



Topics :  
Transmission cables  
Distribution cables  
Tropical environments  
Ageing

June 1992

# **Proceedings "Cable T 92" Workshop Power Insulated Cables in Tropical Environments**

# « CABLE T 92 » WORKSHOP

*BALI, INDONESIA*

*22-23 JUNE, 1992*

## ***POWER CABLES IN TROPICAL ENVIRONMENTS :***

### **SYNTHESIS**

***By L. DESCHAMPS***

*SEE / EDF (France)*

## **SPONSORS ORGANISATIONS**

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- Prof. Wiranto Arismunandar, Rector of ITB
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# CABLE T 92 WORKSHOP

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*60 participants from 10 countries*

- Australia
- Finland
- France
- Germany
- Indonesia
- Iran
- Japan
- Malaysia
- Philipines
- Switzerland

## OBJECTIVES & GENERAL THEMES

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*The general objective of this workshop is to examine the specific problems raised by technology, design, manufacturing, laying, installation, utilization, etc., of LV, MV, HV and EHV power cables in tropical environments.*

*The subjects to be dealt with are as follows :*

- Specific environmental conditions : temperature, humidity, damage caused by animals, etc ...
- Materials : choice of materials, temperature influence, humidity, etc ...
- Cables : structure, manufacturing, etc ...
- Laying and installation problems
- Utilization, service experience
- Standardizing problems

# SPECIFIC ENVIRONMENTAL CONDITIONS

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- Temperature : 27 to 36 °C
- Thermal characteristics of the soil  
(1,2 °C.M/W –  $T_{\text{soil}} = 25$  to 28 °C).
- Moisture parameters (60 % RH)
- UV Ray and shining
- High Keraunic Level
- Animals which damage the cables = Rats - termites



# MATERIALS

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- Insulation : PVC – XLPE
- Sheath : PVC – PE
- Metallic Components for conductors :  
Aluminium, Alu Alloy or Copper
- Raw materials :  
local for metal,  
local for LV components,  
import for MV and HV
- Specific tests : IEC and local standards

# TECHNOLOGIES PROTECTION AGAINST ANIMALS

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- Rats
  - Metallic sheath 0,2 mm
  - Metallic braid mesh < 0,5 mm
- Termites
  - Hard materials
  - Chemical components
  - Mechanical protection (concrete)

# TECHNOLOGIES PROTECTION AGAINST WATER

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- Dry design with continuous metallic barrier
- Wet design without metallic barrier and cable components qualified for good water behavior
  - WTR products (experience 8 years)
  - Special EPR formulations

# LV CABLES

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Similar cables used for overhead

- AERIAL BUNDLE CABLE ( ABC)
  - Aluminium Conductor
  - XLPE Insulation
- SAME PROBLEMS
  - Corrosion at Piercing Connector (IPC)
  - Amount and Dispersion of Carbon Black for UV Resistance
  - Good dispersion critical if quantity 2 % or less

# MV CABLES

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Similar cables used for underground

Water tightness

- Need for swelling powder or swelling tape for water blocking under Metallic screen.
- No agreement as to need for water blocking of the conductor.

# HV CABLES

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- At present oil filled cables still used in Indonesia, but PLN has specification for 150 KV XLPE cables
- Singapore uses 66 KV XLPE and Malaysia 132 KV XLPE cables
- All countries agreed that a metallic water barrier is essential

# CABLES

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No Major differences in cable design for cables in tropical environment except the need for animal protection

# LAYING AND INSTALLATION PROBLEMS

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- Importance of water blocking caps during laying
- Minimum bending radius of cables  $> 18 \times$  diameter
- Special sheath bonding :  
larger section  $\implies$  simplification
- Accessories = premouled preferred
  - Standardization difficult



# LAYING AND INSTALLATION

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- LV and MV cables : directly buried 0,8 – 1,2 m
- Protection : bricks or slabs
- Accessories : problem of skillfulness of labor
- Mechanized laying : not very useful
- After laying : DC not recommended

## UTILIZATION – SERVICE EXPERIENCE

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- Economic life span of cables : 20 to 40 years
- Actual life span depends on operating conditions
- No policy of replacement
- Distribution accessories should not be too sensitive to worksmanship

# UTILIZATION – SERVICE EXPERIENCE

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- Advantages of different designs (3 single cores : 3 cores ; lead, aluminium and stainless steel sheath and copper wire screening)
- Main reasons of failures (digging, terminations, joints)
- Improvements (training, certifying, ...)

# STANDARDIZATION

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- Some local standards are available
- Standards, should be prepared by manufactures and user together
- International standard not yet fully adapted