

电力工业电气设备质量检验检测中心

Quality Inspection and Test Center
for Equipment of Electric Power

(2008) 缆字 第 218 号



检测报告

Inspection Report



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2. 检测报告无检测、校核、审核、批准人签字无效。
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4. 报告有效期从试验完成之日开始计算
5. 本报告仅对检测样品负责。



电力工业电气设备质量检验测试中心
QUALITY INSPECTION AND TEST CENTER FOR EQUIPMENT OF ELECTRIC POWER
P. R. OF CHINA

检测报告
INSPECTION REPORT

(2008)缆字第 218 号
Ref: 2008LZ218

委托单位 深圳市华夏城电业有限公司
Client United Electric Co., Ltd.

试样说明

名称: 12/20 kV 交联电缆热缩式户内终端
型号规格: HIT22K 3C
制造厂: 深圳市宏商材料科技股份有限公司

试样编号: DL 2008-177
制造日期: 2008年03月
取样方式: 送样

Description of Samples

Name of Test Samples: 12/20 kV XLPE cable heat shrinkable indoor termination
Type and Size: HIT22K 3C Year of Manufacture: Mar., 2008
Manufacturer: Hongshang Heat Shrinkable Materials Co., Ltd.
Sample No: DL2008-177 Sampling Way: taken by client self

检测标准 IEC 60502-4:2005 额定电压1 kV($U_m=1.2$ kV)到30 kV($U_m=36$ kV)挤包绝缘电力电缆及其附件 第4部分: 额定电压6 kV($U_m=7.2$ kV)到30 kV($U_m=36$ kV)电缆附件试验要求
GB/T 12706.4—2002 额定电压1 kV($U_m=1.2$ kV)到35 kV($U_m=40.5$ kV)挤包绝缘电力电缆及其附件 第4部分: 额定电压6 kV($U_m=7.2$ kV)到35 kV($U_m=40.5$ kV)电缆附件试验要求

Specification

IEC 60502-4:2005 Power cables with extruded insulation and their accessories for rated voltages from 1 kV($U_m=1.2$ kV) up to 30 kV($U_m=36$ kV) Part 4: Test requirements on accessories for cables with rated voltages from 6 kV($U_m=7.2$ kV) up to 30 kV($U_m=36$ kV)
GB/T 12706.4—2002 Power cables with extruded insulation and their accessories for rated voltages from 1 kV($U_m=1.2$ kV) up to 35 kV($U_m=40.5$ kV) Part 4: Test requirements on accessories for cables with rated voltages from 6 kV($U_m=7.2$ kV) up to 35 kV($U_m=40.5$ kV)

检测类别 型式试验

Category of Test Type tests

检测日期 2008-05-13 ~ 2008-06-04
Date of Testing 2008-05-13 ~ 2008-06-04

检测结论 根据 IEC 60502-4:2005 和 GB/T 12706.4—2002 标准, 对深圳市宏商材料科技股份有限公司送检的 HIT22K 3C 型 12/20 kV 交联电缆热缩式户内终端样品进行检测, 所检测的型式试验项目合格。

Conclusion The type HIT22K 3C 12/20 kV XLPE cable heat shrinkable indoor terminations taken to test by client self have passed the type tests specified in IEC 60502-4:2005 and GB/T 12706.4—2002, the 12/20 kV XLPE cable heat shrinkable indoor terminations tested were up to the standards.

检测人员: 苗福贵 龚健
Inspected and Tested by Miao Fugui Gong Jian

校核: 阎孟昆 审核: 杨荣凯
Checked by Yan Mengkun Examined and verified by Yang Rongkai

批准: 黄维民 职务: 主任 签发日期: 2008-06-27
Approved by Huang Weimin Designation: Director Date of issue:

1 前言

本报告用中文书写, 应委托方要求译成英文对照。如对本报告的解释有意义上的差异时则以中文为准。

Foreword

This report was written in Chinese and translated into English as requested by the client. In the event of any differences in the interpretation of this report, the Chinese text shall take precedence over the English translation.

2 试样的数量和安装

由制造厂将四套被试终端安装在两根 YJV22-12/20 3×185 的电缆上构成 1 号和 2 号组合试样, 组合试样中电缆终端之间的电缆长度均大于 5 m。其中, 1 号组合试样用于进行标准中表 4 规定的 1.1 系列、1.2 系列和 1.3 系列的试验; 2 号组合试样用于进行标准中表 4 规定的 1.4 系列的试验。

The Number and Installation of Combination Samples

It was required that four sets of terminations to be tested were installed by the manufacturer on two length of cables forming No.1 and No.2 combination samples. The length of the cable in the combination sample was greater than 5 m between the two terminations. The cable used in the combination sample was a XLPE insulated three cores cables for rated voltage 12/20 kV, a cross-section of 185 sq.mm. The type tests sequence 1.1, 1.2 and 1.3 were carried out on No.1 combination samples. The type tests sequence 1.4 were carried out on No.2 combination samples.

3 试验方法

Test Methods

3.1 工频电压试验

试验按 IEC 61442:2005 第 4 章的规定在室温下进行。

AC voltage withstand test

The tests were carried out at ambient temperature in accordance with IEC 61442: 2005, clause 4.

3.2 局部放电试验

试验按 IEC 61442: 2005 第 7 章的规定进行, 试验时背景干扰为 1 pC。

Partial discharge test

The tests were carried out in accordance with IEC 61442: 2005, clause 7, the level of maximum noise background being 1 pC during the tests.

3.3 冲击电压试验

试验按 IEC 61442: 2005 第 6 章的规定进行。

Impulse voltage withstand test

The tests were carried out in accordance with IEC 61442: 2005, clause 6.

3.4 恒压负荷循环试验

每个负荷循环时间为 8 h, 其中至少有 2 h 使导体温度保持在正常运行时最高温度以上 5 ℃~10 ℃, 随后至少 3 h 自然冷却至不超过环境温度 10 ℃。在整个试验期间, 试品上应施加 30 kV 的工频电压。

Heating cycle voltage test

Each thermal cycle was of 8h duration with at least 2 h at a steady temperature of 5 ℃~10 ℃ above the maximum cable conductor temperature in normal operation followed by at least 3 h of natural cooling to within 10 ℃ of ambient temperature. During the whole of the test period a voltage of 30 kV shall be applied to the sample.

3.5 动热稳定试验

试验按 IEC 61442: 2005 第 11 章和第 12 章的规定进行。

Dynamic short-circuit and thermal short-circuit tests

The tests were carried out in accordance with IEC 61442: 2005, clause 11 and clause 12.

3.6 潮湿试验

试验按 IEC 61442: 2005 第 13 章的规定进行。

Humidity tests

The tests were carried out in accordance with IEC 61442: 2005, clause 13.

4 试验顺序和检测结果

试验顺序和检测结果见表 1 (标准中规定 1.1 系列)、表 2 (标准中规定 1.2 系列和 1.3 系列)和表 3 (标准中规定 1.4 系列)。

Test Sequence and Results

The test sequence and results were given in Table 1 (sequence 1.1), Table 2 (sequence 1.2 ,1.3) and Table 3 (sequence 1.4).

表1 / Table 1

试验顺序 Test sequence	检测项目 Items	标准要求 Requirements	检测结果 Results	评价 Remarks
1	工频电压试验 AC withstand voltage test	54 kV, 5 min, 不击穿, 不闪络 Neither breakdown nor flashover shall occur at 54 kV for 5 min	54 kV 下, 5 min, 组合 试样各相均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 54 kV for 5 min	符合要求 PASS
2	室温下局部放电 试验 Partial discharge test at ambient temperature	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下, 组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2pC at 20 kV	符合要求 PASS
3	高温下冲击电压 试验 Impulse withstand voltage test at 95 °C~100 °C	125 kV, 正负极性各 10次不击穿, 不闪络 Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 125 kV	125 kV, 正负极性各10 次(见附录B)组合试样各 相均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 125 kV(See Annex B)	符合要求 PASS
4	在空气中恒压负荷 循环试验 Heating cycles voltage test in air	在 30 kV 电压和导 体加热至温度 95 °C~100 °C下, 共进行 3 次循环 不击穿, 不闪络 Neither breakdown nor flashover shall occur during 3 cycles in air at the conductor temperature of 95 °C to 100 °C and 30 kV	在 30 kV 电压和导体 温度 95 °C~100 °C 下, 共经受 3 次循环组合试 样均未击穿和闪络 No breakdown and flashover occurred on the combination samples during 3 cycles in air at the conductor temperature of 95 °C to 100 °C and 30 kV	符合要求 PASS

试验顺序 Test sequence	检测项目 Items	标准要求 Requirements	检测结果 Results	评价 Remarks
5	高温下局部放电 试验 Partial discharge test at 95 °C~ 100 °C	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下, 组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2 pC at 20 kV	符合要求 PASS
6	室温下局部放电 试验 Partial discharge test at ambient temperature	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下, 组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2 pC at 20 kV	符合要求 PASS
7	恒压负荷循环试验 Heating cycle voltage test	在 30 kV 电压和导 体加热至温度 95 °C~100 °C下, 共进行 60 次循环 不击穿, 不闪络 Neither breakdown nor flashover shall occur during 60 cycles in air at the conductor temperature of 95 °C to 100 °C and 30 kV	在 30 kV 电压和导体温 度 95 °C~100 °C下, 共 经受 60 次循环, 组合试 样均未击穿和闪络 No breakdown and flashover occurred on the combination samples during 60 cycles in air at the conductor temperature of 95 °C to 100 °C and 30 kV	符合要求 PASS
8	高温下局部放电 试验 Partial discharge test at 95 °C~ 100 °C	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下, 组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2 pC at 20 kV	符合要求 PASS
9	室温下局部放电 试验 Partial discharge test at ambient temperature	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下, 组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2 pC at 20 kV	符合要求 PASS
10	冲击电压试验 Impulse withstand voltage test	125 kV, 正负极性各 10次不击穿, 不闪络 Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 125 kV	125 kV, 正负极性各10次 (见附录C)组合试样各相 均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 125 kV (See Annex C)	符合要求 PASS
11	工频电压试验 AC withstand voltage test	30 kV, 15 min, 不击穿, 不闪络 Neither breakdown nor flashover shall occur at 30 kV for 15 min	30 kV 下, 15 min, 组合 试样各相均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 30 kV for 15 min	符合要求 PASS

表2 / Table 2

试验顺序 Test sequence	检测项目 Items	标准要求 Requirements	检测结果 Results	评价 Remarks
1	工频电压试验 AC withstand voltage test	54 kV, 5 min, 不击穿, 不闪络 Neither breakdown nor flashover shall occur at 54 kV for 5 min	54 kV 下, 5 min, 组合 试样各相均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 54 kV for 5 min	符合要求 PASS
2	热稳定试验 Thermal short-circuit test	23.0 kA, 2 s 两次, 无可见的损坏 No visible deterioration at 23.0 kA, 2 s	23.20 kA, 2.02 s 和 23.24 kA, 2.01 s 无可见的损坏 (见附录E2) No visible deterioration at 23.20 kA, 2.02 s and 23.24 kA, 2.01 s (See Annex E2)	符合要求 PASS
3	动稳定试验 Dynamic short-circuit test	81.0 kA, 不少于 10 ms, 无可见的损坏 No visible deterioration at 81.0 kA, not less than 10 ms	81.18 kA, 56 ms, 无可见的损坏 (见附录E1) No visible deterioration at 81.18 kA, 56 ms (See Annex E1)	符合要求 PASS
4	冲击电压试验 Impulse withstand voltage test	125 kV, 正负极性各 10次不击穿, 不闪络 Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 125 kV	125 kV, 正负极性各10次 (见附录D)组合试样各相 均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 125 kV (See Annex D)	符合要求 PASS
5	工频电压试验 AC withstand voltage test	30 kV, 15 min, 不击穿, 不闪络 Neither breakdown nor flashover shall occur at 30 kV for 15 min	30 kV 下, 15 min, 组合 试样各相均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 30 kV for 15 min	符合要求 PASS

表3 / Table 3

试验顺序 Test sequence	检测项目 Items	标准要求 Requirements	检测结果 Results	评价 Remarks
1	潮湿试验 Humidity tests	在 15 kV, 300 h 下, 不击穿, 不闪络, 无 电蚀和机械损伤 Neither breakdown nor flashover, no tracking, erosion or mechanical damage shall occur at 15 kV for 300 h	完成 15 kV, 300 h 潮湿试 验, 组合试样各相均未击穿 和闪络, 无电蚀和机械损伤 No breakdown, flashover, tracking, erosion and mechanical damage occurred on the combination samples at 15 kV for 300 h	符合要求 PASS

附录A 检测中使用的主要试验仪器设备清单

Annex A List of the main equipment and instruments used in tests

序号 Sequence	仪器设备名称 型号/规格 Name of the equipment and instruments Model / Type	设备编号 No.	测量范围 Measuring range	不确定度/ 准确度 Uncertainty/ Veracity	检定/校准 机构 Verification /Calibration institution	有效日期 Valid period
1	TAWF 串联谐振装置 Series resonance system	0311205	(0~75) kV	1 级 Grade 1	国家高电压计量站 National high voltage measurement station	2008-10-17
2	JFD-2H 局放检测系统 PD measurement system	20041202	(0.5~1000) pC	10 级 Grade 10	国家高电压计量站 National high voltage measurement station	2010-05-24
3	DDG-A-180/18×2 大电流试验装置 Equipment of heavy current test	86021	(0~5000) A	—	—	—
4	LM-0.5 电流互感器 Current transformer	0516	(0~3000) A	0.5 级 Grade 0.5	国家高电压计量站 National high voltage measurement station	2008-09-05
5	H-DJF-2 数据采集系统 Data collected system	C11-13	(0~100) kA	0.5 级	国家高电压计量站 National high voltage measurement station	2009-01-10
6	冲击分压器 Impulse voltage divider	03	(0~900) kV	1 级	国家高电压计量站 National high voltage measurement station	2009-5-20
7	64M 峰值电压表 Meter in peak value of voltage	080816	(0~600) kV	1 级 Grade 1	国家高电压计量站 National high voltage measurement station	2009-05-19
8	DT9806 数字电压表 Digital voltage meter	A053632	(0~200) mV	0.5 级 Grade 0.5	湖北省计量测试技 术研究院 Hubei Institute of Measurement and Testing Technology	2008-11-07

附录B 恒压负荷循环试验前组合试样冲击电压试验实际耐受电压值和冲击电压波形(高温下, 125 kV, 允许 ±3% 偏差)

Annex B The values and oscillograms of impulse voltages on the combination samples before heating cycles voltage test (at high temperature, 125 kV, ±3% tolerance)

B1 冲击电压实际耐受电压值

The values of impulse voltages

温度: 25.0 °C 相对湿度: 60% 大气压: 0.1001 MPa

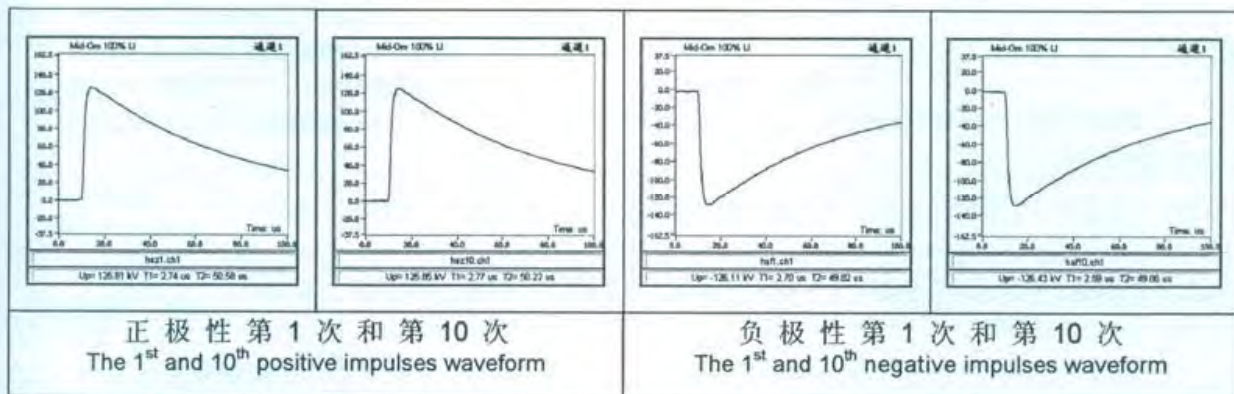
Ambient temperature: 25.0 °C, Relative humidity: 60%, Atmosphere: 0.1001 MPa

单位/unit: kV

正极性 Positive polarity	125.8	125.8	125.4	124.9	125.1	127.1	125.2	125.3	125.5	125.9
负极性 Negative polarity	126.1	125.7	125.3	125.5	127.3	126.1	125.3	127.3	125.1	126.4

B2 冲击电压波形图

Oscillograms of the impulse voltages waveform



附录C 恒压负荷循环试验后组合试样冲击电压试验实际耐受电压值和冲击电压波形(室温下, 125 kV, 允许 ±3% 偏差)

Annex C The values and oscillograms of impulse voltages on the combination samples after heating cycles voltage test (at ambient temperature, 125 kV, ±3% tolerance)

C1 冲击电压实际耐受电压值

The values of impulse voltages

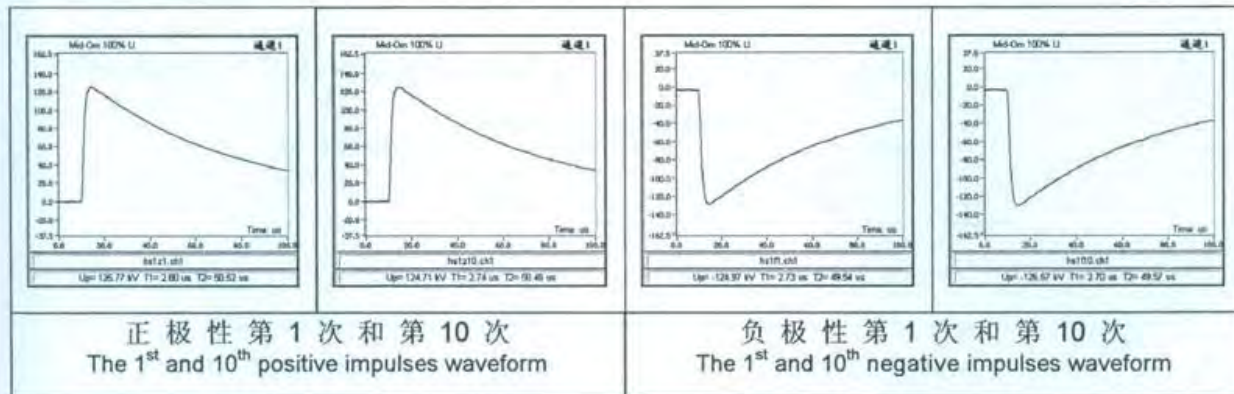
温度: 30.0 °C 相对湿度: 47% 大气压: 0.0997 MPa

Ambient temperature: 30.0 °C, Relative humidity: 47%, Atmosphere: 0.0997 MPa

单位/unit: kV

正极性 Positive polarity	125.8	125.8	125.3	125.6	126.1	126.9	126.5	125.9	125.3	124.7
负极性 Negative polarity	125.0	125.6	125.0	125.4	125.1	126.1	126.8	126.9	125.6	126.6

C2 冲击电压波形图
Oscillograms of the impulse voltages waveform



附录D 动热稳定试验后组合试样冲击电压试验实际耐受电压值(室温下, 125 kV, 允许±3%偏差)
Annex C The values of impulse voltages on the combination samples after thermal short-circuit tests (at ambient temperature, 125 kV, ±3 % tolerance)

D1 冲击电压实际耐受电压值

The values of impulse voltages

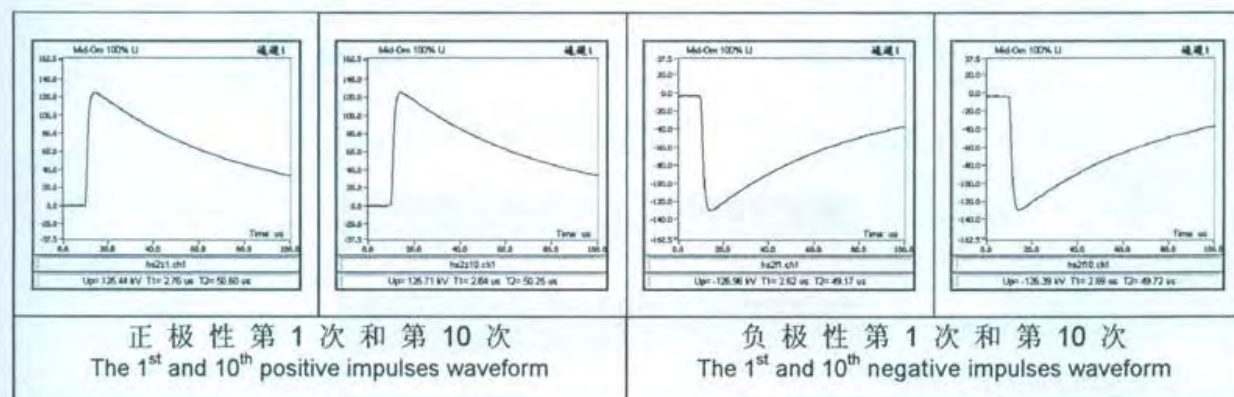
温度: 30.0 °C 相对湿度: 47 % 大气压: 0.0997 MPa

Ambient temperature: 30.0 °C, Relative humidity: 47 %, Atmosphere: 0.0997 MPa

单位/unit: kV

正极性 Positive polarity	125.4	126.4	127.4	126.3	126.9	126.5	126.4	126.7	126.7	125.7
负极性 Negative polarity	126.9	126.4	126.1	126.9	126.6	126.1	126.0	126.0	126.1	126.4

D2 冲击电压波形图
Oscillograms of the impulse voltages waveform

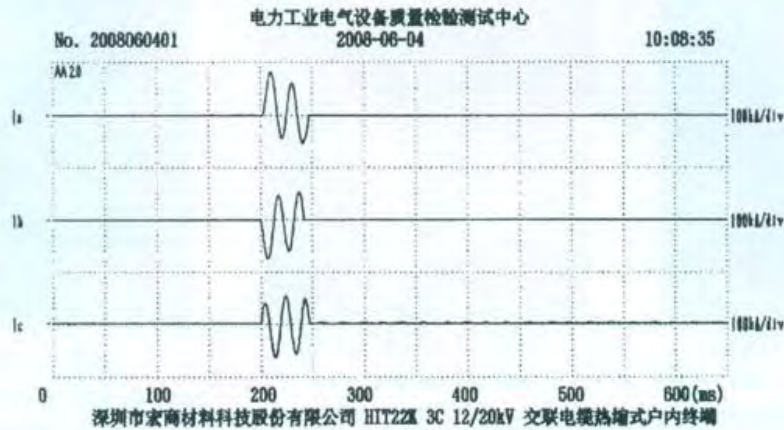


附录E 组合试样动热稳定试验波形

Annex E The waveform of dynamic short-circuit tests and thermal short-circuit tests of the combination sample

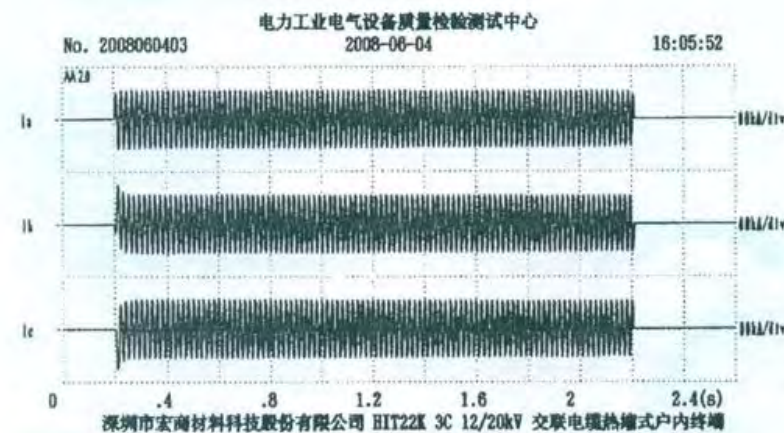
E1 组合试样动稳定试验波形

The waveform of dynamic short-circuit tests of the combination sample






E2 组合试样热稳定试验波形

The waveform of thermal short-circuit tests of the combination sample



附录F 试验照片

Annex F Photograph about testing

		
户内终端外观图 The appearance of the sample	潮湿试验后（正面） After humidity test (the right side)	潮湿试验后（反面） After humidity test (opposite direction)

附录G 试验电缆描述

Annex G Identification of test cable

额定电压 rated voltage $U_0/U(U_m)$ kV	12/20 (24)	
结构 construction	芯数 core	三芯 three cores
	屏蔽结构 construction of screen	分相屏蔽 separated screen
导体 conductor	材质 material	铜 copper
	形状 type	紧压圆形绞合 round compact stranded
	截面 cross section	185 mm ²
	外径 diameter	16.5 mm
绝缘 insulation	材质 material	交联聚乙烯 XLPE
	厚度 thickness	5.5mm
	外径 diameter	29.4 mm
屏蔽 screen	导体屏蔽厚度 thickness of conductor screen	0.9 mm
	绝缘屏蔽厚度 thickness of insulation screen	0.7 mm
	绝缘屏蔽是否可剥离 strippability of insulation screen	可剥离 strippable
	绝缘屏蔽外径 diameter of insulation screen	30.8 mm
	金属屏蔽 metallic screen	铜带屏蔽 copper tape
铠装 armour	钢带铠装 steel strip armour	
外护套 oversheath	材质 material	聚氯乙烯 PVC
	外径 diameter	76.6 mm
电缆标示 mark of cable	YJV22-12/20 3×185	

电力工业电气设备质量检验测试中心

Quality Inspection and Test Center
for Equipment of Electric Power

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No.L1026

检测报告

Inspection Report



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电力工业电气设备质量检验测试中心
QUALITY INSPECTION AND TEST CENTER FOR EQUIPMENT OF ELECTRIC POWER
P. R. OF CHINA

检 测 报 告
INSPECTION REPORT

(2008)缆字第 219 号

Ref: 2008LZ219

委托单位 深圳市华夏埃玛电气有限公司
Client United Electric Co., Ltd.

试样说明

名称: 12/20 kV 交联电缆热缩式户外终端
型号规格: HOT22K 3C
制造厂: 深圳市宏商材料科技股份有限公司

试品编号: DL 2008-178

制造日期: 2008年03月

取样方式: 送样

Description of Samples

Name of Test Samples: 12/20 kV XLPE cable heat shrinkable outdoor termination

Type and Size: HOT22K 3C

Year of Manufacture: Mar., 2008

Manufacturer: Hongshang Heat Shrinkable Materials Co., Ltd.

Sample No: DL2008-178

Sampling Way: taken by client self

检测标准 IEC 60502-4:2005 额定电压1 kV($U_m=1.2$ kV)到30 kV($U_m=36$ kV)挤包绝缘电力电缆及其附件 第4部分: 额定电压6 kV($U_m=7.2$ kV)到30 kV($U_m=36$ kV)电缆附件试验要求

GB/T 12706.4—2002 额定电压1 kV($U_m=1.2$ kV)到35 kV($U_m=40.5$ kV)挤包绝缘电力电缆及其附件 第4部分: 额定电压6 kV($U_m=7.2$ kV)到35 kV($U_m=40.5$ kV)电缆附件试验要求

Specification

IEC 60502-4:2005 Power cables with extruded insulation and their accessories for rated voltages from 1 kV($U_m=1.2$ kV) up to 30 kV($U_m=36$ kV) Part 4: Test requirements on accessories for cables with rated voltages from 6 kV($U_m=7.2$ kV) up to 30 kV($U_m=36$ kV)

GB/T 12706.4—2002 Power cables with extruded insulation and their accessories for rated voltages from 1 kV($U_m=1.2$ kV) up to 35 kV($U_m=40.5$ kV) Part 4: Test requirements on accessories for cables with rated voltages from 6 kV($U_m=7.2$ kV) up to 35 kV($U_m=40.5$ kV)

检测类别 型式试验

Category of Test Type tests

检测日期 2008-05-13~2008-06-25

Date of Testing 2008-05-13~2008-06-25

检测结论 根据 IEC 60502-4:2005 和 GB/T 12706.4—2002 标准, 对深圳市宏商材料科技股份有限公司送检的 HOT22K 3C 型 12/20 kV 交联电缆热缩式户外终端样品进行检测, 所检测的型式试验项目合格。

Conclusion The type HOT22K 3C 12/20 kV XLPE cable heat shrinkable outdoor terminations taken to test by client self have passed the type tests specified in IEC 60502-4:2005 and GB/T 12706.4—2002, the 12/20 kV XLPE cable heat shrinkable outdoor terminations tested were up to the standards.

检测人员:

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Gong Jian

校核:

Checked by Yan Mengkun

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签发日期:

Date of issue:

1 前言

本报告用中文书写, 应委托方要求译成英文对照。如对本报告的解释有意义上的差异时则以中文为准。

Foreword

This report was written in Chinese and translated into English as requested by the client. In the event of any differences in the interpretation of this report, the Chinese text shall take precedence over the English translation.

2 试样的数量和安装

由制造厂将四套被试终端安装在两根 YJV22-12/20 3×185 的电缆上构成 1 号和 2 号组合试样, 组合试样中电缆终端之间的电缆长度均大于 5 m。其中, 1 号组合试样用于进行标准中表 4 规定的 1.1 系列、1.2 系列和 1.3 系列的试验; 2 号组合试样用于进行标准中表 4 规定的 1.5 系列的试验。

The Number and Installation of Combination Samples

It was required that four sets of terminations to be tested were installed by the manufacturer on two length of cables forming No.1 and No.2 combination samples. The length of the cable in the combination sample was greater than 5 m between the two terminations. The cable used in the combination sample was a XLPE insulated three cores cables for rated voltage 12/20 kV, a cross-section of 185 sq.mm. The type tests sequence 1.1, 1.2 and 1.3 were carried out on No.1 combination samples. The type tests sequence 1.5 were carried out on No.2 combination samples.

3 试验方法

Test Methods

3.1 工频电压试验

试验按 IEC 61442:2005 第 4 章的规定在室温下进行。

AC voltage withstand test

The tests were carried out at ambient temperature in accordance with IEC 61442: 2005, clause 4.

3.2 局部放电试验

试验按 IEC 61442: 2005 第 7 章的规定进行, 试验时背景干扰为 1 pC。

Partial discharge test

The tests were carried out in accordance with IEC 61442: 2005, clause 7, the level of maximum noise background being 1 pC during the tests.

3.3 冲击电压试验

试验按 IEC 61442: 2005 第 6 章的规定进行。

Impulse voltage withstand test

The tests were carried out in accordance with IEC 61442: 2005, clause 6.

3.4 恒压负荷循环试验

每个负荷循环时间为 8 h, 其中至少有 2 h 使导体温度保持在正常运行时最高温度以上 5 ℃~10 ℃, 随后至少 3 h 自然冷却至不超过环境温度 10 ℃。在整个试验期间, 试品上应施加 30 kV 的工频电压。

Heating cycle voltage test

Each thermal cycle was of 8h duration with at least 2 h at a steady temperature of 5 ℃~10 ℃ above the maximum cable conductor temperature in normal operation followed by at least 3 h of natural cooling to within 10 ℃ of ambient temperature. During the whole of the test period a voltage of 30 kV shall be applied to the sample.

3.5 动热稳定试验

试验按 IEC 61442: 2005 第 11 章和第 12 章的规定进行。

Dynamic short-circuit and thermal short-circuit tests

The tests were carried out in accordance with IEC 61442: 2005, clause 11 and clause 12.

3.6 盐雾试验

试验按 IEC 61442: 2005 第 13 章的规定进行。

Salt fog tests

The tests were carried out in accordance with IEC 61442:2005, clause 13.

4 试验顺序和检测结果

试验顺序和检测结果见表 1 (标准中规定 1.1 系列)、表 2 (标准中规定 1.2 系列和 1.3 系列)和表 3 (标准中规定 1.5 系列)。

Test Sequence and Results

The test sequence and results were given in Table 1 (sequence 1.1), Table 2(sequence 1.2 ,1.3) and Table 3 (sequence 1.5).

表1 / Table 1

试验顺序 Test sequence	检测项目 Items	标准要求 Requirements	检测结果 Results	评价 Remarks
1	工频电压试验 AC withstand voltage test	54 kV, 5 min, 不击穿, 不闪络 Neither breakdown nor flashover shall occur at 54 kV for 5 min	54 kV 下, 5 min, 组合 试样各相均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 54 kV for 5 min	符合要求 PASS
2	淋雨下工频电压 试验 AC withstand voltage test under rain	48 kV, 1 min, 不击穿, 不闪络 Neither breakdown nor flashover shall occur at 48 kV for 1 min	48 kV 下, 1 min, 组合 试样各相均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 48 kV for 1 min	符合要求 PASS
3	室温下局部放电 试验 Partial discharge test at ambient temperature	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下, 组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2 pC at 20 kV	符合要求 PASS
4	高温下冲击电压 试验 Impulse withstand voltage test at 95 °C~100 °C	125 kV, 正负极性各 10 次不击穿, 不闪络 Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 125 kV	125 kV, 正负极性各 10 次(见附录 B)组合试 样各相均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 125 kV(See Annex B)	符合要求 PASS
5	在空气中恒压负荷 循环试验 Heating cycles voltage test in air	在 30 kV 电压和导 体加热至温度 95 °C~100 °C下, 共进行 3 次循环 不击穿, 不闪络 Neither breakdown nor flashover shall occur during 3 cycles in air at the conductor temperature of 95 °C to 100 °C and 30 kV	在 30 kV 电压和导体温 度 95 °C~100 °C 下, 共 经受 3 次循环组合试样 均未击穿和闪络 No breakdown and flashover occurred on the combination samples during 3 cycles in air at the conductor temperature of 95 °C to 100 °C and 30 kV	符合要求 PASS

试验顺序 Test sequence	检测项目 Items	标准要求 Requirements	检测结果 Results	评价 Remarks
6	高温下局部放电 试验 Partial discharge test at 95 °C ~ 100 °C	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下,组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2 pC at 20 kV	符合要求 PASS
7	室温下局部放电 试验 Partial discharge test at ambient temperature	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下,组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2 pC at 20 kV	符合要求 PASS
8	恒压负荷循环试验 Heating cycle voltage test	在 30 kV 电压和导 体加热至温度 95 °C~100 °C下, 共进行 60 次循环 不击穿,不闪络 Neither breakdown nor flashover shall occur during 60 cycles in air at the conductor temperature of 95 °C to 100 °C and 30 kV	在 30 kV 电压和导体温 度 95 °C~100 °C 下,共 经受 60 次循环,组合试 样均未击穿和闪络 No breakdown and flashover occurred on the combination samples during 60 cycles in air at the conductor temperature of 95 °C to 100 °C and 30 kV	符合要求 PASS
9	高温下局部放电 试验 Partial discharge test at 95 °C ~ 100 °C	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下,组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2 pC at 20 kV	符合要求 PASS
10	室温下局部放电 试验 Partial discharge test at ambient temperature	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下,组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2 pC at 20 kV	符合要求 PASS
11	冲击电压试验 Impulse withstand voltage test	125 kV, 正负极性各 10 次不击穿,不闪络 Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 125 kV	125 kV, 正负极性各 10 次(见附录 C)组合试样 各相均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 125 kV (See Annex C)	符合要求 PASS
12	工频电压试验 AC withstand voltage test	30 kV, 15 min, 不击穿,不闪络 Neither breakdown nor flashover shall occur at 30 kV for 15 min	30 kV 下, 15 min, 组合 试样各相均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 30 kV for 15 min	符合要求 PASS

表2 / Table 2

试验顺序 Test sequence	检测项目 Items	标准要求 Requirements	检测结果 Results	评价 Remarks
1	工频电压试验 AC withstand voltage test	54 kV, 5 min, 不击穿, 不闪络 Neither breakdown nor flashover shall occur at 54 kV for 5 min	54 kV 下, 5 min, 组合试 样各相均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 54 kV for 5 min	符合要求 PASS
2	热稳定试验 Thermal short-circuit test	23.0 kA, 2 s 两次, 无可见的损坏 No visible deterioration at 23.0 kA, 2 s	23.20 kA, 2.02 s 和 23.24 kA, 2.01 s 无 可见的损坏 (见附录E2) No visible deterioration at 23.20 kA, 2.02 s and 23.24 kA, 2.01 s (See Annex E2)	符合要求 PASS
3	动稳定试验 Dynamic short-circuit test	81.0 kA, 不少于 10 ms, 无可见的损坏 No visible deterioration at 81.0 kA, not less than 10 ms	81.18 kA, 56 ms, 无可见的损坏 (见附录E1) No visible deterioration at 81.18 kA, 56 ms (See Annex E1)	符合要求 PASS
4	冲击电压试验 Impulse voltage withstand	125 kV, 正负极性各 10次不击穿, 不闪络 Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 125 kV	125 kV, 正负极性各 10 次 (见附录D) 组合试样各相 均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 125 kV (See Annex D)	符合要求 PASS
5	工频电压试验 AC withstand voltage test	30 kV, 15 min, 不击穿, 不闪络 Neither breakdown nor flashover shall occur at 30 kV for 15 min	30 kV 下, 15 min, 组合试 样各相均未击穿和闪络 No breakdown and flashover occurred on the combination samples at 30 kV for 15 min	符合要求 PASS

表3 / Table 3

试验顺序 Test sequence	检测项目 Items	标准要求 Requirements	检测结果 Results	评价 Remarks
1	盐雾试验 Salt fog tests	在 15 kV, 1000 h 下, 不击穿, 不闪络, 无 电蚀和机械损伤 Neither breakdown nor flashover, no tracking, erosion or mechanical damage shall occur at 15 kV for 1000 h	完成 15 kV, 1000 h 盐雾试 验, 组合试样各相均未击穿和 闪络, 无电蚀和机械损伤 No breakdown, flashover, tracking, erosion and mechanical damage occurred on the combination samples at 15 kV for 1000 h	符合要求 PASS

附录A 检测中使用的主要试验仪器设备清单

Annex A List of the main equipment and instruments used in tests

序号 Sequence	仪器设备名称 型号/规格 Name of the equipment and instruments Model / Type	设备编号 No.	测量范围 Measuring range	不确定度/ 准确度 Uncertainty/ Veracity	检定/校准 机构 Verification /Calibration institution	有效日期 Valid period
1	TAWF 串联谐振装置 Series resonance system	0311205	(0~75) kV	1 级 Grade 1	国家高电压计量站 National high voltage measurement station	2008-10-17
2	JFD-2H 局放检测系统 PD measurement system	20041202	(0.5~1000) pC	10 级 Grade 10	国家高电压计量站 National high voltage measurement station	2010-05-24
3	DDG-A-180/18×2 大电流试验装置 Equipment of heavy current test	86021	(0~5000) A	—	—	—
4	LM-0.5 电流互感器 Current transformer	0516	(0~3000) A	0.5 级 Grade 0.5	国家高电压计量站 National high voltage measurement station	2008-09-05
5	H-DJF-2 数据采集系统 Data collected system	C11-13	(0~100) kA	0.5 级	国家高电压计量站 National high voltage measurement station	2009-01-10
6	冲击分压器 Impulse voltage divider	03	(0~900) kV	1 级	国家高电压计量站 National high voltage measurement station	2009-5-20
7	64M 峰值电压表 Meter in peak value of voltage	080816	(0~600) kV	1 级 Grade 1	国家高电压计量站 National high voltage measurement station	2009-05-19
8	DT9806 数字电压表 Digital voltage meter	A053632	(0~200) mV	0.5 级 Grade 0.5	湖北省计量测试技 术研究院 Hubei Institute of Measurement and Testing Technology	2008-11-07

附录B 恒压负荷循环试验前组合试样冲击电压试验实际耐受电压值和冲击电压波形(高温下, 125 kV, 允许 ±3 % 偏差)

Annex B The values and oscillograms of impulse voltages on the combination samples before heating cycles voltage test (at high temperature, 125 kV, ±3% tolerance)

B1 冲击电压实际耐受电压值

The values of impulse voltages

温度: 25.0 °C 相对湿度: 60 % 大气压: 0.1001 MPa

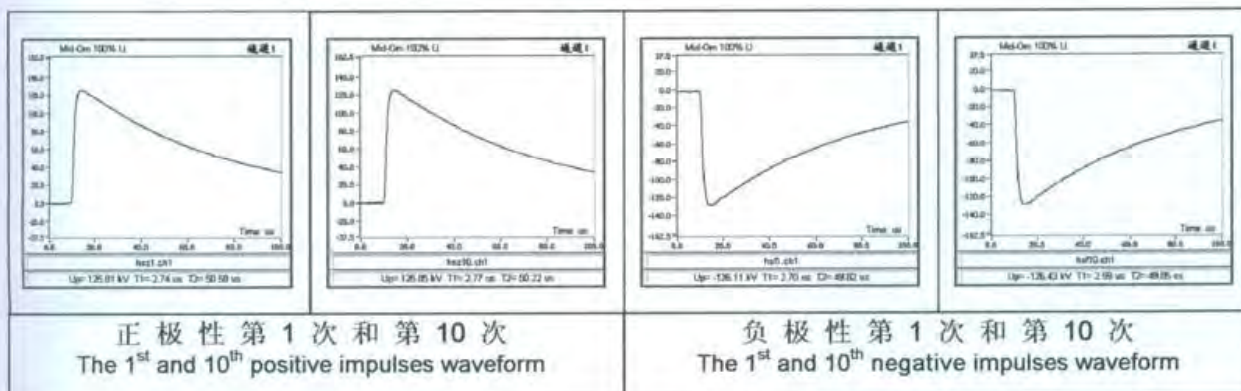
Ambient temperature: 25.0 °C, Relative humidity: 60 %, Atmosphere: 0.1001 MPa

单位/unit: kV

正极性 Positive polarity	125.8	125.8	125.4	124.9	125.1	127.1	125.2	125.3	125.5	125.9
负极性 Negative polarity	126.1	125.7	125.3	125.5	127.3	126.1	125.3	127.3	125.1	126.4

B2 冲击电压波形图

Oscillograms of the impulse voltages waveform



附录C 恒压负荷循环试验后组合试样冲击电压试验实际耐受电压值和冲击电压波形(室温下, 125 kV, 允许 ±3 % 偏差)

Annex C The values and oscillograms of impulse voltages on the combination samples after heating cycles voltage test (at ambient temperature, 125 kV, ±3% tolerance)

C1 冲击电压实际耐受电压值

The values of impulse voltages

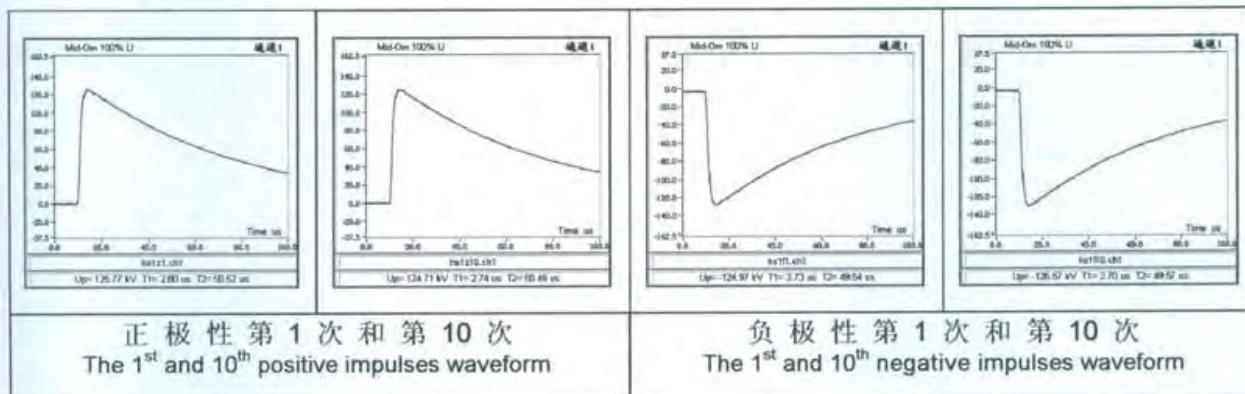
温度: 30.0 °C 相对湿度: 47 % 大气压: 0.0997 MPa

Ambient temperature: 30.0 °C, Relative humidity: 47 %, Atmosphere: 0.0997 MPa

单位/unit: kV

正极性 Positive polarity	125.8	125.8	125.3	125.6	126.1	126.9	126.5	125.9	125.3	124.7
负极性 Negative polarity	125.0	125.6	125.0	125.4	125.1	126.1	126.8	126.9	125.6	126.6

C2 冲击电压波形图
Oscillograms of the impulse voltages waveform



附录D 动热稳定试验后组合试样冲击电压试验实际耐受电压值(室温下, 125 kV, 允许±3%偏差)

Annex C The values of impulse voltages on the combination samples after thermal short-circuit tests (at ambient temperature, 125 kV, ±3 % tolerance)

D1 冲击电压实际耐受电压值

The values of impulse voltages

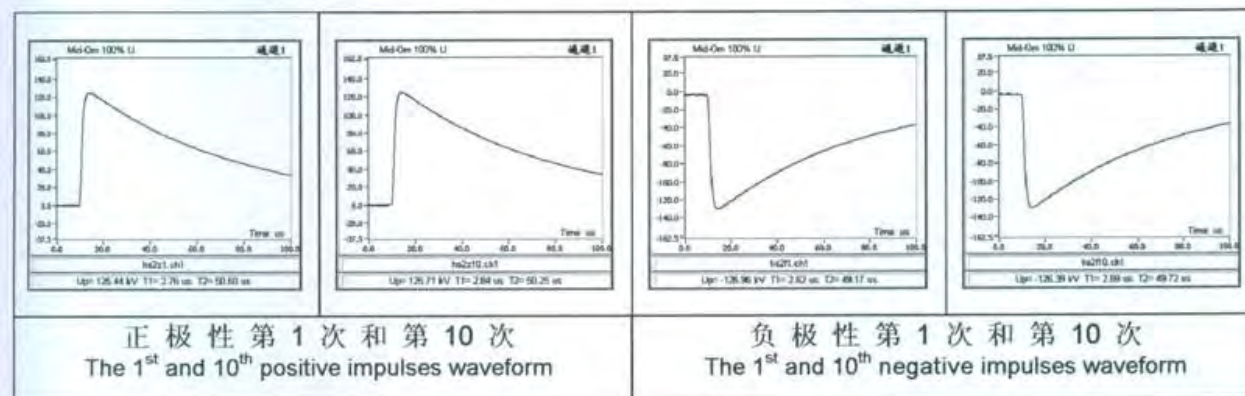
温度: 30.0 °C 相对湿度: 47 % 大气压: 0.0997 MPa

Ambient temperature: 30.0 °C, Relative humidity: 47 %, Atmosphere: 0.0997 MPa

单位/unit: kV

正极性 Positive polarity	125.4	126.4	127.4	126.3	126.9	126.5	126.4	126.7	126.7	125.7
负极性 Negative polarity	126.9	126.4	126.1	126.9	126.6	126.1	126.0	126.0	126.1	126.4

D2 冲击电压波形图
Oscillograms of the impulse voltages waveform

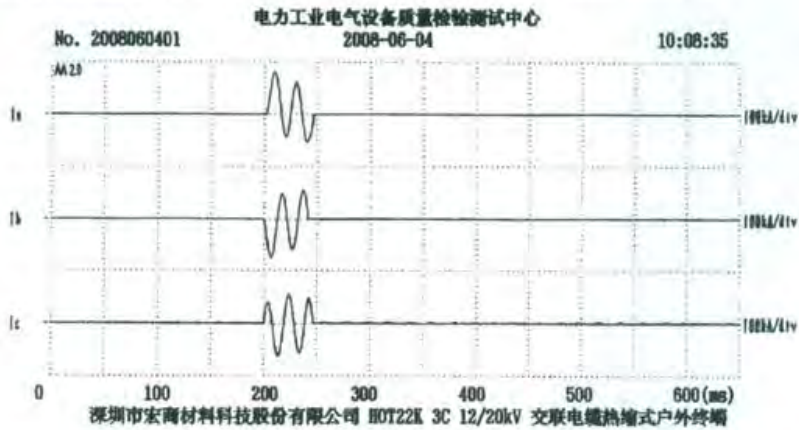


附录E 组合试样动热稳定试验波形

Annex E The waveform of dynamic short-circuit tests and thermal short-circuit tests of the combination sample

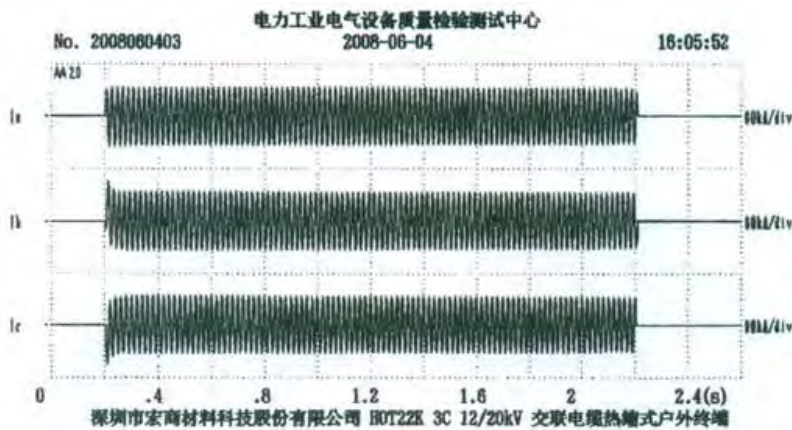
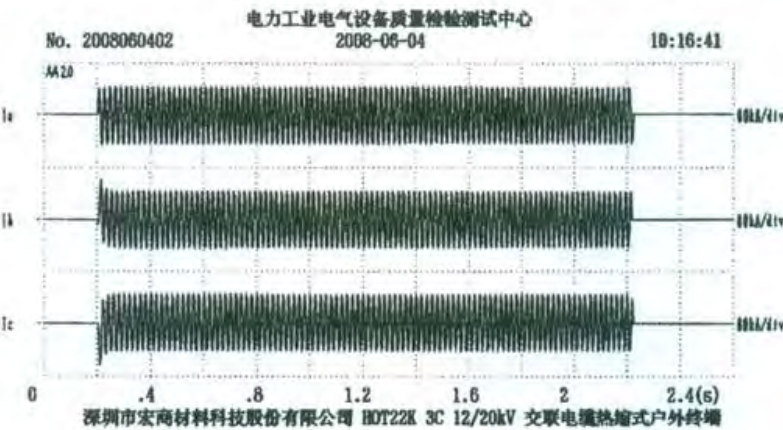
E1 组合试样动稳定试验波形

The waveform of dynamic short-circuit tests of the combination sample






E2 组合试样热稳定试验波形

The waveform of thermal short-circuit tests of the combination sample



附录F 试验照片

Annex F Photograph about testing

		
户外终端外观图 The appearance of the sample	盐雾试验后 (正面) After salt fog test (the right side)	盐雾试验后 (反面) After salt fog test (opposite direction)

附录G 试验电缆描述

Annex G Identification of test cable

额定电压 rated voltage $U_0/U(U_m)$ kV	12/20 (24)	
结构 construction	芯数 core	三芯 three cores
	屏蔽结构 construction of screen	分相屏蔽 separated screen
导体 conductor	材质 material	铜 copper
	形状 type	紧压圆形绞合 round compact stranded
	截面 cross section	185 mm ²
	外径 diameter	16.5 mm
绝缘 insulation	材质 material	交联聚乙烯 XLPE
	厚度 thickness	5.5mm
	外径 diameter	29.4 mm
屏蔽 screen	导体屏蔽厚度 thickness of conductor screen	0.9 mm
	绝缘屏蔽厚度 thickness of insulation screen	0.7 mm
	绝缘屏蔽是否可剥离 strippability of insulation screen	可剥离 strippable
	绝缘屏蔽外径 diameter of insulation screen	30.8 mm
	金属屏蔽 metallic screen	铜带屏蔽 copper tape
铠装 armour	钢带铠装 steel strip armour	
外护套 oversheath	材质 material	聚氯乙烯 PVC
	外径 diameter	76.6 mm
电缆标示 mark of cable	YJV22-12/20 3×185	

电力工业电气设备质量检验测试中心

Quality Inspection and Test Center
for Equipment of Electric Power

(2008) 缆字 第 220 号



检测报告

Inspection Report



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电力工业电气设备质量检验测试中心
QUALITY INSPECTION AND TEST CENTER FOR EQUIPMENT OF ELECTRIC POWER
P. R. OF CHINA

检测报告
INSPECTION REPORT

(2008)缆字第 220 号
Ref: 2008LZ220

委托单位 深圳市华夏埃玛电气有限公司
Client United Electric Co., Ltd.

试样说明

名称: 12/20 kV 交联电缆热缩式直通接头
型号规格: HJ22K 3C
制造厂: 深圳市宏商材料科技股份有限公司

试样编号: DL 2008-179
制造日期: 2008年03月
取样方式: 送样

Description of Samples

Name of Test Samples: 12/20 kV XLPE cable heat shrinkable straight joint
Type and Size: HJ22K 3C Year of Manufacture: Mar., 2008
Manufacturer: Hongshang Heat Shrinkable Materials Co., Ltd.
Sample No: DL2008-179 Sampling Way: taken by client self

检测标准 IEC 60502-4:2005 额定电压1 kV($U_m=1.2$ kV)到30 kV($U_m=36$ kV)挤包绝缘电力电缆及其附件 第4部分: 额定电压6 kV($U_m=7.2$ kV)到30 kV($U_m=36$ kV)电缆附件试验要求
GB/T 12706.4—2002 额定电压1 kV($U_m=1.2$ kV)到35 kV($U_m=40.5$ kV)挤包绝缘电力电缆及其附件 第4部分: 额定电压6 kV($U_m=7.2$ kV)到35 kV($U_m=40.5$ kV)电缆附件试验要求

Specification

IEC 60502-4:2005 Power cables with extruded insulation and their accessories for rated voltages from 1 kV($U_m=1.2$ kV) up to 30 kV($U_m=36$ kV) Part 4: Test requirements on accessories for cables with rated voltages from 6 kV($U_m=7.2$ kV) up to 30 kV($U_m=36$ kV)

GB/T 12706.4—2002 Power cables with extruded insulation and their accessories for rated voltages from 1 kV($U_m=1.2$ kV) up to 35 kV($U_m=40.5$ kV) Part 4: Test requirements on accessories for cables with rated voltages from 6 kV($U_m=7.2$ kV) up to 35 kV($U_m=40.5$ kV)

检测类别 型式试验

Category of Test Type tests

检测日期 2008-05-13 ~ 2008-06-04
Date of Testing 2008-05-13 ~ 2008-06-04

检测结论 根据 IEC 60502-4:2005 和 GB/T 12706.4—2002 标准, 对深圳市宏商材料科技股份有限公司送检的 HJ22K 3C 型 12/20 kV 交联电缆热缩式直通接头样品进行检测, 所检测的型式试验项目合格。

Conclusion The type HJ22K 3C 12/20 kV XLPE cable heat shrinkable straight joints taken to test by client self have passed the type tests specified in IEC 60502-4:2005 and GB/T 12706.4—2002, the 12/20 kV XLPE cable heat shrinkable straight joints tested were up to the standards.

检测人员: 苗福贵 龚健
Inspected and Tested by Miao Fugui Gong Jian

校核: 阎孟昆
Checked by Yan Mengkun

审核: 杨荣凯
Examined and verified by Yang Rongkai

批准: 黄蔚民
Approved by Huang Weimin

职务: 孙主任 签发日期: 2008-06-27
Designation: Director Date of issue:

1 前言

本报告用中文书写, 应委托方要求译成英文对照。如对本报告的解释有意义上的差异时则以中文为准。

Foreword

This report was written in Chinese and translated into English as requested by the client. In the event of any differences in the interpretation of this report, the Chinese text shall take precedence over the English translation.

2 试样的数量和安装

由制造厂将两套被试直通接头样品安装在两根 YJV22-12/20 3×185 的电缆上构成 1 号和 2 号组合试样, 组合试样中接头与电缆终端之间的电缆长度均大于 2 m。1 号和 2 号组合试样用于进行标准中表 5 规定的 2.1 系列的试验; 其中, 2 号组合试样还用于进行标准中表 5 规定的 2.2 系列和 2.3 系列的试验。

The Number and Installation of Combination Samples

It was required that two sets of straight joints to be tested were installed by the manufacturer on two length of cables forming No.1 and No.2 combination samples. The length of the cable in the combination sample was greater than 2 m between the terminations and straight joints. The cable used in the combination sample was a XLPE insulated three cores cable for rated voltage 12/20 kV, a cross-section of 185 sq.mm. The type tests sequence 2.1 were carried out on No.1 and No.2 combination samples. The type tests sequence 2.2, 2.3 were carried out on No.2 combination samples.

3 试验方法

Test Methods

3.1 工频电压试验

试验按 IEC 61442: 2005 第 4 章的规定在室温下进行。

AC voltage withstand test

The tests were carried out at ambient temperature in accordance with IEC 61442: 2005, clause 4.

3.2 局部放电试验

试验按 IEC 61442: 2005 第 7 章的规定进行, 试验时背景干扰为 1 pC。

Partial discharge test

The tests were carried out in accordance with IEC 61442: 2005, clause 7, the level of maximum noise background being 1 pC during the tests.

3.3 冲击电压试验

试验按 IEC 61442: 2005 第 6 章的规定进行。

Impulse voltage withstand test

The tests were carried out in accordance with IEC 61442: 2005, clause 6.

3.4 恒压负荷循环试验

每个负荷循环时间为 8 h, 其中至少有 2 h 使导体温度保持在正常运行时最高温度以上 5 °C~10 °C, 随后至少 3 h 自然冷却至不超过环境温度 10 °C。在整个试验期间, 试样上应施加 30 kV 的工频电压。

Heating cycle voltage test

Each thermal cycle was of 8h duration with at least 2 h at a steady temperature of 5 °C~10 °C above the maximum cable conductor temperature in normal operation followed by at least 3 h of natural cooling to within 10 °C of ambient temperature. During the whole of the test period a voltage of 30 kV shall be applied to the sample.

3.5 动热稳定试验

试验按 IEC 61442: 2005 第 11 章和第 12 章的规定进行。

Dynamic short-circuit and thermal short-circuit tests

The tests were carried out in accordance with IEC 61442: 2005, clause 11 and clause 12.

4 试验顺序和检测结果

试验顺序和检测结果见表 1(标准中规定 2.1 系列)、表 2(标准中规定 2.2 和 2.3 系列)

Test Sequence and Results

The test sequence and results were given in Table 1(sequence 2.1), Table 2(sequence 2.2, 2.3)

表1 / Table 1

试验顺序 Test sequence	检测项目 Items	标准要求 Requirements	检测结果 Results	评价 Remarks
1	工频电压试验 AC withstand voltage test	54 kV, 5 min, 不击穿 No breakdown shall occur at 54 kV for 5 min	54 kV 下, 5 min, 组合 试样各相均未击穿 No breakdown occurred on the combination samples at 54 kV for 5 min	符合要求 PASS
2	室温下局部放电 试验 Partial discharge test at ambient temperature	20 kV 下放电 量不大于10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下, 组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2pC at 20 kV	符合要求 PASS
3	高温下冲击电压 试验 Impulse withstand voltage test at 95 °C~100 °C	125 kV, 正负极性各 10 次不击穿 No breakdown shall occur at 10 positive and 10 negative impulses of 125 kV	125 kV, 正负极性各 10次(见附录 B)组合试 样各相均未击穿 No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 125 kV(See Annex B)	符合要求 PASS
4	在空气中恒压负荷 循环试验 Heating cycles voltage test in air	在 30 kV 电压和导 体加热至温度 95 °C~100 °C 下, 共进行 3 次循环 不击穿 No breakdown shall occur during 3 cycles in air at the conductor temperature of 95 °C to 100 °C and 30 kV	在 30 kV 电压和导体温 度 95 °C~100 °C 下, 共 经受 3 次循环组合试样 均未击穿 No breakdown occurred on the combination samples during 3 cycles in air at the conductor temperature of 95 °C to 100 °C and 30 kV	符合要求 PASS
5	高温下局部放电 试验 Partial discharge test at 95 °C~ 100 °C	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下, 组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2pC at 20 kV	符合要求 PASS

试验顺序 Test sequence	检测项目 Items	标准要求 Requirements	检测结果 Results	评价 Remarks
6	室温下局部放电 试验 Partial discharge test at ambient temperature	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下, 组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2 pC at 20 kV	符合要求 PASS
7	恒压负荷循环试验 Heating cycle voltage test	在 30 kV 电压和导 体加热至温度 95 ℃~100 ℃ 下, 30 次循环在空气 中, 30 次循环在 水中, 不击穿 No breakdown shall occur during 30 cycles in air and 30 cycles under water at the conductor temperature of 95 ℃ to 100 ℃ and 30 kV	在 30 kV 电压和导体温 度 95 ℃~100 ℃ 下, 共 经受了 30 次循环在空气 中, 30 次循环在水中, 组 合试样均未击穿 No breakdown occurred on the combination samples subjected to 30 cycles in air and 30 cycles under water at the conductor temperature of 95 ℃ to 100 ℃ and 30 kV	符合要求 PASS
8	高温下局部放电 试验 Partial discharge test at 95℃~ 100℃	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下, 组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2 pC at 20 kV	符合要求 PASS
9	室温下局部放电 试验 Partial discharge test at ambient temperature	20 kV 下放电 量不大于 10 pC The magnitude of the discharge at 20 kV shall not exceed 10 pC	20 kV 下, 组合试样各相 放电均不大于 2 pC The magnitude of the discharge of the combination samples didn't exceed 2 pC at 20 kV	符合要求 PASS
10	冲击电压试验 Impulse withstand voltage test	125 kV, 正负极性各 10 次不击穿 No breakdown shall occur at 10 positive and 10 negative impulses of 125 kV	125 kV, 正负极性各 10 次 (见附录 C) 组合试样 各相均未击穿 No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 125 kV (See Annex C)	符合要求 PASS
11	工频电压试验 AC withstand voltage test	30 kV, 15 min, 不击穿 No breakdown shall occur at 30 kV for 15 min	30 kV 下, 15 min, 组合 试样各相均未击穿 No breakdown occurred on the combination samples at 30 kV for 15 min	符合要求 PASS

表2 / Table 2

试验顺序 Test sequence	检测项目 Items	标准要求 Requirements	检测结果 Results	评价 Remarks
1	工频电压试验 AC withstand voltage test	54 kV, 5 min, 不击穿 No breakdown shall occur at 54 kV for 5 min	54 kV 下, 5 min, 组合 试样各相均未击穿 No breakdown occurred on the combination samples at 54 kV for 5 min	符合要求 PASS
2	热稳定试验 Thermal short-circuit test	23.0 kA, 2 s 两次, 无可见的损坏 No visible deterioration at 23.0 kA, 2 s	23.20 kA, 2.02 s 和 23.24 kA, 2.01 s 无可见的损坏 (见附录E2) No visible deterioration at 23.20 kA, 2.02 s and 23.24 kA, 2.01 s (See Annex E2)	符合要求 PASS
3	动稳定试验 Dynamic short-circuit test	81.0 kA, 不少于 10 ms, 无可见的损坏 No visible deterioration at 81.0 kA, not less than 10 ms	81.18 kA, 56 ms, 无可见的损坏 (见附录E1) No visible deterioration at 81.18 kA, 56 ms (See Annex E1)	符合要求 PASS
4	冲击电压试验 Impulse withstand voltage test	125 kV, 正负极性各 10 次不击穿 No breakdown shall occur at 10 positive and 10 negative impulses of 125 kV	125 kV, 正负极性各 10 次 (见附录 D) 组合试 样各相均未击穿 No breakdown occurred on the combination samples at 10 positive and 10 negative impulses of 125 kV (See Annex D)	符合要求 PASS
5	工频电压试验 AC withstand voltage test	30 kV, 15 min, 不击穿 No breakdown shall occur at 30 kV for 15 min	30 kV 下, 15 min, 组合 试样各相均未击穿 No breakdown occurred on the combination samples at 30 kV for 15 min	符合要求 PASS

附录A 检测中使用的主要试验仪器设备清单

Annex A List of the main equipment and instruments used in tests

序号 Sequence	仪器设备名称 型号/规格 Name of the equipment and instruments Model / Type	设备编号 No.	测量范围 Measuring range	不确定度/ 准确度 Uncertainty/ Veracity	检定/校准 机构 Verification /Calibration institution	有效日期 Valid period
1	TAWF 串联谐振装置 Series resonance system	0311205	(0~75) kV	1 级 Grade 1	国家高电压计量站 National high voltage measurement station	2008-10-17
2	JFD-2H 局放检测系统 PD measurement system	20041202	(0.5~1000) pC	10 级 Grade 10	国家高电压计量站 National high voltage measurement station	2010-05-24
3	DDG-A-180/18×2 大电流试验装置 Equipment of heavy current test	86021	(0~5000) A	—	—	—
4	LM-0.5 电流互感器 Current transformer	0516	(0~3000) A	0.5 级 Grade 0.5	国家高电压计量站 National high voltage measurement station	2008-09-05
5	H-DJF-2 数据采集系统 Data collected system	C11-13	(0~100) kA	0.5 级	国家高电压计量站 National high voltage measurement station	2009-01-10
6	冲击分压器 Impulse voltage divider	03	(0~900) kV	1 级	国家高电压计量站 National high voltage measurement station	2009-5-20
7	64M 峰值电压表 Meter in peak value of voltage	080816	(0~600) kV	1 级 Grade 1	国家高电压计量站 National high voltage measurement station	2009-05-19
8	DT9806 数字电压表 Digital voltage meter	A053632	(0~200) mV	0.5 级 Grade 0.5	湖北省计量测试技 术研究院 Hubei Institute of Measurement and Testing Technology	2008-11-07

附录B 恒压负荷循环试验前组合试样冲击电压试验实际耐受电压值和冲击电压波形(高温下, 125 kV, 允许 ±3% 偏差)

Annex B The values and oscillograms of impulse voltages on the combination samples before heating cycles voltage test (at high temperature, 125 kV, ±3% tolerance)

B1 冲击电压实际耐受电压值

The values of impulse voltages

温度: 25.0 °C 相对湿度: 60 % 大气压: 0.1001 MPa

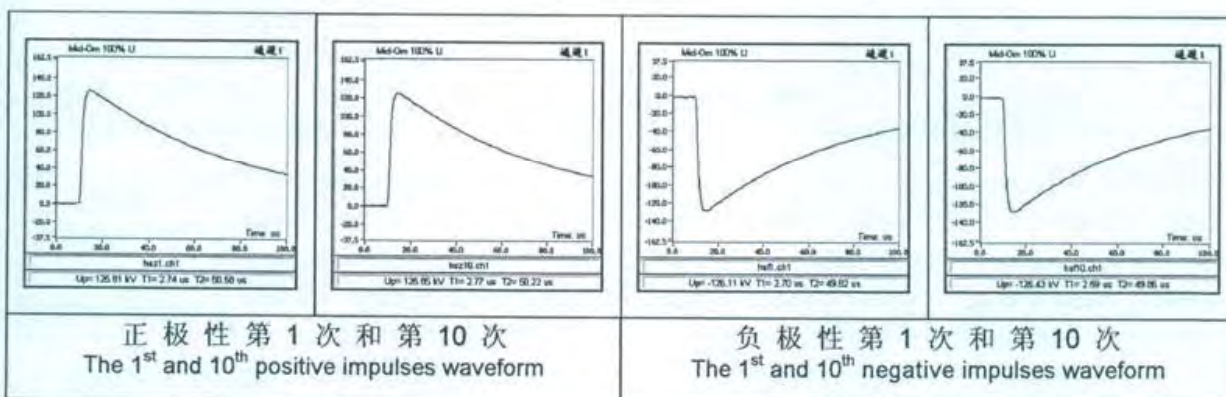
Ambient temperature: 25.0 °C, Relative humidity: 60 %, Atmosphere: 0.1001 MPa

单位/unit: kV

正极性 Positive polarity	125.8	125.8	125.4	124.9	125.1	127.1	125.2	125.3	125.5	125.9
负极性 Negative polarity	126.1	125.7	125.3	125.5	127.3	126.1	125.3	127.3	125.1	126.4

B2 冲击电压波形图

Oscillograms of the impulse voltages waveform



附录C 恒压负荷循环试验后组合试样冲击电压试验实际耐受电压值和冲击电压波形(室温下, 125 kV, 允许 ±3% 偏差)

Annex C The values and oscillograms of impulse voltages on the combination samples after heating cycles voltage test (at ambient temperature, 125 kV, ±3% tolerance)

C1 冲击电压实际耐受电压值

The values of impulse voltages

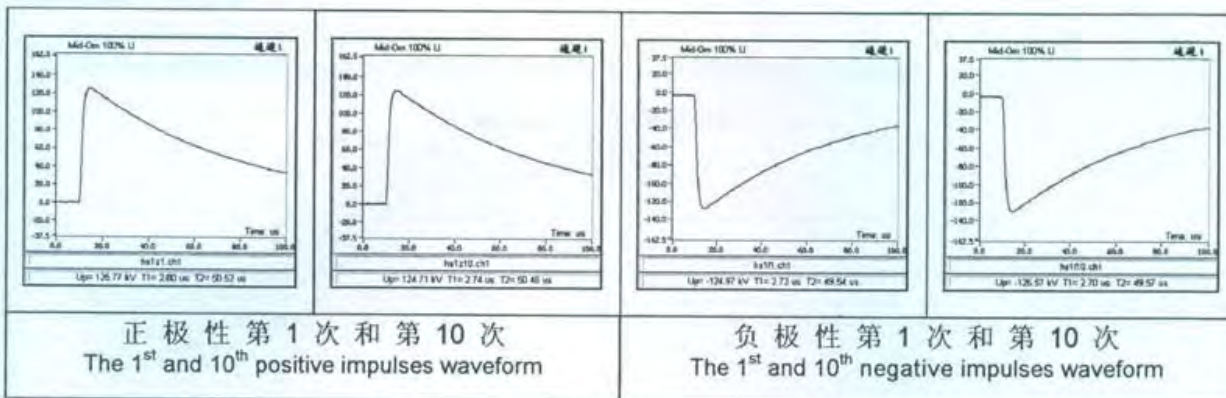
温度: 30.0 °C 相对湿度: 47 % 大气压: 0.0997 MPa

Ambient temperature: 30.0 °C, Relative humidity: 47 %, Atmosphere: 0.0997 MPa

单位/unit: kV

正极性 Positive polarity	125.8	125.8	125.3	125.6	126.1	126.9	126.5	125.9	125.3	124.7
负极性 Negative polarity	125.0	125.6	125.0	125.4	125.1	126.1	126.8	126.9	125.6	126.6

C2 冲击电压波形图
Oscillograms of the impulse voltages waveform



附录D 动热稳定试验后组合试样冲击电压试验实际耐受电压值(室温下, 125 kV, 允许±3%偏差)
Annex C The values of impulse voltages on the combination samples after thermal short-circuit tests (at ambient temperature, 125 kV, ±3 % tolerance)

D1 冲击电压实际耐受电压值

The values of impulse voltages

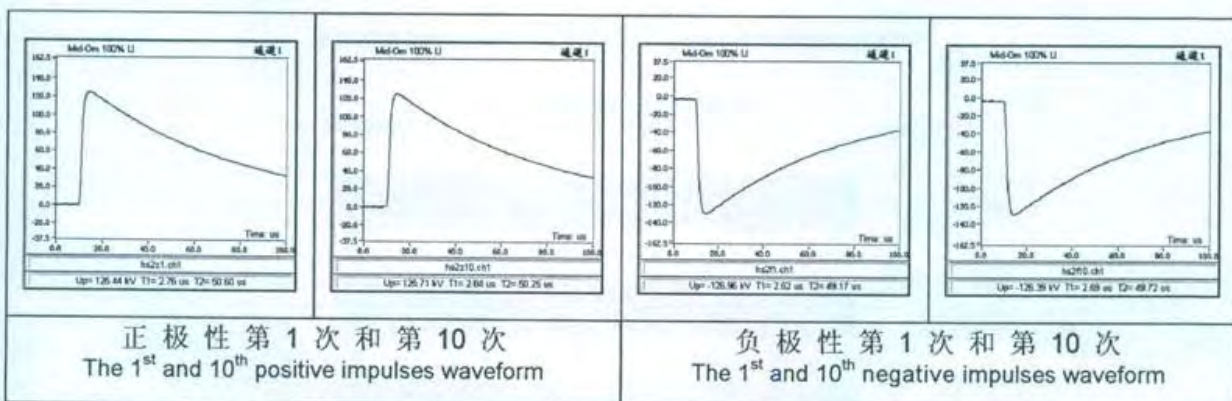
温度: 30.0 °C 相对湿度: 47 % 大气压: 0.0997 MPa

Ambient temperature: 30.0 °C, Relative humidity: 47 %, Atmosphere: 0.0997 MPa

单位/unit: kV

正极性 Positive polarity	125.4	126.4	127.4	126.3	126.9	126.5	126.4	126.7	126.7	125.7
负极性 Negative polarity	126.9	126.4	126.1	126.9	126.6	126.1	126.0	126.0	126.1	126.4

D2 冲击电压波形图
Oscillograms of the impulse voltages waveform

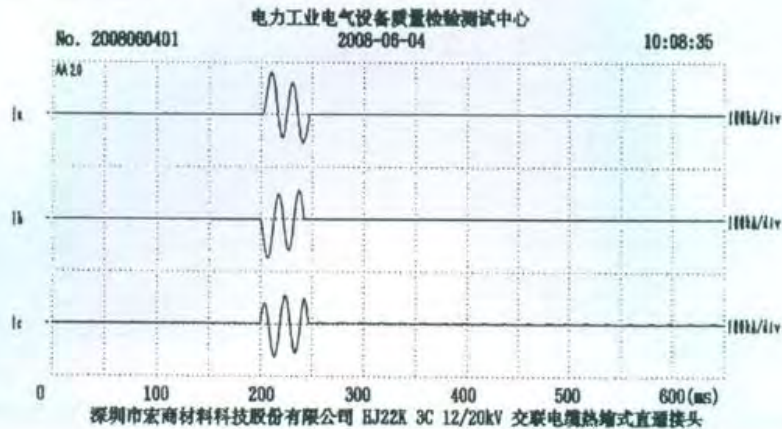


附录E 组合试样动热稳定试验波形

Annex E The waveform of dynamic short-circuit tests and thermal short-circuit tests of the combination sample

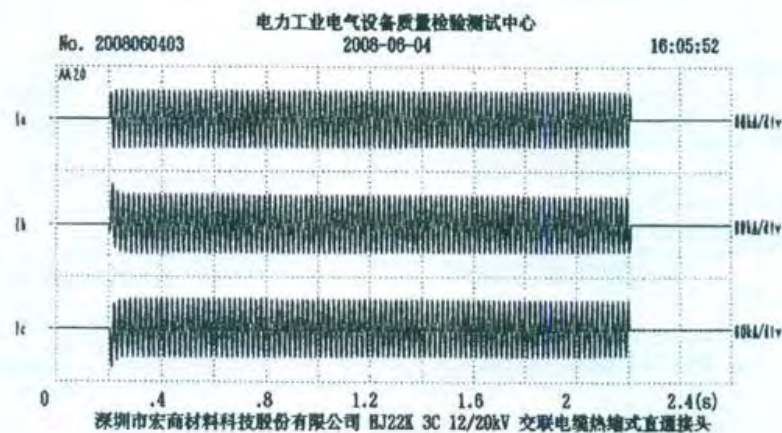
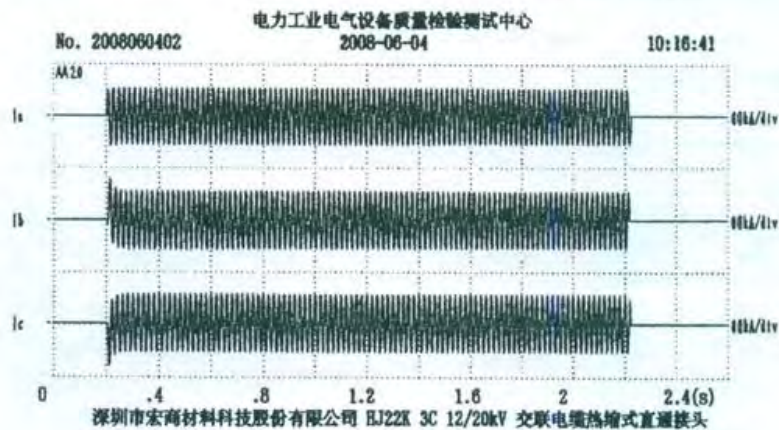
E1 组合试样动稳定试验波形

The waveform of dynamic short-circuit tests of the combination sample



E2 组合试样热稳定试验波形

The waveform of thermal short-circuit tests of the combination sample



附录F 试验照片
 Annex F Photograph about testing



附录G 试验电缆描述
 Annex G Identification of test cable

额定电压 rated voltage $U_0/U(U_m)$ kV		12/20 (24)
结构 construction	芯数 core	三芯 three cores
	屏蔽结构 construction of screen	分相屏蔽 separated screen
导体 conductor	材质 material	铜 copper
	形状 type	紧压圆形绞合 round compact stranded
	截面 cross section	185 mm ²
	外径 diameter	16.5 mm
绝缘 insulation	材质 material	交联聚乙烯 XLPE
	厚度 thickness	5.5mm
	外径 diameter	29.4 mm
屏蔽 screen	导体屏蔽厚度 thickness of conductor screen	0.9 mm
	绝缘屏蔽厚度 thickness of insulation screen	0.7 mm
	绝缘屏蔽是否可剥离 strippability of insulation screen	可剥离 strippable
	绝缘屏蔽外径 diameter of insulation screen	30.8 mm
	金属屏蔽 metallic screen	铜带屏蔽 copper tape
铠装 armour		钢带铠装 steel strip armour
外护套 oversheath	材质 material	聚氯乙烯 PVC
	外径 diameter	76.6 mm
电缆标示 mark of cable		YJV22-12/20 3×185

TEST REPORT

Client: United Electric Co., Ltd.

Manufacturer: Hongshang Heat Shrinkable Materials Co., Ltd.

Description of Samples:

Name of Test Samples: 26/35kV heat shrinkable indoor termination for 3-core XLPE power cable

Type and Size: UEHMX 36 IT3/2

Test Standards

GB/T 12706.4-2002 Power cables with extruded insulation and their accessories for rated voltage from 1kV(Um=1.2kV) up to 35kV(Um=40.5kV). Part 4: Test requirements on accessories for cables with rated voltage from 6kV(Um=7.2kV) up to 35kV(Um=40.5kV)

IEC60502-4:2005 Power cables with extruded insulation and their accessories for rated voltage from 1kV(Um=1.2kV) up to 30kV (Um=36kV) Part 4: Test requirements on accessories for cable with rated voltage from 6kV(Um=7.2kV) up to 30kV(Um=36kV)

Tested by: GCA High Voltage Laboratory (Authorized by China National High Voltage Measuring Center to test the cable accessories up to 220kV and issue the test report with equal validity)

Category of Test: Type test

Date of Testing: From July 20, 2006 to December 19, 2006.

Conclusion: The object, constructed in accordance with the description, has been subjected to the series of proving tests in accordance with **GB/T 12706.4 and IEC60502-4**

Inspected and tested by: _____

Checked by: _____

Approved by: _____

Issued date: December 21, 2006

1. The number and installation of combination samples:

It was required that four heat shrinkable indoor terminations to be tested were installed by the manufacturer on four length of XLPE insulated cables forming four combination samples. The cable used in the combination samples was 26/35kV 3-core XLPE insulated cable with a cross section of 185sq.mm. The combination samples on which the type tests sequence 1.1, 1.2 and 1.3 were carried out. The manufacturer in four combination samples installed the four outdoor terminations and four straight through joints. In addition, the four heat shrinkable indoor terminations to be tested were installed by the manufacturer on two length of cables forming two combination samples. The combination samples on which the type tests sequence 1.4 were carried out.

2. Test methods:

2.1 A.C. voltage withstand: The test was made at ambient temperature in accordance with IEC61442:1997, clause 4.

2.2 Partial discharge test: The tests were carried out in accordance with IEC61442:1997, clause 7, the level of maximum noise background being 2pC during the testing.

2.3 Impulse voltage withstand test: the tests were carried out in accordance with IEC61442:1997, clause 6.

2.4 Heat cycle voltage test: Each thermal cycle was of 8h duration with at least 2h at a steady temperature of 5~10°C above the maximum cable conductor temperature in normal operation followed by at least 3h of natural cooling to within 10°C of ambient temperature. During the whole of the test period a voltage of 65kV shall be applied to the samples.

2.5 Humidity tests: The tests were carried out in accordance with IEC61442:1997, clause 13.

3. Test sequence and results:

The test sequence and results were given in Table 1(sequence 1.1), Table 2(sequence 1.2 and 1.3) and Table 3 (sequence 1.4).

Table 1

Test Sequence	Item	Requirement	Result
1.	A.C. voltage dry withstand, 5 min	Neither breakdown nor flashover shall occur at 117kV	No breakdown and flashover occurred on the combination samples at 117kV
2.	Partial discharge at ambient temperature	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV
3.	Impulse voltage withstand at 95°C~100°C	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 200kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 200kV
4.	Heat cycles voltage test in air	3 cycles at conductor temperature of 95°C~100°C and 65kV	Subjected to 3 cycles in air at the conductor temperature of 95°C~100°C and 65kV
5.	Partial discharge at 95°C~100°C	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV

6.	Partial discharge at ambient temperature	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV
7.	Heating cycles voltage test in air	60 cycles in air at the conductor temperature of 95°C~100°C and 65kV	Subjected to 60 cycles in air at the conductor temperature of 95°C~100°C and 65kV
8.	Partial discharge at 95°C~100°C	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV
9.	Partial discharge at ambient temperature	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV
10.	Impulse voltage withstand	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 200kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 200kV
11.	A.C. voltage dry withstand, 15 min	Neither breakdown nor flashover shall occur at 65kV	No breakdown and flashover occurred on the combination samples at 65kV

Table 2

Test Sequence	Item	Requirement	Result
1.	A.C. voltage withstand	Neither breakdown nor flashover shall occur at 117kV for 5min	No breakdown and flashover occurred on the combination samples at 117kV for 5min
2.	Thermal short-circuit test	No transfigure and welding occurred on all parts at 24.7kA, 2s	No transfigure and welding occurred on all parts at 24.7kA, 2.02s and 24.7kA, 2.03s
3.	Impulse voltage withstand	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 200kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 200kV
4.	A.C. voltage withstand	Neither breakdown nor flashover shall occur at 65kV for 15min	No breakdown and flashover occurred on the combination samples at 65kV for 15min

Table 3

Test Sequence	Item	Requirement	Result
1.	Humidity test	No any flashover, tracking, erosion or mechanical damage occur at 300h, 32.5kV	No any flashover, tracking, erosion or mechanical damage occurred on the combination samples at 300h, 32.5kV

Conclusions

The type UEHVMX 36 IT3/2 26/35kV heat shrinkable indoor termination for 3-core XLPE cable taken to test by client self have passed the type tests specified in GB/T 12706.4 and IEC60502-4, the 26/35kV heat shrinkable indoor termination tested was up to standard.

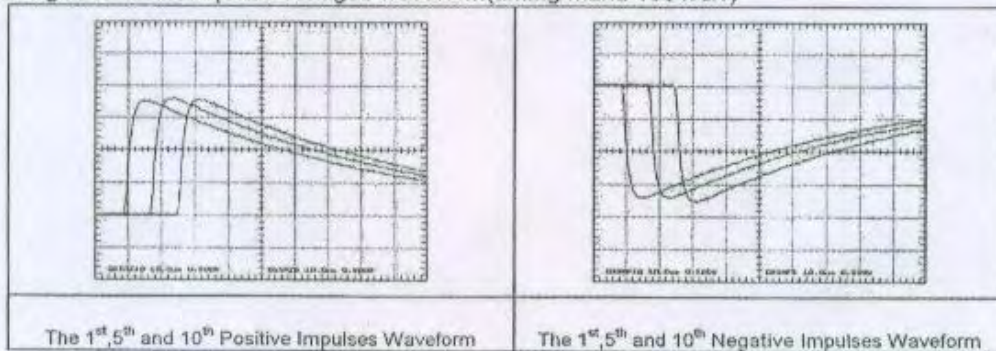
Annex A: The values of impulse voltages on the combination samples before heating cycles voltage test (200kV, ±3% tolerance)

Ambient temperature: 11°C, Relative humidity: 77%, Atmosphere: 0.1001MPa

unit: kV

Positive polarity	202	201	200	200	200	201	199	198	202	202
Negative polarity	202	200	201	201	202	201	200	200	200	205

Oscillograms of the impulse voltages waveform (timing mark: 10 μs/div)



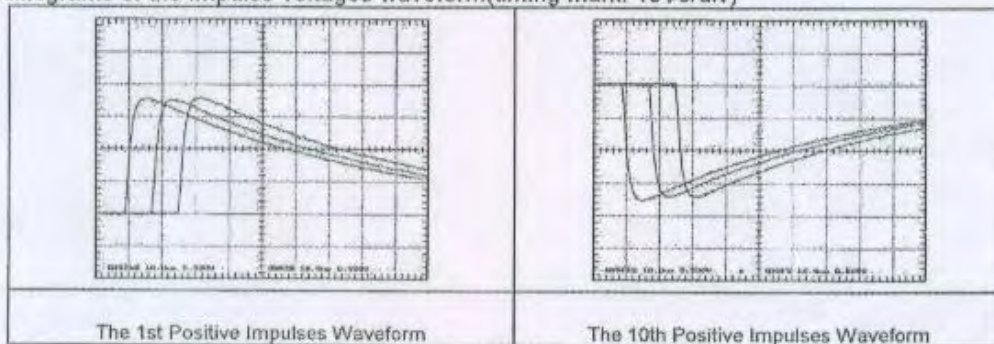
Annex B: The values of impulse voltages on the combination samples after heating cycles voltage test (200kV, ±3% tolerance)

Ambient temperature: 9°C, Relative humidity: 76%, Atmosphere: 0.1018MPa

unit: kV

Positive polarity	200	200	200	201	199	201	200	201	200	200
Negative polarity	204	200	200	201	200	202	202	200	201	199

Oscillograms of the impulse voltages waveform (timing mark: 10 μs/div)



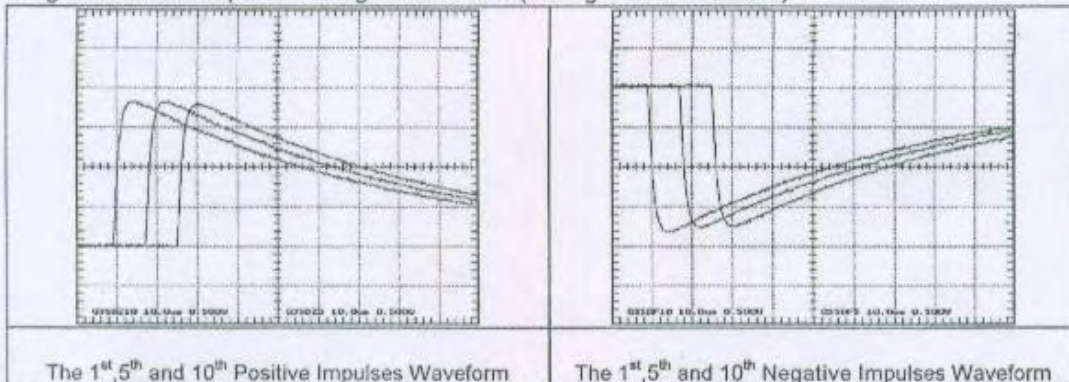
Annex C: The values of impulse voltages on the combination samples after Dynamic short-circuit and thermal short-circuit tests (200kV, $\pm 3\%$ tolerance)

Ambient temperature: 4°C, Relative humidity: 78%, Atmosphere: 0.1022MPa

unit: kV

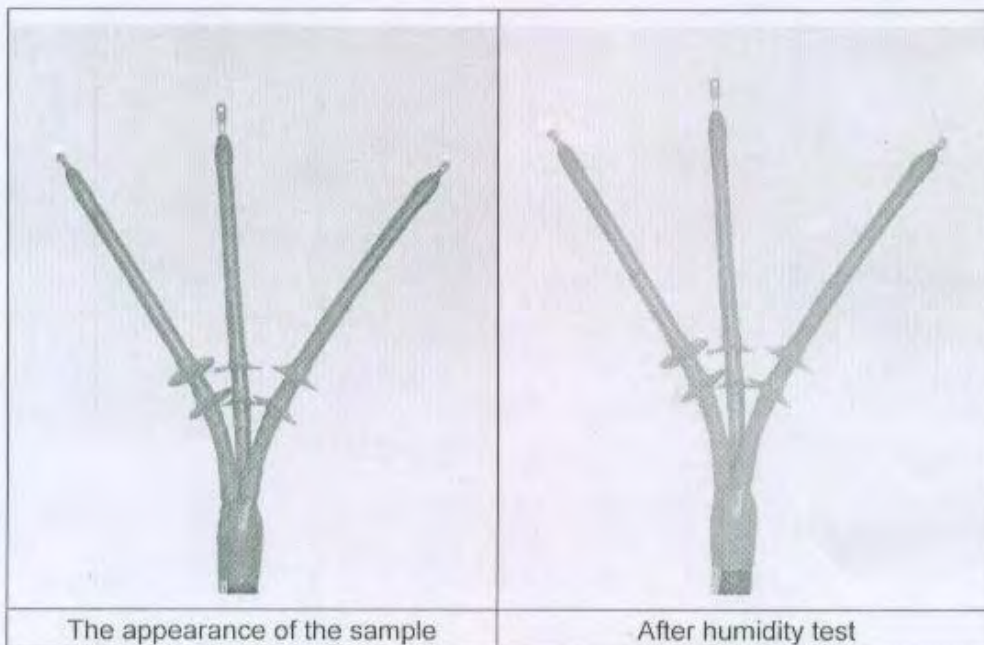
Positive polarity	203	200	202	202	202	200	201	199	198	199
Negative polarity	206	201	204	201	200	205	204	201	201	200

Oscillograms of the impulse voltages waveform (timing mark: 10 μ s/div)



The 1st, 5th and 10th Positive Impulses Waveform

The 1st, 5th and 10th Negative Impulses Waveform



The appearance of the sample

After humidity test

TEST REPORT

Client: United Electric Co., Ltd.

Manufacturer: Hongshang Heat Shrinkable Materials Co., Ltd.

Description of Samples:

Name of Test Samples: 26/35kV heat shrinkable outdoor termination for 3-core XLPE power cable
Type and Size: UEHMX 36 OT 3/2

Test Standards

GB/T 12706.4-2002 Power cables with extruded insulation and their accessories for rated voltage from 1kV(Um=1.2kV) up to 35kV(Um=40.5kV) Part 4: Test requirements on accessories for cables with rated voltage from 6kV(Um=7.2kV) up to 35kV(Um=40.5kV)

IEC60502-4:2005 Power cables with extruded insulation and their accessories for rated voltage from 1kV(Um=1.2kV) up to 30kV (Um=36kV) Part 4: Test requirements on accessories for cable with rated voltage from 6kV(Um=7.2kV) up to 30kV(Um=36kV)

Tested by: GCA High Voltage Laboratory (Authorized by China National High Voltage Measuring Center to test the cable accessories up to 220kV and issue the test report with equal validity)

Category of Test: Type test

Date of Testing: From July 20, 2006 to December 19, 2006.

Conclusion: The object, constructed in accordance with the description, has been subjected to the series of proving tests in accordance with **GB/T 12706.4** and **IEC60502-4**

Inspected and tested by:  _____

Checked by: _____

Approved by: _____

Issued date: December 21, 2006

1. The number and installation of combination samples:

It was required that four heat shrinkable outdoor terminations to be tested were installed by the manufacturer on four length of XLPE insulated cables forming four combination samples. The cable used in the combination samples was 26/35kV 3-core XLPE insulated cable with a cross section of 185sq.mm. The combination samples on which the type tests sequence 1.1, 1.2 and 1.3 were carried out. The manufacturer in four combination samples installed the four indoor terminations and four straight through joints. In addition, the four heat shrinkable outdoor terminations to be tested were installed by the manufacturer on two length of cables forming two combination samples. The combination samples on which the type tests sequence 1.5 were carried out.

2. Test methods:

2.1 A.C. voltage withstand: The test was made at ambient temperature in accordance with IEC61442:1997, clause 4.

2.2 Partial discharge test: The tests were carried out in accordance with IEC61442:1997, clause 7, the level of maximum noise background being 2pC during the testing.

2.3 Impulse voltage withstand test: the tests were carried out in accordance with IEC61442:1997, clause 6.

2.4 Heat cycle voltage test: Each thermal cycle was of 8h duration with at least 2h at a steady temperature of 5~10°C above the maximum cable conductor temperature in normal operation followed by at least 3h of natural cooling to within 10°C of ambient temperature. During the whole of the test period a voltage of 65kV shall be applied to the samples.

2.5 Salt fog tests: The tests were carried out in accordance with IEC61442:1997, clause 13.

3. Test sequence and results:

The test sequence and results were given in Table 1(sequence 1.1), Table 2(sequence 1.2 and 1.3) and Table 3 (sequence 1.5).

Table 1

Test Sequence	Item	Requirement	Result
1.	A.C. voltage dry withstand, 5 min	Neither breakdown nor flashover shall occur at 117kV	No breakdown and flashover occurred on the combination samples at 117kV
2.	A.C. voltage withstand for 1min. under rain	Neither breakdown nor flashover shall occur at 104kV	No breakdown and flashover occurred on the combination samples at 104kV
3.	Partial discharge at ambient temperature	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV
4.	Impulse voltage withstand at 95°C~100°C	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 200kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 200kV
5.	Heating cycles voltage test in air	3 cycles at conductor temperature of 95°C~100°C and 65kV	Subjected to 3 cycles in air at the conductor temperature of 95°C~100°C and 65kV
6.	Partial discharge at 95°C~100°C	The magnitude of the discharge at 45kV shall	The magnitude of the discharge of the combination samples didn't exceed 10pC

		not exceed 10pC	at 45kV
7.	Partial discharge at ambient temperature	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV
8.	Heating cycles voltage test in air	60 cycles in air at the conductor temperature of 95°C~100°C and 65kV	Subjected to 60 cycles in air at the conductor temperature of 95°C~100°C and 65kV
9.	Partial discharge at 95°C~100°C	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV
10.	Partial discharge at ambient temperature	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV
11.	Impulse voltage withstand	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 200kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 200kV
12.	A.C. voltage dry withstand, 15 min	Neither breakdown nor flashover shall occur at 65kV	No breakdown and flashover occurred on the combination samples at 65kV

Table 2

Test Sequence	Item	Requirement	Result
1.	A.C. voltage withstand	Neither breakdown nor flashover shall occur at 117kV for 5min	No breakdown and flashover occurred on the combination samples at 117kV for 5min
2.	Thermal short-circuit test	No transfigure and welding occurred on all parts at 24.7kA, 2s	No transfigure and welding occurred on all parts at 24.7kA, 2.02s and 24.7kA, 2.03s
3.	Impulse voltage withstand	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 200kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 200kV
4.	A.C. voltage withstand	Neither breakdown nor flashover shall occur at 65kV for 15min	No breakdown and flashover occurred on the combination samples at 65kV for 15min

Table 3

Test Sequence	Item	Requirement	Result
1.	Salt fog test	No any flashover, tracking, erosion or mechanical damage occur at 1000h, 32.5kV	No any flashover, tracking, erosion or mechanical damage occurred on the combination samples at 1000h, 32.5kV

Conclusions

The type UEHMX 36 OT3/2 26/35kV heat shrinkable outdoor termination for 3-core XLPE cable taken to test by client self have passed the type tests specified in GB/T 12706.4 and IEC60502-4, the 26/35kV heat shrinkable outdoor termination tested was up to standard.

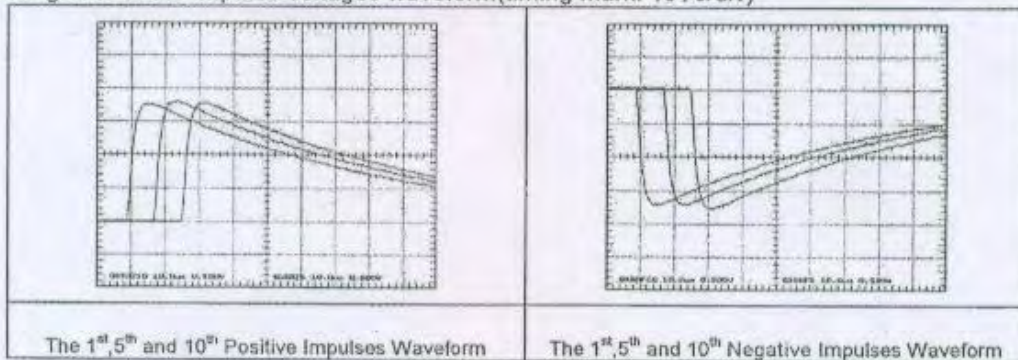
Annex A: The values of impulse voltages on the combination samples before heating cycles voltage test (200kV, $\pm 3\%$ tolerance)

Ambient temperature: 11°C, Relative humidity: 77%, Atmosphere: 0.1001MPa

unit: kV

Positive polarity	202	201	200	200	200	201	199	198	202	202
Negative polarity	202	200	201	201	202	201	200	200	200	205

Oscillograms of the impulse voltages waveform (timing mark: 10 μ s/div)



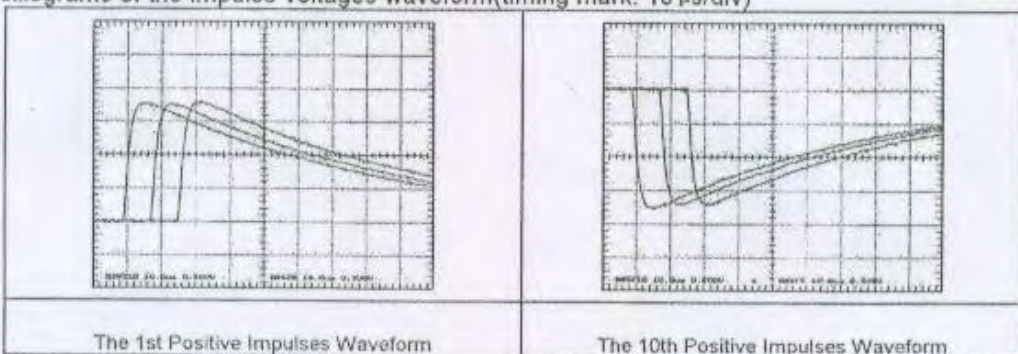
Annex B: The values of impulse voltages on the combination samples after heating cycles voltage test (200kV, $\pm 3\%$ tolerance)

Ambient temperature: 9°C, Relative humidity: 76%, Atmosphere: 0.1018MPa

unit: kV

Positive polarity	200	200	200	201	199	201	200	201	200	200
Negative polarity	204	200	200	201	200	202	202	200	201	199

Oscillograms of the impulse voltages waveform (timing mark: 10 μ s/div)



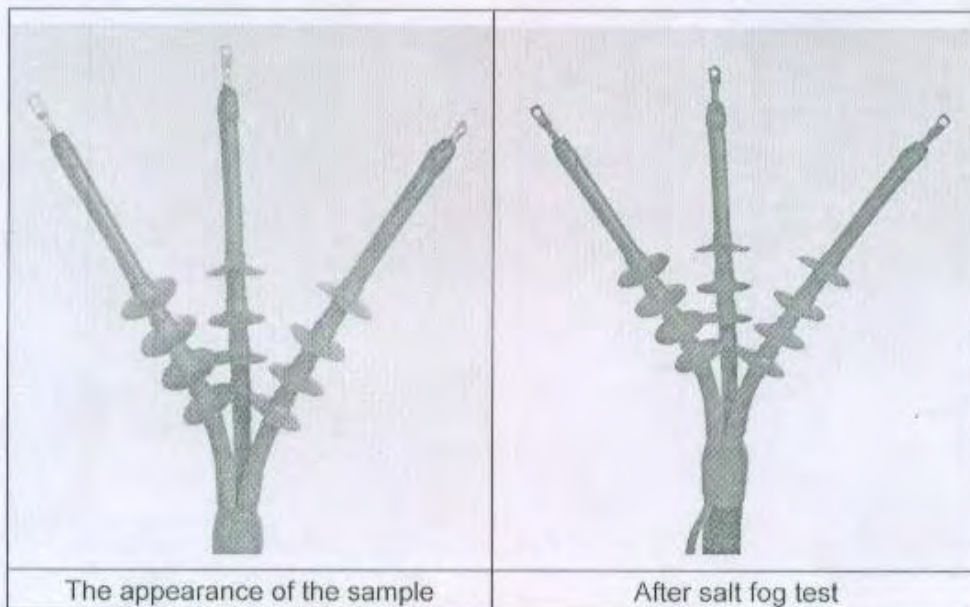
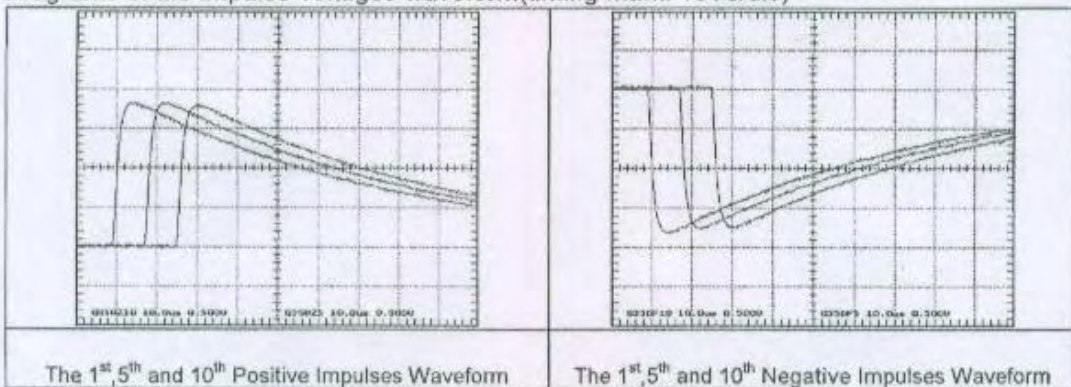
Annex C: The values of impulse voltages on the combination samples after Dynamic short-circuit and thermal short-circuit tests (200kV, $\pm 3\%$ tolerance)

Ambient temperature: 4°C, Relative humidity: 78%, Atmosphere: 0.1022MPa

unit: kV

Positive polarity	203	200	202	202	202	200	201	199	198	199
Negative polarity	206	201	204	201	200	205	204	201	201	200

Oscillograms of the impulse voltages waveform (timing mark: 10 μ s/div)



1. The number and installation of combination samples:

It was required that four Heat shrinkable straight through joints installed on four length cables by the manufacturer forming four combination samples. The cable used in the combination sample was 26/35kV 3-core XLPE insulated cable with a cross section of 185sq.mm. The combination samples on which the type test sequence 2.2 and 2.3 were carried out.

2. Test methods:

- 2.1 A.C. voltage withstand: The test was made at ambient temperature in accordance with IEC61442:1997, clause 4.
- 2.2 Partial discharge test: The tests were carried out in accordance with IEC61442:1997, clause 7, the level of maximum noise background being 2pC during the testing.
- 2.3 Impulse voltage withstand test: the tests were carried out in accordance with IEC61442:1997, clause 6.
- 2.4 Heat cycle voltage test: Each thermal cycle was of 8h duration with at least 2h at a steady temperature of 5~10°C above the maximum cable conductor temperature in normal operation followed by at least 3h of natural cooling to within 10°C of ambient temperature. During the whole of the test period a voltage of 65kV shall be applied to the samples.

3. Test sequence and results:

The test sequence and results were given in Table 1(sequence 2.1), Table 2(sequence 2.2 and 2.3).

Table 1

Test Sequence	Item	Requirement	Result
1.	A.C. voltage dry withstand, 5 min	Neither breakdown nor flashover shall occur at 117kV	No breakdown and flashover occurred on the combination samples at 117kV
2.	Partial discharge at ambient temperature	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV
3.	Impulse voltage withstand at 95°C~100°C	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 200kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 200kV
4.	Heating cycles voltage test in air	3 cycles at conductor temperature of 95°C~100°C and 65kV	Subjected to 3 cycles in air at the conductor temperature of 95°C~100°C and 65kV
5.	Partial discharge at 95°C~100°C	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV
6.	Partial discharge at ambient temperature	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV
7.	Heating cycles voltage test	60 cycles, 30cycles in air and 30 cycles under water	Subjected to 30 cycles in air and 30 cycles under water at the conductor

		at the conductor temperature of 95°C~100°C and 65kV	temperature of 95°C~100°C and 65kV
8.	Partial discharge at 95°C~100°C	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV
9.	Partial discharge at ambient temperature	The magnitude of the discharge at 45kV shall not exceed 10pC	The magnitude of the discharge of the combination samples didn't exceed 10pC at 45kV
10.	Impulse voltage withstand	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 200kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 200kV
11.	A.C. voltage dry withstand,15 min	Neither breakdown nor flashover shall occur at 65kV	No breakdown and flashover occurred on the combination samples at 65kV

Table 2

Test Sequence	Item	Requirement	Result
1.	A.C. voltage withstand	Neither breakdown nor flashover shall occur at 117kV for 5min	No breakdown and flashover occurred on the combination samples at 117kV for 5min
2.	Thermal short-circuit test	No transfigure and welding occurred on all parts at 24.7kA, 2s	No transfigure and welding occurred on all parts at 24.7kA, 2.02s and 24.7kA, 2.03s
3.	Impulse voltage withstand	Neither breakdown nor flashover shall occur at 10 positive and 10 negative impulses of 200kV	No breakdown and flashover occurred on the combination samples at 10 positive and 10 negative impulses of 200kV
4.	A.C. voltage withstand	Neither breakdown nor flashover shall occur at 65kV for 15min	No breakdown and flashover occurred on the combination samples at 65kV for 15min

Conclusions

The type UEHMX 36 SJ3/2 26/35kV heat shrinkable straight through joint for 3-core XLPE cable taken to test by client self have passed the type tests specified in GB/T 12706.4 and IEC60502-4, the 26/35kV heat shrinkable straight through joint tested was up to standard.

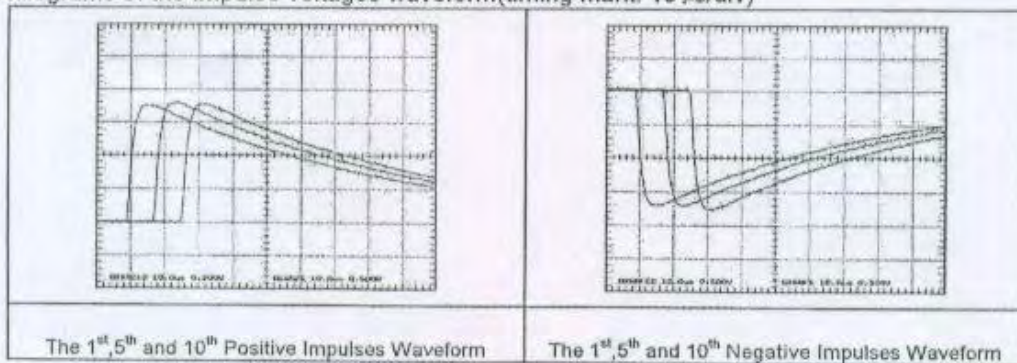
Annex A: The values of impulse voltages on the combination samples before heating cycles voltage test (200kV, $\pm 3\%$ tolerance)

Ambient temperature: 11°C, Relative humidity: 77%, Atmosphere: 0.1001MPa

unit: kV

Positive polarity	202	201	200	200	200	201	199	198	202	202
Negative polarity	202	200	201	201	202	201	200	200	200	205

Oscillograms of the impulse voltages waveform (timing mark: 10 μ s/div)



The 1st, 5th and 10th Positive Impulses Waveform

The 1st, 5th and 10th Negative Impulses Waveform

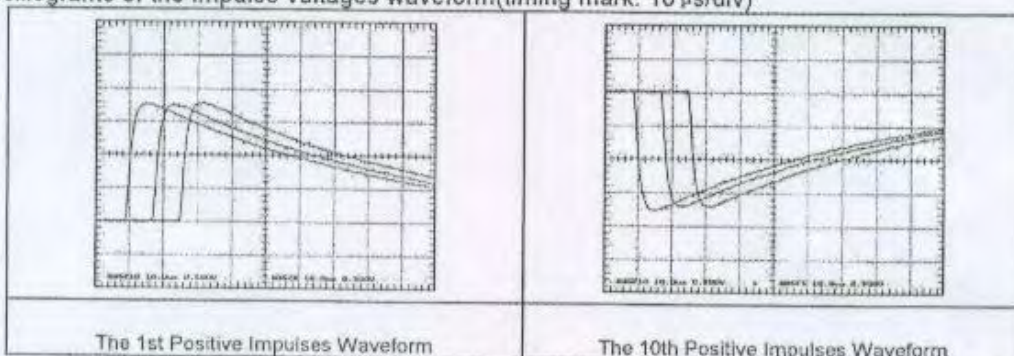
Annex B: The values of impulse voltages on the combination samples after heating cycles voltage test (200kV, $\pm 3\%$ tolerance)

Ambient temperature: 9°C, Relative humidity: 76%, Atmosphere: 0.1018MPa

unit: kV

Positive polarity	200	200	200	201	199	201	200	201	200	200
Negative polarity	204	200	200	201	200	202	202	200	201	199

Oscillograms of the impulse voltages waveform (timing mark: 10 μ s/div)



The 1st Positive Impulses Waveform

The 10th Positive Impulses Waveform

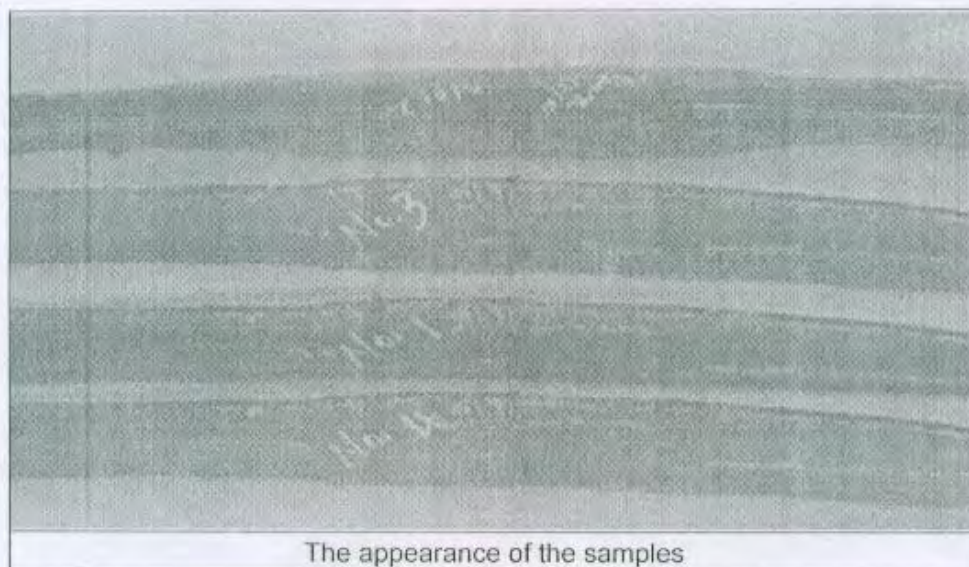
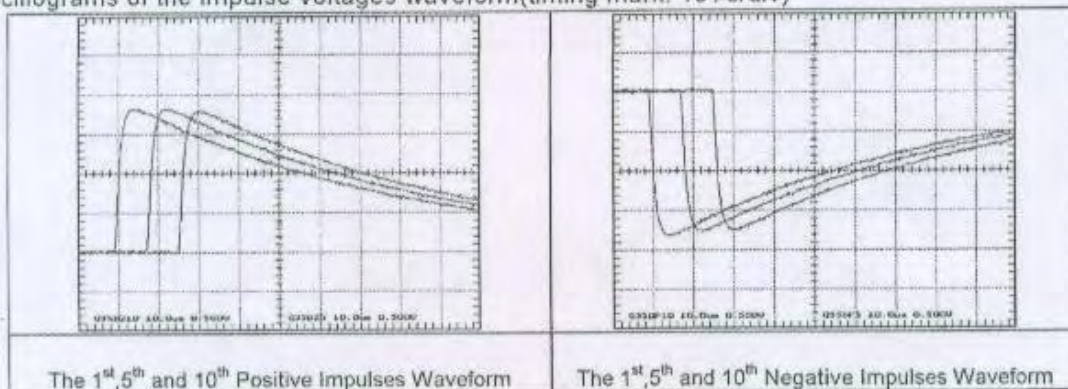
Annex C: The values of impulse voltages on the combination samples after Dynamic short-circuit and thermal short-circuit tests (200kV, $\pm 3\%$ tolerance)

Ambient temperature: 4°C, Relative humidity: 78%, Atmosphere: 0.1022MPa

unit: kV

Positive polarity	203	200	202	202	202	200	201	199	198	199
Negative polarity	206	201	204	201	200	205	204	201	201	200

Oscillograms of the impulse voltages waveform (timing mark: 10 μ s/div)





RWE Eurotest GmbH
ELECTROTECHNICAL
TESTING LABORATORY



Test certificate

No.: 04.10.22.227-1 **Version:** 2/2

Customer : Hongshang Heat Shrinkable Materials Co., Ltd.
The 2nd Industrial Area
Nankeng Cun, Banthan
Buji Town, Shenzhen 518129
China

Test object : Shrink straight joint 0.6/1 kV

Type : ALVK-SC 4 x 25-150 mm²

Manufacturer : Hongshang Heat Shrinkable Materials Co., Ltd.

Date of receipt : 22.03.2005

Date of test : 24.03.2005

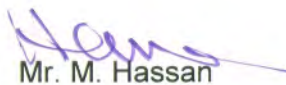
Applied test regulations : DIN VDE 0278-623:1997-01 (HD 623 S1:1996-02)

Test carried out : Type test

Test result : The shrink straight joint 0.6/1 kV, type ALVK-SC 4 x 25-150 mm²
manufactured by Hongshang Heat Shrinkable Materials Co., Ltd.
qualified in the type test according to DIN VDE 0278-623:1997-01.

Specialist testers : Mr. A. Cichowski, Mr. Ch. Pieper, Mr. H. Walter

Dortmund, 03.06.2005


Mr. M. Hassan

(Assistant manager test laboratory)


Mr. H. Walter

(Specialist tester)

Report No. 04.10.22.227-1 contains 8 pages and 4 annexes.

*) Scope of accreditation and type of documentation see overleaf. Test results in this report are only valid for the tested objects.
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The authenticity of this report is only ensured with RWE-coinage on the first page.

Testing Laboratory

The RWE Eurotest testing laboratory is an independent institute that has been approved according to European standards.

Our testing laboratory, accredited in conformity with DIN EN ISO/IEC 17025, is at the disposal of manufacturers and users alike for testing the conformity of electro technical products against standards and confirming fitness for use. Our accreditation by the Deutsche Akkreditierungsstelle Technik (DATech e.V.), a member of the Deutscher Akkreditierungsrat (DAR) accreditation council, guarantees our customers uniform testing procedures in conformity with European testing regulations and thus internationally accepted test results:

Whether you are a manufacturer or a user, you will have a strong partner with many years of testing experience at every stage of the product cycle. We will provide the following support for you:

- Type tests
- Sample tests
- Routine tests
- Commissioning tests
- Damage and fault analysis
- Material tests for safety features and equipment

Scope of accreditation

RWE Eurotest is accredited to carry out testing in the fields:

- High-voltage appliances and installations
- Low-voltage switchgear and control gear assemblies
- Cables
- Power cable accessories
- Pressed connectors and detachable cable clamps
- Corrosion protection
- EMC-testing
- Oil-examinations

The detailed listing of the scope of accreditation is available at our homepage www.rweeurotest.com.

Documentations

- Test certificates will be issued for passed tests performed against standards in the scope of accreditation.
- Test reports will be issued for tests not performed against standards in the scope of accreditation or failed tests.
- Examination reports will document investigations on special features.

Summary

RWE Eurotest GmbH carried out a type test according to DIN VDE 0278-623:1997-01(HD 623 S1:1996-02) on the shrink straight joint 0.6/1 kV, type ALVK-SC 4 x 25-150 mm² manufactured by Hongshang Heat Shrinkable Materials Co., Ltd.

The shrink straight joint 0.6/1 kV, type ALVK-SC 4 x 25-150 mm² manufactured by Hongshang Heat Shrinkable Materials Co., Ltd. qualified in the type test (see table 3) according to DIN VDE 0278-623:1997-01.

Contents:	Page:
1. Applied test regulations	4
2. Technical data of the test object	4
3. Test and measuring equipment	6
4. Tests carried out and results	7

Annex:

- 01 Installation instructions: shrink straight joint 0.6/1 kV, type ALVK-SC 4 x 25-150 mm² (1 sheet)
- 02 Technical data of the sleeves, type HRA-6x (1 sheets)
- 03 Load cycling in air
 - a) with largest conductor size (1 sheet)
 - b) with smallest conductor size (1 sheet)
- 04 Load cycling in water
 - a) with largest conductor size (1 sheet)
 - b) with smallest conductor size (1 sheet)

1. Applied test regulations**DIN VDE 0278-623:1997-01**

Power cable accessories with rated voltages U
up to 30 kV (U_m up to 36 kV)

Part 623: Specification for joints, stop ends and outdoor terminations for
distribution cables of rated voltage 0.6/1 kV
German version HD 623 S1:1996-02

2. Technical data of the test object**Shrink straight joint 0.6/1 kV:**

Manufacturer:	Hongshang Heat Shrinkable Materials Co., Ltd.
Type:	ALVK-SC 4 x 25-150 mm ²
- largest conductor size:	
inner sleeve	HRA-6x 33/5.5 - 250
outer sleeve	HRA-6x 119/23 - 800
- smallest conductor size:	
inner sleeve	HRA-6x 33/5.5 - 250
outer sleeve	HRA-6x 119/23 - 800
(see annex 02)	
Designation:	Non-rigid straight joint
Manufacturing date:	2004
Maximum conductor cross section:	150 mm ²
- material:	Aluminium
- shape of conductor:	shaped, solid
Minimum conductor cross section:	35 mm ²
- material:	Aluminium
- shape of conductor:	round, solid
Rated voltage U_0/U (U_m):	0.6/1.0 (1.2) kV
Installation instruction:	Annex 01

Connector:

Mechanical connector with 2 shear-off-head bolts:

- for largest conductor size: 150 mm² se
- mechanical connector type 20911902
- for smallest conductor size: 25 mm² re
- mechanical connector type 20911902

Manufacturer: Arcus Elektrotechnik Alois Schiffmann GmbH

Test cable:

The technical data of the cables used in the tests, the largest conductor size and the smallest conductor size, are summarized in table 1.

Specification	Test cable	
	largest conductor size	smallest conductor size
Manufacturer	F & G	Pirelli
Standard	DIN VDE 0276-603:2000-05	
Rated voltage	0.6 /1 kV	
Cable construction	4-core, individually screened	
Conductors	Aluminium, solid 150 mm ² shaped	Aluminium, solid 35 mm ² round
Insulation	XLPE	
Oversheath	PVC	PVC
Water blocking	none	
Cable marking	NA2XY-J 4x150 SE	NA2XY-J 4x35 RE
Principal dimensions of cable	according to DIN VDE 0276-603:2000-05	
- Conductor	b: (12.09-12.13) mm d: (16.06-16.10) mm	6.46-6.51 mm
- Insulation thickness	1.40-1.52 mm	0.99 -1.05 mm
- Inner covering thickness	1.254 mm	1.35 mm
- Oversheath thickness	2.,415 mm	1.97 mm
- Cable diameter	43.923 mm	27.57 mm
Year of manufacture	1991	1999

Table 1: Technical data of the cables

Structure of the test lengths:

The test objects were assembled according to DIN VDE 0278-623:1997-01, table 6a, sequence A1 by the manufacturer. Two test lengths were made (figure 1):

Test length 1: Test object with largest conductor size (150 mm²)

Test length 2: Test object with smallest conductor size (35 mm²)

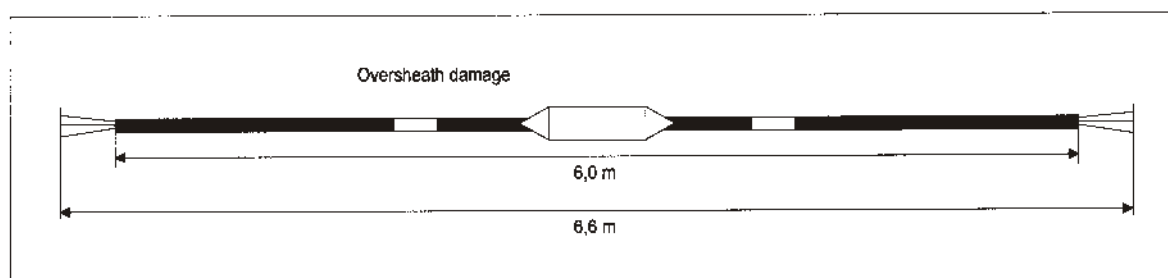


Figure 1: Schematic structure of the test lengths 1 and 2

3. Test and measuring equipment

Equip.-No.	cal.	Equipment	Type	Manufacturer
32	*	Hochspannungsprüfgenerator	PGK 10 AC/DC	BAUR
36	*	Hochstromprüfeinrichtung	Rack-Stelltrafo	Eigenbau
483	*	Isolationsmessgerät	BM 21	MEGGER
260	*	Stromwandler	UGSS 306	Ritz
277	*	Voltmetereinheit (Data-Unix-Control HP 3852 A)	HP 44701 A	Hewlett Packard
		Thermoelemente 0,5/1,5 mm	NiCr-Ni	Rössel

*) Measuring equipment is calibrated based on national and international reference standards. Calibration certificates can be inspected on request.

Table 1: Test and measuring equipment

The measurement uncertainty of the measuring instruments has been calculated and is archived by RWE Eurotest. Documents can be inspected on request.

4. Tests carried out and results

Realization of the tests

The calibration of conductor temperature was carried out according to DIN VDE 0278-623:1997-01, annex 1, section A1.3.3, method 3: Test using a control cable (cable length about 6.6 m).

Result of the tests

The tests were performed according to DIN VDE 0278-623:1997-01, table 2. The results of the tests using the largest and the smallest conductor size are summarized in table 3.

Tests with largest and smallest conductor size DIN VDE 0278-623: 1997-01, table 2, test sequence A/B1					
Tests	1)	Requirements	Result	met	2)
A.C. voltage withstand (in air)	6.6.4	1 min at 4 kV no breakdown	no breakdown	yes	
Insulation resistance (in air)	6.6.7	$\geq 50 \text{ M}\Omega$	$> 50 \text{ M}\Omega$	yes	
A.C. voltage withstand (in water)	6.6.4	1 min at 4 kV no breakdown	no breakdown	yes	
Insulation resistance (in water)	6.6.7	$\geq 50 \text{ M}\Omega$	$> 50 \text{ M}\Omega$	yes	
Load cycling in air - with largest conductor size - with smallest conductor size	6.6.8	63 Load cycles (90 °C +5 to 10 K)			03
Load cycling in water (Oversheath damage)	6.6.8	63 Load cycles (90 °C +5 to 10 K)			04
A.C. voltage withstand (in water)	6.6.4	1 min at 4 kV no breakdown	no breakdown	yes	
Insulation resistance (in water)	6.6.7	$\geq 50 \text{ M}\Omega$	$> 50 \text{ M}\Omega$	yes	
Examination	6.6.12		3)		
Screen short circuit	6.6.10	not applicable			

1) DIN VDE 0278-623 section
2) annex
3) According to agreement between the customer and the manufacturer this test is not subject of the type test.

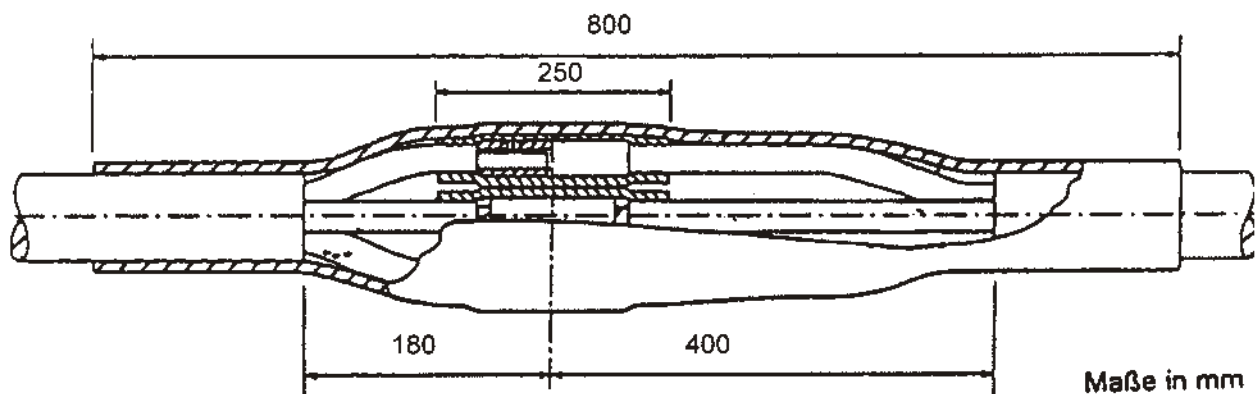
Table 3: result of the tests

Instruction Manual

Straight Joint Kit including Screw connectors U/Do 0,6 /1 kV for Plastic Cable (NAYY)

ASVM 4 x 25 – 150 mm²

Joint Content:	1 x HRA-6x 119/23 - 800, 4 x HRA-6x 33 / 5.5 - 250, Screw Connector, 1 x Instruction Manual, 1 x Cleaning Set	4
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Installation Instruction:

1. Strip the outer sheath of the cable as shown in the drawing above. Clean and degrease all cables.
2. Bend out the core cables and adjust to the right length. Remove core insulation to half the connector depth.
3. Nest the outer crimp sleeve on the cable and the inner sleeves to the core wires.
4. Connect the conductors as per manufacturer's instructions. Remove all burns and sharp edges.
5. Position the inner sleeves centrally over the conductors. Shrink from sleeve middle, working outwards.
6. Clean and rug the cable sheath about 150 mm on each side of the cable joint. Position the outer sleeve centrally over the joint and shrink from sleeve middle, working outwards.
7. The joint should cool down to the same temperature level as the surrounding environment before it's moved or applied with load.

Hongshang Heat Shrink Materials Co. Ltd
The 2nd Industrial Area, Nankeng Cun, Bantian
Buji Town, Shenzhen 518129 China

HEAVY DUAL WALL TUBING

Hongshang

HRA-6X

**6:1 VERY HIGH SHRINK RATIO,
HEAVY DUAL WALL TUBING
HOT MELTING ADHESIVE-LINED**

Features/Applications

Idea for application to extremely different diameter between cables, connectors and components, their high shrink ratio provides close fit to a wide variety of irregular shapes connector and figurations. Provide excellent mechanical protection to cable joints and terminations, complete environmental protection, and resistant to impact and abrasion.

- ▶▶ Shrink ratio: 6:1
- ▶▶ Resistant to UV
- ▶▶ High electrical insulation
- ▶▶ Superior mechanical protection

Operating temperature: -55°C to +110°C
Minimum fully recovery temperature: 120°C
Standard color: Black



Technical Data

Property	Test Method	Typical Data
Operating temperature	IEC 216	-55°C to +110°C
Tensile strength	ASTM D 2671	>14 MPa
Elongation at break	ASTM D 2671	>400%
Density	ASTM D 792	1.05g/cm ³
Longitudinal shrinkage	UL 224	0 to -10%
Eccentricity	ASTM D 2671	<40%
Elongation at break after aging	150°C, 168 hrs.	>300%
Dielectric strength	IEC 243	>20KV/mm
Volume resistance	IEC 93	>10 ¹¹ Ω.cm
Copper stability	ASTM D 2671	Pass
Resistance to stress cracking (50°C)	ASTM D 1693	No cracking
Water absorption	ISO 62	<0.15%

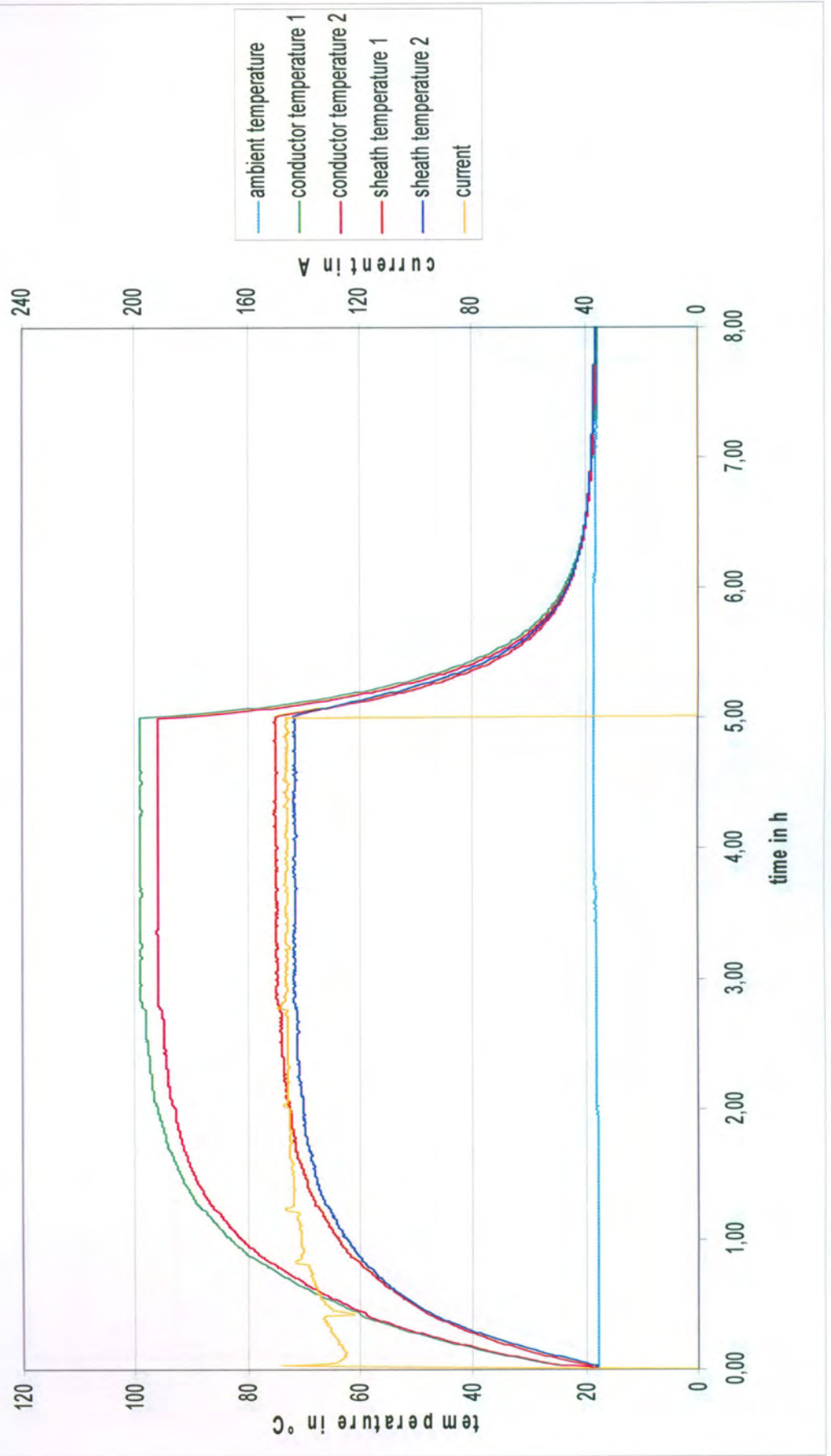
Thermoplastic Adhesive for HRA-6X

Property	Test Method	Typical Data
Water absorption	ISO 62	<0.2%
Softening point	ASTM D E8	85°C
Peel strength (PE)	DIN 30672	4N/cm
Copper stability	ASTM D 2671	Non-corrosive
Resistance to fungus and decay	ISO 846	Pass

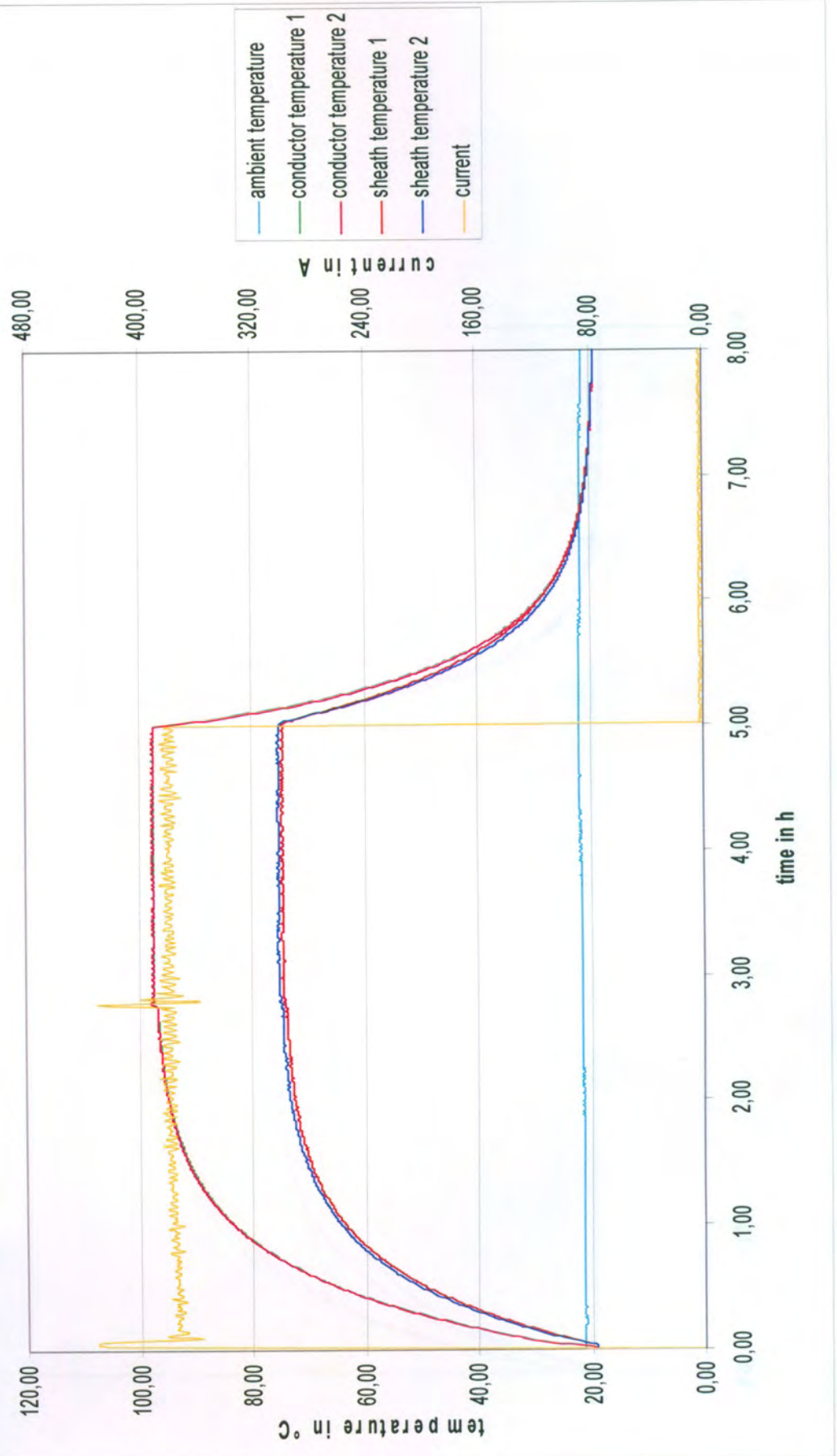
Product Dimensions (mm)

Order Ref. Number	Diameter		Recovered wall thickness (mm)	Standard length (mm)
	as supplied (mm)	after recovery (mm)		
HRA-6X 19.0/3.2	19.0	3.2	3.2	1000-1220
HRA-6X 33.0/5.5	33.0	5.5	3.4	1000-1220
HRA-6X 44.4/7.4	44.4	7.4	3.6	1000-1220
HRA-6X 50.8/8.3	50.8	8.3	4.3	1000-1220
HRA-6X 69.8/11.7	69.8	11.7	4.8	1000-1220
HRA-6X 88.9/17.1	88.9	17.1	4.8	1000-1220
HRA-6X 119.4/22.9	119.4	22.9	4.8	1000-1220
HRA-6X 235/40	235	40	4.8	1000-1220

Thermal-Cycle-Test 15 in air
NA2XY-J 4x35 mm² RE
current and temperature



**Thermal-Cycle-Test 78 in water
NA2XY-J 4x150 mm² SE
current and temperature**



**Thermal-Cycle-Test 78 in water
NA2XY-J 4x35 mm² RE
current and temperature**

