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Preface

DTU Wind Energy is not designing and manufacturing wind turbines and do therefore not need a Design Load Basis (DLB) that is accepted by a certification body. However, to assess the load consequences of innovative features and devices added to existing turbine concepts or new turbine concept developed in our research, it is useful to have a full DLB that follows the current design standard and is representative of a general DLB used by the industry. It will set a standard for the design load evaluations performed at DTU Wind Energy, which is aligned with the challenges faced by the industry and therefore ensures that our research continues to have a strong foundation in this interaction. Furthermore, the use of a full DLB that follows the current standard can improve and increase the feedback from the research at DTU Wind Energy to the international standardization of design load calculations.

Content

Summary

This report describes the full Design Load Basis (DLB) used for load calculations at DTU Wind Energy for onshore wind turbines. It is based on the third edition of the IEC 61400-1 standard and covers the typical cases for assessment of extreme and fatigue loads on the turbine components. Special cases that are intended for specific turbines must be added to this DLB if necessary e.g. faults of specific sensors or actuators. For other targeted investigations, some cases in this DLB for onshore turbines may be omitted.

The description is generic and not linked to the development and testing of the HAWC2 code or external models and controllers coupled to HAWC2 through the DLL interface. The description is therefore formulated without direct references to HAWC2 features, commands, or terminology. This generic formulation has the advantage that the DLB can be used independently of the simulation tool. A detailed description of the pre-processing tools for generating the input files for the HAWC2 simulations can be found in [1].

Each Design Load Case (DLC) of the DLB is described in the following chapter. The DLC description also contains a short description on how the simulation results will be post-processed to obtain the tables of extreme and fatigue loads for the main components. More detailed descriptions of the post-processing methods are given in [2] and [3].

1. Design Load Cases

This chapter contains a description of each Design Load Case (DLC) in the DLB. Table 1 shows an overview of the DLCs, where the columns are:

Name:	Identifier of the DLC
Load:	Type of load analysis (U=extreme/ultimate loads and F=fatigue)
PSF:	Partial safety factor on the loads.
Description:	Short description of the operating conditions.
WSP:	Mean wind speeds at hub height in m/s, e.g. 4:2:26 means the range 4, 6, 8,…, 26 m/s (Vr=rated, Vin=cut-in, Vout=cut-out wind speeds, Vref=reference speed of the IEC class, Vmaint=max. speed during maintenance, V1 and V50 are wind speeds with 1- and 50-year recurrence period).
Yaw:	Mean yaw errors in degrees, e.g. -8/+8 deg means that simulations are performed for these two yaw errors for each wind speed and turbulence seed.
Turb.:	Turbulence model or intensity.
Seeds:	Number of turbulence seeds used per mean wind speed and yaw error.
Shear:	Vertical shear exponent or reference to equation in the IEC 61400-1 standard.
Gust:	Gust type according to the IEC 61400-1 standard.
Fault:	Short description of fault type.
T:	Length of simulated load signal used for analysis in seconds.
Files:	Number of result files.

The wind speed range for normal operation is here set to 4 – 26 m/s; however, it must be adjusted to the specific turbine, e.g. in case that the turbine has a storm controller.

All simulations are to be performed with aerodynamic imbalance due to uncertainty in blade pitch calibration of 0.5 deg, whereby one blade has a -0.5 deg pitch offset, another blade has +0.5 deg pitch offset, and the last blade of a three bladed rotor has no offset. Similar, all simulations are performed with a mass imbalance of each blade corresponding to 0.2% of the total blade mass, which is placed on two blades in their centers of gravity.

For the listed DLCs with the chosen operational wind speed range, the total number of simulations, and therefore also result files, is 1880 and total simulation time of 259 hours. Note that any transients in the simulation start-up must be excluded and are not counted to the time lengths of the simulated load signals that will be used for the load analysis.

A detailed description of each DLC is given in the pages after Table 1. It contains also a brief description of how the result files with the loads are post-processed to obtain the design load tables.

Table 1: Overview of the Design Load Basis of DTU Wind Energy. For turbines with storm operation the wind speed range must be adjusted accordingly.

Name	Load	PSF[1]	Description	WSP [m/s]	Yaw [deg]	Turb.	Seeds	Shear	Gust	Fault	T [s]	Files
DLC11	U	1.25	Normal production	4:2:26	-10/0/+10	NTM	6	0.2	None	None	600	216
DLC12	F	1.0	Normal production	4:2:26	-10/0/+10	NTM	6	0.2	None	None	600	216
DLC13	U	1.35	Normal production	4:2:26	-10/0/+10	ETM	6	0.2	None	None	600	216
DLC14	U	1.35	Normal production	Vr+/-2,Vr	0	None	None	0.2	ECD	None	100	3
DLC15	U	1.35	Normal production	4:2:26	0	None	None	Eq. in IEC	EWS	None	100	48
DLC21	U	1.35	Grid loss	4:2:26	-10/0/+10	NTM	4	0.2	None	Grid loss at 10s	100	144
DLC22p	U	1.1	Pitch runaway	12:2:26	0	NTM	12	0.2	None	Max. pitch to fine at 10s	100	96
DLC22y	U	1.1	Extreme yaw error	4:2:26	15:15:345	NTM	1	0.2	None	Abnormal yaw error	600	276
DLC22b	U	1.1	One blade stuck at min. angle	4:2:26	0	NTM	12	0.2	None	1 blade at fine pitch	600	144
DLC23	U	1.1	Grid loss	Vr+/-2, Vout	0	None	None	0.2	EOG	Grid loss at three diff. times	100	9
DLC24	F/U	1.0	Production in large yaw error	4:2:26	-20/+20	NTM	3	0.2	None	Large yaw error	600	72
DLC31	F	1.0	Start-up	Vin, Vr, Vout	0	None	None	0.2	None	None	100	3
DLC32	U	1.35	Start-up at four diff. times	Vin, Vr+/-2, Vout	0	None	None	0.2	EOG	None	100	16
DLC33	U	1.35	Start-up in EDC	Vin, Vr+/-2, Vout	0	None	None	0.2	EDC	None	100	16
DLC41	F	1.0	Shut-down	Vin, Vr, Vout	0	None	None	0.2	None	None	100	3
DLC42	U	1.35	Shut-down at six diff. times	Vr+/-2, Vout	0	None	None	0.2	EOG	None	100	18
DLC51	U	1.35	Emergency shut-down	Vr+/-2, Vout	0	NTM	12	0.2	None	None	100	36
DLC61	U	1.35	Parked in extreme wind	V50	-8/+8	11%	6	0.11	None	None	600	12
DLC62	U	1.1	Parked grid loss	V50	0:15:345	11%	1	0.11	None	None	600	24
DLC63	U	1.35	Parked with large yaw error	V1	-20/+20	11%	6	0.11	None	None	600	12
DLC64	F	1.0	Parked	4:2:0.7 Vref	-8/+8	NTM	6	0.2	None	None	600	192
DLC71	U	1.1	Rotor locked and extreme yaw	V1	0:15:345	11%	1	0.11	None	Rotor locked at 0:30:90 deg	600	96
DLC81	U	1.5	Maintenance	Vmaint	-8/+8	NTM	6	0.2	None	Maintenance	600	12
										Totals	259h	1880

[1] Listed PSFs are for the standard values according to Table 3 of IEC 61400-1 Ed. 3. Note that the PSF can be lowered if gravity is part of the characteristic load for the particular channel.

<table>
<tr><td>DLC11</td><td colspan="3">Power production in normal turbulence</td></tr>
<tr><td>Assessment</td><td>Extreme extrapolation</td><td>Partial safety factor</td><td>1.25</td></tr>
<tr><td>Description</td><td colspan="3">Simulation of power production without faults performed for wind speeds in the entire operational range with normal turbulence according to the IEC class. Yaw errors during normal operation are set to +/- 10 deg. Six seeds per wind speed and yaw error are used.</td></tr>
<tr><td>Simulation setup</td><td colspan="3">Length: 600 s
Wind: 4 – 26 m/s with steps of 2 m/s
Yaw: -10/0/+10 deg
Turbulence: NTM, 6 seeds per wind speed and yaw error
Shear: Vertical and exponent of 0.2
Gust: None
Fault: None</td></tr>
<tr><td>Total no. simulations</td><td colspan="3">216</td></tr>
<tr><td>Post-processing</td><td colspan="3">The extrapolation of extreme loads from cases DLC11 is performed to statistically determine the long term load extremes [3]. Note that the simulations used here are the same as computed in DLC12.</td></tr>
</table>

<table>
<tr><td>DLC12</td><td colspan="3">Power production in normal turbulence</td></tr>
<tr><td>Assessment</td><td>Fatigue</td><td>Partial safety factor</td><td>1.0</td></tr>
<tr><td>Description</td><td colspan="3">Simulation of power production without faults performed for wind speeds in the entire operational range with normal turbulence according to the IEC class. Yaw errors during normal operation are set to +/- 10 deg. Six seeds per wind speed and yaw error are used.</td></tr>
<tr><td>Simulation setup</td><td colspan="3">Length: 600 s
Wind: 4 – 26 m/s with steps of 2 m/s
Yaw: -10/0/+10 deg
Turbulence: NTM, 6 seeds per wind speed and yaw error
Shear: Vertical and exponent of 0.2
Gust: None
Fault: None</td></tr>
<tr><td>Total no. simulations</td><td colspan="3">216</td></tr>
<tr><td>Post-processing</td><td colspan="3">A load spectrum is extracted for each load sensor and each wind speed using rainflow counting on the 18 results files for each wind speed representing three hour of normal operation at that particular wind speed. The individual load spectra are then combined to a life-time load spectrum using the wind distribution of the wind class, and then the equivalent fatigue loads are computed from this combined spectrum based on the Palmgren-Miner assumption. Note that the combined load spectrum also contains load cycles from DLC24, DLC31, DLC41, and DLC64.</td></tr>
</table>

DLC13	**Power production in extreme turbulence**		
Assessment	Extreme – normal event	**Partial safety factor**	1.35[2]
Description	Simulation of power production without faults or yaw error performed for wind speeds in the entire operational range with extreme turbulence according to the IEC class. Yaw errors are set to +/- 10 deg. Six seeds per wind speed and yaw error are used.		
Simulation setup	Length: 600 s Wind: 4 – 26 m/s with steps of 2 m/s Yaw: -10/0/+10 deg Turbulence: ETM, Six seeds per wind speed Shear: Vertical and exponent of 0.2 Gust: None Fault: None		
Total no. simulations	216		
Post-processing	The mean of the extremes values for each wind speed are extracted for each load sensor.		

DLC14	**Power production in extreme coherent gust with wind direction change**		
Assessment	Extreme – normal event	**Partial safety factor**	1.35[2]
Description	Simulation of power production without faults or turbulence and with extreme coherent gust with wind direction change according to the IEC standard. Wind speeds close to rated are considered to capture the extreme blade tip deflections and flapwise blade moments.		
Simulation setup	Length: 100 s Wind: Vr and Vr +/- 2m/s Yaw: 0 deg Turbulence: None Shear: Vertical and exponent of 0.2 Gust: ECD: Equations (23) and (25) of IEC 61400-1 (Ed. 3) Fault: None		
Total no. simulations	3		
Post-processing	The extremes values over all wind speeds are extracted for each load sensor.		

[2] For load sensors where gravity has a positive effect the partial safety factor can be reduced according IEC61400-1 (3. Ed.)

DLC15	**Power production in extreme wind shear**		
Assessment	Extreme – normal event	**Partial safety factor**	1.35[2]
Description	Simulation of power production without faults performed for wind speeds in the entire operational range without turbulence and with extreme vertical or horizontal wind shear transients in four different combinations, two pairs of opposite sign in the two directions.		
Simulation setup	Length: 100 s Wind: 4 – 26 m/s with steps of 2 m/s Yaw: 0 deg Turbulence: None Shear: EWS: Equations (26) and (27) of IEC 61400-1 (Ed. 3) Gust: None Fault: None		
Total no. simulations	48		
Post-processing	The extremes values over all wind speeds are extracted for each load sensor.		

DLC21	**Power production with grid loss**		
Assessment	Extreme – normal event	**Partial safety factor**	1.35[2]
Description	Simulation of power production with grid loss (generator torque drops to zero) after 10 s and thereafter the overspeed protection of the turbine controller[3] will shut-down the turbine. Normal turbulence and four seeds per wind speed and yaw error are used.		
Simulation setup	Length: 100 s Wind: 4 – 26 m/s with steps of 2 m/s Yaw: -10/0/+10 deg Turbulence: NTM, 4 seeds per wind speed and yaw error Shear: Vertical and exponent of 0.2 Gust: None Fault: Grid loss at t=10 s		
Total no. simulations	144		
Post-processing	For each load sensor, the average value of the upper half extreme values of the 12 realizations is computed for each wind speed.		

[3] In case that the controller does not include an overspeed monitoring feature, the simulations are set up by forcing an overspeed shut-down at the time instant where the rotor speed has accelerate to the specific overspeed limit.

DLC22b	Power production with one blade at minimum pitch angle		
Assessment	Extreme – abnormal event	**Safety factor**	1.1
Description	Simulation of power production with failure in the pitch system or bearing of one blade such that the turbine is operating with this blade at minimum pitch angle. All operational wind speeds and normal turbulence are considered with 12 seeds per wind speed.		
Simulation setup	Length: 100 s Wind: 4 – 26 m/s with steps of 2 m/s Yaw: 0 deg Turbulence: NTM, 12 seeds per wind speed Shear: Vertical and exponent of 0.2 Gust: None Fault: Failure of pitch system on one blade leading to this blade remaining at minimum pitch angle.		
Total no. simulations	144		
Post-processing	For each load sensor, the average value of the upper half extreme values of the 12 realizations is computed for each wind speed.		

DLC22p	Power production with pitch runaway[4]		
Assessment	Extreme – abnormal event	**Safety factor**	1.1
Description	Simulation of power production with failure in pitch system after 10 s leads to collective pitching towards minimum pitch angle at the maximum pitch speed. Wind speeds from 12 m/s and above and normal turbulence with 12 seeds per wind speed are considered.		
Simulation setup	Length: 100 s Wind: 12 – 26 m/s with steps of 2 m/s Yaw: 0 Turbulence: NTM, 12 seeds per wind speed Shear: Vertical and exponent of 0.2 Gust: None Fault: Failure in pitch system leading to collective pitch runaway where all blades pitch at t=10 s with maximum speed towards minimum pitch angle.		
Total no. simulations	96		
Post-processing	For each load sensor, the average value of the upper half extreme values of the 12 realizations is computed for each wind speed.		

[4] The DLC may be omitted if it can be argued that there is a redundant safety system that detects a pitch run-away and shuts down the turbine immediately, or that makes a pitch run-away impossible.

DLC22y	Power production with abnormal yaw error		
Assessment	Extreme – abnormal event	**Safety factor**	1.1
Description	Simulation of power production with abnormally large yaw error due to failure in the turbine safety system. All operational wind speeds and normal turbulence are considered with one seed per wind speed and yaw error.		
Simulation setup	Length: 600 s Wind: 4 – 26 m/s with steps of 2 m/s Yaw: 15 to 345 deg with steps of 15 deg Turbulence: NTM, 1 seed per wind speed and yaw error Shear: Vertical and exponent of 0.2 Gust: None Fault: Failure of yaw system leading to abnormal yaw errors.		
Total no. simulations	276		
Post-processing	For each load sensor, the average value of the upper half extreme values of the 12 realizations is computed for each wind speed.		

DLC23	Power production with grid loss during extreme operating gust		
Assessment	Extreme – abnormal event	**Safety factor**	1.1
Description	Simulation of power production with grid loss performed at close to rated and at cut-out wind speeds. To capture the extremes of this abnormal event, the grid loss is initiated at three different time instances after the gust has started.		
Simulation setup	Length: 100 s Wind: Vr+/-2 m/s and Vout Yaw: 0 deg Turbulence: None Shear: Vertical and exponent of 0.2 Gust: EOG: Equation (17) of IEC 61400-1 (Ed. 3) Fault: Grid loss initiated at three difference instances in the gust.		
Total no. simulations	9		
Post-processing	The extremes values over all wind speeds and timings are extracted for each load sensor.		

DLC24	**Power production with large yaw errors**		
Assessment	Fatigue	**Safety factor**	1.0
Description	Simulation of power production with large yaw errors of +/-20 deg performed for all operational wind speeds with normal turbulence using three seeds per wind speed and yaw error. The large yaw errors are a result of a failure in the yaw control and the size of the yaw error is defined by the safety system.		
Simulation setup	Length: 600 s Wind: 4 – 26 m/s with steps of 2 m/s Yaw: -20/+20 deg Turbulence: NTM, 3 seeds per wind speed and yaw error Shear: Vertical and exponent of 0.2 Gust: None Fault: Failure in yaw control leading to maximum yaw error ensured by the safety system.		
Total no. simulations	72		
Post-processing	The one hour load spectra obtained from the six realizations of each wind speeds are added to the load spectra from DLC12 assuming that these large yaw errors occur 50h per year.		

DLC31	**Start-up in normal wind profile**		
Assessment	Fatigue	**Safety factor**	1.0
Description	Simulation of start-up in normal wind profile and at cut-in, rated, and cut-out wind speeds.		
Simulation setup	Length: 100 s Wind: Vin, Vr and Vout Yaw: 0 deg Turbulence: None Shear: Vertical and exponent of 0.2 Gust: None Fault: None		
Total no. simulations	3		
Post-processing	A total of 1000 start-ups at cut-in wind speed, 50 at rated wind speed and 50 at cut-out wind speed per year are assumed, and the load cycles during start-up for each load sensor and each wind speed are added to the combined load spectrum obtained from DLC12 and DLC24.		

DLC32	**Start-up during extreme operating gust**		
Assessment	Extreme – normal event	**Safety factor**	1.35[2]
Description	Simulation of start-up performed at cut-in, close to rated and cut-out wind speeds. To capture the extremes of this event, the start-up is initiated at four different time instances after the gust has started.		
Simulation setup	Length: 100 s Wind: Vin, Vr+/-2 m/s and Vout Yaw: 0 deg Turbulence: None Shear: Vertical and exponent of 0.2 Gust: EOG: Equation (17) of IEC 61400-1 (Ed. 3) Fault: None		
Total no. simulations	16		
Post-processing	The extremes values over all wind speeds and timings are extracted for each load sensor.		

DLC33	**Start-up during extreme wind direction change**		
Assessment	Extreme – normal event	**Safety factor**	1.35[2]
Description	Simulation of start-up during extreme wind direction change performed at cut-in, close to rated and cut-out wind speeds. Two timings for each sign of the direction change is used: start-up is just before the direction change and one half way through the direction change.		
Simulation setup	Length: 100 s Wind: Vin, Vr+/-2 m/s and Vout Yaw: 0 deg Turbulence: None Shear: Vertical and exponent of 0.2 Gust: EDC: Equation (21) of IEC 61400-1 (Ed. 3) Fault: None		
Total no. simulations	16		
Post-processing	The extremes values over all wind speeds and timings are extracted for each load sensor.		

DLC41	**Shut-down in normal wind profile**		
Assessment	Fatigue	**Safety factor**	1.0
Description	Simulation of normal shut-down in normal wind profile and at cut-in, rated, and cut-out wind speeds.		
Simulation setup	Length: 100 s Wind: Vin, Vr, and Vout Yaw: 0 deg Turbulence: None Shear: Vertical and exponent of 0.2 Gust: None Fault: None		
Total no. simulations	3		
Post-processing	A total of 1000 shut-downs at cut-in wind speed, 50 at rated wind speed and 50 at cut-out wind speed per year are assumed, and the load cycles during normal shut-down for each load sensor and each wind speed are added to the combined load spectrum obtained from DLC12 and DLC24.		

DLC42	**Shut-down during extreme operating gust**		
Assessment	Extreme – normal event	**Safety factor**	1.35
Description	Simulation of normal shut-down performed at close to rated and cut-out wind speeds. To capture the extremes of this event, the shut-down is initiated at six different time instances after the gust has started.		
Simulation setup	Length: 100 s Wind: Vr+/-2 m/s and Vout Yaw: 0 deg Turbulence: None Shear: Vertical and exponent of 0.2 Gust: EOG: Equation (17) of IEC 61400-1 (Ed. 3) Fault: None		
Total no. simulations	18		
Post-processing	The extremes values over all wind speeds and timings are extracted for each load sensor.		

DLC51	Emergency shut-down		
Assessment	Extreme – normal event	**Safety factor**	1.35[2]
Description	Simulation of emergency shut-down performed at close to rated and cut-out wind speeds in normal turbulence with 12 seeds per wind speed. The emergency stop may or may not incorporate a mechanical brake dependent on the turbine type.		
Simulation setup	Length: 100 s Wind: Vr+/-2 m/s and Vout Yaw: 0 deg Turbulence: NTM, 12 seeds per wind speed Shear: Vertical and exponent of 0.2 Gust: None Fault: None		
Total no. simulations	36		
Post-processing	The average of the upper half extremes values for each wind speed is computed for each load sensor.		

DLC61	Parked in 50-year extreme wind		
Assessment	Extreme – normal event	**Safety factor**	1.35[2]
Description	Simulation of parked turbine with idling rotor and minor yaw error (according to the standard) at a wind speed with 50-year recurrence period and turbulence intensity of 11%. Six seeds per yaw error are used.		
Simulation setup	Length: 600 s Wind: V50 Yaw: -8/+8 deg Turbulence: 11% intensity, 6 seeds per wind speed and yaw error Shear: Vertical and exponent of 0.11 Gust: None Fault: None		
Total no. simulations	12		
Post-processing	The average of the upper half extremes values is computed for each load sensor.		

DLC62	**Parked without grid connection in 50-year extreme wind**		
Assessment	Extreme – abnormal event	**Safety factor**	1.1
Description	Simulation of parked turbine with idling rotor and abnormally large yaw error due to grid loss at a wind speed with 50-year recurrence period and turbulence intensity of 11%. One seed per yaw error is used.		
Simulation setup	Length: 600 s Wind: V50 Yaw: 0:15:345 deg Turbulence: 11% intensity, 1 seed per wind speed and yaw error Shear: Vertical and exponent of 0.11 Gust: None Fault: None		
Total no. simulations	24		
Post-processing	The average of the upper half extremes values is computed for each load sensor.		

DLC63	**Parked with large yaw error in 1-year wind**		
Assessment	Extreme – normal event	**Safety factor**	1.35[2]
Description	Simulation of parked turbine with idling rotor and large yaw error due to failure in yaw control system at a wind speed with 1-year recurrence period and turbulence intensity of 11%. Six seeds per yaw error are used.		
Simulation setup	Length: 600 s Wind: V1 Yaw: -20/+20 deg Turbulence: 11% intensity Shear: Vertical and exponent of 0.11 Gust: None Fault: None		
Total no. simulations	12		
Post-processing	The average of the upper half extremes values is computed for each load sensor.		

DLC64	**Parked**		
Assessment	Fatigue	**Safety factor**	1.0
Description	Simulation of parked turbine with idling rotor and minor yaw error (according to the standard) at wind speeds from 4 m/s to 70% of the reference wind speed of the IEC class. Six seeds per wind speed and yaw error are used.		
Simulation setup	Length: 600 s Wind: 4 m/s to 0.7*Vref with steps of 2 m/s Yaw: -8/+8 deg Turbulence: None Shear: Vertical and exponent of 0.2 Gust: None Fault: None		
Total no. simulations	192[5]		
Post-processing	Assuming that the turbine is idling 2.5% of the time in each wind speed bin, the load cycles during idling for each load sensor and each wind speed are added to the combined load spectrum obtained from DLC12 and DLC24.		

DLC71	**Parked with rotor locked in 1-year extreme wind**		
Assessment	Extreme – abnormal event	**Safety factor**	1.1
Description	Simulation of parked turbine with rotor locked at 0:30:90 deg and abnormally large yaw error due to electrical fault at a wind speed with 1-year recurrence period and turbulence intensity of 11%. One seed per yaw error is used.		
Simulation setup	Length: 600 s Wind: V1 Yaw: 0:15:345 deg Turbulence: 11% intensity Shear: Vertical and exponent of 0.11 Gust: None Fault: None		
Total no. simulations	96		
Post-processing	The average of the upper half extremes values is computed for each load sensor.		

[5] The number of simulations will vary with the reference wind speed of the selected IEC wind class.

DLC81	**Maintenance**		
Assessment	Extreme – normal event	**Safety factor**	1.35[2]
Description	Simulation of parked turbine with the rotor locked in the best position[6] and minor yaw error at the maximum wind speed for maintenance and normal turbulence model. Six seeds per yaw error are used.		
Simulation setup	Length: 600 s Wind: Vmaint Yaw: -8/+8 deg Turbulence: NTM, 6 seeds per yaw error. Shear: Vertical and exponent of 0.2 Gust: None Fault: None		
Total no. simulations	12		
Post-processing	The average of the upper half extremes values is computed for each load sensor.		

[6] This best azimuth position of the rotor when it is locked for maintenance may be turbine dependent.

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