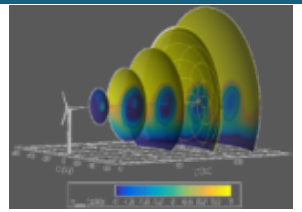
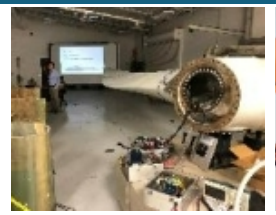
SAND2021-2683PE

# IEC 61400-5: Wind Turbine Blades






*PRESENTED BY*

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# Background

Initiated by China in 2009

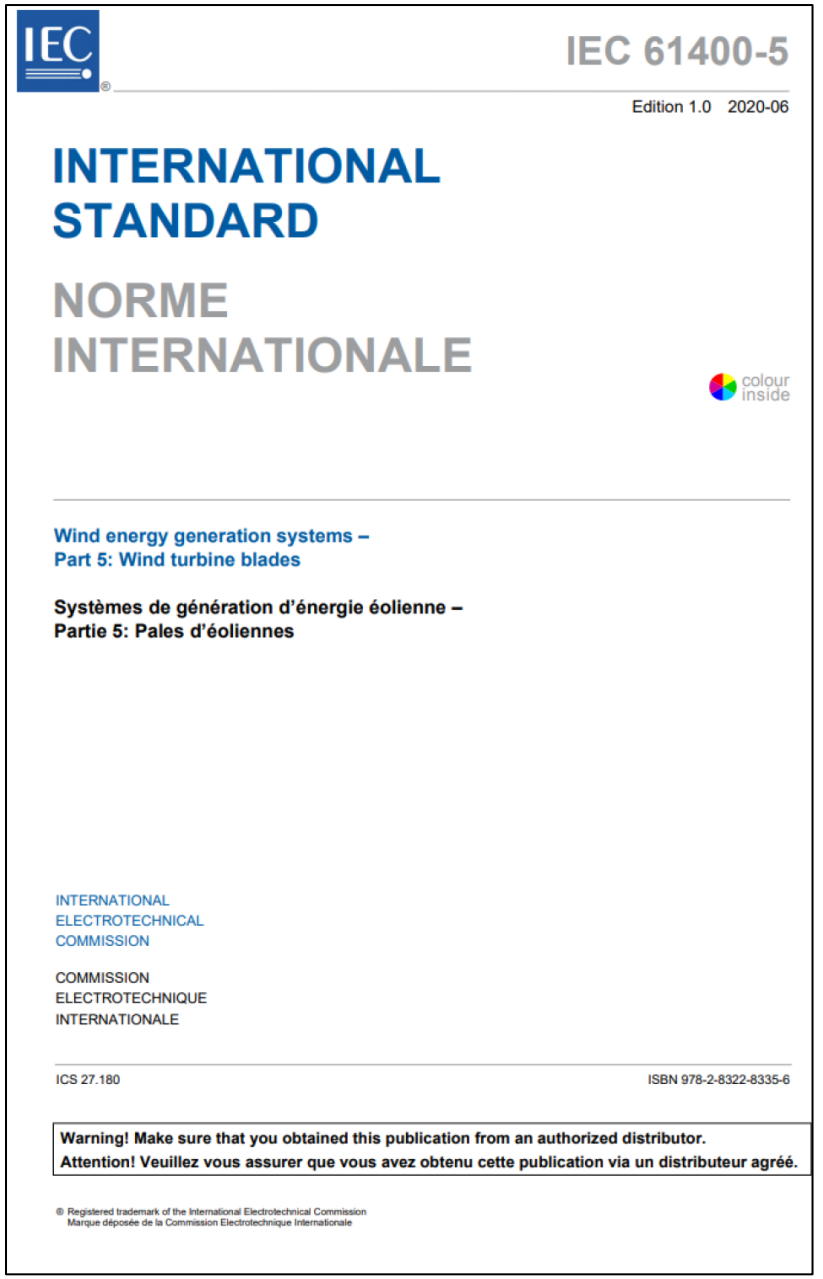
- Convenor: Jianping Wang (CN)
- Secretary: Derek Berry (US)

11 countries, 67 Members, ~20 active members

OEM's, research labs, blade manufacturers, blade designers, certification agencies

First CD in 2016

Edition 1 published in June 2020 (!)


IEC 61400-5

Edition 1.0 2020-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Wind energy generation systems –
Part 5: Wind turbine blades

Systèmes de génération d'énergie éolienne –
Partie 5: Pales d'éoliennes

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# Scope

Aerodynamic and structural design

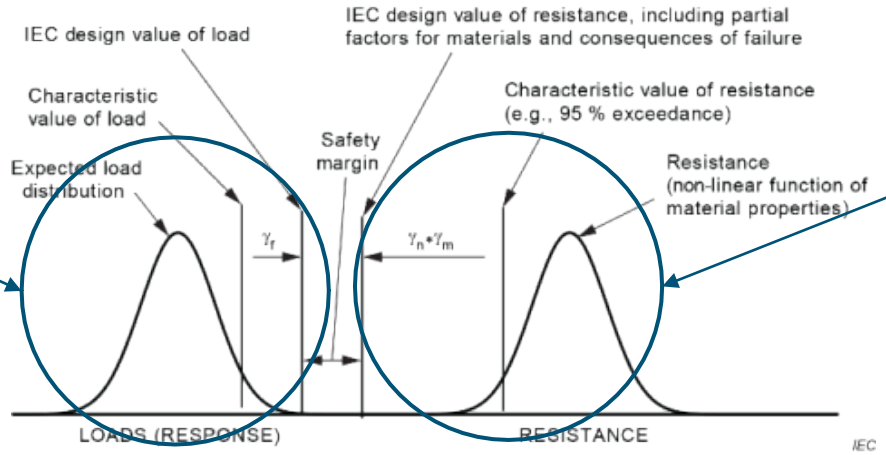
Material selection, evaluation and testing,

Manufacture (including associated quality management),

Transportation, installation, operation and maintenance of the blades.

Goal: Incentivize better testing and analysis through opportunity to reduce safety factors

61400-1




61400-5

$$\gamma_m = \gamma_{m1} * \gamma_{m2} * \gamma_{m3} * \gamma_{m4} * \gamma_{m5}$$

| Factor | Values |
|---|---|
| $\gamma_{m1}$ | **Factor for environmental degradation (non-reversible effects)**<br>1,00 – No effect accounted for |
| $\gamma_{m2}$ | **Factor for temperature effects (reversible effects)**<br>1,10 – When using core material modulus values at room temperature<br>1,00 – When using core material modulus values taking into account the highest operating temperature |
| $\gamma_{m3}$ | **Factor for manufacturing effects**<br>1,00 – No effect accounted for |
| $\gamma_{m4}$ | **Factor for calculation accuracy and validation of method**<br>$\gamma_{m4a}$: Factor for analytical method<br>1,40 – For two-dimensional analytical methods (non FEA)<br>1,20 – For linear finite element analysis methods<br>1,00 – For computation using a finite element analysis that models geometric nonlinearities<br>$\gamma_{m4b}$: Factor for validation<br>1,25 – For no validation<br>1,00 – For methods of which has been validated by intermediate level or full blade testing to non-linear buckling detection or failure<br>$\gamma_{m4}$ is the product of $\gamma_{m4a}$ and $\gamma_{m4b}$. |
| $\gamma_{m5}$ | **Factor for load characterization**<br>1,20 – Loads in 4 main directions<br>1,00 – Minimum 12 evenly distributed load directions |

# Outline

# Future Plans

Initiate MT5 committee to begin work on Ed. 2 in 2021, publish in 2026

Address lightly covered areas of Ed. 1

- Erosion
- Damage tolerant design

Update safety factors and potentially add additional ones (e.g. repairs)

Revisit manufacturing quality treatment

Look into separation into sub-sections

Add more owner/operator representatives

Edit and strengthen O&M documentation requirements

Re-Examine connections to -23 Structural Testing, -28 Life Extension, and -?? Operations & Maintenance

Stretch goal: Develop a framework whereby safety factors can be further reduced in exchange for defined inspection/repair intervals and methods.