Wind Turbine System Requirements

These are example requirements, and are intended solely to show how requirements documents can be linked to the model.

**% Copyright 2009-2017 The MathWorks, Inc.**

### Blade Requirements

|  |  |
| --- | --- |
| Type description | AL 40 |
| Blade length | 40 m |
| Material | Carbon/wood/glass/epoxy |
| Standard colour | RAL 7035 |
| Gloss | Class 2: (30-70%) to be measured acc. to DS/ISO2813 |
| Type of rotor air brake | Full blade |
| Blade profiles | FFA - W3, NACA 63.4 |
| Twist | 20° |
| Largest chord | 3.08 m |

### Brakes Requirements

|  |  |
| --- | --- |
| **Mechanical** |  |
| Type description | Active Brake |
| Brake disc | Steel, mounted on high speed shaft |
| Number of calipers | 2 piece |
| **Brake Hydraulics** |  |
| Voltage | 3 x 480 V |
| Working pressure range | 140-150 bar |
| Oil capacity | 11 l |

### Environment Requirements

|  |  |
| --- | --- |
| Temperature interval for operation | -30 to +30°C |
| Temperature interval for structure | -40 to +50°C |

### Geartrain Requirements

|  |  |
| --- | --- |
| Type description | 1. step planet, 2. step helical |
| Gear house material | Cast |
| Ratio | 1:84.3 |
| Mechanical power | 1800 kW |
| Bending strength acc. to ISO 6336 | SF > 1.6 |
| Surface durability acc. to ISO 6336 | SH > 1.25 |
| Scuffing safety acc. to DNV 41. | SS > 1.3 |
| Shaft seals | Labyrinth |
| Oil sump | App. 250 l |

### 

### Generator Requirements

|  |  |
| --- | --- |
| Type description | 1 speed generator, water cooled |
| Rated power | 1650 kW |
| Apparent power | 1808 kVA |
| Rated current IN | 1740 A |
| Max power at Class F PFma | 1815 kW |
| Max current at Class F IFmax | 1914 A |
| No load current I0 | 430 A |
| Reactive power consumption at rated power (tolerance. acc to IEC 60034-1) | 740 kvar |
| Reactive power consumption at no load (tolerance. acc to IEC 60034-1) | 447 kvar |
| Number of poles P | 6 |
| Synchronous rotation speed n0 | 1200 rpm |
| Rotation speed at rated power nN | 1214 rpm |
| Slip at rated power sN | 0.0117 |
| Voltage UN | 3 x 600 V |
| Frequency F | 60 Hz |
| Coupling | Δ |
| Enclosure | IP54 |
| Insulation class/ Temperature increase | F/B |

### Main Controller Requirements

|  |  |
| --- | --- |
| Annual average wind speed 8.5 m/s | 8.5 m/s |
| Wind shear 0.20 | 0.2 |
| Extreme wind speed | 42.5 m/s (10 min. average) |
| Survival wind speed 59.5 m/s (3 sec. average) | 59.5 m/s (3 sec. average) |
| Automatic stop limit 20 m/s (10 min. average) | 20 m/s (10 min. average) |
| Re-cut in 18 m/s (10 min. average) | 18 m/s (10 min. average) |
| Characteristic turbulence intensity | 16% (including wind farm turbulence) |
| Maximum in-flow angle | 8° |

### Nacelle Requirements

|  |  |
| --- | --- |
| Material EN-GJS-400-18U-LT | EN-GJS-400-18U-LT |
| Standard colour RAL 7035 | RAL 7035 |
| Corrosion class, outside Acc. to DS EN ISO 12944:C5 I | Acc. to DS EN ISO 12944:C5 I |
| **Rotor** |  |
| Number of blades 3 pieces | 3 pieces |
| Tip speed (synchronous) 61.8 m/s | 61.8 m/s |
| Rotor shaft tilt 5° | 5° |
| Eccentricity (tower center to hub center) | 3447 mm |
| Solidity (Total blade area/rotor area) | 0.05 |
| Rotor orientation | Upwind |

### Pitch Actuation Requirements

|  |  |
| --- | --- |
| Hydraulic pressure | 2e7 Pa |
| Accumulator Capacity | 0.1 L |
| Accumulator Preload Pressure | 1.5e7 Pa |
| Accumulator Maximum Pressure | 2.5e7 Pa |

### Pitch Controller Requirements

|  |  |
| --- | --- |
| Track angle within | 1 degree |
| Rise Time | 3 seconds |
| Settling Time | 5 seconds |

### Tower Requirements

|  |  |
| --- | --- |
| Type Description Conical, tubular | Conical, tubular |
| Material Welded steel plate | Welded steel plate |
| Corrosion class, outside Acc. to DS EN ISO 12944: C5 I | Acc. to DS EN ISO 12944: C5 I |
| Colour RAL 7035 | RAL 7035 |
| Access conditions | Internal, safety harness, ladder cage |

### Yaw Actuation Requirements

|  |  |
| --- | --- |
| Type description | Planetary gear motor |
| Gear ratio of yaw gear unit | app. 1:1687 |
| Voltage | 3 x 480 V |
| Rotational speed at full load | 1140 rpm |
| Number of yaw gears | 4 pieces |
| **Yaw Brake** | Hydraulic disc brake |
| Number of Yaw Friction Units | 6 pieces |
| Voltage | 3 x 480 V |
| Working pressure range | 140-150 bar |
| Oil capacity | App. 10 l. |

### Yaw Controller Requirements

|  |  |
| --- | --- |
| Max Yaw Rate | 0.5 deg/sec |