Bearings for Wind Energy Sectors

I. Types of Bearings

Bearing Types	Location / sub-system
Spherical Roller	Main Shaft
Cylindrical Roller- single row	Main Shaft, Main Gearbox, Generator, Pitch/yaw Gearbox
Cylindrical Roller- double row	Main Gearbox
Tapered Roller – single row	Main Shaft, Main Gearbox, Pitch/yaw Gearbox
Tapered Roller – double row	Main Shaft, Main Gearbox
Deep Groove Ball	Main Gearbox, Generator, Pitch/yaw Gearbox
Four Point Contact Ball	Main Gearbox, Pitch/yaw Gearbox
Eight Point Contact two row Ball	Pitch/yaw Gearbox

II. Standards followed

- IEC/ISO 61400-1 to 25: Design Requirements for Wind Turbines
  IEC 61400-1 - Wind Turbine Safety and Design
  IEC 61400-2 - Small Wind Turbine Safety
  IEC 61400-12 - Power Performance
  IEC 61400-11 - Noise Measurement
  IEC 61400-13 - Mechanical Load Measurements
  IEC 61400-22 - Wind Turbine Certification
  IEC 61400-23 - Blade Structural Testing
  IEC 61400-21 - Power Quality

- IEC/ISO 61400-1 & ISO 281: wind turbine design requirements - calculate hub loads across a range of mean wind characteristics using an aero-elastic simulation mode. Load data used to determine the main bearing life.
- ISO 15243:2004 Rolling Bearings- Damage and Failures – Terms, characteristics and causes
- ISO/TS 16281:2008: Rolling bearings - Methods for calculating the modified reference rating life for universally loaded bearings
- ISO/TR 1281-2:2008: Rolling bearings - Explanatory notes on ISO 281 -- Part 2: Modified rating life calculation, based on a systems approach to fatigue stresses

III. Sources / Manufacturers

- NSK Rolling element bearings
- SKF
- NTN-SNR Wind Turbine Bearing Solutions
- Timken Wind Energy Solutions
- Scheerer Bearing Corporation
- URB Group of Bearings

References:

1. Edward Hart et.al., “A review of wind turbine main bearings: design, operation, modelling, damage, mechanism and fault detection”, Wind Energy Science, No. 5, Pp 105-124, 2020.
2. Jarred Kenworthy et.al., “Wind Turbine Main Bearing Rating Life as determined by IEC 61400-1 and ISO-281”, NREL/PR-5000-86299, National Renewable Energy Laboratory, U S Department of Energy.
3. Harris T., Rumberger J. H., Butterfield C. P., Wind Turbine Design Guideline DG03: Yaw and Pitch Rolling Bearing Life, Technical Report NREL/TP-500-42362, December 2009, National Renewable Energy Laboratory, U S Department of Energy.
4. Fabian Schwack et.al., “Wear in wind turbine pitch bearings – a comparative design study”, Wind Energy, No. 25, pp 700-718, 2022, (wileyonlinelibrary.com/journal/we)
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9. https://www.scheererbearing.com