TEST REPORT FIRES-FR-160-06-AUNE

Cables with integrity function
Type – (N)HXH, (N)HXCH, HTKSH, HTKSHekw

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FIRES
The Experts on Fire Safety

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-160-06-AUNE**
Tested property: Function in fire
Test method: DIN 4102 – 12:1998-11

Date of issue: **08. 12. 2006**

Name of the product: Cables with integrity function
Type – (N)HXH, (N)HXCH, HTKSH, HTKSHekw

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

Baks, Jagodne 5, 05-480 Karczew, Poland – producer of construction

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

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Task No.: PR-06-0184
Specimen received: 10. 11. 2006
Date of the fire test: 16. 11. 2006
Technician responsible for the technical side of this report: Miroslav Hudák

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Number of pages:	6	Number of appendices:	21
Test reports:	3	Copy No.:	2

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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. Test specimens were 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: Ing. Štefan Rástocký
Test carried out by: Miroslav Hudák

Operator: Alexander Reľovský

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 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 supporting system with accessories – power and communication non-halogen cables, cable trays, cable ladders, ceiling ledges with clamps UEF, UDF, UKO and sleeves – OZO, OZMO.

Cables: (N)HXH PH90/E30-E90 4x1,5 RE 0,6/1 kV (14 x)
(N)HXH PH90/E30-E90 4x50 RM 0,6/1 kV (8 x)
(N)HXCH PH90/E30-E90 4x1,5/1,5 RE 0,6/1 kV (12 x)
(N)HXCH PH90/E30-E90 4x50/25 RM 0,6/1 kV (6 x)
HTKSH PH90/E30 4x2x0,8 (12 x)
HTKSHekw PH90/E30 1x2x2,3 (10 x)

Supporting system: was made by cable ladders, trays, individual clamps, clamps in ceiling ledges. Supporting system was made by three vertical ceiling hangers type WCE which horizontal brackets type WMCO were fixed to. Vertical hangers were fixed to concrete ceiling by means of dowels PSRO M10 x 80 in spacing of 1200 mm. Fixation and arrangement of horizontal brackets are visible in appendix No.12 of this report. Two trays type KCOP300H60/3 were fixed to horizontal brackets from one side of vertical consoles and two ladders type DGOP400H60/3 were fixed from other side of vertical hangers. Trays and ladders were fixed to horizontal brackets by means of screws M8 with nuts M8 through clamps of type ZMO. Joints of trays and ladders was realized by means of connecting components type (BLO300, LPOLH60) at tray and type LDOCHE60E at ladder and by means of screws M8 with nuts M8 – 20 bolted joints at tray and 12 bolted joints at ladder. From outside, horizontal brackets were fixed through grips type UPWO by means of threaded bar PGM10 fixed from both sides by nut M10 with washer M10 to ceiling hanger type USOV. Ceiling hangers were fixed to ceiling by dowels type PSRO M10.
Ceiling assembling was realized by means of clamps type: UEF, UDF, OZMO, OZO which were fixed to ceiling by dowels SRO M6 x 30 and by means of ceiling ledge, which was fixed to concrete ceiling by three dowels PSRO M8 x 75. Clamps type UKO were inserted to this ceiling ledge. Number of components and arrangement are visible in drawing.

Cable penetration through the wall of test furnace was sealed by mineral wool Nobasil.
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

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 specimen was 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
46,7	4,8	21,9	1,0

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]**
16. 11. 2006	50,3	14,3

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
Specimens 1-2: cables (N)HXCH PH90/E30-E90 4x1,5/1,5 RE	**90 minutes no failure**
Specimens 3-4: cables (N)HXH PH90/E30-E90 4x1,5 RE	**90 minutes no failure**
Specimens 5-6: cables (N)HXCH PH90/E30-E90 4x50/25 RM	**90 minutes no failure**
Specimens 7-8: cables (N)HXH PH90/E30-E90 4x50 RM	**90 minutes no failure**
Specimens 9-10: cables (N)HXH PH90/E30-E90 4x50 RM	**90 minutes no failure**
Specimens 11-12: cables (N)HXH PH90/E30-E90 4x1,5 RE	**90 minutes no failure**
Specimens 13-14: cables (N)HXCH PH90/E30-E90 4x1,5/1,5 RE	**90 minutes no failure**
Specimens 15-16: cables (N)HXH PH90/E30-E90 4x1,5 RE	**90 minutes no failure**
Specimens 17-18: cables (N)HXCH PH90/E30-E90 4x1,5/1,5 RE	**90 minutes no failure**
Specimens 19-20: cables (N)HXH PH90/E30-E90 4x1,5 RE	**90 minutes no failure**
Specimens 21-22: cables (N)HXCH PH90/E30-E90 4x1,5/1,5 RE	**90 minutes no failure**
Specimens 23-24: cables (N)HXH PH90/E30-E90 4x1,5 RE	**90 minutes no failure**
Specimens 25-26: cables (N)HXH PH90/E30-E90 4x1,5 RE	**90 minutes no failure**
Specimens 27-28: cables (N)HXH PH90/E30-E90 4x50 RM	**90 minutes no failure**
Specimens 29-30: cables (N)HXH PH90/E30-E90 4x1,5 RE	**90 minutes no failure**
Specimens 31-32: cables (N)HXH PH90/E30-E90 4x50 RM	**90 minutes no failure**
Specimens 33-34: cables (N)HXCH PH90/E30-E90 4x1,5/1,5 RE	**90 minutes no failure**
Specimens 35-36: cables (N)HXCH PH90/E30-E90 4x50/25 RM	**90 minutes no failure**
Specimens 37-38: cables (N)HXCH PH90/E30-E90 4x1,5/1,5 RE	**90 minutes no failure**
Specimens 39-40: cables (N)HXCH PH90/E30-E90 4x50/25 RM	**90 minutes no failure**
Specimen 41: cable HTKSHekw PH90/E30 1x2x2,3	**62 minutes**
Specimen 42: cable HTKSHekw PH90/E30 1x2x2,3	**75 minutes**
Specimen 43: cable HTKSH PH90/E30 4x2x0,8	**75 minutes**
Specimen 44: cable HTKSH PH90/E30 4x2x0,8	**75 minutes**
Specimen 45: cable HTKSHekw PH90/E30 1x2x2,3	**47 minutes**
Specimen 46: cable HTKSHekw PH90/E30 1x2x2,3	**62 minutes**
Specimen 47: cable HTKSH PH90/E30 4x2x0,8	**90 minutes no failure**
Specimen 48: cable HTKSH PH90/E30 4x2x0,8	**90 minutes no failure**
Specimen 49: cable HTKSHekw PH90/E30 1x2x2,3	**71 minutes**
Specimen 50: cable HTKSHekw PH90/E30 1x2x2,3	**76 minutes**
Specimen 51: cable HTKSH PH90/E30 4x2x0,8	**32 minutes**
Specimen 52: cable HTKSH PH90/E30 4x2x0,8	**32 minutes**
Specimen 53: cable HTKSH PH90/E30 4x2x0,8	**90 minutes no failure**
Specimen 54: cable HTKSH PH90/E30 4x2x0,8	**67 minutes**
Specimen 55: cable HTKSH PH90/E30 4x2x0,8	**74 minutes**
Specimen 56: cable HTKSH PH90/E30 4x2x0,8	**83 minutes**
Specimen 57: cable HTKSH PH90/E30 4x2x0,8	**90 minutes no failure**
Specimen 58: cable HTKSH PH90/E30 4x2x0,8	**90 minutes no failure**
Specimen 59: cable HTKSHekw PH90/E30 1x2x2,3	**73 minutes**
Specimen 60: cable HTKSHekw PH90/E30 1x2x2,3	**56 minutes**
Specimen 61: cable HTKSHekw PH90/E30 1x2x2,3	**90 minutes no failure**
Specimen 62: cable HTKSHekw PH90/E30 1x2x2,3	**90 minutes no failure**

The fire test was discontinued in 102nd 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

SKÚŠOBNÉ LABORATÓRIUM • PRÜFLABORATORIUM • TESTING LABORATORY
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-1-

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

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 V1 to V8
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Appendix 5	Measured times of tested specimens from V17 to V24
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Appendix 7	Measured times of tested specimens from V33 to V40
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Appendix 9	Layout of cables in the test furnace
Appendix 10-11	Photos taken before and after the fire test
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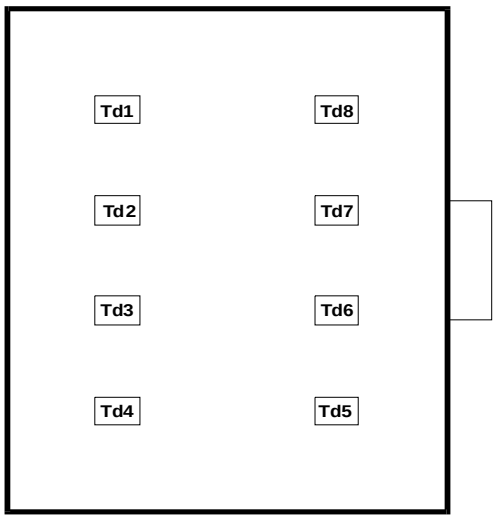
Measured values inside the test furnace

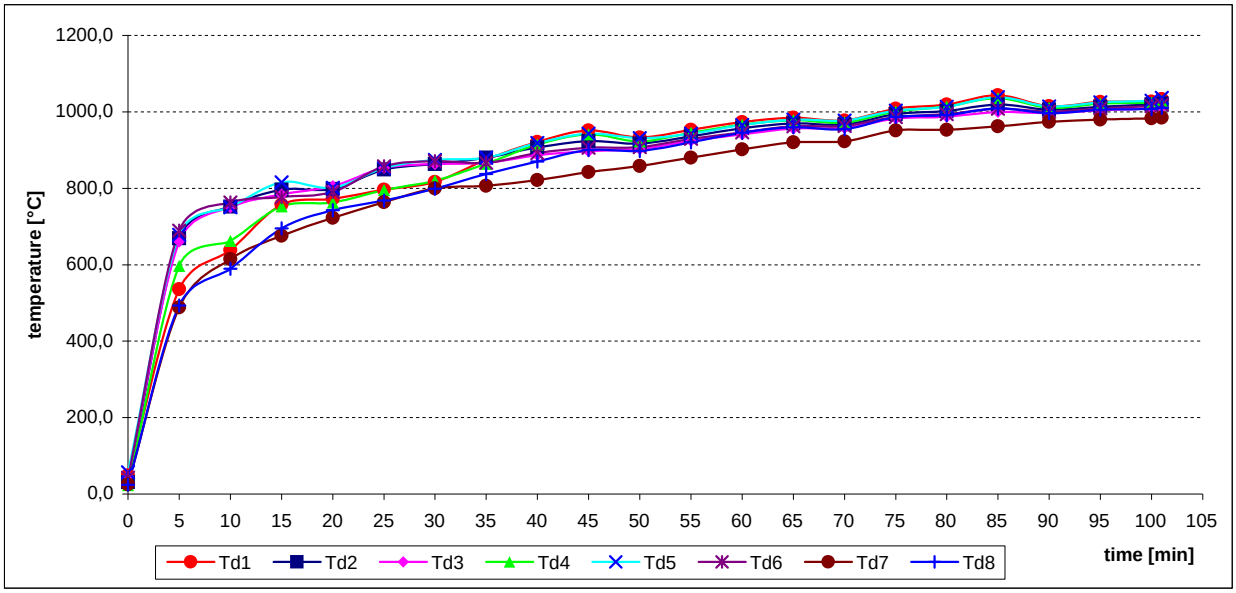
Time	Temperature [°C]											Deviation	Pressure [Pa]
t [min]	Td1	Td2	Td3	Td4	Td5	Td6	Td7	Td8	Tave	Tn	To	d_e [%]	p
0	48,6	30,9	46,2	23,5	56,6	42,7	25,2	24,3	37,3	20,0	14,3	0,0	0,0
5	536,1	669,5	660,3	596,8	677,9	689,6	487,9	493,3	601,4	576,2	12,6	-9,9	16,3
10	637,8	752,4	750,0	662,2	749,9	763,1	614,3	589,9	690,0	678,3	10,5	-2,6	18,6
15	757,0	796,4	783,6	753,2	815,9	776,7	675,8	694,7	756,7	738,5	11,6	-0,8	17,6
20	772,4	797,8	805,2	762,8	801,7	790,8	722,5	742,4	774,5	781,3	11,2	0,0	14,8
25	796,5	849,5	853,3	795,4	853,5	857,9	763,7	768,2	817,3	814,6	11,0	-0,3	15,5
30	816,4	863,1	863,2	819,6	874,5	871,0	799,9	798,7	838,3	841,8	11,2	-0,5	19,2
35	875,3	880,1	866,3	864,5	879,8	866,7	806,5	837,7	859,6	864,8	11,3	-0,5	18,4
40	921,1	906,5	886,7	914,3	918,6	892,0	821,7	870,1	891,4	884,7	11,2	-0,4	19,4
45	951,3	923,9	896,7	941,2	942,6	906,4	842,6	900,6	913,2	902,3	10,8	-0,4	19,7
50	933,0	916,8	902,7	922,9	931,0	907,4	858,7	897,9	908,8	918,1	11,1	-0,4	19,6
55	952,8	936,1	924,8	945,3	943,3	929,1	879,9	920,2	928,9	932,3	11,5	-0,4	19,7
60	973,3	956,9	941,4	966,0	965,3	946,3	901,5	945,2	949,5	945,3	12,2	-0,3	19,6
65	984,7	970,0	955,9	978,1	980,0	961,9	920,4	959,6	963,8	957,3	12,3	-0,2	18,5
70	977,4	967,1	957,9	972,1	976,9	963,3	922,8	954,4	961,5	968,4	12,4	-0,2	18,4
75	1008,0	993,9	982,5	1001,0	1003,0	986,6	951,0	986,8	989,3	978,7	12,4	0,0	17,1
80	1019,0	1002,0	987,0	1014,0	1013,0	994,0	953,0	991,2	996,9	988,4	12,4	0,0	17,5
85	1043,0	1019,0	1000,0	1036,0	1038,0	1008,0	962,3	1009,0	1014,6	997,4	12,6	0,0	18,1
90	1015,0	1006,0	996,9	1011,0	1014,0	1001,0	974,1	996,3	1002,0	1005,9	12,4	0,0	17,6
95	1026,0	1013,0	1004,0	1022,0	1025,0	1009,0	979,6	1006,0	1011,0	1014,0	12,4	0,0	16,7
100	1027,0	1019,0	1009,0	1024,0	1029,0	1015,0	982,8	1007,0	1014,5	1021,7	12,5	0,0	17,4
101	1033,0	1022,0	1012,0	1028,0	1037,0	1018,0	984,7	1011,0	1018,5	1023,2	12,4	0,0	17,8

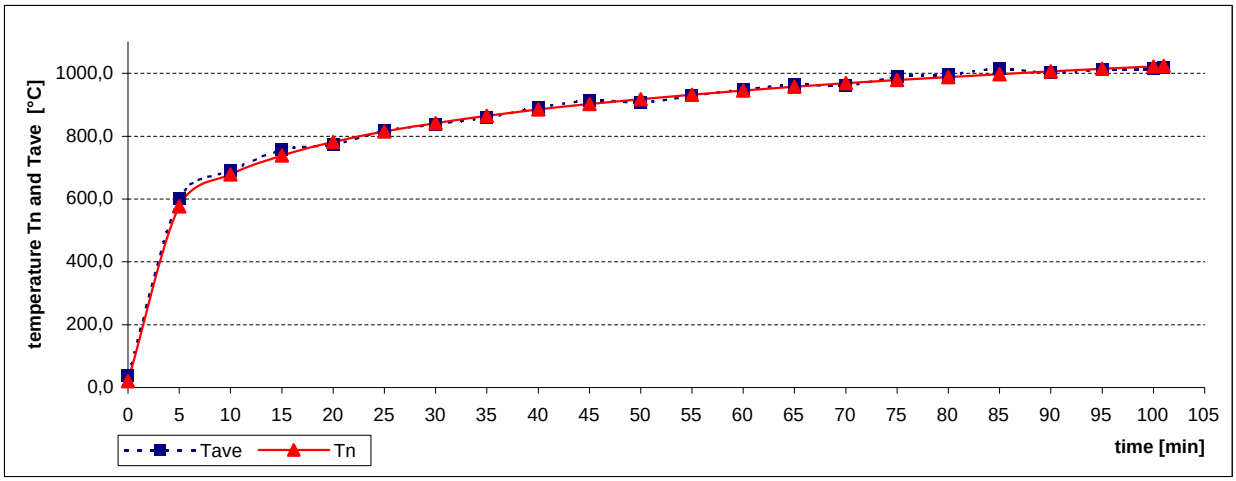
Tave Average temperature in the test furnace calculated from plate thermometers
Tn Standard temperature in the test furnace laid down to test guideline
To Ambient temperature
d_e Deviation of the average temperature from the standard temperature calculated according to test guideline
p Pressure inside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

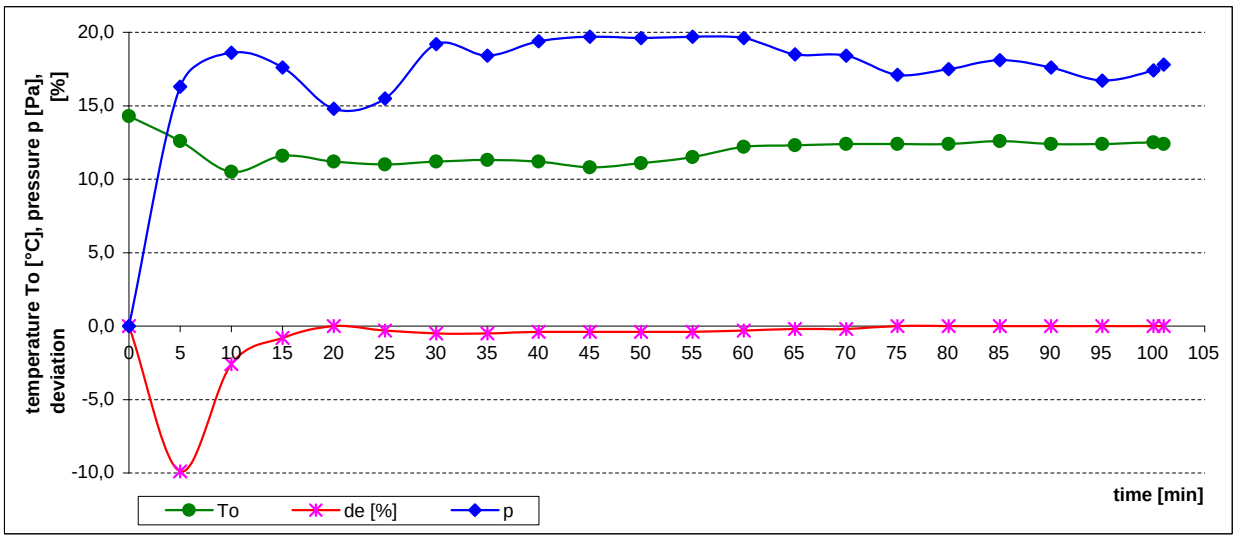
Layout of measuring points in the test furnace:



Measured values inside the test furnace / graph







Measured time of tested specimens from V1 to V8

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
V1	1-L1	no failure
	2-L2	no failure
	3-L3	no failure
	4-PEN	no failure
V2	5-L1	no failure
	6-L2	no failure
	7-L3	no failure
	8-PEN	no failure
V3	9-L1	no failure
	10-L2	no failure
	11-L3	no failure
	12-PEN	no failure
V4	13-L1	no failure
	14-L2	no failure
	15-L3	no failure
	16-PEN	no failure
V5	17-L1	no failure
	18-L2	no failure
	19-L3	no failure
	20-PEN	no failure
V6	21-L1	no failure
	22-L2	no failure
	23-L3	no failure
	24-PEN	no failure
V7	25-L1	no failure
	26-L2	no failure
	27-L3	no failure
	28-PEN	no failure
V8	29-L1	no failure
	30-L2	no failure
	31-L3	no failure
	32-PEN	no failure

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

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 V9 to V16

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
V9	33-L1	no failure
	34-L2	no failure
	35-L3	no failure
	36-PEN	no failure
V10	37-L1	no failure
	38-L2	no failure
	39-L3	no failure
	40-PEN	no failure
V11	41-L1	no failure
	42-L2	no failure
	43-L3	no failure
	44-PEN	no failure
V12	45-L1	no failure
	46-L2	no failure
	47-L3	no failure
	48-PEN	no failure
V13	49-L1	no failure
	50-L2	no failure
	51-L3	no failure
	52-PEN	no failure
V14	53-L1	no failure
	54-L2	no failure
	55-L3	no failure
	56-PEN	no failure
V15	57-L1	no failure
	58-L2	no failure
	59-L3	no failure
	60-PEN	no failure
V16	61-L1	no failure
	62-L2	no failure
	63-L3	no failure
	64-PEN	no failure

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

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 V17 to V24

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
V17	65-L1	no failure
	66-L2	no failure
	67-L3	no failure
	68-PEN	no failure
V18	69-L1	no failure
	70-L2	no failure
	71-L3	no failure
	72-PEN	no failure
V19	73-L1	no failure
	74-L2	no failure
	75-L3	no failure
	76-PEN	no failure
V20	77-L1	no failure
	78-L2	no failure
	79-L3	no failure
	80-PEN	no failure
V21	81-L1	no failure
	82-L2	no failure
	83-L3	no failure
	84-PEN	no failure
V22	85-L1	no failure
	86-L2	no failure
	87-L3	no failure
	88-PEN	no failure
V23	89-L1	no failure
	90-L2	no failure
	91-L3	no failure
	92-PEN	no failure
V24	93-L1	no failure
	94-L2	no failure
	95-L3	no failure
	96-PEN	no failure

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

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 V25 to V32

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
V25	97-L1	no failure
	98-L2	no failure
	99-L3	no failure
	100-PEN	no failure
V26	101-L1	no failure
	102-L2	no failure
	103-L3	no failure
	104-PEN	no failure
V27	105-L1	no failure
	106-L2	no failure
	107-L3	no failure
	108-PEN	no failure
V28	109-L1	no failure
	110-L2	no failure
	111-L3	no failure
	112-PEN	no failure
V29	113-L1	no failure
	114-L2	no failure
	115-	no failure
	116-PEN	no failure
V30	117-L1	no failure
	118-L2	no failure
	119-L3	no failure
	120-PEN	no failure
V31	121-L1	no failure
	122-L2	no failure
	123-L3	no failure
	124-PEN	no failure
V32	125-L1	no failure
	126-L2	no failure
	127-L3	no failure
	128-PEN	no failure

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

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 V33 to V40

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
V33	129-L1	no failure
	130-L2	no failure
	131-L3	no failure
	132-PEN	no failure
V34	133-L1	no failure
	134-L2	no failure
	135-L3	no failure
	136-PEN	no failure
V35	137-L1	no failure
	138-L2	no failure
	139-L3	no failure
	140-PEN	no failure
V36	141-L1	no failure
	142-L2	no failure
	143-L3	no failure
	144-PEN	no failure
V37	145-L1	no failure
	146-L2	no failure
	147-L3	no failure
	148-PEN	no failure
V38	149-L1	no failure
	150-L2	no failure
	151-L3	no failure
	152-PEN	no failure
V39	153-L1	no failure
	154-L2	no failure
	155-L3	no failure
	156-PEN	no failure
V40	157-L1	no failure
	158-L2	no failure
	159-L3	no failure
	160-PEN	no failure

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

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 V41 to V62

Specimen	Bulbs	Time to permanent failure / interruption [min:s]
V41	209-L	62:11
	210-PEN	62:11
V42	211-L	75:18
	212-PEN	75:18
V43,44	213,215,217,219-L	75:39
	214,216,218,220-PEN	75:39
V45	221-L	47:04
	222-PEN	47:04
V46	223-L	62:23
	224-PEN	62:23
V47,48	225,227,229,231-L	90:05
	226,228,230,232-PEN	90:05
V49	233-L	71:11
	234-PEN	71:11
V50	235-L	76:54
	236-PEN	76:54
V51,52	237,239,241,243-L	32:30
	238,240,242,244-PEN	32:30
V53,54	245,247,249,251-L	67:01
	246,248,250,252-PEN	67:01
V55	253,255,257,259-L	74:12
	254,256,258,260-PEN	74:12
V56	261,263,265,267-L	83:59
	262,264,266,268-PEN	83:59
V57	269,271,273,275-L	no failure
	270,272,274,276-PEN	no failure
V58	277,279,281,283-L	no failure
	278,280,282,284-PEN	no failure
V59	285-L	73:53
	286-PEN	73:53
V60	287-L	56:37
	288-PEN	56:37
V61	289-L	90:08
	290-PEN	90:08
V62	291-L	no failure
	292-PEN	no failure

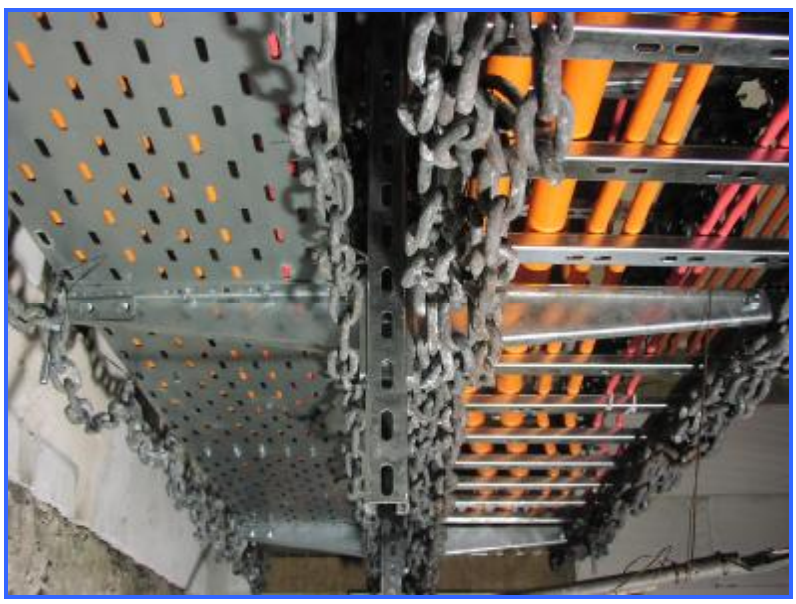
Specimens 41-42: cables HTKSHekw PH90/E30 1x2x2,3
Specimens 43-44: cables HTKSH PH90/E30 4x2x0,8
Specimens 45-46: cables HTKSHekw PH90/E30 1x2x2,3
Specimens 47-48: cables HTKSH PH90/E30 4x2x0,8
Specimens 49-50: cables HTKSHekw PH90/E30 1x2x2,3
Specimens 51-52: cables HTKSH PH90/E30 4x2x0,8
Specimens 53-54: cables HTKSH PH90/E30 4x2x0,8
Specimens 55-56: cables HTKSH PH90/E30 4x2x0,8
Specimens 57-58: cables HTKSH PH90/E30 4x2x0,8
Specimens 59-60: cables HTKSHekw PH90/E30 1x2x2,3
Specimens 61-62: cables HTKSHekw PH90/E30 1x2x2,3

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 PH90/E30-E90 4x1,5/1,5 RE	Specimens placed in ceiling profile ledges with clips UKO
Specimens 3-4: cables (N)HXH PH90/E30-E90 4x1,5 RE	Specimens placed in ceiling profile ledges with clips UKO
Specimens 5-6: cables (N)HXCH PH90/E30-E90 4x50/25 RM	Specimens placed in ceiling profile ledges with clips UKO
Specimens 7-8: cables (N)HXH PH90/E30-E90 4x50 RM	Specimens placed in ceiling profile ledges with clips UKO
Specimens 9-10: cables (N)HXH PH90/E30-E90 4x50 RM	Specimens placed in ceiling clips OZO
Specimens 11-12: cables (N)HXH PH90/E30-E90 4x1,5 RE	Specimens placed in ceiling clips OZO
Specimens 13-14: cables (N)HXCH PH90/E30-E90 4x1,5/1,5 RE	Specimens placed in ceiling clips OZMO
Specimens 15-16: cables (N)HXH PH90/E30-E90 4x1,5 RE	Specimens placed in ceiling clips OZMO
Specimens 17-18: cables (N)HXCH PH90/E30-E90 4x1,5/1,5 RE	Specimens placed in ceiling clips UDF
Specimens 19-20: cables (N)HXH PH90/E30-E90 4x1,5 RE	Specimens placed in ceiling clips UDF
Specimens 21-22: cables (N)HXCH PH90/E30-E90 4x1,5/1,5 RE	Specimens placed in ceiling clips UEF
Specimens 23-24: cables (N)HXH PH90/E30-E90 4x1,5 RE	Specimens placed in ceiling clips UEF
Specimens 25-26: cables (N)HXH PH90/E30-E90 4x1,5 RE	Specimens placed at the upper ladder
Specimens 27-28: cables (N)HXH PH90/E30-E90 4x50 RM	Specimens placed at the upper ladder
Specimens 29-30: cables (N)HXH PH90/E30-E90 4x1,5 RE	Specimens placed in upper tray
Specimens 31-32: cables (N)HXH PH90/E30-E90 4x50 RM	Specimens placed in upper tray
Specimens 33-34: cables (N)HXCH PH90/E30-E90 4x1,5/1,5 RE	Specimens placed at the upper ladder
Specimens 35-36: cables (N)HXCH PH90/E30-E90 4x50/25 RM	Specimens placed at the upper ladder
Specimens 37-38: cables (N)HXCH PH90/E30-E90 4x1,5/1,5 RE	Specimens placed in upper tray
Specimens 39-40: cables (N)HXCH PH90/E30-E90 4x50/25 RM	Specimens placed in upper tray
Specimens 41-42: cables HTKSHekw PH90/E30 1x2x2,3	Specimens placed in ceiling profile ledges with clips UKO
Specimens 43-44: cables HTKSH PH90/E30 4x2x0,8	Specimens placed in ceiling profile ledges with clips UKO
Specimens 45-46: cables HTKSHekw PH90/E30 1x2x2,3	Specimens placed in ceiling clips OZMO
Specimens 47-48: cables HTKSH PH90/E30 4x2x0,8	Specimens placed in ceiling clips OZMO
Specimens 49-50: cables HTKSHekw PH90/E30 1x2x2,3	Specimens placed in ceiling clips UDF
Specimens 51-52: cables HTKSH PH90/E30 4x2x0,8	Specimens placed in ceiling clips UDF
Specimens 53-54: cables HTKSH PH90/E30 4x2x0,8	Specimens placed in ceiling clips UEF
Specimens 55-56: cables HTKSH PH90/E30 4x2x0,8	Specimens placed at the lower ladder
Specimens 57-58: cables HTKSH PH90/E30 4x2x0,8	Specimens placed in lower tray
Specimens 59-60: cables HTKSHekw PH90/E30 1x2x2,3	Specimens placed at the lower ladder
Specimens 61-62: cables HTKSHekw PH90/E30 1x2x2,3	Specimens placed in lower tray

Photos taken before the test



Photos taken after the termination of the test

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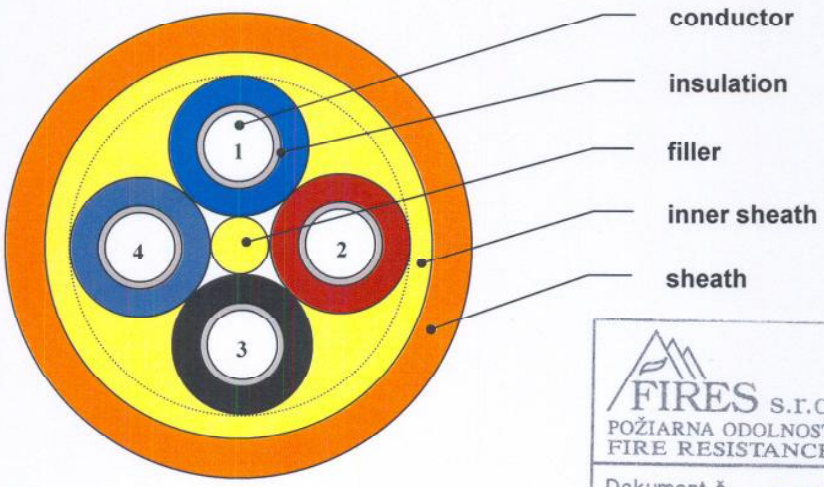
(N)HXH PH90/E30-E90 0,6/1 kV

FIRE RESISTANT HALOGEN FREE POWER CABLES



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FIRE RESISTANCE

Dátum/Date 16. 11. 2024

Podpis/Signature

Dokument č. / Document No. FIRES-FR-160-06-AVE

Príloha č./Appendix No. 12

APPLICATIONS

(N)HXH PH90/E30-E90 0,6/1 kV fire resistant power cables, insulated and sheathed with halogen free compounds, are intended for power supply to fire protection equipment which is to operate in fire conditions (e.g. water pumps in fire extinguishing systems, smoke removing fans).

Halogen free cables shall be applied in locations where, in case of fire, higher safety for human beings and expensive electronic equipment is required.

Functions of the cables are maintained – power is supplied to equipment which must operate in fire conditions and during fire fighting. The cables are flame retardant and their smoke emission is low, emitted fumes are non toxic and non corrosive.

The cables are suitable for indoor and outdoor installations.

CONSTRUCTION

conductor	–	bare copper single wire round conductors meeting requirements of class 1 per PN-EN 60228,
insulation	–	mica tape and halogen free cross-linked compound insulation - colours in accordance with PH-HD 308,
filler	–	filler made of halogen free compound,
inner sheath	–	inner sheath made of halogen free compound,
sheath	–	orange cable sheath of halogen free compound (oxygen index bigger than 35%).

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(N)HXH PH90/E30-E90 0,6/1 kV

CHARACTERISTICS

The cables maintain their functions for 90 minutes, meeting requirements of PN-EN 50200 standard

Conductor cross-section	
Number of conductors	Nominal conductor cross-section
n	mm^2
1	16 ÷ 400
2 - 5	1 ÷ 240
7 – 19	1; 1,5; 2,5 i 4
24 - 40	1; 1,5; 2,5

Operating voltage	0.6/1 kV
Voltage test	4.0 kV rms
Insulation resistivity at 90°C, minimum	1 x 10^{11} Ω·cm
Inductance, approximate	0.7 mH/km
Corrosivity of emitted gases per PN-EN 50267-2-3, IEC 60754-2	
pH, approximate	6.8
conductivity, approximate	0.4 µS/mm
Smoke density per PN-EN 50268-2-3, IEC 61034-2	
light transmittance, minimum	94%

Operating temperature range	
during operation	from -15 to +90°C
during installation	from -5 to +70°C
Minimum bending radius	12 x cable diameter
Cable combustibility	flame retardant
Fire resistance	90 minutes at 842°C
Combustibility tests	PN-EN 50265-2-4, IEC 60332-3, PN-EN 50200 and PN-EN 50362
Reference standards	AT-0603-0064/2006, WT-TK-44 DIN VDE 0266 PN-HD 604 S1

CE = the cable meets requirements of the low voltage directive 73/23/EEC and 93/68/EEC

Cable type	Number of conductors x conductor cross-section	Cable outer diameter (appr.)	Copper index	Cable weight (appr.)
	number x mm^2	mm	kg/km	kg/km
(N)HXH PH90/E30-E90	2 x 2,5 RE	14,0	48	304
(N)HXH PH90/E30-E90	4 x 1,5 RE	16,1	58	340
(N)HXH PH90/E30-E90	4 x 50 RM	34,7	1920	2764

Cable type	Number of conductors x conductor cross-section	Cable outer diameter (appr.)	Copper index	Cable weight (appr.)
	number x mm^2	mm	kg/km	kg/km
(N)HXH-J PH90/E30-E90	7 x 1,5 RE	17,3	101	430
(N)HXH-J PH90/E30-E90	7 x 2,5 RE	19,8	168	560

RE – single wire round conductor
RM – multiwire round conductor

Other cross-sections and conductor counts available on request.

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FIRE RESISTANCE

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Dokument č./Document No. FIRES-FR-160-06-AJLE

Príloha č./Appendix No. 13

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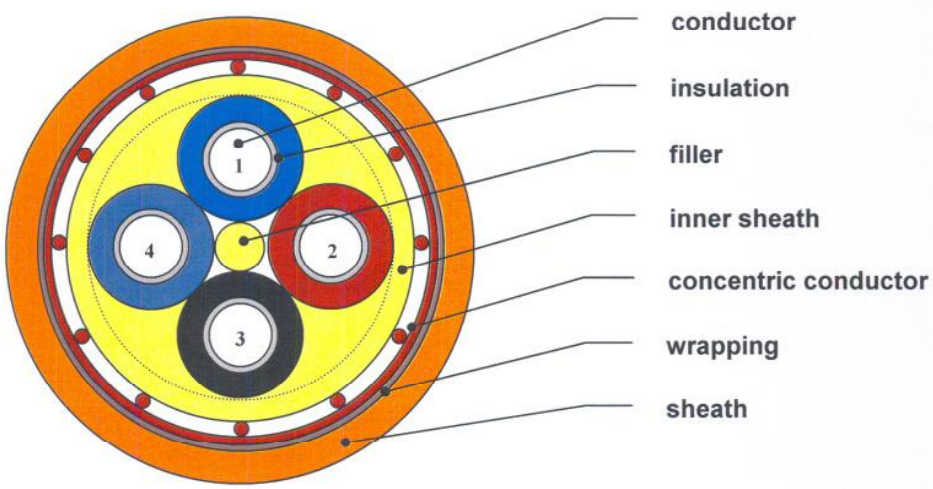
(N)HXCH PH90/E30-E90 0,6/1 kV

FIRE RESISTANT HALOGEN FREE POWER CABLES



APPLICATIONS

(N)HXCH PH90/E30-E90 0,6/1 kV fire resistant power cables, insulated and sheathed with halogen free compounds, are intended for power supply to fire protection equipment which is to operate in fire conditions (e.g. water pumps in fire extinguishing systems, smoke removing fans).

Halogen free cables shall be applied in locations where, in case of fire, higher safety for human beings and expensive electronic equipment is required.

Functions of the cables are maintained – power is supplied to equipment which must operate in fire conditions and during fire fighting. The cables are flame retardant and their smoke emission is low, emitted fumes are non toxic and non corrosive.

The cables are suitable for indoor and outdoor installations.

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FIRE RESISTANCE

Dátum/Date 16. 11. 2006

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Dokument č./Document No. FIRES-FD-160-06-AKK

Príloha č./Appendix No. 14

CONSTRUCTION

conductor	–	bare copper single wire round conductors meeting requirements of class 1 per PN-EN 60228,
insulation	–	mica tape and halogen free cross-linked compound insulation - colours in accordance with PH-HD 308,
filler	–	filler made of halogen free compound,
inner sheath	–	inner sheath made of halogen free compound,
concentric conductor	–	concentric conductor made of bare copper wires and a copper tape binder wrapped over the inner sheath,
wrapping	–	made with polyester tape,
sheath	–	orange cable sheath of halogen free compound (oxygen index bigger than 35%).

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ISO 9001:2000

(N)HXCH PH90/E30-E90 0,6/1 kV

CHARACTERISTICS

The cables maintain their functions for 90 minutes, meeting requirements of PN-EN 50200 standard

Conductor cross-section	
Number of conductors	Nominal conductor cross-section
n	mm^2
1	16 ÷ 400
2 - 5	1 ÷ 240
7 – 19	1; 1,5; 2,5 i 4
24 - 40	1; 1,5; 2,5

Operating voltage	0.6/1 kV
Voltage test	4.0 kV rms
Insulation resistivity at 90°C, minimum	1 x 10^{11} Ω·cm
Inductance, approximate	0.7 mH/km
Corrosivity of emitted gases per PN-EN 50267-2-3, IEC 60754-2	
pH, approximate	6.8
conductivity, approximate	0.4 µS/mm
Smoke density per PN-EN 50268-2-3, IEC 61034-2	
light transmittance, minimum	94%

Operating temperature range	
during operation	from -15 to +90°C
during installation	from -5 to +70°C
Minimum bending radius	12 x cable diameter
Cable combustibility	flame retardant
Fire resistance	90 minutes at 842°C
Combustibility tests	PN-EN 50265-2-4, IEC 60332-3, PN-EN 50200 and PN-EN 50362
Reference standards	WT-TK-44 DIN VDE 0266 PN-HD 604 S1

CE = the cable meets requirements of the low voltage directive 73/23/EEC and 93/68/EEC

Cable type	Number of conductors x conductor cross-section	Cable outer diameter (appr.)	Copper index	Cable weight (appr.)
	number x mm^2	mm	kg/km	kg/km
(N)HXCH PH90/E30-E90	4 x 1,5/1,5 RE	17,1	72	373

Cable type	Number of conductors x conductor cross-section	Cable outer diameter (appr.)	Copper index	Cable weight (appr.)
	number x mm^2	mm	kg/km	kg/km
(N)HXCH PH90/E30-E90	4 x 50/25 RM	37,5	2160	3090

RE – single wire round conductor
RM – multiwire round conductor

Other cross-sections and conductor counts available on request.

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FIRE RESISTANCE

Dátum/Date 16. 11. 2006
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Dokument č./Document No. FIRES-FR-160-06-ANJE

Príloha č./Appendix No. 15

TECHNOKABEL®

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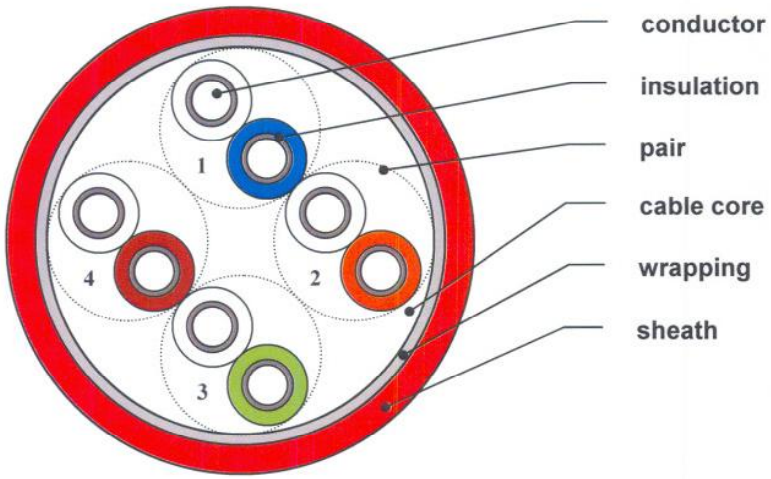
HTKSH PH90/E30

FIRE RESISTANT HALOGEN FREE CABLES



APPLICATIONS

HTKSH PH90/E30 fire resistant and halogen free cables are intended for installation in alarm, signalling, transmission, sound warning and similar systems, also for data processing systems and for analogue or digital data transmission in industrial electronics and control applications in objects of sharp fire protection requirements, particularly in fire alarm and fire automatic control systems.

Halogen free cables are applied in locations where, in case of fire, higher safety for human beings and expensive electronic equipment is required.

Functions of the cables are maintained – data are transmitted and power is supplied to equipment which must operate in fire conditions and during fire fighting (e.g. emergency lighting). The cables are flame retardant and their smoke emission is low, emitted fumes are non toxic and non corrosive.

The cables are suitable for indoor installations.

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FIRE RESISTANCE

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Podpis/Signature

Dokument č./Document No. FIRES-FR-160-06-ANX

Príloha č./Appendix No. 16

CONSTRUCTION

conductor	–	bare annealed copper single wire round conductors meeting requirements of class 1 per PN-EN 60228,
insulation	–	mica tape and halogen free compound insulation - colours in accordance with PN-92/T-90321 standard,
pair	–	insulated conductors twisted into pairs,
cable core	–	pairs laid-up into a cable core,
wrapping	–	cable core wrapped in a polyester tape,
sheath	–	red cable sheath of halogen free compound (oxygen index bigger than 35%).

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HTKSH PH90/E30

CHARACTERISTICS

The cables maintain their functions for 90 minutes, meeting requirements of PN-EN 50200 standard

Conductor diameter		mm	0.8	1.0	1.4	1.8	2.3	2.8
Conductor cross-section		mm^2	0.5	0.75	1.5	2.5	4	6
DC loop resistance at 20°C, maximum		Ω/km	75	48	24.5	14.9	9.3	6.3
Capacitance between conductors at 1 kHz	maximum	nF/km	120	120	120	120	120	120
	average		60	70	70	70	100	100

Operating voltage	240 V
Voltage test	1.5 kV rms
Insulation resistance, minimum	20 MΩ·km
Inductance, approximate	0.7 mH/km
Corrosivity of emitted gases per PN-EN 50267-2-3, IEC 60754-2	
pH, approximate	6.8
conductivity, approximate	0.4 µS/mm
Smoke density per PN-EN 50268-2-3, IEC 61034-2	
light transmittance, minimum	94%

Operating temperature range	
during operation	from - 30 to + 80°C
during installation	from - 5 to + 70°C
Minimum bending radius	10 x cable diameter
Cable combustibility	flame retardant
Fire resistance	90 minutes at 842°C
Combustibility tests	PN-EN 60332-1-2 and PN-EN 50200
Circuit integrity E30	DIN 4102-12
Reference standards	WT-TK-43 PN-92/T-90320 PN-92/T-90321

CE = the cable meets requirements of the low voltage directive 73/23/EEC and 93/68/EEC

Cable type	Number of pairs (x 2) x conductor diameter	Cable outer diameter (appr.)	Copper index	Cable weight (appr.)
	number x mm	mm	kg/km	kg/km
HTKSH PH90/E30	1 x 2 x 0,8	6,5	9,6	61
HTKSH PH90/E30	2 x 2 x 0,8	8,0	19,2	77
HTKSH PH90/E30	1 x 2 x 1,0	7,1	15,1	67
HTKSH PH90/E30	2 x 2 x 1,0	10,4	30,2	92
HTKSH PH90/E30	1 x 2 x 1,4	8,1	28,8	88

Cable type	Number of pairs (x 2) x conductor diameter	Cable outer diameter (appr.)	Copper index	Cable weight (appr.)
	number x mm	mm	kg/km	kg/km
HTKSH PH90/E30	2 x 2 x 1,4	11,7	57,6	155
HTKSH PH90/E30	1 x 2 x 1,8	9,7	48,9	127
HTKSH PH90/E30	1 x 2 x 2,3	10,7	79,8	168,5
HTKSH PH90/E30	4 x 2 x 0,8	10,3	38,4	127

Other diameters and conductor counts available on request.

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Dokument č./Document No. FIRES-FR-160-06-AWE

Príloha č./Appendix No. 14

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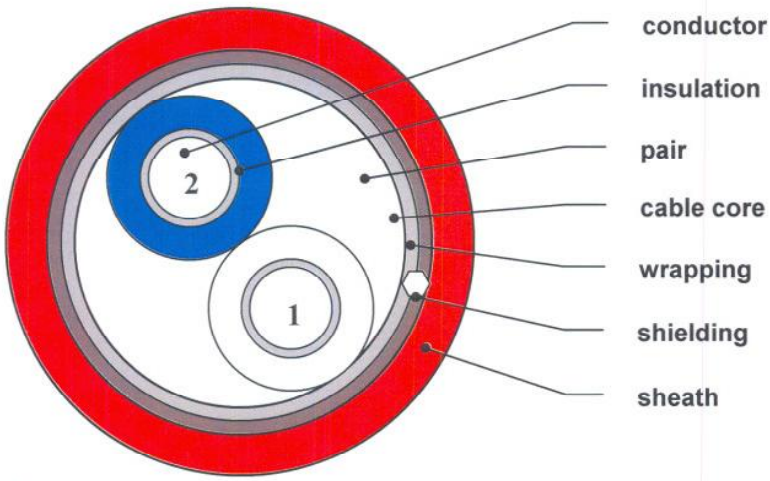
HTKSHekw PH90/E30

FIRE RESISTANT HALOGEN FREE CABLES



APPLICATIONS

HTKSHekw PH90/E30 fire resistant and halogen free cables are intended for installation in alarm, signalling, transmission, sound warning and similar systems, also for data processing systems and for analogue or digital data transmission in industrial electronics and control applications in objects of sharp fire protection requirements, particularly in fire alarm and fire automatic control systems.

Halogen free cables are applied in locations where, in case of fire, higher safety for human beings and expensive electronic equipment is required.

Functions of the cables are maintained – data are transmitted and power is supplied to equipment which must operate in fire conditions and during fire fighting (e.g. emergency lighting). The cables are flame retardant and their smoke emission is low, emitted fumes are non toxic and non corrosive.

Cable circuits are protected by an overall electrostatic shield against external electric field interferences.

The cables are suitable for indoor installations.

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FIRE RESISTANCE

Dátum/Date 16. 11 2006
Podpis/Signature

Dokument č./Document No. FIRES-FR-160-06-ANX

Príloha č./Appendix No. 18

CONSTRUCTION

conductor	–	bare annealed copper single wire round conductors meeting requirements of class 1 per PN-EN 60228,
insulation	–	mica tape and halogen free compound insulation - colours in accordance with PN-92/T-90321 standard,
pair	–	insulated conductors twisted into pairs,
cable core	–	pairs laid-up into a cable core,
wrapping	–	cable core wrapped in a polyester tape,
shielding	–	overall electrostatic shield incorporating a plastic laminated metal foil and a tinned copper drain wire,
sheath	–	red cable sheath of halogen free compound (oxygen index bigger than 35%).

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HTKSHekw PH90/E30

CHARACTERISTICS

The cables maintain their functions for 90 minutes, meeting requirements of PN-EN 50200 standard

Conductor diameter		mm	0.8	1.0	1.4	1.8	2.3	2.8
Conductor cross-section		mm^2	0.5	0.75	1.5	2.5	4	6
DC loop resistance at 20°C, maximum		Ω/km	75	48	24.5	14.9	9.3	6.3
Capacitance between conductors at 1 kHz	maximum	nF/km	200	200	200	200	200	200
	average		90	130	130	130	150	150

Operating voltage	240 V
Voltage test	1.5 kV rms
Insulation resistance, minimum	20 MΩ·km
Inductance, approximate	0.7 mH/km
Corrosivity of emitted gases per PN-EN 50267-2-3, IEC 60754-2	
pH, approximate	6.8
conductivity, approximate	0.4 µS/mm
Smoke density per PN-EN 50268-2-3, IEC 61034-2	
light transmittance, minimum	94%

Operating temperature range	
during operation	from - 30 to + 80°C
during installation	from - 5 to + 70°C
Minimum bending radius	10 x cable diameter
Cable combustibility	flame retardant
Fire resistance	90 minutes at 842°C
Combustibility tests	PN-EN 60332-1-2 and PN-EN 50200
Circuit integrity E30	DIN 4102-12
Reference standards	WT-TK-43 PN-92/T-90320 PN-92/T-90321

CE = the cable meets requirements of the low voltage directive 73/23/EEC and 93/68/EEC

Cable type	Number of pairs (x 2) x conductor diameter	Cable outer diameter (appr.)	Copper index	Cable weight (appr.)
	number x mm	mm	kg/km	kg/km
HTKSHekw PH90/E30	1 x 2 x 1,0	7,4	20,1	73
HTKSHekw PH90/E30	1 x 2 x 1,4	8,2	28,8	95
HTKSHekw PH90/E30	2 x 2 x 1,4	11,8	62,6	165

Cable type	Number of pairs (x 2) x conductor diameter	Cable outer diameter (appr.)	Copper index	Cable weight (appr.)
	number x mm	mm	kg/km	kg/km
HTKSHekw PH90/E30	1 x 2 x 1,8	9,8	53,9	134
HTKSHekw PH90/E30	1 x 2 x 2,3	10,8	84,8	173,5

Other diameters and conductor counts available on request.

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FIRE RESISTANCE

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Príloha č./Appendix No. 19

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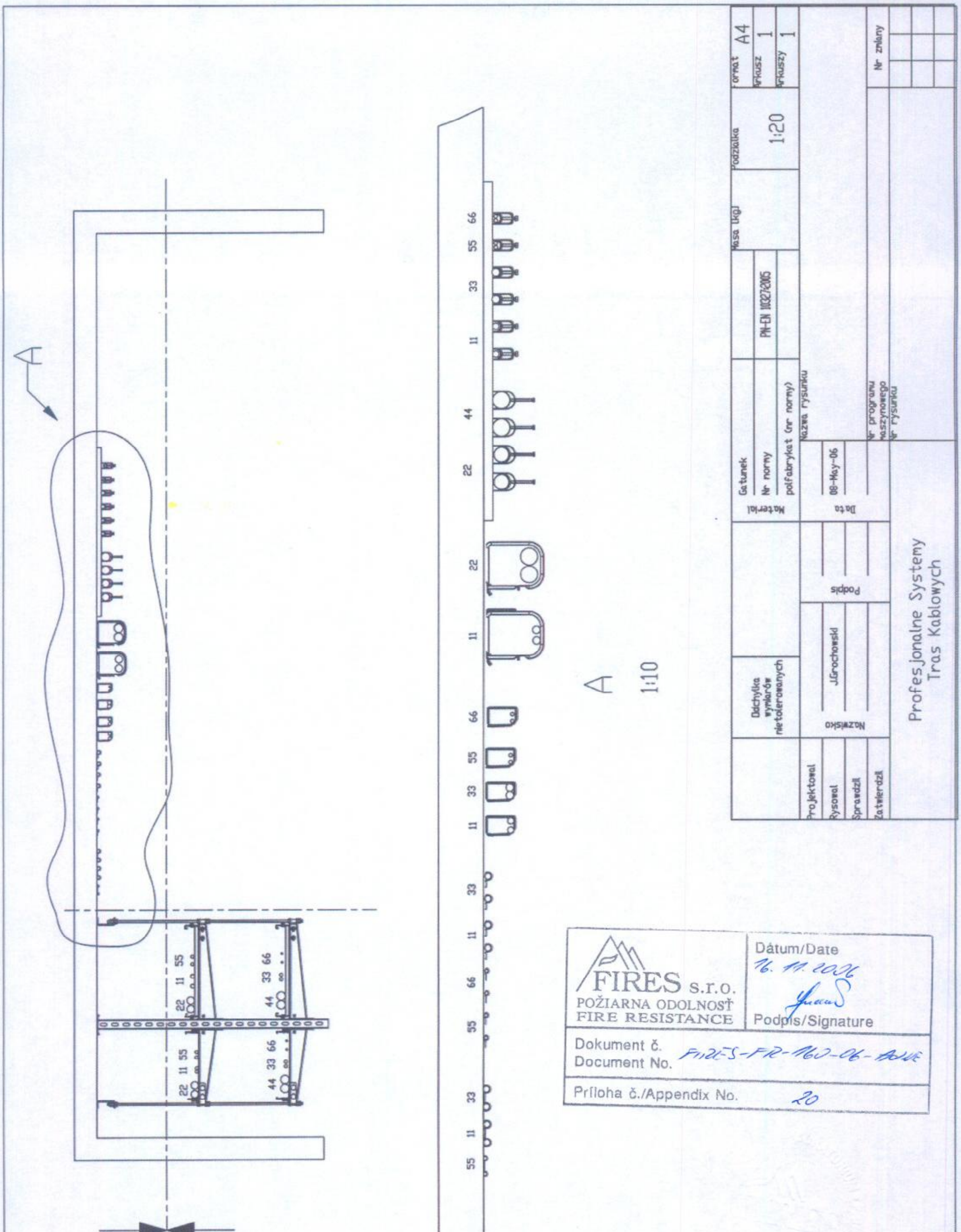

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FIRE RESISTANCE

Dátum/Date: 16. 11. 2006

Podpis/Signature

Dokument č.
Document No. FIRES-FR-160-06-AUVE

Príloha č./Appendix No. 20

Badanie systemów tras kablowych wg normy DIN 4102-12

w FIRES Batizowce, Słowacja.

Firma TECHNOKABEL - BAKS

MICA 5 w dniu 13-17.11.06

Typ kabla / Parametry kabla i trasy kablowej	(N)HXH PH90 4x1,5RE E90	(N)HXH PH90 4x50RM E90	(N)HXCH PH90 4x1,5RE/ 1,5 E90	(N)HXCH PH90 4x50RE/25 E90	HTKSH PH90 4x2x0,8 E90	HTKSHekw PH90 1x2x2,3 E90
Oznaczenie kabla na rysunku	1	2	3	4	5	6
Średnica kabla [mm]	16,1	34,7	17,1	37,5	10,3	10,8
Ciężar kabla [kg/m]	0,38	2,80	0,43	3,09	0,14	0,18
1. Korytko 60x300 mm, - podpory - 1200 mm, - obciążenie 10 kg/m.	2	2	-----	---	2	----
2. Drabinka 60x400 mmm, - podpory - 1200 m, - obciążenie 20 kg/m.	2	2	-----	---	2	----
3 Korytko 60x300 mm, - podpory - 1200 mm, - obciążenie 10 kg/m.	----	----	2	2	-----	2
4. Drabinka 60x400 mmm, - podpory - 1200 m, - obciążenie 20 kg/m.	----	----	2	2	-----	2
5. Uchwyt UEF - mocowanie co 300 mm - obciążenie ? kg/m,	2	---	2	---	2	---
6. Uchwyt UDF - mocowanie co 300 mm - obciążenie ? kg/m,	2	---	2	---	2	2
7. Obejmy OZMO - mocowanie co 300 mm - obciążenie 1,0kg/uchwyt	2	----	2	---	2	2
8. Obejmy OZO - mocowanie co 300 mm, - obciążenie 3 kg/uchwyt	2	2	---	----	---	---
9. Uchwyty UK na szynach - mocowanie co 300 mm, - obciążenie ?/uchwyt	2	2	2	2	2	2

Ilość odcinków [szt.]	14	8	12	6	12	10

Długość odcinka wynosi 5,7 m

Potrzebna ilość kabli [m]						

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Dátum/Date 16. 11. 2006
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Dokument č. / Document No. FIRES-FR-160-06-ANEX

Príloha č./Appendix No. 21