



Medium Voltage 12/20 (24)kV NF C 33-226 cable system

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- Late 70's : NF C 33-223 Cable Standard in France
 - ◆ result of the move from **paper insulated cables** to **polymeric cables**
 - ◆ standard based on “low cost” solutions : aluminium conductors, homopolymer XLPE insulation, aluminium foil for the metallic screen, PVC outer sheath
- End of 90's : EDF searches new savings on the cost of distribution network equipments, including cables
 - ◆ 1st step : reduce insulation thickness from 5,5 mm (IEC) to 4,5 mm
 - Achieved in 2000 : 4,5 mm for 20 kV
 - Very positive feedback : no increase in breakdowns
 - ◆ 2nd step : move from a **constructive** standard (NF C 33-223) towards a **performance** standard called C 33-226 (soon NF C 33-226)
 - achieved from 2002
 - applied by EDF mid-2004 everywhere in France

- Market Challenge : allow differentiation to facilitate innovation towards cost reduction and quality improvement
- Technical alternatives allowed :
 - ◆ Conductor : Al or Cu, stranded or massive
 - ◆ External semiconductor : strippable (even with grooves) or bonded
 - ◆ Longitudinal water tightness : swelling powder or tapes
 - ◆ Outer sheath material : PVC or PE

- **Thickness of semiconductors**

insulation, metallic screen and outer sheath are “free” but “governed” by maximal electrical strengths, short circuit requirements, electrical and mechanical tests :

- ◆ 3,6 kV/mm at conductor screen
- ◆ 2,35 kV/mm at insulation screen
- ◆ Short circuit in metallic screen : 2500 A - 1 s

- **Accessories** to provide “interoperability”

- Provide adequate **cable preparation tools**



- The C 33-226 standard foresees 4 different types of cables :
 - ◆ One core cable Flame retardant (C2)
 - ◆ Aerial bundled cables (Flame retardant : C2)
 - ◆ Standard triplex cables for underground applications
 - ◆ “Directly buriable“ Triplex cables for underground applications

- **Move to PE outer sheath** : reduction of sheath thickness at 2,1 mm minimum corresponding to 2,5 nominal on all cross-sections
- **Advantages of PE versus PVC** : hardness, watertightness, thermo-mechanical behaviour
 - ◆ improved mechanical strength of the outer sheath (resistance to shocks and abrasion) : reduced risk of damaging the cable during laying
 - ◆ laying temperature between $- 10^{\circ}\text{C}$ and $+ 50^{\circ}\text{C}$ (measured on the sheath) against 0°C to 35°C with PVC
 - ◆ increased life expectancy for the cable (particularly reduced risk of corrosion of the Aluminium screen)



- **Insulation thickness** : 4,3 mm for 150 mm² and above (unchanged at 5,5 mm for 95 & 50 mm²)
- **Reduction of metallic screen thickness** from 0,2 mm to 0,15 mm (maintaining carrying capacity of 2500 A during 1s)
- **Strippable outer semiconductor** : makes the cable preparation easier, French fitters were used to it
- **Outer sheath colour** :
 - ◆ black with two red strips for non flame retardant cables
 - ◆ black with two grey strips for flame retardant cables



- **Market challenge**

- ◆ allow to burry the cable in any type of soil (even rocky),
- ◆ without the need to bring soft backfill,
- ◆ without any risk to damage the cable during laying or in service

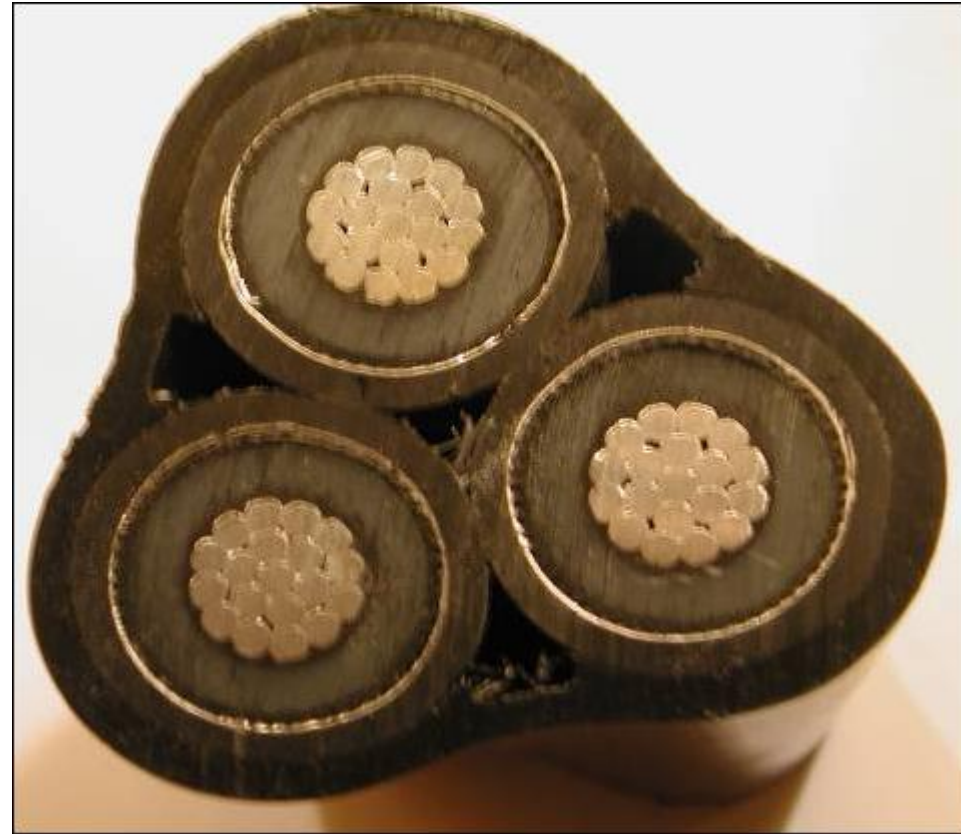
- **Nexans solution**

- ◆ an extruded HDPE outer sheath
extruded on a standard triplex cable



Advantages

- excellent resistance to shocks and abrasion
- possibility of laying without rollers
- use of excavated earth as backfill
- reduction of deepness and width of trenches
- quicker laying
- small increase of cable weight and diameter
- limited reduction of carrying capacity (5 to 10 %)
- reduction of laying cost

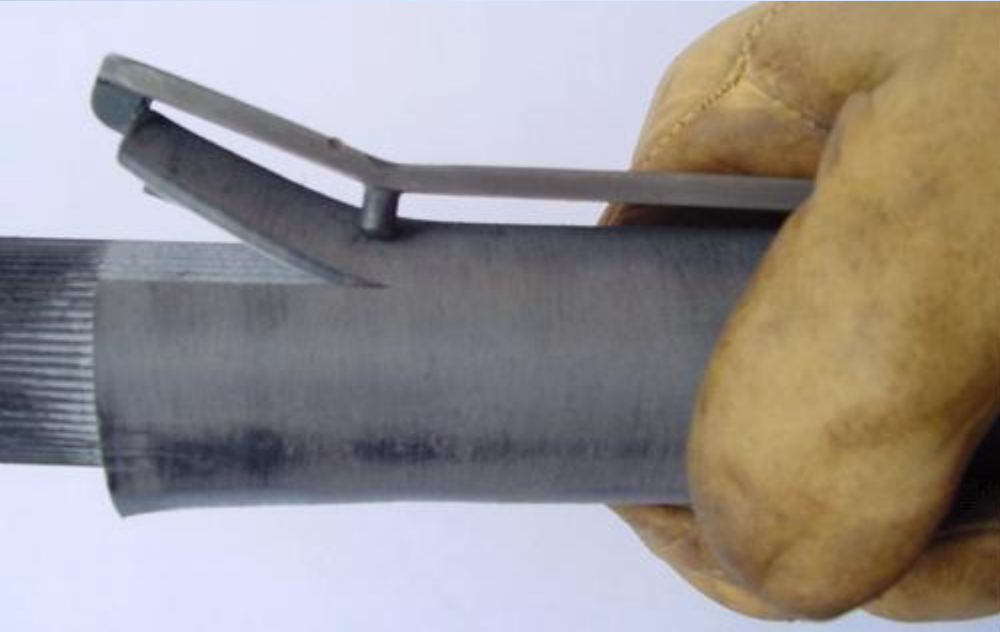


Nexans not only offers cables. We also provide :

- a complete range of **accessories**
- a set of cable **preparation tools** covering the whole range of cross-sections and all standards
- **training courses** for fitters
- the whole package being **qualified by EDF**



- **Nexans has a strong experience of the new standard : we have already manufactured 7000 km of C 33-226 cable**





**Global expert
in cables
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Thank you for your attention