Workshop on presentation of Pilot standards
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Dr. Robert Jeanjean
High voltage transmission lines
DESIGN OF OVERHEAD LINES

Possibility of moving forward to a probabilistic approach to structural design in an objective best fit lines to their environment, more effective coordination between the various components of a structure and convergence to the approach advocated by the new CENELEC 50341.

This new design method based on statistical characterization of climate events.

The proposed probabilistic design method allows:
• Reliability more homogeneous structures of the transportation system, and justify the design of structures rigorously
• Reliability more homogeneous structures of the transportation system, and justify the design of structures rigorously
• Better coordination of mechanical components together
• Convergence towards international standards.
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DESIGN OF OVERHEAD LINES

This methodology can make the network less vulnerable in order to guarantee the safety of persons and property and ensure continuity of supply to customers: the application of probabilistic design method can shorten the program Securing the transportation system.
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DESIGN OF OVERHEAD LINES

What are the Basic Electrical Milestones?

- CONDUCTORS
- CLIMATIC LOADS
- SUPPORTS AND FOUNDATIONS
CONDUCTORS

- Types of conductors

- Geometric and mechanical properties
- Behaviour of suspended cable: parabole and catenary equation of state change, voltage change with the over load on the cable
- Vibration conductors: Causes, remedies, voltage limits
- Galop conductors: explanation of the phenomenon, effects on the lines, mitigation measures
- Ampacity of conductors: parameters affecting the heating of the conductor by Joule effect, calculating the maximum ampacity conditions continued and urgent
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CLIMATIC LOADS

- Wind: description, variation in height of the wind, reference pressure, wind efforts

- Ice and ice-wind combined: type of accretion on wires and brackets, quantification of ice loads and forces transmitted to the supports

- Temperature: effects of maximum and minimum temperatures on traction in cables
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SUPPORT AND FOUNDATIONS

- Type of airline supports
- Advantages and disadvantages of various types of supports wood poles, steel or concrete
- Calculation of the supports and wooden poles, allowable stresses, safety factors, linear and nonlinear analysis
- Foundations for metal posts
- Flush poles in the ground and foundation types
- Suspension devices of posts
- Spans weight and maximum wind

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Support and Foundations

- Repartition of supports on a profile
- Criteria for ground clearance and obstacles
- Maximum scope
- Constraints localization of supports
- Scope equivalent
- Effects of the media flexibility
- Minimum Distance between cables
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MÉTHODOGY OF WORK

TO COLLECT
- EN 50341-1
- NATIONAL REGULATION
- TECHNICAL SPECIFICATION

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MÉTHODOGY OF WORK

TO READ CHAPTER BY CHAPTER THE EN 50341-1

TO AMEND IT WITH THE NATIONAL REQUIREMENT

THEN TO BUILT THE SPECIFIC NNA

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ENERGY COOPERATION BETWEEN THE EU, THE LITTORAL STATES OF THE BLACK & CASPIAN SEAS AND THEIR NEIGHBOURING COUNTRIES
Overhead electrical lines exceeding AC 45 kV

EN 50341-1 (2001)
Overhead electrical lines exceeding AC 45 kV

Structure

- **EN 50341-1** General requirement:
- **EN 50341-2** Index of National Normative Aspects
- **EN 50341-3-** NNA
Part 3: National Normative Aspects
The National Normative Aspects (NNAs) reflect national practices. They generally include A-deviations, special national conditions and national complements.

**A-deviations:**
A-deviations are required by existing national laws or regulations, which cannot be altered at the time of preparation of the standard. Reference is made to CENELEC Internal Regulations Part 2, definition 3.1.9.

**Special national conditions (snc):**
Special national conditions are national characteristics or practices that cannot be changed even over a long period, e.g. those due to climatic conditions, earth resistivity, etc.
EN 50341-1:2001

Overhead electrical lines exceeding AC 45 kV.

Part 1: General requirements
Common specifications
Introduction

1 Scope
1 Scope

This standard applies to overhead electric lines with rated voltages exceeding 45 kV AC and with rated frequencies below 100 Hz. This standard specifies the general requirements that shall be met for the design and construction of new overhead lines to ensure that the line is suitable for its purpose with regard to safety of persons, maintenance, operation and environmental considerations.
EN 50341-1:2001

2 Definitions, symbols and references

2.1 Definitions

2.2 List of symbols

2.3 References
3 Basis of design

3.1 General

3.2 Requirements
   - 3.2.1 Basic requirements
   - 3.2.2 Reliability of overhead lines
   - 3.2.3 Security requirements
   - 3.2.4 Safety requirements during construction and maintenance
3 Basis of design
3.1 General

This clause of the standard provides the basis and the general principles for the structural, geotechnical and mechanical design of overhead lines exceeding AC 45 kV. The clause should be read in conjunction with Eurocodes 1, 2, 3, 5, 7 and 8. The provisions in this standard supersede the corresponding clauses in the said Eurocodes.
3 Basis of design

3.1 General

The general principles of structural design are based on the limit state concept used in conjunction with the partial factor method as described in 3.7. The values of the partial factor for actions and material properties depend on the degree of uncertainty for the loads, resistances, geometrical quantities and design model, and on the type of structure and the type of limit state. Partial factors can also depend on the coordination of strength envisaged for the line.
In principle there are two approaches used to determine numerical values for actions and for partial factors.

The first is on the basis of the statistical evaluation of meteorological and experimental data and field observations. This should be done in the framework of a probabilistic reliability theory as described in IEC 60826.

A second approach is on the basis of calibration by a long and successful history of construction of overhead lines. For most of the factors proposed in the Eurocodes mentioned above this is the guiding principle.
In practice, the two approaches are used in combination, see Figure 3.1. In particular, a statistical method requires a sufficient set of data. In many cases additional activities to obtain such data will be valuable. Comparison with the traditional design method can be performed, related to the long standing experience of constructing and operating overhead lines mentioned above. From this point of view, the statistical approach can be considered as giving added value to the more traditional/empirical approach and vice versa.
The Empirical approach given in 4.3 is an alternative to the General approach applied regarding actions in 4.2. The Empirical approach incorporates the above mentioned experience of national high voltage regulations, which have existed in some countries since about 1900. Therefore, these regulations can give a good basis for calibration of the empirical method.

A countercheck of certain values with data obtained from a statistical analysis of available information should be carried out to confirm and calibrate the design criteria.
Each individual National Committee shall decide which specific national and/or regional requirements are to be employed in the design of overhead lines and also defines their relevant partial factors, see 4.2.11 and 4.3.11, if and as required. The National Committee can further decide to use the Empirical approach in 4.3. Partial factors along with related requirements are stated in the NNAs, thus being decisive. They may also be specified in a Project Specification.
3.2.5 Coordination of strength

3.2.6 Additional considerations

3.2.7 Design working life

3.2.8 Durability

3.2.9 Quality assurance
3.3 Limit states ....

- 3.3.1 General
- 3.3.2 Ultimate limit states
- 3.3.3 Serviceability limit states
- 3.3.4 Limit state design

3.4 Actions....

- 3.4.1 Principal classifications
- 3.4.2 Characteristic values of actions
- 3.4.3 Combination values of variable actions
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- 3.5 Material properties
- 3.6 Modelling for structural analysis and resistance
  - 3.6.1 General
  - 3.6.2 Interactions between support foundations and soil
- 3.7 Design values and verification method
  - 3.7.1 General
  - 3.7.2 Design values
  - 3.7.3 Basic design equation
  - 3.7.4 Combination of actions
Table 5.1 - Nominal voltages and corresponding highest system voltages

<table>
<thead>
<tr>
<th>Nominal voltage (kV)</th>
<th>Highest system voltage (kV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>52</td>
</tr>
<tr>
<td>50</td>
<td>72.5</td>
</tr>
<tr>
<td>60</td>
<td>72.5</td>
</tr>
<tr>
<td>63</td>
<td>72.5</td>
</tr>
<tr>
<td>66</td>
<td>72.5</td>
</tr>
<tr>
<td>70</td>
<td>82.5</td>
</tr>
<tr>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>110</td>
<td>123</td>
</tr>
<tr>
<td>132</td>
<td>145</td>
</tr>
<tr>
<td>150</td>
<td>170</td>
</tr>
<tr>
<td>220</td>
<td>245</td>
</tr>
<tr>
<td>225</td>
<td>245</td>
</tr>
<tr>
<td>275</td>
<td>300</td>
</tr>
<tr>
<td>380</td>
<td>420</td>
</tr>
<tr>
<td>400</td>
<td>420</td>
</tr>
<tr>
<td>480</td>
<td>525</td>
</tr>
<tr>
<td>700</td>
<td>765</td>
</tr>
</tbody>
</table>

NOTE: Bold figures are according to IEC 60038.
Table 5.4 - Minimum electrical clearance distances in air necessary to withstand the power frequency voltage (to be used in extreme wind conditions)

<table>
<thead>
<tr>
<th>Highest system voltage $U_s$ (kV)</th>
<th>$D_{50Hz_p-e}$ (in metres) $K_g = 1,45$ conductor-structure</th>
<th>$D_{50Hz_p-p}$ (in metres) $K_g = 1,60$ conductor to conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>52</td>
<td>0,11</td>
<td>0,17</td>
</tr>
<tr>
<td>72,5</td>
<td>0,15</td>
<td>0,23</td>
</tr>
<tr>
<td>82,5</td>
<td>0,16</td>
<td>0,26</td>
</tr>
<tr>
<td>100</td>
<td>0,19</td>
<td>0,30</td>
</tr>
<tr>
<td>123</td>
<td>0,23</td>
<td>0,37</td>
</tr>
<tr>
<td>145</td>
<td>0,27</td>
<td>0,42</td>
</tr>
<tr>
<td>170</td>
<td>0,31</td>
<td>0,49</td>
</tr>
<tr>
<td>245</td>
<td>0,43</td>
<td>0,69</td>
</tr>
<tr>
<td>300</td>
<td>0,51</td>
<td>0,83</td>
</tr>
<tr>
<td>420</td>
<td>0,70</td>
<td>1,17</td>
</tr>
<tr>
<td>525</td>
<td>0,86</td>
<td>1,47</td>
</tr>
<tr>
<td>765</td>
<td>1,28</td>
<td>2,30</td>
</tr>
</tbody>
</table>
Table 5.2 - Clearances $D_{el}$ and $D_{pp}$ to withstand lightning overvoltages

<table>
<thead>
<tr>
<th>Lightning withstand voltage $U_{90%_{r,l}}$ of the line insulator strings (kV)</th>
<th>$D_{el}$ (in metres) $K_g = 1.3$, $K_s$ (1 000 m)</th>
<th>$D_{pp}$ (in metres) $K_g = 1.6$, $K_s$ (1 000 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>0.48</td>
<td>0.54</td>
</tr>
<tr>
<td>300</td>
<td>0.58</td>
<td>0.65</td>
</tr>
<tr>
<td>350</td>
<td>0.67</td>
<td>0.74</td>
</tr>
<tr>
<td>400</td>
<td>0.77</td>
<td>0.85</td>
</tr>
<tr>
<td>450</td>
<td>0.85</td>
<td>0.96</td>
</tr>
<tr>
<td>500</td>
<td>0.95</td>
<td>1.06</td>
</tr>
<tr>
<td>550</td>
<td>1.04</td>
<td>1.17</td>
</tr>
<tr>
<td>600</td>
<td>1.14</td>
<td>1.26</td>
</tr>
<tr>
<td>650</td>
<td>1.23</td>
<td>1.37</td>
</tr>
<tr>
<td>700</td>
<td>1.33</td>
<td>1.47</td>
</tr>
<tr>
<td>750</td>
<td>1.41</td>
<td>1.58</td>
</tr>
<tr>
<td>800</td>
<td>1.50</td>
<td>1.68</td>
</tr>
<tr>
<td>850</td>
<td>1.60</td>
<td>1.79</td>
</tr>
<tr>
<td>900</td>
<td>1.69</td>
<td>1.89</td>
</tr>
<tr>
<td>950</td>
<td>1.78</td>
<td>2.00</td>
</tr>
<tr>
<td>1 000</td>
<td>1.88</td>
<td>2.08</td>
</tr>
<tr>
<td>1 050</td>
<td>1.97</td>
<td>2.19</td>
</tr>
<tr>
<td>1 100</td>
<td>2.06</td>
<td>2.29</td>
</tr>
<tr>
<td>1 150</td>
<td>2.14</td>
<td>2.40</td>
</tr>
<tr>
<td>1 200</td>
<td>2.23</td>
<td>2.50</td>
</tr>
<tr>
<td>1 250</td>
<td>2.33</td>
<td>2.60</td>
</tr>
<tr>
<td>1 300</td>
<td>2.42</td>
<td>2.71</td>
</tr>
<tr>
<td>1 350</td>
<td>2.51</td>
<td>2.81</td>
</tr>
<tr>
<td>1 400</td>
<td>2.61</td>
<td>2.92</td>
</tr>
<tr>
<td>1 450</td>
<td>2.70</td>
<td>3.02</td>
</tr>
<tr>
<td>1 500</td>
<td>2.79</td>
<td>3.13</td>
</tr>
<tr>
<td>1 550</td>
<td>2.89</td>
<td>3.23</td>
</tr>
<tr>
<td>1 600</td>
<td>2.98</td>
<td>3.33</td>
</tr>
<tr>
<td>1 650</td>
<td>3.07</td>
<td>3.44</td>
</tr>
<tr>
<td>1 700</td>
<td>3.17</td>
<td>3.54</td>
</tr>
<tr>
<td>1 750</td>
<td>3.26</td>
<td>3.65</td>
</tr>
<tr>
<td>1 800</td>
<td>3.35</td>
<td>3.75</td>
</tr>
<tr>
<td>1 850</td>
<td>3.45</td>
<td>3.86</td>
</tr>
<tr>
<td>1 900</td>
<td>3.54</td>
<td>3.96</td>
</tr>
<tr>
<td>1 950</td>
<td>3.63</td>
<td>4.06</td>
</tr>
<tr>
<td>2 000</td>
<td>3.72</td>
<td>4.17</td>
</tr>
<tr>
<td>2 050</td>
<td>3.82</td>
<td>4.27</td>
</tr>
<tr>
<td>2 100</td>
<td>3.91</td>
<td>4.38</td>
</tr>
<tr>
<td>2 150</td>
<td>4.00</td>
<td>4.48</td>
</tr>
</tbody>
</table>

**NOTE:** This table gives numerical values of clearances at 1 000 m of altitude. If the altitude is consistently lower or higher than 1 000 m, the clearance distances can be corrected using the altitude factor given in E 2.1.4.
### Table 5.4.5.2 – Minimum clearances to residential and other buildings

<table>
<thead>
<tr>
<th>Load Case</th>
<th>Clearance cases: Residential and other buildings</th>
<th>Line adjacent to buildings</th>
<th>Antenna, street lamps, flag poles, advertising signs and similar structures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Line above buildings</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>With fire resistant roofs where the slope is greater than 15° to the horizontal</td>
<td>With non fire resistant roofs and fire sensitive installations such as fuel stations, etc.</td>
<td>Antennas and lightning protection facilities</td>
</tr>
<tr>
<td>Maximum conductor temperature</td>
<td>2 m+ $D_{ex}$, but greater than 3 m</td>
<td>10 m+ $D_{ex}$</td>
<td>2 m+ $D_{ex}$, but greater than 3 m (Horizontal clearance)</td>
</tr>
<tr>
<td>Ice load</td>
<td>2 m+ $D_{ex}$, but greater than 3 m</td>
<td>10 m+ $D_{ex}$</td>
<td>2 m+ $D_{ex}$, but greater than 3 m (Horizontal clearance)</td>
</tr>
<tr>
<td>Wind load</td>
<td>2 m+ $D_{ex}$, but greater than 3 m</td>
<td>10 m+ $D_{ex}$</td>
<td>2 m+ $D_{ex}$, but greater than 3 m (Horizontal clearance)</td>
</tr>
<tr>
<td>Extreme ice load</td>
<td>$D_{ex}$</td>
<td>$D_{ex}$</td>
<td>$D_{ex}$</td>
</tr>
<tr>
<td>Remarks</td>
<td>It is considered that it is reasonable for a person to stand on the roof for maintenance and to use a hand tool. In the event of heavy icing it is assumed that no-one will use the roofs under this condition.</td>
<td>The clearance shall be sufficient to remove the possibility that induced voltages could lead to ignition.</td>
<td>The clearance $D_{ex}$ shall be maintained even when the structure falls towards the line conductors.</td>
</tr>
</tbody>
</table>

**NOTE:** In some countries it is not permitted in general to cross over or to be close to buildings and the clearances given in this clause do not apply to those countries. Those countries should define how close power lines can be to buildings in the NNAs.
4 Actions on lines

4.1 Introduction...

4.2 Actions, General approach
   - 4.2.1 Permanent loads
   - 4.2.2 Wind loads
   - 4.2.3 Ice loads
   - 4.2.4 Combined wind and ice loads
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- 4.2.5 Temperature effects
- 4.2.6 Construction and maintenance loads
- 4.2.7 Security loads
- 4.2.8 Forces due to short circuit currents
- 4.2.9 Other special forces
- 4.2.10 Load cases
- 4.2.11 Partial factors for actions
4.3 Actions, Empirical approach

- 4.3.1 Permanent loads
- 4.3.2 Wind loads
- 4.3.3 Ice loads
- 4.3.4 Combined wind and ice loads
- 4.3.5 Temperature
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- 4.3.6 Construction and maintenance loads
- 4.3.7 Security loads
- 4.3.8 Forces due to short circuit currents
- 4.3.9 Other special forces
- 4.3.10 Load cases
- 4.3.11 Partial factors for actions
### Table 4.2.7 - Standard load cases

<table>
<thead>
<tr>
<th>Load case</th>
<th>Load as per subclause</th>
<th>Conditions</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a, 1b</td>
<td>4.2.2</td>
<td>Extreme wind load&lt;br&gt;Wind load at a minimum temperature</td>
<td>See (a)&lt;br&gt;If relevant, see 4.2.5</td>
</tr>
<tr>
<td>2a, 2b, 2c, 2d</td>
<td>4.2.3</td>
<td>Uniform ice loads on all spans&lt;br&gt;Uniform ice loads, transversal bending&lt;br&gt;Unbalanced ice loads, longitudinal bend.&lt;br&gt;Unbalanced ice loads, torsional bending</td>
<td>If relevant, see (b)&lt;br&gt;See (c)&lt;br&gt;If relevant, see (d)</td>
</tr>
<tr>
<td>3</td>
<td>4.2.4</td>
<td>Combined wind and ice loads</td>
<td>See (e)</td>
</tr>
<tr>
<td>4</td>
<td>4.2.6</td>
<td>Construction and maintenance loads</td>
<td></td>
</tr>
<tr>
<td>5a, 5b</td>
<td>4.2.7 (a), 4.2.7 (b)</td>
<td>Security loads, torsional loads&lt;br&gt;Security loads, longitudinal loads</td>
<td>Reduced partial factors for material properties may apply as given in clauses 7 and 8.</td>
</tr>
</tbody>
</table>
### Table 4.3.1 - Conductor tension load cases

<table>
<thead>
<tr>
<th>Load case</th>
<th>Temperature °C</th>
<th>Load</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>-5</td>
<td>Conductor self-weight + normal additional load (respective increased additional load)</td>
<td>(1)</td>
</tr>
<tr>
<td>Normal</td>
<td>-20</td>
<td>Conductor self-weight</td>
<td>(1)</td>
</tr>
<tr>
<td>Normal</td>
<td>+15</td>
<td>Conductor self-weight + maximum wind load</td>
<td>(1), (3)</td>
</tr>
<tr>
<td>Normal</td>
<td>+40</td>
<td>Conductor self-weight</td>
<td>(1), (2)</td>
</tr>
</tbody>
</table>

**NOTE 1** Details of normal and exceptional load cases may be defined in the relevant NNAs.

**NOTE 2** In case of overhead lines for which a high electric current is likely to occur in summer time, a higher conductor temperature shall be considered, for instance +60 °C. The maximum conductor temperature is defined in the Project Specification.

**NOTE 3** Normal ambient reference temperature associated with the wind load as given in NNAs.
5. Electrical requirements

5.1 Voltage classification

5.2 Currents
   - 5.2.1 Normal current
   - 5.2.2 Short-circuit current

5.3 Insulation co-ordination
   - 5.3.1 General
5.3.2 Origin and classification of voltage stresses on overhead lines and evaluation of the representative over voltages

5.3.3 Determination of the co-ordination withstand voltage

5.3.4 Determination of the required withstand voltage

5.3.5 Electrical clearance distances to avoid flashover
5.4 Internal and external clearances

- 5.4.1 Introduction
- 5.4.2 General considerations and load cases
- 5.4.3 Clearances within the span and at the tower
- 5.4.4 Clearances to ground in areas remote from buildings, roads, railways and navigable waterways
- 5.4.5 Clearances to buildings, traffic routes, other lines and recreational areas
5.5 Corona effect

- 5.5.1 Radio noise
- 5.5.2 Audible noise
- 5.5.3 Corona loss

5.6 Electric and magnetic fields

- 5.6.1 Electric and magnetic fields under a line
- 5.6.2 Electric and magnetic field induction
- 5.6.3 Interference with telecommunication circuits
6. Earthing systems

6.1 Purpose

6.2 Dimensioning of earthing systems at power frequency

6.2.1 General

6.2.2 Dimensioning with respect to corrosion and mechanical strength

6.2.3 Dimensioning with respect to thermal strength
6.2.4 Dimensioning with regard to human safety

6.3 Construction of earthing systems
   6.3.1 Installation of earth electrodes
   6.3.2 Transferred potentials

6.4 Earthing measures against lightning effects

6.5 Measurements for and on earthing systems

6.6 Site inspection and documentation of earthing systems
Basic design

(1) Tower of insulating material?
   Yes
   (2) Tower surroundings frequently occupied?
       Yes
       (3) Immediate automatic disconnection?
           Yes
           (4) Determination of earth potential rise $U_e$
               Yes
               (5) $U_e = 2U_D$?
                   Yes
                   (6) Determination of touch voltage $U_T$
                       Yes
                       (7) $U_T = U_{ot}$?
                           Yes
                           (8) Measures required for the reduction of the touch voltages

   No
   (3) Immediate automatic disconnection?
       No

   Correct design
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7 Supports

7.1 Initial design considerations

7.2 Materials

- 7.2.1 Steel materials, bolts, nuts and washers, welding consumables
- 7.2.2 Cold formed steel
- 7.2.3 Requirements for steel grades subject to galvanising
- 7.2.4 Holding-down bolts
- 7.2.5 Concrete and reinforcing steel
- 7.2.6 Timber
- 7.2.7 Guy materials
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7.2.8 Other materials

7.3 Lattice steel towers

7.3.1 General
7.3.2 Basis of design
7.3.3 Materials
7.3.4 Serviceability limit states
7.3.5 Ultimate limit states
7.3.6 Connections
7.3.7 Fabrication and erection
7.3.8 Design assisted by testing
7.4 Steel poles

- 7.4.1 General
- 7.4.2 Basis of design
- 7.4.3 Materials
- 7.4.4 Serviceability limit states
- 7.4.5 Ultimate limit states
- 7.4.6 Connections
- 7.4.7 Fabrication and erection
7.4.8 Design assisted by testing

7.5 Timber poles

- 7.5.1 General
- 7.5.2 Basis of design
- 7.5.3 Materials
- 7.5.4 Serviceability limit states
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Country Origin and Code

- AT Austrian National Committee EN 50341-3-1
- BE Belgian National Committee EN 50341-3-2
- CH Swiss National Committee EN 50341-3-3
- DE German National Committee EN 50341-3-4
- DK Danish National Committee EN 50341-3-5
- ...
EN 50341-3-8

National Normative Aspects (NNA) for FRANCE

based on EN 50341-1:2001

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The French National Committee (NC) is identified by the following address:

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The French NC has prepared this Part 3-8 of EN 50341, listing the French national normative aspects, under its sole responsibility, and duly passed it through the CENELEC and CLC/TC 11 procedures.

NOTE: The French NC also takes sole responsibility for the technically correct coordination of this EN 50341-3-8 with EN 50341-1.

This EN 50341-3-8 is normative in France and informative for other countries.
This Part 3-8 has to be read in conjunction with EN 50341-1, hereinafter referred to as Part 1. All clause numbers used in this Part 3-8 correspond to those of Part 1. Specific sub-clauses, which are prefixed "FR", are to be read as amendments to the relevant text in Part 1. Any necessary clarification regarding the application of this Part 3-8 in conjunction with Part 1 shall be referred to the French NC who will, in cooperation with CLC/TC 11, clarify the requirements.

When no reference is made in Part 3-8 to a specific sub-clause, then Part 1 applies.
In the case of "boxed values" defined in Part 1, amended values (if any) which are defined in Part 3-8 are compulsory in France.

However any boxed value, either in Part 1 or in Part 3-8, shall not be amended in the direction of greater risk in a Project Specification.

The French NC declares in accordance with 3.1 of Part 1 that this Part 3-8 follows the "Deterministic Approach" (sub-clause 4.3), and that consequently sub-clause 4.1 "General approach" is not applicable for France.

The French national standards/regulations related to overhead electrical lines exceeding 45 kV (a.c.) are identified/listed in 2.3/FR.1 to 2.3/FR.2.
Thank you for your attention