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INTRODUCTION
The purpose of this document is to communicate the minimum requirements for the annual blade inspection.

NAMING CONVENTION
The Inspection report must be named after the following naming convention. All naming information can be found on the front page of Inspection Report.

Filename = sitename_turbine no_blade_report type_insp.type_date
          (1)     (2)     (3)     (4)     (5)     (6)

Example
1. Site name          Axeltofta
2. Turbine no.        12345
3. Blade              B
4. Report type        INSP (in report REP)
5. Inspection type    EX or IN (external or internal)
6. Inspection date    7. December 2015

This will give the following filename
Filename = Axeltofta_12345_B_INSP_EX_20151207.doc

HSE
Before starting the work, the service technician shall be familiar with the hazards and risk assessment related to the work. Use the HSE guidelines and minimum requirements stated by your respective company.

PHOTO REQUIREMENTS
All findings must be documented with photos and put into the inspection report. Refer to Instruction - Blade Photos for the minimum requirements on how to take a photo.
When a damage on a blade is detected, the photocard must be placed next to the damage and documented with a picture. For in depth description on the minimum requirements of taking a picture, please refer to “Instruction – Blade Photos”.

**Diagram: Photocard**

- **Date:** Write day (DD), month (MM) and year (YYYY) (eg. 05/05/2015)
- **Site:** Write site name (eg. BOWBEAT)
- **Company:** Write service firm name (eg. BLADENA)
- **Inspectors:** Write technicians name (eg. A.HANSEN)
- **Damage Number:** Turn wheel to right damage no. (eg. 1)
- **Distance from root:** Turn wheel to right distance from root (eg. 30m)
- **Distance from LE:** Turn wheel to right distance from LE. (eg. 25%)
- **Distance from root:** Measure 14-25cm

**Instructions:**

- **Hole for rope**
- **Handle**

---

**Photo Card Rev. 3.0**

**IMPORTANT!** Keep the ROOT arrow pointed in the right direction (Tip direction may also be used)

- **Blade no.:** Write Blade letter (A,B,C) and serial no. (eg. 4007452 - A)
- **Turbine no.:** Write park ID. and serial number (eg. 2304091)
- **Company:** Write service firm name (eg. BLADENA)
- **Inspectors:** Write technicians name (eg. A.HANSEN)
- **Distance from root:** Turn wheel to right distance from root (eg. 30m)
- **Distance from LE:** Turn wheel to right distance from LE. (eg. 25%)
- **Position:** Turn wheel to right damage location (eg. PS)
- **Damage number:** Turn wheel to right damage no. (eg. 1)
- **Distance from root:** Measure 14-25cm
The blade damages can be prioritized when it comes to the impact they have on the wind turbine blade itself. To define the category of the damage, it is important to assess the location, the impact and the time it requires to repair the damage. Below the different categories are described as a guideline to use when inspecting the blades.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>DAMAGE</th>
<th>ACTION</th>
<th>TURBINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cosmetic</td>
<td>No need for immediate action</td>
<td>Continue Operation</td>
</tr>
<tr>
<td></td>
<td>Readings of lightning system below 50mΩ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Damage, below wear and tear</td>
<td>Repair only if other damages are to be repaired</td>
<td>Continue Operation</td>
</tr>
<tr>
<td>3</td>
<td>Damage, above wear and tear</td>
<td>Repair done within next 6 months</td>
<td>Continue Operation</td>
</tr>
<tr>
<td></td>
<td>Readings of lightning system above 50mΩ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Serious damage</td>
<td>Repair performed within next 3 months. Damage monitored</td>
<td>Continue Operation</td>
</tr>
<tr>
<td>5</td>
<td>Critical damage</td>
<td>Immediate action required to prevent turbine damage. Contact technical support</td>
<td>STOP Operation safety is not ensured</td>
</tr>
</tbody>
</table>
3 | INSPECTION METHODS

There are three acknowledged methods to conduct a blade inspection, which all have their advantages and disadvantages depending on the task ahead. The methods are described below to depict the various advantages and disadvantages. All three methods can be used when the limitation of each method is known and taken into account.

ROPE INSPECTION

While conducting a visual blade inspection using rope access the technicians will be able to investigate not only the surfaced damage but also the surrounding area which is done by tap testing. Should there be any damages within category 1-3 the blade technician will be able to repair the damage whilst inspecting. Rope access also allows the technicians to measure the lighting receptors and exchange them if necessary. This particular method requires specific weather conditions. If the wind speed exceeds 10m/s it is not recommendable to work on the blades, and if repairs are to be conducted, the temperature and humidity must be accordingly to the chemical datasheet. The documentation of the damages is done with pictures and photocard, which unfortunately makes it hard to trace the exact location of the damage. The inspections can be done within a timeline depending on the technicians experience and weather conditions.

GROUND BASED CAMERA INSPECTION

With a ground based camera high resolution photos are merged in a total overview of the blade. This gives a thorough documentation. A good software provides traceability and the pictures will include a scale and the possibility to zoom in on very small details.

The ground based inspection can be expensive depending on the type of quality and who is conducting it. Remember that when doing a camera inspection like this, the software is not always a part of the service. The shadow side of the blade is hard to capture on a ground based camera because the image lighting is usually poor or the angle cannot be positioned correctly (some might have an amazing camera but poor software and vice versa). The maximum wind speed can be as high as 18 m/s during inspection. The method requires a lot of storage facilities for the many high-resolution photos.

DRONE INSPECTION

By utilizing this method it is possible to have both video and still pictures, however the image size tend to be large and hence require a larger storage capacity. The drones can operate in most weather conditions as long as the wind speed does not exceed 14m/s and the temperature does not affect the battery. The drone is sensitive to warm weather and will not operate if the battery is overheated. The automatic inserted scale can be distorted due to the angle the pictures are taken in.
## DAMAGE EXAMPLES

A list of damage examples in different categories. 13 examples in all.

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>LE Erosion</td>
</tr>
<tr>
<td>02</td>
<td>LE tape</td>
</tr>
<tr>
<td>03</td>
<td>Longitudinal cracks along LE bond lines</td>
</tr>
<tr>
<td>04</td>
<td>Open Bond Line in TE</td>
</tr>
<tr>
<td>05</td>
<td>Paint Damages</td>
</tr>
<tr>
<td>06</td>
<td>45 Cracks on surface (Cutting from Factory)</td>
</tr>
<tr>
<td>07</td>
<td>Other Cracks on Surface</td>
</tr>
<tr>
<td>08</td>
<td>Pinholes</td>
</tr>
<tr>
<td>09</td>
<td>Blades with Hydraulic Oil</td>
</tr>
<tr>
<td>10</td>
<td>Lightning damage on Receptor/Bronze Tip</td>
</tr>
<tr>
<td>11</td>
<td>Vortex (Missing Panels)</td>
</tr>
<tr>
<td>12</td>
<td>Other Add-ons Missing</td>
</tr>
<tr>
<td>13</td>
<td>Voids</td>
</tr>
</tbody>
</table>

### LE EROSION

LE area in the outer 1/3 of blade length 200mm on either side of center line. Document the length of the damage.

### LE TAPE

Loose or open LE tape must be documented by photo.
LONGITUDINAL CRACKS ON LE BOND LINES
Longitudinal cracks along LE must be documented by photo and end of cracks marked with non carbon based marker.

OPEN BOND LINE IN TE
TE Cracks in bond line (open trailing edge) must be sealed with glue.

PAINT DAMAGES
0-6 m from tip= all paint damages must be reported and documented. For spalling of the coat exposing fibers in areas smaller than ø5 cm no actions are needed.
In tip area all paint damages must be documented and repaired.
06

45° CRACKS ON SURFACE (CUTTING FROM FACTORY)
Reporting width length and position.

07

OTHER CRACKS ON SURFACE
Reporting width length and position.

08

PINHOLES
Areas with pinholes must be documented.
09

BLADES WITH HYDRAULIC OIL
Document the findings.

10

LIGHTNING DAMAGE
No action is needed.
Document with photo.

11

VORTEX (MISSING PANELS)
The sealant securing and aerodynamically sealing the VG Panels must be intact. Cracks and detachment of the VG Panels or broken fins must be documented.
OTHER ADD-ONS MISSING
Eg. Zigzag tape, gurney flaps, serrated edges, dinoshells, spoilers.

VOIDS
Document voids.
# Blade Check List

Following is a list that guides you on what to check when performing a blade inspection.

<table>
<thead>
<tr>
<th>Component</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leading edge</td>
<td>There must be no pinholes or dirt near the leading edge (200mm from leading edge). This applies especially to pinholes on an running area of 0.1m * 0.1 m and pinholes to the laminate.</td>
</tr>
<tr>
<td>Pinholes</td>
<td>On the rest of the blade pinholes are acceptable on 10% of the blade area. In an area of 0.1 running m² pinholes or pinholes to laminate are not acceptable.</td>
</tr>
<tr>
<td>Tip</td>
<td>Tip must not appear damaged. No dirt, pinholes or cracks are acceptable on the outermost meter of the blade.</td>
</tr>
<tr>
<td>Drain hole</td>
<td>The drain hole must be open and have clean edges.</td>
</tr>
<tr>
<td>Trailing edge</td>
<td>There must be no holes in the trailing edge.</td>
</tr>
<tr>
<td>Red Tip /Marking Color</td>
<td>The transition between the basic color and the marking color must be sharp and perpendicular longitudinally on the blade.</td>
</tr>
<tr>
<td>Drips, Blobs and Overflows</td>
<td>Drips and blobs must not occur on the blade. Overflows are unacceptable on the back of the edges of the trailing edge.</td>
</tr>
<tr>
<td>Metal Signs (if applicable)</td>
<td>Check that no metal signs indicating “blade status – inspected, ready etc.” are fastened and does not “bang” against the blade in strong winds.</td>
</tr>
<tr>
<td>Cracks</td>
<td>White markings must be registered. Ends of marking must be marked along with the date.</td>
</tr>
<tr>
<td>Lightning Receptor</td>
<td>Write down the measured resistance for each receptor. The lightning receptor must be clear from paint. If the resistance is higher than 50mΩ or the receptor is 25% damaged it should be replaced.</td>
</tr>
</tbody>
</table>
In the section “Damage Overview” is an overview figure of the blade showing PS and SS. Next to the figure is a table where all damages must be listed by damage number and given a damage category depending on the damage. The number boxes can be moved out on the blade figure by dragging to show in which area the damage appear on the blade. Make copies of the boxes if more are needed.

The measured resistance on each lightning receptors on the blade must be noted under “Lightning Receptors” in the table.

On the following pages in the inspection report one photo per each page is inserted in the page table. Damage number, category and a short damage description are added. If more pages are needed, copy and paste empty table pages.
Appendix A | TERMS AND DEFINITIONS

BLADE OVERVIEW

1. BLADE LENGTH: Length of the blade from blade root to blade tip.
2. ROOT END: The end of the blade on which the blade is attached by bolts (bolted) to the blade bearing.
3. ROOT SECTION: The cylindrical section of the blade at the root towards the Blade tip. The root is attached by bolts (bolted) to the blade bearing.
4. TRANSITION ZONE: The flat back at the root zone on blades, where the transition from round to profile is done by use of third surface.
5. MAX CHORD SECTION: The section of the blade between the Root Section and the 1/3 of the total Blade Length.
6. MAX CHORD: The longest distance between the two chord wise extreme points (viz. Leading Edge and Trailing Edge Extreme Point respectively).
7. MID-SECTION: The section of the blade between the 1/3 of the blade length and 2/3 of the blade length.
8. TIP SECTION: The section of the blade between mid-section and blade tip. i.e. the last 1/3 of the blade.
9. BLADE TIP: The tip of the blade in the opposite direction of the root defined at the last meter of the blade.
10. ZERO METER MARK: Starting point of all lengthwise measurements of the blade. Placed at the root.
11. BOLT: Steel bolt used to attach to the blade to the blade bearing.
12. BOLT CIRCLE DIAMETER (BCD): The diameter between centres of opposite bolts in the root.
13. BOLT FLANGE: The steel flange placed at the root of the blade towards the hub.
14. BOLT CONNECTION: The steel bushing inserting into the root in a circular pattern, and used as a threaded connection for the bolts.
15. BOLT CONNECTION SECURING SCREW: Nut along the circumference close to the root and used to secure the bolt in the bolt connection. Used in the so-called IKEA bolt connection.
16. LEADING EDGE (LE): Rounded aerofoil part of the blade facing the rotational direction of the blade. Also, the angle of attack of the wind.
17. TRAILING EDGE (TE): The thin aerofoil rear section of the blade facing away from the rotational direction of the blade.
CLOSED SHELL

18. SUCTION SIDE (PS): The panel from TE towards LE (TTL) has less curvature than the other.
19. PRESSURE SIDE (SS): The panel from TE towards LE (TTL) has more curvature than the other.
20. BALSA: Core material of balsa wood.
21. SUCTION SIDE SPAR CAP: The load carrying laminate above the shear web(s) on suction side.
22. PRESSURE SIDE SPAR CAP: The load carrying laminate above the shear web(s) on pressure side.
23. SHEAR WEB: The shear web(s) running lengthwise between the two shells.
24. OUTER LAMINATE: The outer laminate layers of the sandwich panel e.g. on the shell.
25. INNER LAMINATE: The inner laminate layers of the sandwich panel e.g. on the shell.
26. TRAILING EDGE BOND LINE: The bond line bonding between the two trailing edge panels. For a Siemens blade there is no glue but still a connection.
27. SANDWICH PANEL: A panel consisting of two skins and a core material.
28. TOP COAT: The coating on the surface /outer side of the shells.
29. LIGHTNING SYSTEM CABLE: Cable connection the Lightning receptor with the grounding.
BOX SPAR CONCEPT

30. **SKIN ABOVE LOAD CARRYING SHELL – SUCTION SIDE**: The panel placed above the spar cap on the suction side of the blade.
31. **SKIN ABOVE LOAD CARRYING SHELL – PRESSURE SIDE**: The panel placed above the spar cap on the pressure side of the blade.
32. **TRAILING EDGE PANEL - SUCTION SIDE**: The panel placed in the area between the web(s) and the trailing edge on suction side.
33. **TRAILING EDGE PANEL - PRESSURE SIDE**: The panel placed in the area between the web(s) and the trailing edge on pressure side.
34. **LEADING EDGE PANEL ON SUCTION SIDE**: The panel placed in the shell between the web and the leading edge transition point on suction side. The panel is usually a sandwich panel.
35. **LEADING EDGE PANEL ON PRESSURE SIDE**: The panel placed in the shell between the web and the leading edge transition point on pressure side. The panel is usually a sandwich panel.
36. **AFT SHEAR WEB**: The shear web placed towards the trailing edge, if the profile consists of two webs.
37. **FRONT SHEAR WEB**: The shear web placed towards the leading edge, if the profile consists of two webs.
38. **LEADING EDGE TRANSITION POINT**: The point on the blade surface at the front end Panel (on both suction side and pressure side respectively) where the sandwich panel stops (towards the leading edge).
39. **LEADING EDGE CONNECTION POINT**: The point at the leading edge where the two shells are connected.
40. **TRAILING EDGE CONNECTION POINT**: The point at the trailing edge where the two shells are connected.
41. **BLADE CENTER LINE CHORD WISE**
42. **BLADE CHORD**: The straight line going from the leading edge dividing point to the trailing edge dividing point.
43. **RE-INFORCEMENT TAPE**: Tape applied on the leading edge and running along the lengthwise direction of the blade.
44. **HEIGHT**: The perpendicular distance between the outer side of the blade surface on Pressure side and Suction side at any point along the Blade Center line length wise.
LOAD CARRYING SHELL

45. LOAD CARRYING SHELL: Sections of the aerodynamic profile of the Blade.
46. CORE: The material, typical foam or balsa, between the two layers of laminate.
47. LEADING EDGE BOND LINE: The bond line bonding between the leading edge panels.
48. SPAR CAP BOND LINE: The bond line bonding the spar cap to the panel at the suction side of the blade.
49. WEB/SPAR BOND LINE: The bond line ensuring bonding on the suction side of the blade between the front web and the spar cab, on the side facing the leading edge.


**ADD-ONS**

50. **LIGHTNING RECEPTOR**: receptor placed along the blade length designed to attract and direct the electricity via the Lightning System Cable to the ground.

51. **DRAINHOLE**: Angled hole near the tip or shoulder. Exit hole for water, dirt etc.

52. **GURNEY FLAPS**: Gurney flap are add-on placed along the trailing edge on the pressure side of the blade.

53. **SERRATED EDGE**: Saw-toothed TE plastic add-on placed on the trailing edge in the tip zone of the blade.

54. **SERRATED FLAPS**: Like the tail fin on a Stegosaurus. They are add-on placed on the trailing edge in the Tip zone of the blade.

55. **VORTEX GENERATOR**: Angled plastic add-ons placed on the suction side front end panel in the root section with the purpose of optimizing the lift and performance of the blade.

56. **BALANCING WEIGHT**: Mass typically attached to the shear webs, used for balancing purposes.

**OTHER DEFINITIONS – NOT ILLUSTRATED**

57. **WINGLET**: an add-on glued angled tip onto the blade.

58. **SPOILER**: Fixed control surfaces attached at or near the trailing edge in the root section. They are given a spoiler effects and resembles the spoiler of a racing car.

59. **ANTI ICING**: System using either hot air or carbon heating up the blade on the LE to avoid ice build-up.

60. **DE-ICING**: System using either hot air or carbon heating up the blade on the LE to remove ice during icing events.

61. **LIGHTNING PROTECTION SYSTEM (LPS)**: One cable going from tip to root connecting the receptors with the root area.

62. **SHOULDER AREA**: The TE part of the max chord section where the blade geometry forms a “shoulder”.

63. **BLADE CENTER LINE LENGTH WISE**: The line going from the center of the root end to the very tip of the blade starting at the zero meter mark and halving the Blade Center Line Chord wise at any point.

64. **BOND LINE**: Line of adhesive bonding two parts together.

65. **LE PROTECT TAPE**: Leading edge impact-resistant (Polyurethane) protective tape covering LE, usually on the outer 1/3 of the blade.

66. **LE PROTECTIVE PAINT**: Leading edge impact-resistant paint applied to the outer 1/3 of the blade.

67. **TC MARK**: The location of the appointed mark from where the installation can be performed.

68. **LPS ROOT TERMINAL**: The transition between the cable in the root area to the hub.
# DAMAGE TABLE FOR GENERAL BLADE TYPES

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>DAMAGE</th>
<th>CATEGORY</th>
<th>BOX SPAR CONCEPT</th>
<th>LOAD CARRYING SHELL</th>
<th>CLOSED SHELL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tip</strong></td>
<td>Open tip</td>
<td>5</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Damage that penetrates the laminate layers</td>
<td>4</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Surface damage, not in the laminate</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Coat/paint damage, surface. Missing more than 15 cm²</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Coat/paint damage, surface. Missing less than 15 cm²</td>
<td>2</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Paint damage, surface. Missing more than 10 cm²</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Paint damage, surface. Missing less than 10 cm²</td>
<td>2</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Chip in paint/coat</td>
<td>2</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Trailing edge (TE)</strong></td>
<td>Open TE more than 10 cm within 5 meters of the tip</td>
<td>5</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Open TE less than 10 cm within 5 meters of the tip</td>
<td>4</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Open TE more than 20 cm beyond 5 meters of the tip</td>
<td>5</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Open TE less than 20 cm beyond 5 meters of the tip</td>
<td>4</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Cracks parallel to the TE longer than 1 meter</td>
<td>5</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Cracks parallel to the TE shorter than 1 meter</td>
<td>4</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Surface damage, not into the laminate</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Coat/paint damage, surface. Missing more than 20 cm²</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Coat/paint damage, surface. Missing less than 20 cm²</td>
<td>2</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Paint damage, surface. Missing more than 10 cm²</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Paint damage, surface. Missing less than 10 cm²</td>
<td>2</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Chip in paint/coat</td>
<td>2</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>TE discoloration</td>
<td>1</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Leading edge (LE)</strong></td>
<td>Open LE</td>
<td>5</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>LE erosion, through laminate</td>
<td>5</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>LE erosion, down to laminate and first layer laminate</td>
<td>4</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>LE erosion, down to laminate</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Damaged leading edge tape</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Damaged leading edge protection</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Coat/paint damage, surface. Missing more than 10 cm²</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Coat/paint damage, surface. Missing less than 10 cm²</td>
<td>2</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>LE discoloration, paint or bugs</td>
<td>1</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
### DAMAGE TABLE FOR GENERAL BLADE TYPES

#### LOCATION | DAMAGE

**Shell**
- Shell is open, any size: CATEGORY 5, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- Shell is buckled: CATEGORY 5, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- Crack into laminate, more than 20 cm: CATEGORY 4, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- Crack into laminate, less than 20 cm: CATEGORY 3, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- Cracks in transversal direction: CATEGORY 3, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- Cracks in diagonal direction: CATEGORY 4, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- Cracks in longitudinal direction: CATEGORY 2, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- Glue between spar and shell contains air bobbles (Thermografi): CATEGORY 2, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- Coat/paint damage, surface. Missing more than 25 cm²: CATEGORY 3, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- Coat/paint damage, surface. Missing less than 25 cm²: CATEGORY 2, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- Paint damage, surface. Missing more than 100 cm²: CATEGORY 3, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X
- Paint damage, surface. Missing less than 100 cm²: CATEGORY 2, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X
- Discoloration from lighting/bugs: CATEGORY 2, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- Chip in paint/coat: CATEGORY 2, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X

**Add-on**
- More than 5% or 1 meter missing, total length of VG’s: CATEGORY 3, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- Less than 5% or 1 meter missing, total length of VG’s: CATEGORY 2, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- More than 50% damaged or missing fins on VG panel: CATEGORY 2, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X
- Crack in sealing around serrogated edge: CATEGORY 2, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X
- Two VG’s consecutive panel missing: CATEGORY 3, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X

**Lightning**
- Lightning impact on carbon spar: CATEGORY 4, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X
- Lightning damage on laminate: CATEGORY 4, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X
- Missing sealer or cracks around receptor: CATEGORY 3, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X
- Discoloration from lighting: CATEGORY 2, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X
- Discoloration from lighting >25% of lightning receptor surface damaged: CATEGORY 3, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X
- Lightning conductivity test above 30mΩ: CATEGORY 3, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X
- Lightning conductivity test above 50mΩ: CATEGORY 3, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X

**Blade collar**
- Misaligned: CATEGORY 2, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
- Separated from blade: CATEGORY 3, BOX SPAR CONCEPT X, LOAD CARRYING SHELL X, CLOSED SHELL X
DOCUMENT DEVELOPED BY

Bladena, Vattenfall, EON, Statkraft, ENGIE & KIRT x THOMSEN
in EUDP Project LEX (2014-16) and EUDP Project RATZ (2016-18)