

# Work Instructions: Leading Edge Erosion and Crack Handling

## LE;ER and LE;CR - inspection, classification, mitigation, and generic repair flow

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Audience: Blade repair technicians, inspection technicians, maintenance coordinators

Scope: Vendor-neutral work instruction patterns for leading edge defects used in the project taxonomy

### Key outputs (what this manual enables)

- Decision rules to separate LE erosion vs LE crack
- Severity-based action table for LE;ER and LE;CR
- Step-by-step temporary protection and generic scarf repair flow
- QA checklist and reporting fields

### Document control

Revision	Date	Change summary
v1.0	2026-01-16	Initial synthetic release for academic RAG baseline
v1.1	2026-01-16	Expanded procedures, checklists and reporting templates

## How to use this document

This manual is designed for fast field use: identify the defect, assign a severity level, execute the minimal viable corrective action, and produce a standardized report for downstream systems.

It is intentionally vendor-neutral. Whenever a step references torque, curing, material spec or acceptance values, treat these as placeholders and verify with OEM or site procedures.

### Quick start

- Confirm access, weather, and stop/run status (safety gate).
- Capture evidence: overview photo, close-up, and scale reference.
- Classify defect using the provided taxonomy and severity rubric.
- Select action: monitor, protect, repair, or stop turbine.
- Create a report using the provided template and attach photos.

## Scope

This document provides field-style work instructions for leading edge erosion (LE;ER) and leading edge cracks (LE;CR).

## Safety gate

- Work at height and rotating machinery: follow site permit, LOTO and rescue plan.
- Do not approach blades in wind speeds above site limits.
- Chemicals: use PPE (respirator, gloves, eye protection) and control dust.

## Tools and consumables (typical)

- Cleaning: lint-free wipes, approved solvent, mild detergent, water.
- Inspection: flashlight, inspection mirror, thickness gauge (optional), camera, scale marker.
- Prep: sander/grinder with dust extraction, sandpaper assortment (80/120/240/400 grit), masking tape.
- Repair: filler/putty, epoxy resin system, reinforcement cloth (glass), vacuum bag kit (optional).
- Protection: leading edge protection tape or coating system (per product TDS).

## Procedure A - LE;ER: inspection and classification

### A1. Identify

Leading edge erosion presents as pitting, matte roughness, local material loss, or exposed substrate at the leading edge. Distinguish from paint-off by the location: LE;ER is concentrated at the stagnation line/leading edge.

Severity	Observed cues (examples)	Action
S1	Minor roughness, no substrate exposure	Record and monitor
S2	Small pits or micro-chips; limited length; no fiber exposed	Protect (tape/coating) at next stop
S3	Substrate exposed in spots; rough band along LE; early edge shape loss	Schedule repair within weeks
S4	Obvious LE profile change, deep pits, moisture ingress signs	Urgent repair; consider derate
S5	Structural laminate exposed/delaminating or sharp edge loss	Stop and escalate

### A2. Measure and document

- Measure affected length along blade (cm) and maximum width from LE (cm).
- Capture photos: overview, medium, close-up with scale.
- Record side (pressure/suction) and approximate distance from root (m or % span).
- Note any water ingress, cracking, or tape/coating edge lift.

## **Procedure B - LE;ER: temporary protection (field mitigation)**

Use when erosion is moderate but a full composite repair is not possible in the current window.

### **B1. Surface preparation**

- Clean the area: remove dirt/insects/salts; dry fully.
- Feather sand loose coating edges; remove friable material.
- Wipe with approved solvent; do not leave residue.

### **B2. Apply protection**

- Apply protective tape or coating per product technical data sheet (TDS).
- Avoid wrinkles and trapped air; roll down edges firmly.
- Seal edges if required by the system.

### **B3. Quality check**

- No visible air pockets larger than a few mm.
- Edges fully bonded and sealed.
- Record batch/lot of material used and ambient temperature/humidity.

## **Procedure C - LE;ER: composite rebuild (scarf repair)**

Use when laminate is exposed or the LE profile is degraded.

- C1. Mark damage boundary; extend to sound material.
- C2. Grind a smooth taper (scarf) into the laminate; keep surface clean.
- C3. Lay up glass reinforcement plies to restore thickness; vacuum bag if required.
- C4. Cure per resin system; control temperature.
- C5. Rebuild aerodynamic profile using filler; sand to smooth contour.
- C6. Apply primer/topcoat or leading edge protection system.

Note: exact scarf ratios, ply schedules and cure cycles are OEM- and material-specific. Use engineering-approved work instructions whenever available.

## Procedure D - LE;CR: inspection and classification

Leading edge cracks may be superficial (paint/gelcoat) or structural (laminate/bondline). Always assume progression until proven otherwise.

### D1. Identify crack type

- Coating crack: thin, spider-like, often shallow; no movement when pressed.
- Laminate crack: sharper line, may open under load, may have raised edges.
- Bondline crack (near TE/LE joints): follows a seam; may indicate debond.

Severity	Observed cues (examples)	Action
S1	Hairline coating crack; no moisture ingress	Record + monitor
S2	Short crack, stable; no delam signal	Repair at next service window
S3	Crack length increasing or multiple parallel cracks	Plan repair soon; monitor weekly
S4	Crack with delam signs (tap test dull), moisture, or opening	Urgent repair; consider stop
S5	Rapid propagation, structural opening, or large delamination	Stop turbine and escalate

### D2. Basic NDT (optional but helpful)

- Tap test: compare sound vs dull response around the crack.
- Visual: look for paint lifting, moisture trails, or fiber exposure.
- If available: ultrasound/thermography per site capability.

## Procedure E - LE;CR: repair (generic)

- E1. Stop/run decision per severity and site rules.
- E2. Open the defect to sound material; create a controlled scarf.
- E3. Dry the structure if moisture is present.
- E4. Lay up reinforcement plies with approved resin; consolidate (vacuum optional).
- E5. Cure and post-cure as required.
- E6. Restore profile with filler; sand smooth.
- E7. Recoat and seal; verify adhesion.

## Post-repair QA and close-out

- Visual: smooth contour, no pinholes or exposed fibers.
- Adhesion: no edge lift after cure.
- Documentation: before/after photos, materials used, ambient conditions.
- If required: return-to-service check and follow-up inspection date.