

HARMONIZATION of LONG DURATION TEST in EUROPE

Vic Banks

PIRELLI CABLES (UK)

Harmonization Document

HD 605

- 'Electric cables - Additional test methods'
- HDs 'Extruded insulation cables 1-36kV for distribution and power stations'
- HD 620 'MV distribution cables 6-36kV'
- Utilities or Public Procurement Directive
- Prepared by CENELEC (European Committee for Electrotechnical Standardization) TC20 'Electric cables'

CENELEC TC20

- CLC TC20 WG09 'Cables for use by electricity supply companies'
- TF Long Duration Test : September 1992
 - HD 605 : Large number of LDT methods to assess resistance to water of MV extruded insulation cables
 - Three basic regimes
 - UNIPEDE
 - VDE
 - Temperature Gradient
 - Formulate a harmonized test regime

UNIPEDA

- 'International Union of Producers and Distributors of Electrical Energy'
- Proposal
 - ICC July 1992 Birmingham UK
 - UNIPEDA
 - Several versions in HD 605

UNIPEDA

- Low temperature : 30C
- Moderate electric stress : 2.5U_o
 - 50Hz
- Long period : 2 years
 - Extensive vented tree (and bow tie tree growth)
 - Typical of that seen after service (10-15 years)
 - 500Hz : 4 months

UNIPEDA TEST RESULTS

V D E (German)

- M oderate temperature : 50C
- High electric stress : $4U_0$
 - 50Hz
- Long duration : 2 years
 - Faults in service
 - Prevent any reduction of cable quality
 - Not to simulate water treeing in operation

Temperature Gradient (Italian)

- High temperature : 90/70C
- Low electric stress : 1.5U_o
 - 50Hz
- Moderate period : 8 months
 - A E I C
 - Reproduce service conditions
 - Accelerating factors
 - Short time
 - Avoid any change to ageing process

Test Regimes : Comparison

	UNIPEDE	VDE	Temp. Gradient
Temperature - C	30	50	90/70
Electric stress - U ₀	2.5	4.0	1.5
Duration - years	2	2	0.67
Assessment	AC BD	AC BD	AC BD

Harmonization of 3 basic regimes

- Data on failures in service
 - Cable construction
 - Service conditions
 - Cause of failure
- Testing philosophy
 - Reproduce ageing mechanism in service
 - Discriminate cable performances : 'new vs old'

Harmonization of 3 basic regimes

- Cable construction
 - Semi-conducting screened core
- Preconditioning
- Ageing voltage
- Ageing temperature
- Ageing duration
- Assessment
 - AC breakdown strength

- Harmonize variations in UNIPED E regime

Tests

- Manufacturers, utilities and test houses
- Key publications
 - CIGRE Report 15/21-03 September 1992 Paris
 - CIRED Paper 3.1 May 1995 Brussels
 - JICABLE 95 June 1995 Paris
 - Papers A.8.5, B.2.3 and B.3.1 - 3.6 (500Hz)

Harmonization of UNIPED E regime

- UNIPED E
 - 500h at 55C ; 3U o/50Hz ; 25C ; 2 years
 - CENELEC (SEC) document
- National Committee comments
 - German proposal
 - 4U o/50Hz ; 40C ; 1 and 2 years
 - Agreement : VDE method to be withdrawn
- Merge UNIPED E/VDE regimes

Tests

- Key publications
 - IEEE Intl.Symp.on Elect Insul.1996 Quebec
 - Paper p 592
 - CIRED 97 June 1997
 - Papers 3.2 - 3.4
 - JICABLE 99 June 1999 Paris
 - Papers A.8.3 (500Hz), B.1.1 - 1.5 and C.5.4

Harmonization of UNIPED E/VDE regimes

Cable construction	Semi-conducting screened core
Preconditioning : tap water	500h at 55C
Ageing : tap water - voltage - temperature - duration	3U _o /50Hz (or 500Hz) 40C 1 and 2 years
Assessment	AC BD

Future Work

- Submitted in 2000
- Published : March 2002
- Tests in progress : results available late 2002/early 2003
- Shortening of test duration
 - 1 year
 - High frequency : 500Hz
 - Temperature Gradient