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Affected Propellers

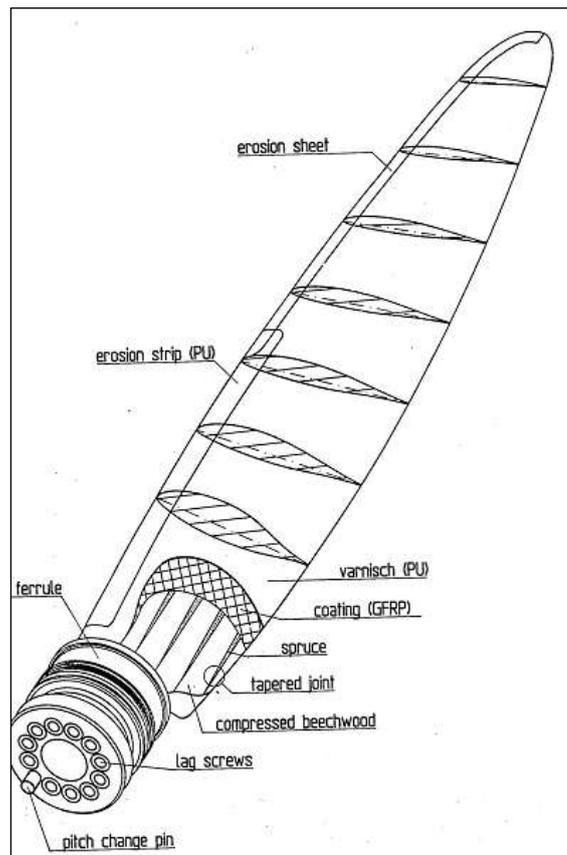
All MT-; MTE- and MTV- Propellers with Natural Composite Blades!

1. Background:

During the operation time between overhaul periods it is sometimes necessary to perform minor field repairs of the natural composite MT-Propeller blades. This Service Letter defines limitations of maximum dimensions of damage which are repairable in field and serves as a guideline how to perform such repairs.

Basically, it must be noted that the load carrying structure of natural MT-Propeller blades is the blade body and the composite shell serves as a surface protection which must be kept intact to maintain protection of the load carrying blade structure.

Principle Design of MT-Propeller Natural Composite Blades



<p>Edition</p> <p>Christian Reinisch Date: May 17th, 2019</p>	<p>Page 1 of 28</p>	<p>Checked / Approved</p>  <p>Martin Albrecht Date: May 17th, 2019</p>
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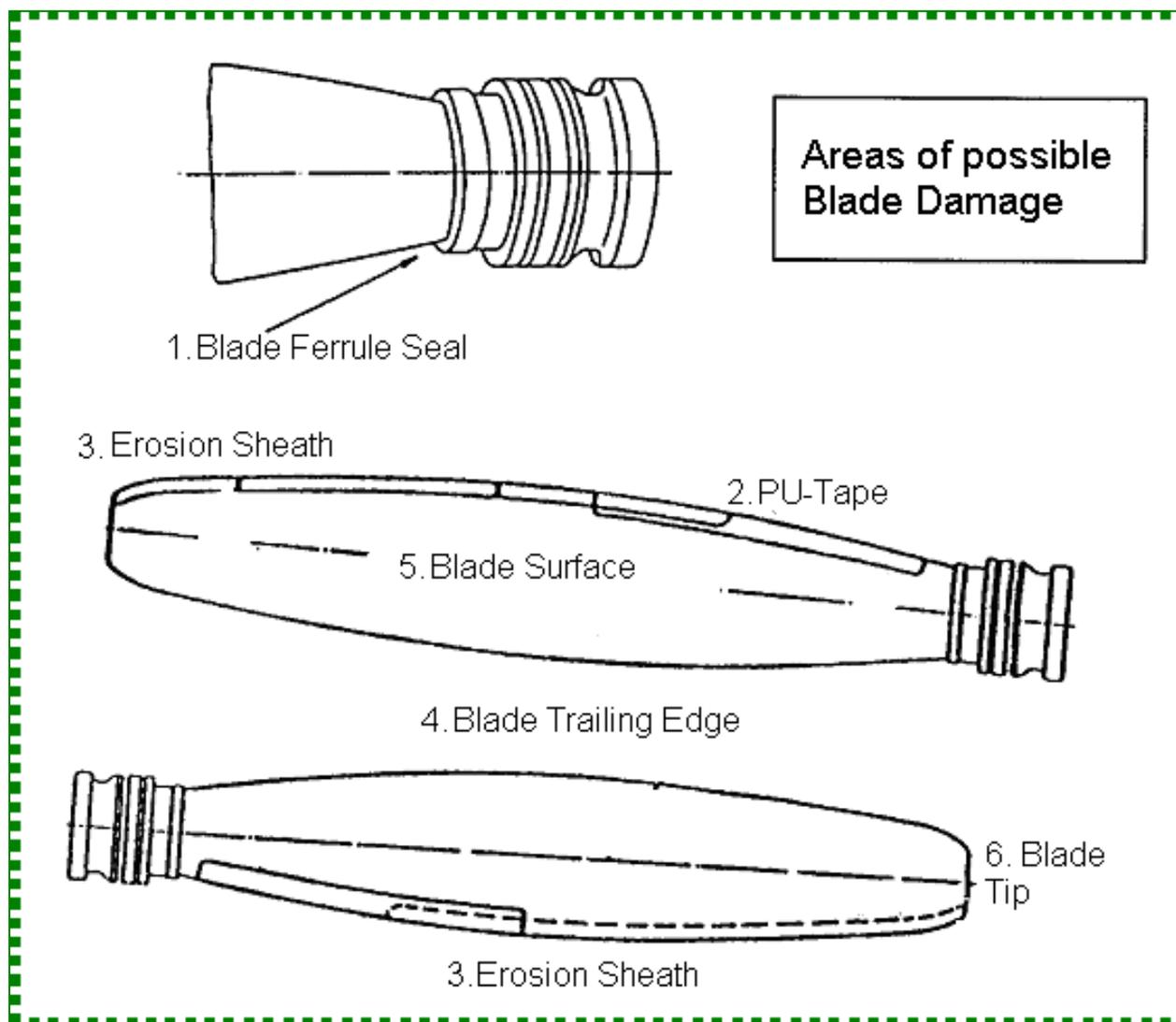


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2. Work Procedure:

Classification of possible damage:

Propeller blade surface damage occurs in the following blade areas.



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The blade ferrule seal serves as a moisture protection of the natural composite blade root in the aluminum blade ferrule.

It consists of grey RTV Silicone and covers the gap between the blade ferrule and the blade root.



Possible Damage: Cuts due to incorrect spinner installation.

Repair: Clean the affected area and fill up the affected area with Silicone.
(Refer to List of Materials)

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2.2. PU Erosion Strip



The PU-Erosion Protection strip serves as erosion protection in the blade area which is not covered by the metal erosion protection leading edge.

Possible Damage: Punched through or missing.

Repair: Completely replace erosion strip according to SI.37 ()

Material:

PU-strip type 3M-Scotch 8562 (transparent) 50 mm (2.0 in) wide or
PU-strip type 3M-Scotch 8663 (black) 50 mm (2.0 in) wide.

The PU-strip must be installed at the leading edge of the propeller starting from the silicone on the blade ferrule, ending 50 mm (2.0 in) beyond the metal leading edge.

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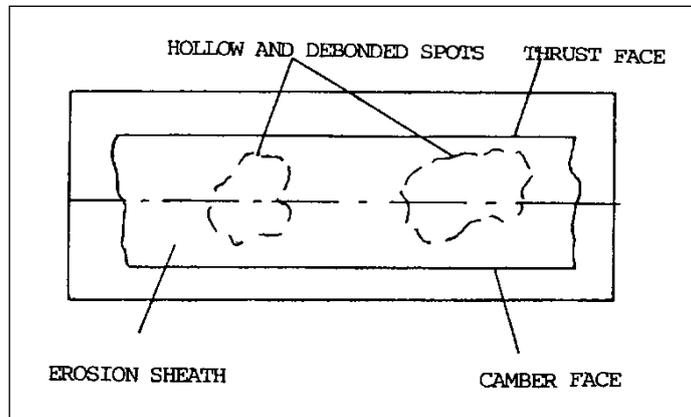
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2.3. Erosion Sheath

The metal erosion sheath is bonded onto the composite structure using a special Hysol Epoxy Bonding System (Refer to the "List of Materials").

Possible Damage:

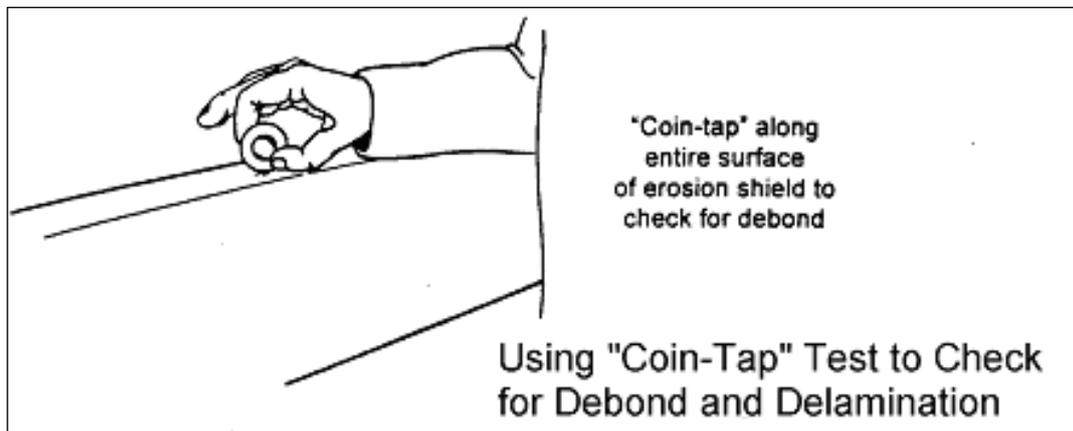
2.3.1. Debonding and Delamination on Stainless Steel Edge:



In case of debonding only very limited repair is possible. However, the extent of debonding where repair is required is defined and not every debonding requires repair.

Required Activities:

- If any hollow and debonded spots exist, mark them.
- Whenever performing pre-flight inspection, monitor whether there are further delamination and/or whether the already existing delamination has become worse.
- The inspection can be executed by using an appropriate coin (Tab-Test).



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**Service Letter
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- ✓ The hollow and debonded spots must not exceed 30% of the surface of the erosion sheath at all (lengthwise only 25 mm (1.0 in) are allowed).
- ✓ Hollow and debonded spots (max. 0.39 square in* / 2.5cm²), no two spots may occur within 130 mm (5.0 in) of each other.
- ✓ Debonded areas which result in an open bonding crack must be sealed in order to prevent water from penetrating.
- ✓ The length of open bonding cracks must not exceed 25 mm (1.0 in)!



- ✓ Bonding cracks which are not open to the blade tip may be resealed by using 5-Minute Epoxy.

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- ✓ Bonding cracks which are open to the blade tip must be sealed using the original erosion sheath bonding epoxy. Refer to Table 1.
- ✓ Whenever performing pre-flight inspection, monitor whether there are further delamination and/or whether the already existing delamination becomes worse.
Check secure fixing of the erosion sheath in any case every time before flight.
- ✓ If any of the above listed limits is exceeded the blade is to be sent to the manufacturer or to an authorized Service Station for repair as soon as possible.

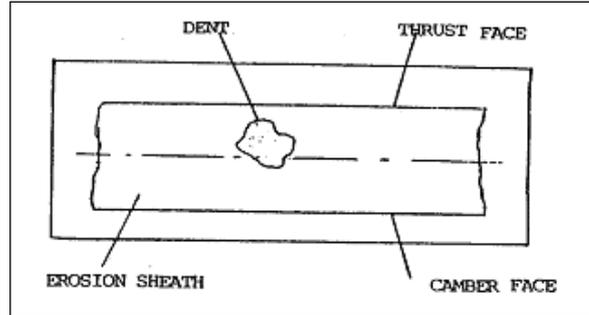
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2.3.2. Erosion Sheath Dents due to FOD on stainless steel edge



Damage Limits on Stainless Steel Erosion Sheaths and Possible Repairs:

- ✓ Circular dents not more than 0.24 in x 0.24 in (6 mm x 6 mm)
- ✓ Pointed dents not more than 0.24 in x 0.24 in (6 mm x 6 mm)
- ✓ If within 51 mm (2.0 in) no other dents of that size are visible, the dent size may exceed the original maximum size by 3 mm (0.12 in) to a maximum of 9 mm x 9 mm (0.36 in x 0.36 in).
- ✓ If within 76 mm (3.0 in) no other dents of that size are visible, the dent size may exceed the original maximum size by 5 mm (0.2 in) to a maximum of 11 mm x 11 mm (0.43 in x 0.43 in).



FOD below 6 mm x 6 mm (0.24 in x 0.24 in):

If within 51 mm (2 in) no other dents of that size are visible, the dent size may exceed the original maximum size by 3 mm (0.12 in) to a maximum of 9 mm x 9 mm (0.36 in x 0.36 in).

If within 76 mm (3.0 in) no other dents of that size are visible, the dent size may exceed original maximum size by 5 mm (0.197 in) to a maximum of 11 mm x 11 mm (0.43 in x 0.43 in)

No action necessary if not delaminated.



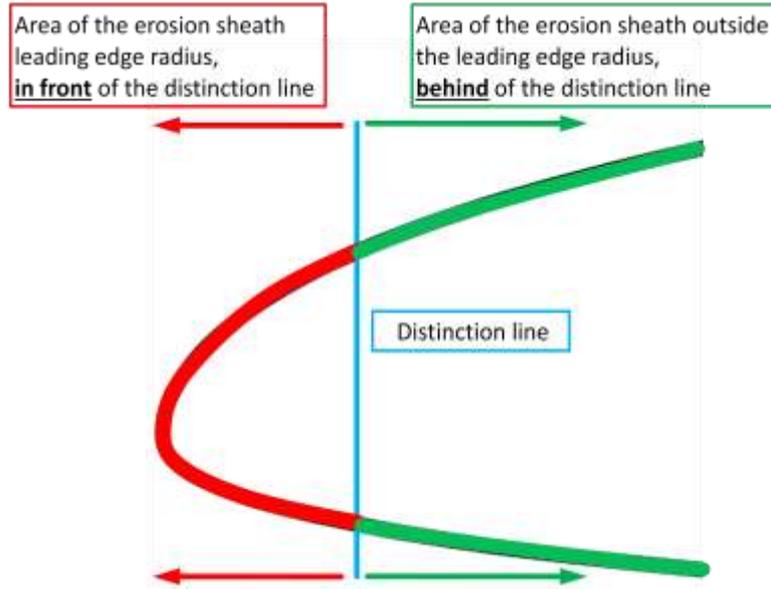
FOD exceeding limits.

Limits are determined on the left side.

Replace Erosion Sheath as soon as possible!

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2.3.3. Punctured stainless steel erosion sheath due to FOD



The leading edge radius is most prone to moisture in operation; therefore it needs to be ensured that the natural composite core of the blade is protected against water intrusion. The distinction line is located behind the leading edge radius and determines how to handle a punctured erosion sheath.

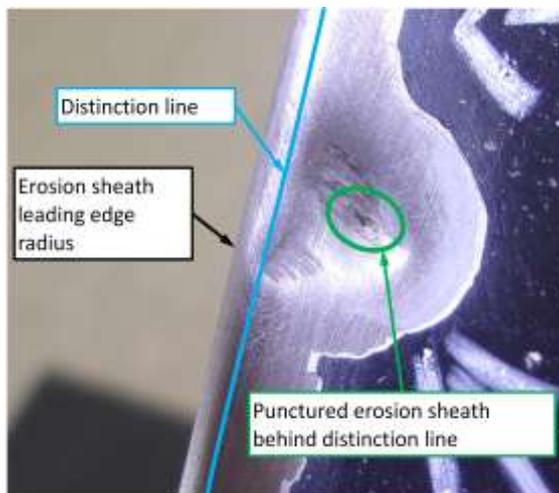
Area where the erosion sheath has been punctured **in front of the distinction line**:

- Fill with epoxy to prevent moisture intrusion
- Monitor the area at pre-flight inspection
- Replace the erosion sheath as soon as possible

Area where the erosion sheath has been punctured **behind the distinction line**:

- Fill with epoxy to prevent moisture intrusion
- Erosion sheath is replaced at next overhaul
- Monitor the area at pre-flight inspection

Example:



Damaged area can be filled with epoxy; erosion sheath will be replaced at next overhaul

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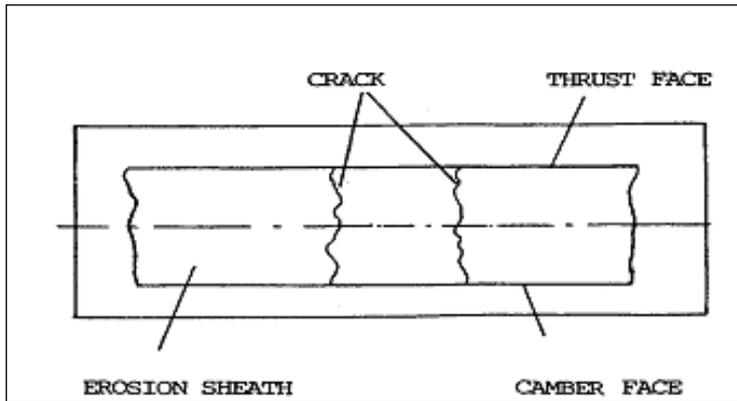
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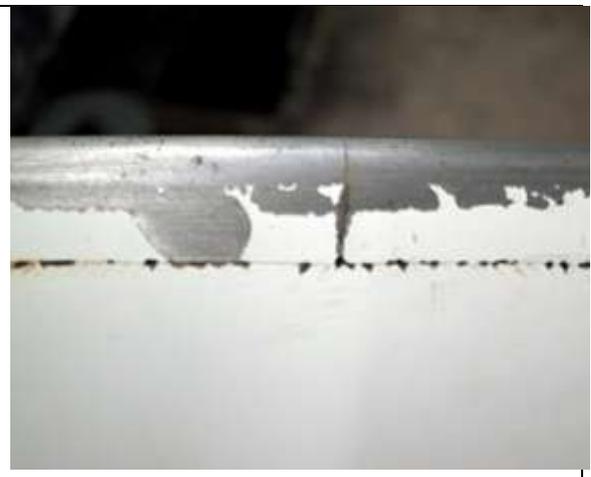
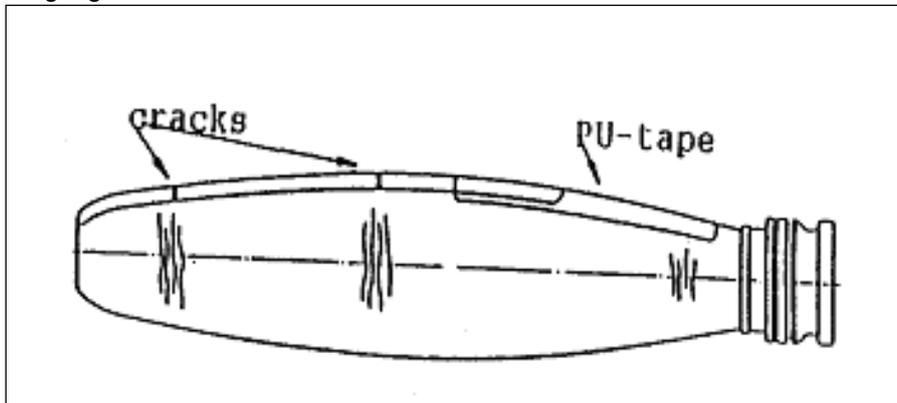
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2.3.4. Cracked Erosion Sheath on stainless steel edge

Cracked erosion sheaths require immediate repair. If chord wise cracks appear, return the propeller to the manufacturer or any authorized Service station.



Chord wise cracks in the erosion sheath may also occur together with fine surface cracks indicating high vibration loads on the blade.



When Erosion Sheath is cracked chord wise no field repair is possible

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2.4. Inspection Criteria Nickel Erosion Shield

2.4.1. Nickel Erosion Shield - Minor Deformation - Entire Erosion Shield

Airworthy damage limits: Deformed material not associated with a crack or missing materials 10 percent or less of the leading edge or no more than 6.35 mm (0.25 in) deep because of impact damage or erosion.

Minor repair limits: Minor repairs are not allowed!
If the deformation is greater than the airworthy damage limits allow, an overhaul is required including the replacement of the leading edge.

Major repair limits: Major repair is not allowed!
If the deformation is greater than the airworthy damage limits allow, an overhaul is required including the replacement of the leading edge.

2.4.2. Nickel Erosion Shield - Gouge – Entire Erosion Shield

Airworthy Damage Limits: Exposed wood must be sealed at all times with Hysol 9359 Part A + B or 5 Minute Epoxy to keep the moisture out (Exposed wood is not permitted)!
Gouges through the Nickel Erosion Shield is permitted with a total accumulated area of 161.2 sq.mm (0.25 sq.in).
The maximum permitted depth of damage to the blade surface below the erosion shield is 0,635 mm (0,025 in).

Note:

This is four layers of composite material. Damage cannot be permanently repaired without replacement of the erosion shield, but within these limits, does not make the blade unairworthy.

Minor Repair Limits: The maximum permitted total accumulated area of gouge through the erosion shield is 161,2sq.mm (0.25 sq.in).
The maximum permitted depth of damage to the blade surface below the erosion shield is 0.635 mm (0.025 in).
Repair in accordance with Service Letter 32 () latest revision.
An erosion shield repaired within this limit must be replaced at overhaul.

Major Repair Limits: Major repair is not allowed!
If the deformation is greater than the Minor repair limits allow, an overhaul is required including leading edge replacement.



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2.4.3. Nickel Erosion Shield – Debond – Entire Erosion Shield

Airworthy damage limits: A maximum of 20 % of the erosion shield may be debonded in any 152 mm (6.0 in) length of the erosion shield
Refer to Figure 1, 3

Minor repair limits: A debond that is within the airworthy damage limits may be repaired in accordance with Service Letter 32 latest revision.

Major repair limits: Major repair is not allowed. If the debond is greater than the airworthy damage limits and cannot be repaired under Minor Repair, an overhaul is required including leading edge replacement.

2.4.4. Nickel Erosion Shield - Chordwise crack – Entire Erosion Shield

Airworthy damage limits: Two chordwise cracks are only allowed if they are not starting from the camber side to the thrust side and may not be within 152.5mm (6 in) of each other. A chordwise crack over 25 mm (1.0 in) may not be within 152 mm (6.0 in) of the blade tip. A chordwise crack over 25 mm (1.0 in) may not be within 152 mm (6.0 in) of the outboard end of the anti-icing boot. A chordwise crack over 25.5 mm (6 in) may not be within 152 mm (6.0 in) of the inboard end of the erosion shield (when not covered by anti-icing boot). Refer to Fig.1, 2

Minor repair limits: Minor repair is not authorized. If the crack is greater than the airworthy damage limits, an overhaul is required inclusive a leading edge replacement.

Note:

In any case, seal the crack with any 5 minute metal epoxy or similar to avoid moisture entering below the leading edge

Major repair limits: Major repair is not authorized. If the crack is greater than the airworthy damage limits, an overhaul is required including leading edge replacement.

2.4.5. Nickel Erosion Shield - Lenghtwise crack – Entire Erosion Shield

Airworthy damage limits: The maximum permitted length of a crack is 50 mm (2.0 in). Two lengthwise cracks may not be within the same linear length on the erosion shield. This includes cracks on opposite sides of the blade. Refer to figure 1, 2, 4, 5.

Minor repair limits: Minor repair is not authorized. If the crack is greater than the airworthy damage limits, an overhaul is required inclusive a leading edge replacement.

Major repair limits: Major repair is not authorized. If the crack is greater than the airworthy damage limits, an overhaul is required including leading edge replacement.

Note:

In any case, seal the crack with any 5-Minute Metal Epoxy or similar to avoid moisture entering below the leading edge.

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NICKEL EROSION SHIELD

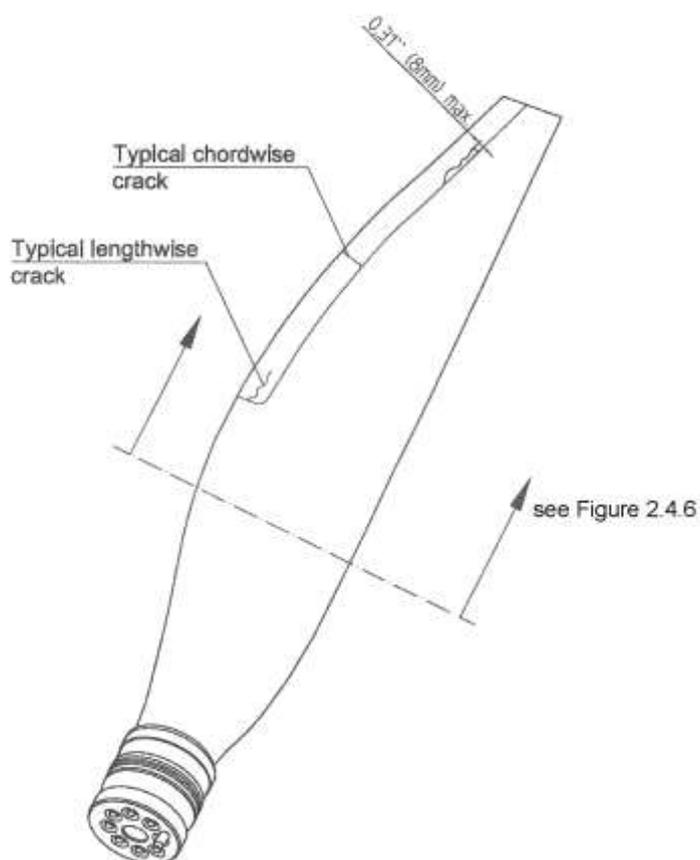


Figure 1: Missing portions of Nickel erosion shield (Trail side) and typical cracks

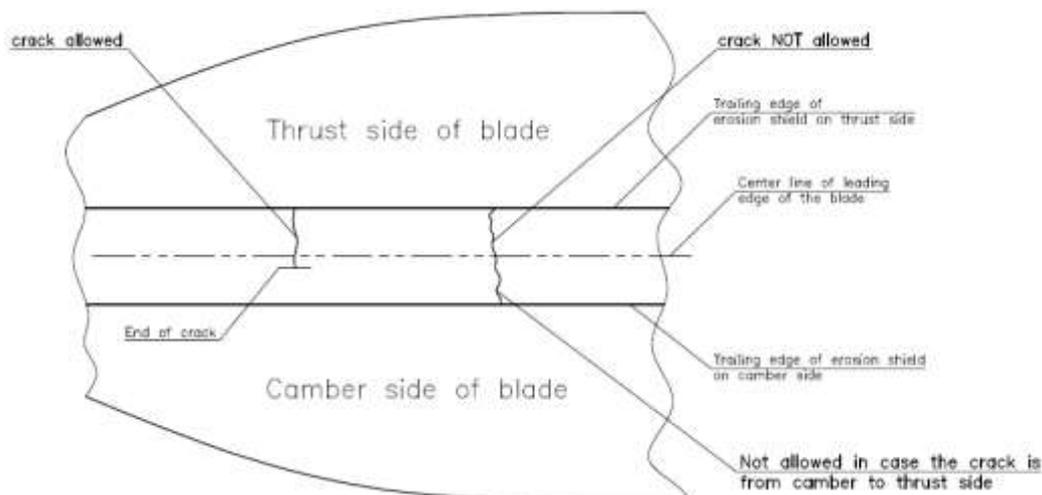


Figure 2: Interpretation of Erosion Shield Damage

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NICKEL EROSION SHIELD

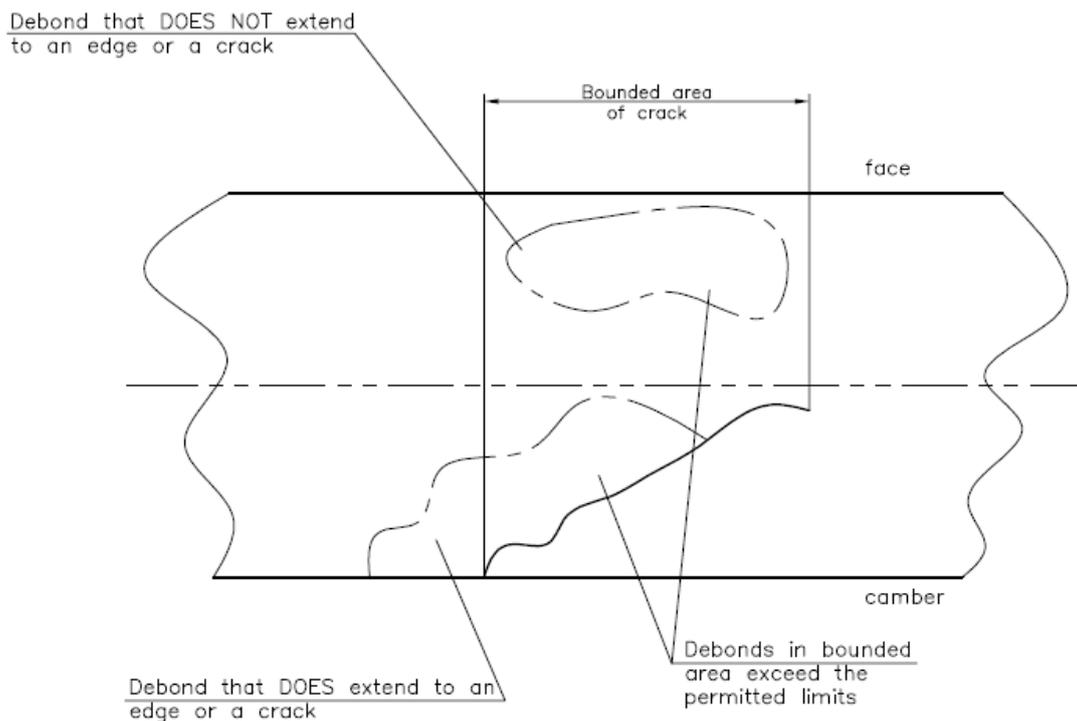


Fig.3 Debonds in excess of allowable limits

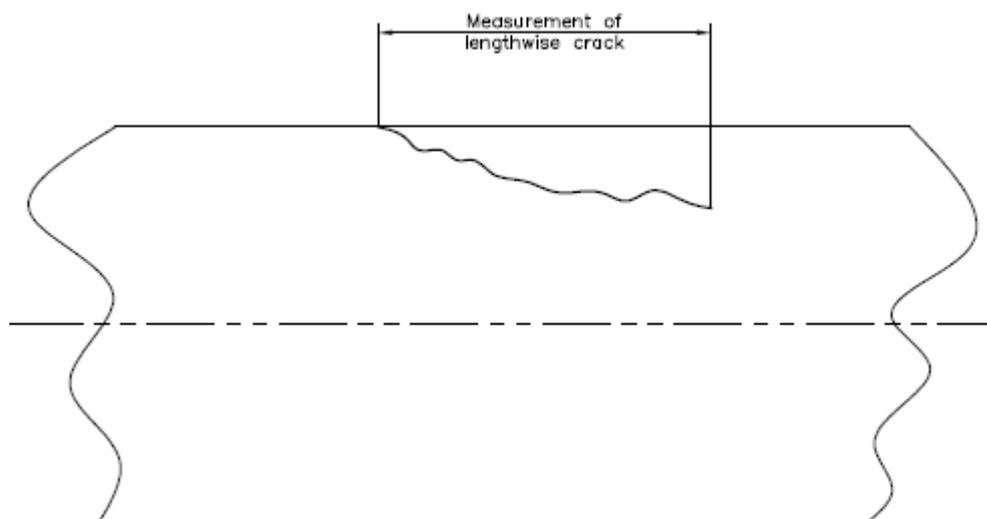


Figure 4: Measuring lengthwise crack

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NICKEL EROSION SHIELD

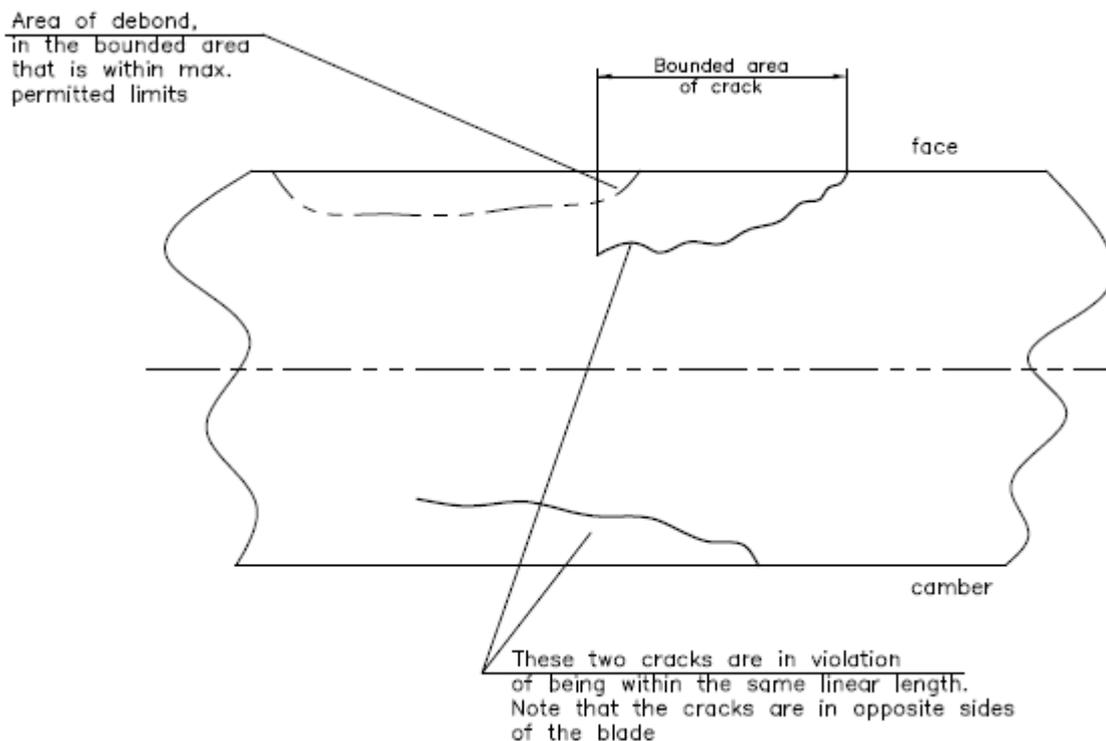


Figure 5: Acceptable Erosion Shield Debond, non acceptable crack location



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2.5. Damaged Trailing Edges

Typical Trailing Edge Damage:

- Hangar Damage
- Tow Bar Damage
- Cowling Damage



Tow bar damage, seal with Epoxy or repair permanently with fiber glass



Delaminated composite shell on the trailing edge



Damage caused by Cowling, seal and fill up with Epoxy

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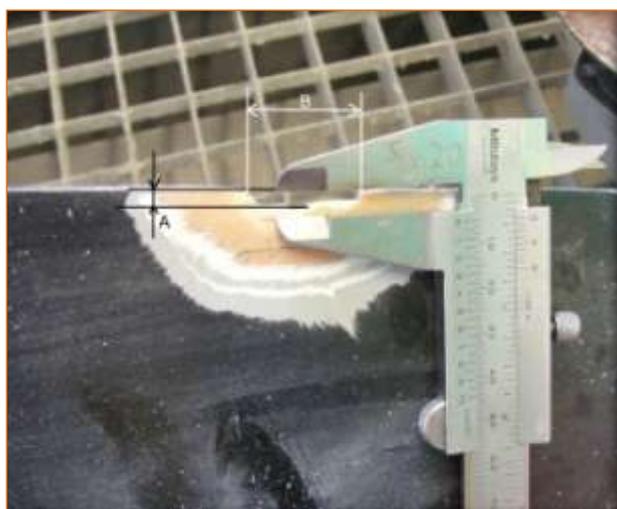


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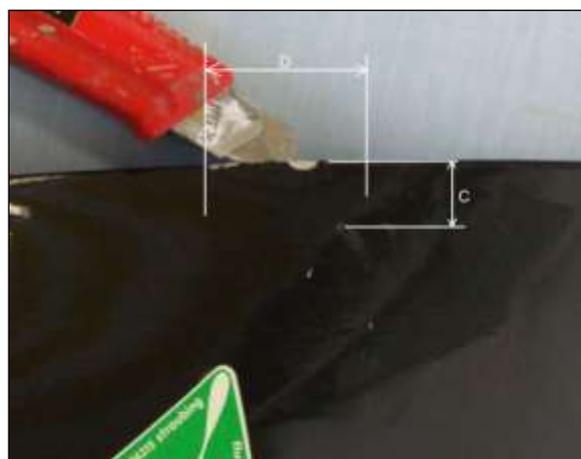
Damage Limits

Crunched trailing edges can be sealed by using 5 minute Epoxy if the damage is not deeper (Dimension A) than 5 mm (0.20 in) and not wider (Dimension B) than 15 mm (0.60 in).

Crunched trailing edges can be repaired by replacing the fiber glass cover if the damage is not deeper (Dimension A) than 7.5 mm (0.30 in) and not wider (Dimension B) than 25 mm (1.0 in).



Delaminated fiber glass shell on the trailing edge may be rebonded if the debonding is not deeper (Dimension C) than 12.5 mm (0,5 in) measured from the trailing edge and not wider (Dimension D) than 25 mm (1 in).



Caution: **Assure that any moisture cannot enter the load carrying blade body.**

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2.5. Damaged Trailing Edges (continued)

Field Repairs

Sealing of damage with 5 Minute Epoxy (e.g. Devcon TM or equivalent)

(Damage not deeper than 5 mm (0.20 in) and not wider than 15 mm (0.60 in).

Minor damages on the trailing edge may be sealed with 5 minute epoxy.

If the fiber glass shell is locally delaminated place trailing edge vertical and let epoxy pour into the crack. Then clamp the loose shell using C-clamps or similar.



Minor damage on the trailing edges may be sealed with 5-Minute Epoxy



Longitudinal cracks may be sealed with 5-Minute Epoxy



If the fiberglass shell on the trailing edge is delaminated the shell may be rebonded.
Let pour 5 minute Epoxy into the trailing edge crack.



Then clamp the trailing edge with C-clamps and let the epoxy cure.
Then clean the trailing edge and repaint the repaired area.

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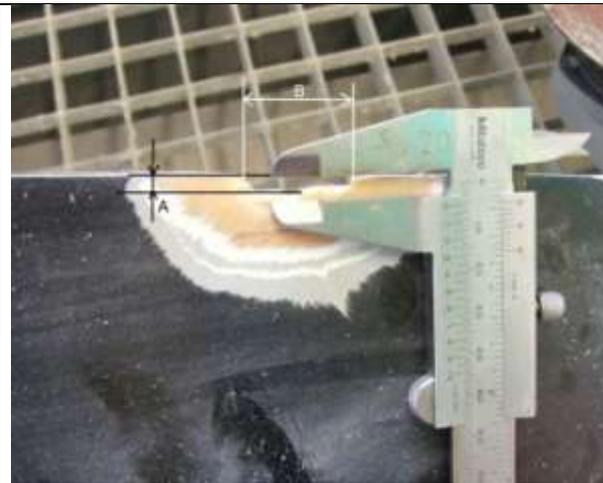
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2.5. Damaged Trailing Edges (continued)

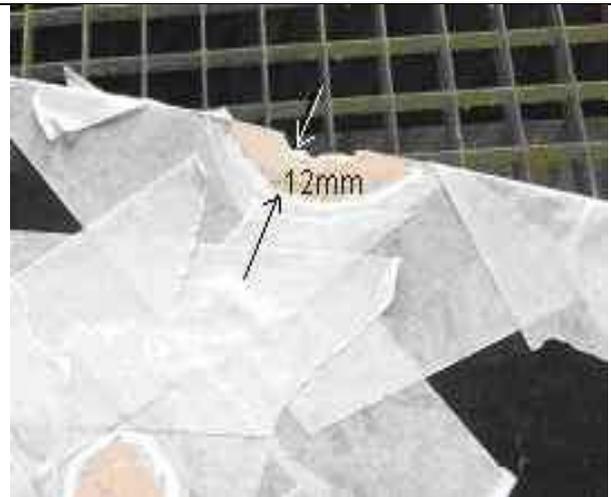
Field Repairs continued

Repair of the Fiber Glass Shell

(Damage not deeper than 7.5 mm (0.3 in) and not wider than 25 mm (1.0 in).)



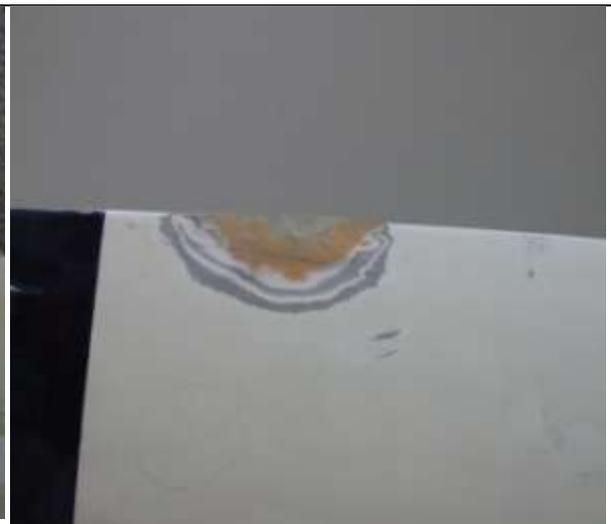
Measure the extent of damage
Max. 7,5 mm (0.3 in) from Trailing Edge and 25 mm (1.0 in) wide allowed for Field Repair.



Scarf-grind area 12,5 mm (0.5 in) wide after removal of paint and filler
Before putting Epoxy on the surfaces carefully degrease the surface using MEK or Acetone.



Apply 3 layers of fiber glass Interglas 92110 or similar on both sides using 5-Minute Epoxy or Epoxy according to list of recommended material.



Grind the fiberglass to smooth surface then add filler and appropriate paint.

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2.6. Blade Surface Damage

Blade Surface damage can occur with the following appearance

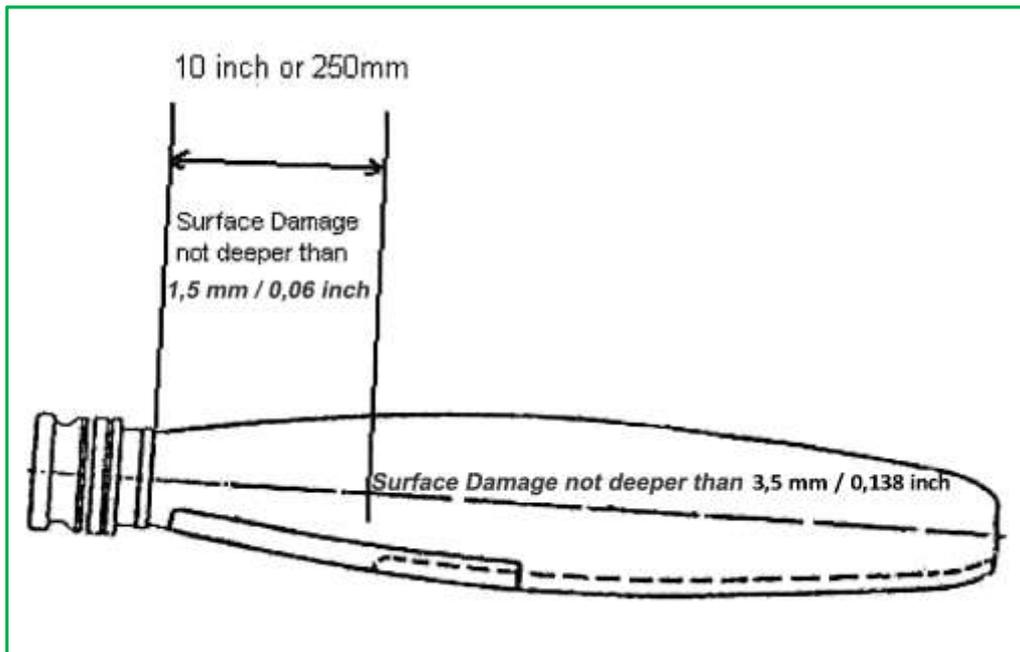
- Stone impacts FOD
- Blisters and Delaminations
- De-Ice Boot Damage causing Blade Damage

All surface damage shall be repaired in order to protect the load carrying blade structure against moisture and erosion.

Damage Limits

Blade surface damage can be field repaired under the following conditions:

- ✓ There may be no crack in the load carrying natural composite structure beyond the following repair limits.
- ✓ All dimensions are measured after local removal of paint and filler.
- ✓ Blade Root: inside 250 mm (10.0 in) from Blade Ferrule: Damage may not be deeper than 1.5 mm (0.06 in.)
- ✓ Blade outside Blade Root: Damage may not be deeper than 3.5 mm (0.14 in).



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Surface damage whose size (E X E) is below 6 mm x 6 mm (0.2 in x 0.2 in) may be sealed by filling the dent with 5 minute Epoxy.

Failed de-ice boots may cause damage to the blade surface structure behind the boot failure. Such damage may be repaired with 5 Minute Epoxy also.

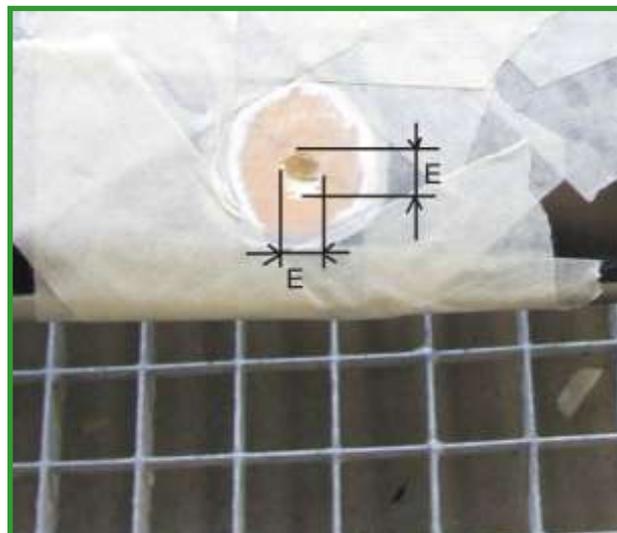
Maximum damage in the De-Ice Boot area:

14 mm x 8 mm x 1, 5 mm (0.55 in x 0.31 in x 0.06 in)



Surface damage whose size (E X E) is above 6mm x 6mm (0.2 in x 0.2 in) but below 12mm x 12mm (0.5 in x 0.5 in) must be field repaired by locally replacing the fiber glass shell.

Blades with surface damage above 12 mm x 12 mm (0.5 in x 0.5 in) must be sent to the manufacturer or to an authorized service station for repair as soon as possible.



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2.6. Blade Surface Damage (continued)



Field Repair Limits:
Blade Root: inside 250 mm (10.0 in) from Blade Ferrule:
Damage may not be deeper than 1.5 mm (0.06 in).
Blade outside Blade Root:
Damage may not be deeper than 3.5 mm (0.14 in)

Blade surface damage obviously exceeding the field repair limits

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2.6. Blade Surface Damage (continued)

Field Repair:



If the damage size allows to just filling up the dent with 5Minute Epoxy only local removal of the paint and filler is required.



If the damage size requires repair of the fiber glass shell completely remove paint and filler approximately 12 mm (0.5 in) around the hole and scarf the composite layer towards the hole.

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Scarf the affected area approximately 12 mm (0.5 in) wide.
Before putting epoxy on the surfaces carefully degrease the surface using MEK or Acetone.
Fill the hole with epoxy and cotton flox or any thick epoxy resin.
Then apply 3 layers of fiber glass onto the area.
The fiber orientation shall be $\pm 45^\circ$ to the blade axis.



Finally grind and locally repaint the repair location

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2.6.1. Gouge in Blade Surface

Airworthy Damage Limits: The maximum permitted diameter or equivalent area **323** sq.mm (0.5 sq.in) of a gouge or loss of material is 25 mm (1 in).
The maximum permitted length of a gouge or loss of material in the blade surface is 63 mm (2.5 in).
The maximum permitted depth of a gouge or loss material is 3,5 mm (0.14 in). See Figure 1.

Minor Repair Limits: Minor repair is not allowed!
If the gouge is greater than the airworthy-damage limits, an overhaul is required inclusive a leading edge replacement.

Major Repair Limits: Major repair is not allowed!
If the gouge is greater than the airworthy damage limits, an overhaul is required including leading edge replacement.

Note:
Exposed wood must be sealed at all times with Hysol 9359 Part A + B or any 5-Minute Metal Epoxy to keep the moisture out.
(Exposed wood is not permitted!)

2.6.2. Delamination of blade surface

Airworthy Damage Limits: The maximum permitted area of delamination is 2580 sq.mm (**4** sq.in)

Minor Repair Limits: Minor repair is not allowed!
If the delamination is greater than the airworthy damage limits, a overhaul is required inclusive a leading edge replacement.

Major Repair Limits: Major repair is not authorized!
If the delamination is greater than the airworthy damage limits, a overhaul is required including leading edge replacement.

Note:
Blade must be replaced if beyond the airworthy limits and shipped to an authorized MT Propeller Service Center.



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2.7. Blade Tip Damage

Minor tip damage caused by airplane handling may be field repaired

Typical minor damages:

 <p>Hangar Damage: Broken Tip Trailing Edge Seal with 5 Minute Epoxy or permanent repair with Fiber Glass.</p>	 <p>Split Blade tip. Repair with fiber glass</p>
 <p>Paint and Filler Material scratched off from Blade Tip. Seal with 5-Minute Epoxy</p>	 <p>Split Blade Tip and delaminated trailing Edge. Rebond Trailing Edge with 5 Minute Epoxy. Repair split Tip with Fiber Glass</p>

This Service Letter replaces SL32 R4

The technical information contained in this document has been approved under the authority of EASA DOA N° EASA.21J.020.



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2.7. Blade Tip Damage (continued)

Damage Limits

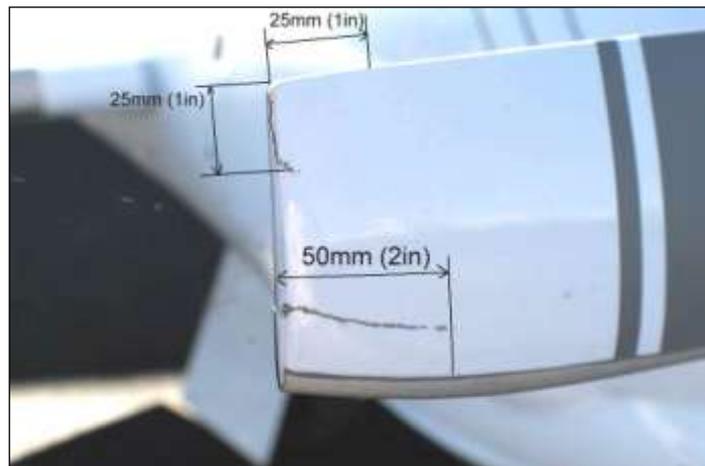
Broken blade tip Trailing edges

Maximum damage size measured from the blade tip trailing edge



Dimension "D" below 12 mm (0.5 in) : Only sealing with 5-Minute Epoxy required.
Dimension "D" above 12 mm (0.5 in) and below 25 mm (1.0 in) local repair with fiber glass required

Split Blade tips and delaminated Blade tip Trailing edges



Split trailing edges may be field repaired if the crack length is below 50 mm (2.0 in).
The fiber glass shell must be scarf repaired from both sides.
Delaminated blade tip trailing edges can be field repaired if the length of delamination is less than 25 mm (1.0 in).

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2.7. Blade Tip Damage (continued)

Field Repair

Fiber glass Repairs

If repairs are carried out on the composite shell the following work sequence is applicable

<p style="text-align: center;">Crunched Blade Trailing Edge Repair (Cross Section View)</p>	<p>Completely remove paint and filler</p> <p>12mm</p> <p>from both sides and scarf both sides 12 mm (0.5 in)</p> <p>Before putting epoxy on the surfaces carefully degrease the surface using MEK or Acetone.</p>
<p>Apply 3 layers of fiber glass (Interglas 92110 or similar) with Epoxy from both sides and support layers with some stiff flat piece of plywood or cardboard.</p>	<p>After the epoxy is cured sand blade tip to original shape. Apply some filler and locally repaint the area.</p>

This Service Letter replaces SL32 R4

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**Service Letter
SL 32 R5**DOA - No.
EASA.21J.020**3. List of Recommended Materials:****Blade Root-Ferrule Seal**

Silicone Sealant RTV 109 General Electric or similar

Epoxy Resin Materials:

Quick Epoxy: Devcon 14210 (5 Minute Epoxy) or similar

Loctite 0151 Epoxy Patch or similar

Scheufler: Resin 285 Hardener 500 or similar

Fuller: Resin A20 Hardener B20 (original MT-System)

Erosion Sheath (V2A and Nickel) Bonding Epoxy:

EA-9309NA QT System Part A: Epoxy Adhesive; Hysol / Henkel

EA-9309NA QT System Part B: Epoxy Adhesive Hysol / Henkel

EA 9359.3 QT System Part A: Epoxy Adhesive; Hysol / Henkel

EA 9359.3 QT System Part B: Epoxy Adhesive Hysol / Henkel

Fiber Glass MaterialFiber Glass Cloth: Interglas Type 92110 Fiber Glass
(twill 2/2 163g/m²) or similar**Paint Process of Sherwin Williams Products****“New Paint System for Composite Blades”****see****MT - Service Instruction No. 68 (latest issue)!**