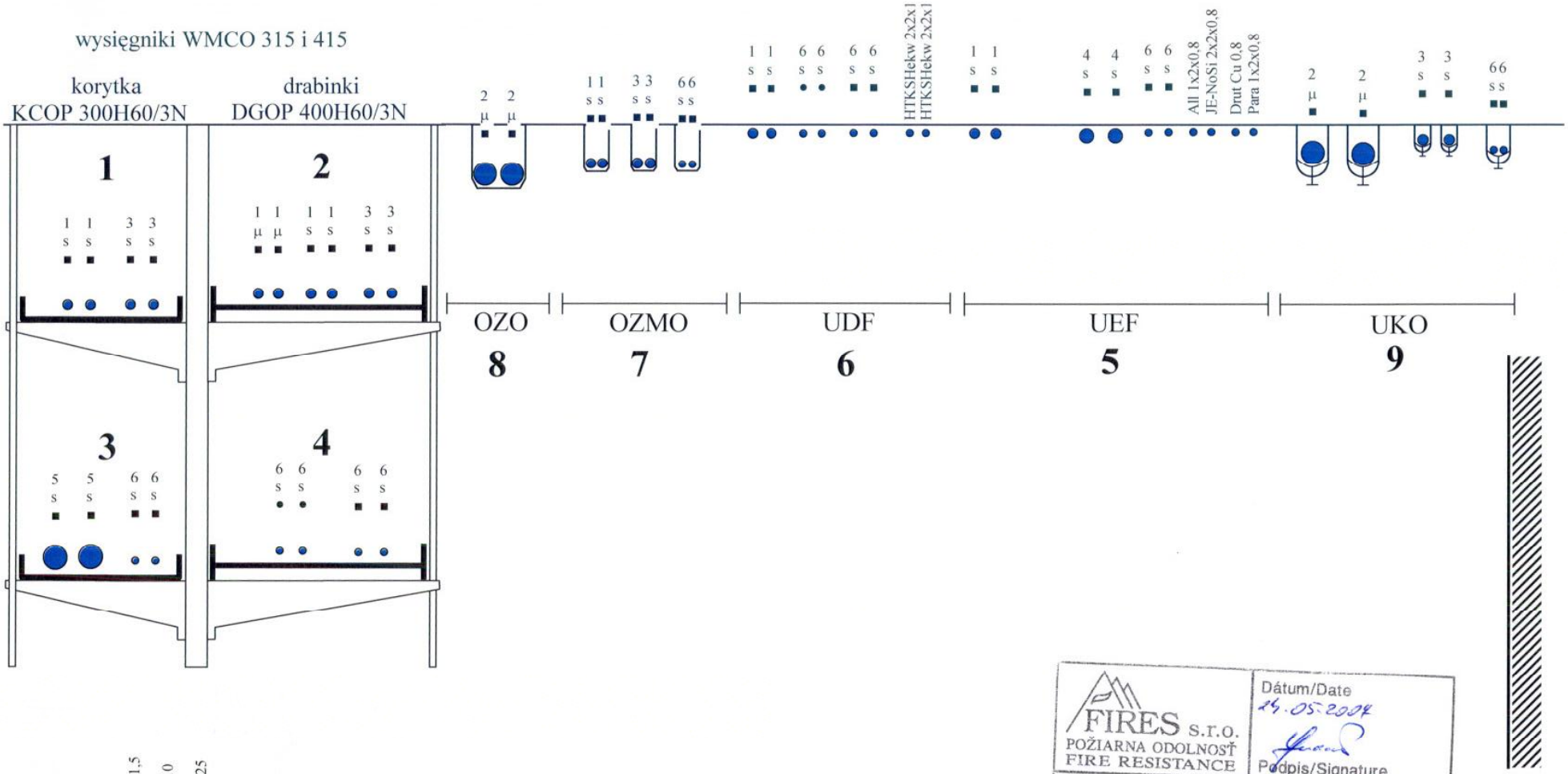


Specimens 1,2: cables (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	Specimens placed in ceiling profile ledges with clips UKO in spacing of 300 mm
Specimens 3,4: cables NHXH - 4x50 RM E90 MICA	
Specimens 5.6: cables (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	Specimens placed in ceiling clips OZMO in spacing of 600 mm
Specimens 7,8: cables (N)HXCH - 4x10 RE/10 E90 CERAMIC	Specimens placed in ceiling clips UEF in spacing of 300 mm
Specimens 9,10: cables (N)HXH - 4x1,5 RE E90 CERAMIC	
Specimens 11,12: cables (N)HXH - 4x1,5 RE E90 CERAMIC	Specimens placed in ceiling clips UDF in spacing of 300 mm
Specimens 13,14: cables (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	Specimens placed in ceiling clips OZMO in spacing of 300 mm
Specimens 15,16: cables (N)HXH - 4x1,5 RE E90 CERAMIC	
Specimens 17,18: cables NHXH - 4x50 RM E90 MICA	Specimens placed in ceiling clips OZO in spacing of 300 mm
Specimens 19,20: cables (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	Specimens placed in the upper ladder
Specimens 21,22: cables (N)HXH - 4x1,5 RE E90 CERAMIC	
Specimens 23,24: cables NHXH - 4x1,5 RE E90 MICA	
Specimens 25,26: cables (N)HXCH - 4x1,5 RE/1,5 E90 CERAMIC	Specimens placed in the upper tray
Specimens 27,28: cables (N)HXH - 4x1,5 RE E90 CERAMIC	
Specimens 29,30: cables (N)HXCH - 4x50 RM/25 E90 CERAMIC	Specimens placed in the lower tray
Specimens 52,53: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC	Specimens placed in ceiling profile ledges with clips UKO in spacing of 300 mm
Specimens 55,56: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC	Specimens placed in ceiling clips UEF in spacing of 300 mm
Specimens 57,58: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC	
Specimens 59,60: cables JE-H(St)H - 2x2x0,8 E30 CERAMIC	Specimens placed in ceiling clips UDF in spacing of 300 mm
Specimens 61,62: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC	
Specimens 63,64: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC	Specimens placed in ceiling clips OZMO in spacing of 300 mm
Specimens 65,66: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC	Specimens placed in the lower ladder
Specimens 67,68: cables JE-H(St)H - 2x2x0,8 E30 CERAMIC	
Specimens 69,70: cables JE-H(St)H - 2x2x0,8 E90 CERAMIC	Specimens placed in the lower tray

Photos taken before the test

Photos taken after the termination of the test





FIRES s.r.o.
POŽIARNA ODOLNOSŤ
FIRE RESISTANCE

Dátum/Date 24.05.2007

Podpis/Signature

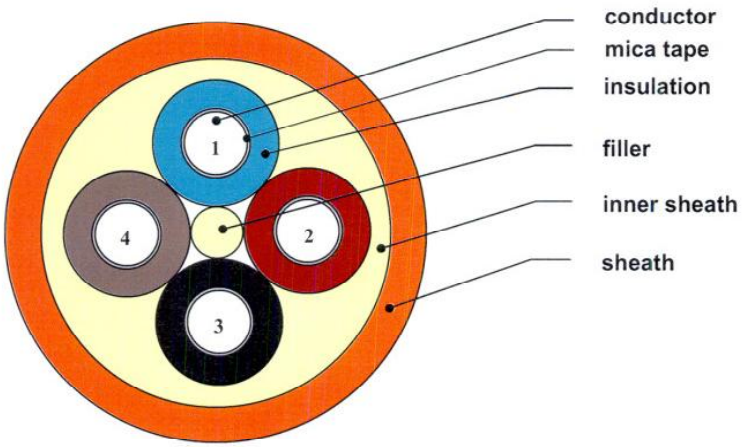
Dokument č./Document No. FIRES-PR-086-04-AUUE

Príloha č./Appendix No. 12

Rozmieszczenie próbek w piecu.
Batizovce 25.05.2007.
Badanie kabli Bitner z osprzętem Baks.

NHXH E90

FIRE RESISTANT HALOGEN FREE POWER CABLES



APPLICATIONS

Safety cables are used in all locations where a special protection against fire and fire damage is necessary for human life and equipment and where strict safety regulations have to be met and where large emergency running time is necessary. They may be used indoor and outdoor, but not directly in earth and water. They are considered as protectively insulated.

CONSTRUCTION

conductor - bare copper, solid or stranded acc. to DIN VDE 0295

insulation - mica tape and cross-linked halogen free forming polymer compound acc. to DIN VDE 0266

filler - flame resistant, halogen free polymer compound

inner sheath - flame resistant, halogen free polymer compound

sheath - flame resistant, halogen free polymer compound acc. to DIN VDE 0276-604

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Dokument č. Document No. FIRES-FR-086-04-NNE	
Príloha č./Appendix No. 13	

NHXH E90

CHARACTERISTICS

Conductor cross-section	
Number of conductors	Nominal conductor cross-section
n	mm^2
1 ÷ 4	1,5 ÷ 240
5 ÷ 7	1,5 ÷ 70
7 ÷ 10	1,5 ÷ 25
10 ÷ 24	1,5 ÷ 2,5

Operating voltage	0,6/1kV
Voltage test	4000 V, 50 Hz
Insulation resistivity at 90°C, minimum	10^{14}

Operating temperature range during operation during installation	 -30°C up to +70°C -5°C up to +50°C
Minimum bending radius	15 x D single core 12 x D multi core D = outer diameter
Cable combustibility	
Fire resistance	E90
Combustibility tests	PN-EN 50226:2006, IEC 60332-3
Reference standards	DIN VDE 0266

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POŽIARNA ODOLNOSŤ
FIRE RESISTANCE

Dátum/Date 24.05.2004
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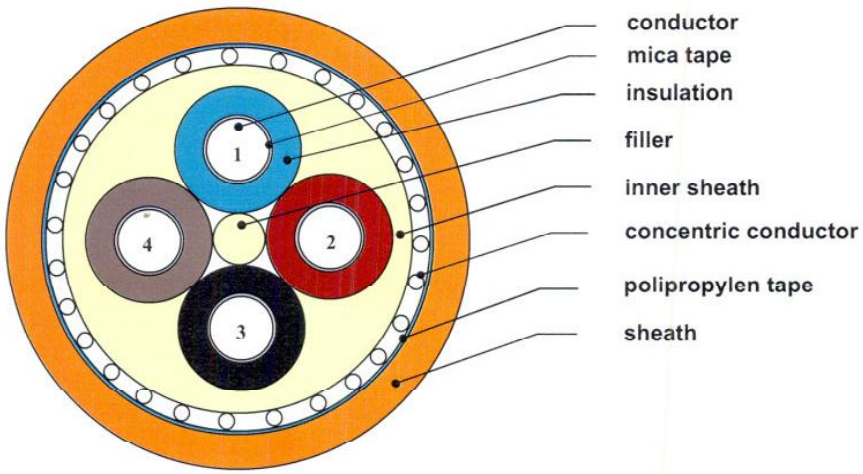
Dokument č./Document No. FIRES-FR-086-04-DOLE

Príloha č./Appendix No. 14

NHXCH E90

FIRE RESISTANT HALOGEN FREE POWER CABLES



APPLICATIONS

Safety cables are used in all locations where a special protection against fire and fire damage is necessary for human life and equipment and where strict safety regulations have to be met and where large emergency running time is necessary. They may be used indoor and outdoor, but not directly in earth and water. They are considered as protectively insulated.

CONSTRUCTION

conductor - bare copper, solid or stranded acc. to DIN VDE 0295
insulation - mica tape and cross-linked halogen free forming polymer compound acc. to DIN VDE 0266
filler - flame resistant, halogen free polymer compound
inner sheath - flame resistant, halogen free polymer compound
concentric conductor - formed by bare coper wires with counter copper tape
polipropylen tape
sheath - flame resistant, halogen free polymer compound acc. to DIN VDE 0276-604

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FIRE RESISTANCE

Dátum/Date 29.05.2008
Podpis/Signature

Dokument č./Document No. FIRES-FR-086-04-NNE

Príloha č./Appendix No. 15

NHXCH E90

CHARACTERISTICS

Conductor cross-section	
Number of conductors	Nominal conductor cross-section
n	mm^2
1 ÷ 4	1,5/1,5 ÷ 150/70
5 ÷ 7	1,5/1,5 ÷ 4/4
10 ÷ 24	1,5/2,5 ÷ 2,5/10

Operating voltage	0,6/1kV
Voltage test	4000 V, 50 Hz
Insulation resistivity at 20°C, minimum	10^{14}

Operating temperature range	
during operation	-30°C up to +70°C
during installation	-5°C up to +50°C
Minimum bending radius	15 x D single core 12 x D multi core D = outer diameter
Cable combustibility	
Fire resistance	E90
Combustibility tests	PN-EN 50226:2006, IEC 60332-3
Reference standards	DIN VDE 0266

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FIRE RESISTANCE

Dátum/Date 24. 05. 2004

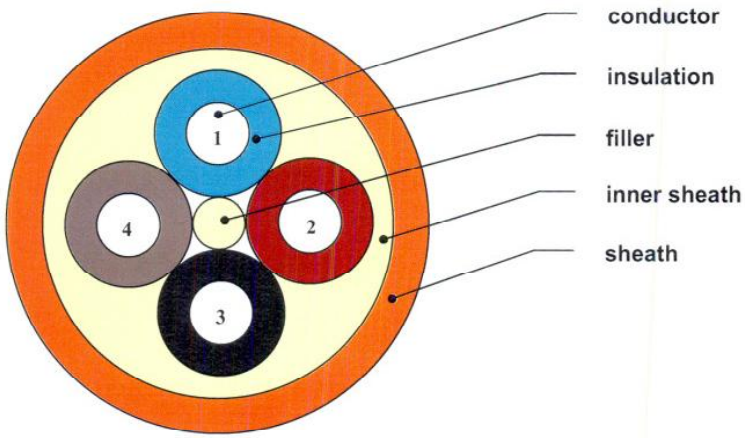
Podpis/Signature

Dokument č./Document No. FIRES-FR-086-04-ANNE

Príloha č./Appendix No. 16

(N)HXH E90

FIRE RESISTANT HALOGEN FREE POWER CABLES



APPLICATIONS

Safety cables are used in all locations where a special protection against fire and fire damage is necessary for human life and equipment and where strict safety regulations have to be met and where large emergency running time is necessary. They may be used indoor and outdoor, but not directly in earth and water. They are considered as protectively insulated.

CONSTRUCTION

conductor - bare copper, solid or stranded acc. to DIN VDE 0295

insulation - cross-linked halogen free ceramic forming polymer compound acc. to DIN VDE 0266

filler - flame resistant, halogen free polymer compound

inner sheath - flame resistant, halogen free polymer compound

sheath - flame resistant, halogen free polymer compound acc. to DIN VDE 0276-604

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FIRE RESISTANCE

Dátum/Date 29. 05. 2009

Podpis/Signature

Dokument č./Document No. FIRES-FR-086-08-AKKE

Príloha č./Appendix No. 12

(N)HXH E90

CHARACTERISTICS

Conductor cross-section	
Number of conductors	Nominal conductor cross-section
n	mm^2
1 ÷ 4	1,5 ÷ 240
5 ÷ 7	1,5 ÷ 70
7 ÷ 10	1,5 ÷ 25
10 ÷ 24	1,5 ÷ 2,5

Operating voltage	0,6/1kV
Voltage test	4000 V, 50 Hz
Insulation resistivity at 90°C, minimum	10^{14}

Operating temperature range during operation during installation	 -30°C up to +70°C -5°C up to +50°C
Minimum bending radius	15 x D single core 12 x D multi core D = outer diameter
Cable combustibility	
Fire resistance	E90
Combustibility tests	PN-EN 50226:2006, IEC 60332-3
Reference standards	DIN VDE 0266

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Dátum/Date 24.05.2004
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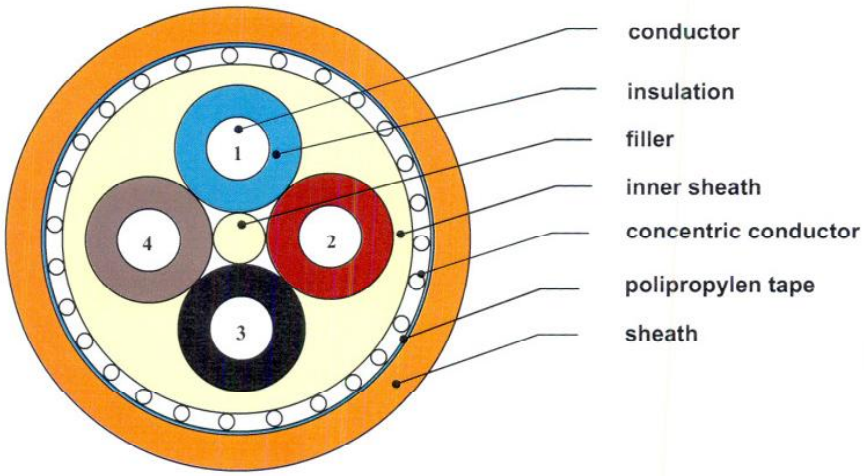
Príloha č./Appendix No. 18

(N)HXCH E90

FIRE RESISTANT HALOGEN FREE POWER CABLES



APPLICATIONS

Safety cables are used in all locations where a special protection against fire and fire damage is necessary for human life and equipment and where strict safety regulations have to be met and where large emergency running time is necessary. They may be used indoor and outdoor, but not directly in earth and water. They are considered as protectively insulated.

CONSTRUCTION

conductor - bare copper, solid or stranded acc. to DIN VDE 0295

insulation - cross-linked halogen free ceramic forming polymer compound acc. to DIN VDE 0266

filler - flame resistant, halogen free polymer compound

inner sheath - flame resistant, halogen free polymer compound

concentric conductor - formed by bare coper wires with counter copper tape

polipropylen tape

sheath - flame resistant, halogen free polymer compound acc. to DIN VDE 0276-604

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FIRE RESISTANCE

Dátum/Date 24.05.2004

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Dokument č./Document No. FIRES-FR-086-04-ANNEX

Príloha č./Appendix No. 19

(N)HXCH E90

CHARACTERISTICS

Conductor cross-section	
Number of conductors	Nominal conductor cross-section
n	mm^2
1 ÷ 4	1,5/1,5 ÷ 150/70
5 ÷ 7	1,5/1,5 ÷ 4/4
10 ÷ 24	1,5/2,5 ÷ 2,5/10

Operating voltage	0,6/1kV
Voltage test	4000 V, 50 Hz
Insulation resistivity at 20°C, minimum	10^{14}

Operating temperature range during operation during installation	 -30°C up to +70°C -5°C up to +50°C
Minimum bending radius	15 x D single core 12 x D multi core D = outer diameter
Cable combustibility	
Fire resistance	E90
Combustibility tests	PN-EN 50226:2006, IC 60332-3
Reference standards	DIN VDE 0266

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FIRE RESISTANCE

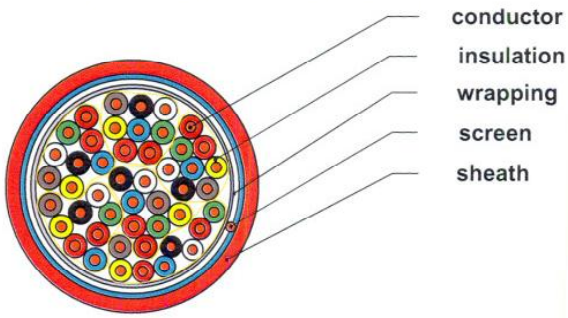
Dátum/Date 24.05.2008
Podpis/Signature

Dokument č./Document No. FIRES-FR-086-08-ANNEX

Príloha č./Appendix No. 20

JE-H(St)H CERAMIC E90

FIRE RESISTANT HALOGEN FREE ELECTRONIC AND TELECOMUNICATIONS CABLE



APPLICATIONS

Safety installations cables are used for the transmission od signals and measuring data in control circuits, in locations where a particular protection against fire and fire damage for human life and equipment is necessary.
Installation cables are not admissible for power installation purposes and direct burial.

CONSTRUCTION

conductor - bare copper, solid acc. to DIN VDE 0295
insulation - cross-linked halogen free ceramic forming polymer compound acc. to DIN VDE 0207-23
wrapping - polipropylen and glass-fibre tape
screen - static screen of plastic coated metal foil with a soild, tinned drain wire
sheath - flame resistant, halogen free polymer compound acc. to DIN VDE 0207-5

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FIRE RESISTANCE

Dátum/Date 24-05-2004
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Dokument č./Document No. FIRES-FR-086-04-ANNEX

Príloha č./Appendix No. 24

JE-H(St)H CERAMIC E90

CHARACTERISTICS

Conductor cross-section	
Number of conductors	Nominal conductor cross-section
n	mm
1 x 2 x .... 80 x 2 x	0,8
1 x 2 x .... 80 x 2 x	1,0

Operating voltage	225V
Voltage test	
core/core	500 V, 50 Hz
core/screen	2000 V, 50 Hz
Insulation resistivity at 90°C, minimum	10^{14}

Operating temperature range	
during operation	-30°C up to +70°C
during installation	-5°C up to +50°C
Minimum bending radius	8 x D single core D = outer diameter
Cable combustibility	
Fire resistance	E90
Combustibility tests	PN-EN 50226:2006, IEC 60332-3
Reference standards	DIN VDE 0815

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FIRE RESISTANCE

Dátum/Date 24.05.2004
Podpis/Signature

Dokument č./Document No. FIRES-FR-086-04-ANJE

Príloha č./Appendix No. 22