OPERATION AND MAINTENANCE MANUAL

No. E 228

GROUND ADJUSTABLE PITCH PROPELLER

HO-E 214 ()

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# Record of Revisions to this Manual

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1 General

Propeller HO-E 214 is a 4-bladed ground adjustable propeller with wooden Hoffmann composite blades. The hub consists of two halves which are bolted together. The hub material is aluminium alloy. The propeller HO-E 214 P has two flanges with the same dimensions, one on the front side and one on the rear side of the hub. Either flange can be used to connect the drive- or stub shaft.

The propeller HO-E 214 U has a larger flange for the drive shaft on one side and a smaller flange for the stub shaft on the other side of the hub.
2  **Designation**

2.1  **Designation of the hub**

\[
\text{HO-E 21 4 ( ) ( ) - ( )}
\]

1  Hoffmann GmbH & Co. KG
2  Ground Adjustable pitch propeller
3  Number of basic construction
4  Number of blades
5  P:  HO drawing PA-37 flange, both sides of hub
     U:  flange one side of hub, PA-37 flange on other side
6  Project related designation
7  Minor changes, not affecting interchangeability

This model designation and the serial number are stamped into the hub.

Additional model information:
Application to a specific vessel can be marked on the blade decals. This number, beginning with EP20-, defines all information on material, adjustment, detaching parts and so on, for the specific application.
2.2 **Designation of the blades**

\[ \text{LD 275 BS - IA } \pm (\_ ) \]

8 Sense of rotation:
   blank: right-hand, tractor
   D: right-hand, pusher
   L: left-hand, tractor
   LD: left-hand, pusher

9 Basic diameter in cm

10 Key letters for blade design

11 Material of blade:
   blank: compreg / spruce, PUR-coating steel sheeting
   P: compreg, PUR-coating, steel sheeting
   I: additional Irathane coating
   IA: Irathane + erosion protection

12 Decrease (-) or increase (+) of the basic diameter in cm

On a decal on each blade the designation of the hub assembly and serial number, as well as the designation of the blade and serial number are printed. The serial number of the blade additionally is stamped into the blade ferrule (not visible from outside).

The complete designation of a ground adjustable pitch propeller is a combination of the designation of hub assembly and blade assembly. Both designations are separated by a slash mark.

**Example:** HO-E 214 U / D 275BS-IA

The serial number of the hub is considered to be the serial number of the complete propeller assembly.

![Decal](image-url)
### 3 Design Data

<table>
<thead>
<tr>
<th></th>
<th>HO-E214 P</th>
<th>HO-E214 U</th>
</tr>
</thead>
<tbody>
<tr>
<td>kW max. (HP)</td>
<td>400 (540) (depend on blade model)</td>
<td>613 (820) (depend on blade model)</td>
</tr>
<tr>
<td>RPM max.</td>
<td>1550 (depend on diameter)</td>
<td>1550 (depend on diameter)</td>
</tr>
<tr>
<td>Number of blades</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Diameter</td>
<td>2.75 m (example)</td>
<td>2.75 m (example)</td>
</tr>
<tr>
<td>Pitch change range</td>
<td>No limit ground adjustable</td>
<td>No limit ground adjustable</td>
</tr>
<tr>
<td>Propeller weight, approx.</td>
<td>108 kg (depend on blade model)</td>
<td>108 kg (depend on blade model)</td>
</tr>
<tr>
<td>Polar moment of inertia,</td>
<td>20 kgm² (depend on blade model)</td>
<td>20 kgm² (depend on blade model)</td>
</tr>
<tr>
<td>approx.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance flange face to</td>
<td>130 mm</td>
<td>130 mm</td>
</tr>
<tr>
<td>C/L blade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting flange</td>
<td>P and P</td>
<td>U and P</td>
</tr>
</tbody>
</table>
4 Construction

The HOFFMANN ground adjustable pitch propeller consists of two sub assemblies:

- Hub assembly
- Blade assembly

The pitch of the HO-E 214 () can be adjusted on the ground when the propeller is not running.

4.1 Hub assembly

The material of the hub is forged aluminium alloy. The hub is divided into two parts in order to install the propeller blades. The halves are screwed together. A sealant is applied into the groove in the middle of the hub and around the blade ferrules to keep the moisture out. The propeller blades are held in position only by squeezing the hub halves together. Each hub half of the propeller HO-E214 P has a flange which fits to the engine drive flange. One hub half of the propeller HO-E 214 U has a flange which fits to the engine drive shaft flange the flange of the other hub half fits to the flange of the stub shaft. Bolts and self-locking nuts (HO-E214U uses on the drive shaft hexagon head bolts which are secured by self locking inserts) secure the hub to the flanges of the shafts. These connecting parts are also sealed. To make it more easy to separate the hub halves for disassembling or to readjust the pitch of the blades one hub half is equipped with 4 each withdrawal screws. They are located in the middle of each blade cut out.
4.2 Blade Assembly

The Hoffmann composite blade is a joint construction. The blade root is made of highly compressed hardwood (compreg) and the blade part is made of light wood (spruce). Blades can also be manufactured of compressed wood only. Special lag screws connect the blade root of the blade to a metal ferrule made from stainless steel or aluminium.

For erosion protection of the blade leading edge a stainless steel strip is glued to the fibre cover of the blade. To increase stiffness the blade is covered with fibre reinforced epoxy. Fatigue failures due to vibration are unlikely with such blades because the internal damping of that material is very high.

Two types of painting for this blade type are common:
Version A: Several layers of special polyurethane paint are sprayed onto the fibre reinforced epoxy covering, this assures a high resistance to atmospheric conditions. This polyurethane paint shows also high resistance against erosion and mechanical damage. The blade shaft is sealed against the metal ferrule to prevent moisture penetration into the metal ferrule.

Version B: For improved erosion protection the entire blade can be coated with Irathane paint about 1.2 mm thick. An additional leading edge protection is performed by gluing special rubber and metal strips to the Irathane coating. The Irathane is painted also over the blade shaft / ferrule transition to prevent moisture penetration into the metal ferrule.

Fig. 4-1 Leading edge erosion protection
5 Reassembling the propeller

All operations in this chapter must only be conducted by a competent person as described in chapter 13.
Before reassembling the propeller visually inspect all propeller parts for transport damage.

CAUTION
A propeller shipped with blades removed must be reassembled by competent persons as certified by HOFFMANN Propeller in accordance with chapter 13

NOTE
Propeller hub halves are anodized but could be additional sprayed with corrosion prevention, but the threads of the hub studs has to be covered to make sure that the friction will be not changed. Only a thin layer on the clamping surfaces of the hub halves is allowed.

Propellers which have the blades removed for shipment will have identifying numbers on the blade decals. They indicate the appropriate hub socket.

NOTE
Index numbers relate to the assembly drawings in chapter 14
Fig. 13-1 (HO-E 214 U) or Fig. 13-2 (HO-E 214 P)

NOTE
Slide the propeller carefully onto the flange of the mounting fixture.
Check the correct position of the dowel pins (1.1.6 HO-E214U or 1.1.2 HO-E214P).

5.1 HO-E214U, install the hub half (1.1) with the bigger flange (which includes the threaded inserts) to the flange of the assembling fixture using two washers and screws.

HO-E214P, install the hub half (1.1) (which includes the threaded bushings) to the stub-shaft flange or the flange of the assembly fixture using two washers and nuts.

CAUTION
Cover the entire inner surface of the hub halves and the blade ferrules with a thin layer of CM 2

5.2 Prior installing the blades clean the inside of the hub half from oil and dirt using a clean cloth and solvent.
5.3 Prepare the blades for installation. Check blade root and clean the ferrule from oil and dirt using a clean cloth and solvent.

5.4 Insert the blades (2.2) into the hub half and secure them against falling out.

5.5 Pre-adjust all blades nearly the desired pitch.

5.6 Prepare second hub half. Prior installing the second hub half clean the inside from oil and dirt using a clean cloth and solvent.

If retaining ring and hub bolts are not installed prepare following step otherwise go forward with 5.7:

**HO-E214U**, install flange bolts 1.1.9 with retaining ring 1.1.8, install plungers 1.10 and screws 1.11

**HO-E214P**, install flange bolts 1.1.5 with retaining ring 1.1.4, install plungers 1.10 and screws 1.11

**WARNING**
Make sure the withdrawal plungers (1.10 **HO-E214 U** and **HO-E214P**) are well below the surface.

5.7 Check the position of the dowel pins (1.1.7 **HO-E214U**, or 1.1.3 **HO-E214P**) and put the second hub half on carefully.

5.8 Bring both hub halves right together using a plastic or wooden hammer. Carefully hammer always in the opposite direction. When the hub halves are correct together the hammer stroke sounds distinctive.

**NOTE**
Before installing the hub bolts and washers clean them from oil and dirt using solvent.

5.9 Install the hub bolts and washers (1.6, 1.7 **HO-E214U**, or 1.3, 1.7 **HO-E214P**) and tighten them by hand only.
NOTE
The reference station is the 0.75 R station (yellow mark) approx. 340mm from the blade tip

CAUTION
The setting of the four blades has to be within 0.2 degrees (12 minutes)

5.10 Adjust the blade angle again if necessary. For the correct blade angle setting a blade angle protractor has to be used.

CAUTION
The inserts (Helicoils) 1.1.3 are equipped with self-locking mechanism. This mechanism and bolts will be affected by every use, so the inserts and bolts have to be replaced after 5 times use.

5.11 Torque the hub bolts 1.6 (HO-E214U,) crosswise to 55 to 60 Nm (487 to 531 inlbs.) wet thread using CM 1, and the hub bolts 1.3 (HO-E214P) crosswise to 55 to 60 Nm (487 to 531 inlbs.) dry thread.

5.12 Final pitch check. Recheck the blade angles again. The readings have to be within 0.2 degrees (12 minutes).

5.13 If the blade angle readings are incorrect, loosen the hub bolts and separate the hub halves again using the withdrawal screws (1.11 HO-E214U, or 1.11 HO-E214P) and repeat steps 5.8 to 5.10.

WARNING
Make sure the withdrawal plungers (1.10 HO-E214 U and HO-E214P) are well below the surface.

5.14 Recheck the torque of the hub bolts (1.6 HO-E214U, or 1.3 HO-E214P) again and wire lock the bolts in pairs, HO-E214P only, the propeller HO-E214U is using self locking Heli Coil inserts, and all other screws using stainless steel locking wire.

5.15 Using CM11, seal around the blade ferrules at the hub interface, the gap of the hub halves and the hole for the withdrawal screws 1.11.
For best corrosion prevention steps in **5.16** are suggested. This will help the propeller to withstand strong environmental conditions.

**5.16** Additional corrosion protection

**Note**

*Pre-Balancing of the propeller has to be done before, otherwise the threats for the balancing weights will be closed*

5.16.1 Cover the propeller like in Fig. 5 - 1

5.16.2 The areas around the holes for the withdrawal screws 1.11, head of the hub clamp bolts (1.6 HO-E214U, or 1.3 HO-E214P), sealed gap and hub surface where blades are installed (like in Fig. 5 - 1) has to be painted with CM 10

5.16.3 Once dry paint the hub assembly using CM3

5.16.4 Once dry paint the hub assembly using CM12

5.16.5 Once dry remove the coverage

**5.17** Add blade creep-lines
6  **Installation**

All operations in this chapter must only be conducted by a competent person as described in chapter 13

(Index numbers relate to the assembly drawings Fig. 14 - 1 or Fig. 14 - 2, Chapter 14)

**WARNING**

MEK (Methyl Ethyl Ketone) weakens the paint of the propeller blade and the sealing.

6.1  Clean the drive- and stub-shaft-flanges and both propeller flanges from oil and dirt using solvent. Remove sharp corners if present. The torque from the engine will be transferred mainly by friction. Therefore the surfaces have to be clean and dry.

6.2  Install the o-rings to the drive- and stub shaft, if applicable, (not a propeller part).

**WARNING**

Use extreme care not to damage the threads of the studs 1.1.9 (HO-E214U), or 1.1.5 (HO-E214P) or the propeller blades.

**NOTE**

Slide the propeller carefully onto the flange.
Check the correct position of the dowel pins (1.1.6 HO-E214U or 1.1.2 HO-E214P).

6.3  Connect the propeller assembly (HO-E214P, and HO-E214U) carefully to the stub shaft. Use washers (1.4), and self-locking nuts (1.5) and tighten all 8 nuts equally crosswise and torque them to 120 - 140 Nm (1062 - 1239 inlbs).

6.4  **HO-E214P,** connect the propeller assembly carefully to the drive shaft using washers (1.4), and self-locking nuts (1.5) and tighten all 8 nuts equally crosswise and torque them to 120 -140 Nm (1062- 1239 inlbs).

**HO-E214U,** Install the drive shaft carefully to the propeller assembly using washers (1.3) and bolts (1.2) and tighten all 16 bolts equally crosswise and torque them to 150 - 155 Nm (1328 - 1372 inlbs) wet threads (CM 1), the bolts will be locked by self locking inserts.

Running torque has to be added
7 Operation

ATTENTION
Check the deck in front of the propeller for loose items before running the engine.

WARNING
Prior operating the propeller make sure every screw, bolt or stop nut has the correct torque value and all wire locks are installed and everything in front of the propeller is clear and secured. Secure the craft according to the crafts manual.

ATTENTION
Move the power lever smoothly! Do not operate the lever abruptly!

7.1 Start the engine according to the crafts manual and warm it up. Slowly increase the power to get an rpm increase of about 200 rpm. Increase the power (be careful not to over speed the engine) slowly in steps until reaching full power. The crafts manual may contain additional information.

7.2 Should the rpm reading be incorrect the tachometer has to be rechecked for accuracy. A low rpm indication needs a verification of the engine output before readjusting the propeller pitch. If the tachometer and engine readings are correct, the propeller has to be removed for readjusting the pitch (see chapter 5) use the mounting fixture. After readjusting the prop has to be sealed again.

7.3 Prop check:
7.3.1 After the static run up inspect the propeller and the blades for possible damage and abnormality. If some abnormalities (like vibration or something else) found, contact Hoffmann Propeller.
7.3.2 Re-torque all bolts, nuts and screws to the correct value. Do not release the torque before. Wire lock the bolts and screws where applicable.

7.4 Seal the flange / prop surfaces according to the drawings Fig. 14 - 1 and Fig. 14 - 2. Allow the sealant to cure according to the applicable instructions. For strong environmental conditions it will be suggested that the whole surface of the hub metal parts may be covered up to the Irathane coating of each propeller blade using CM 10. Not necessary if 5.16 Additional corrosion protection has been done.

7.5 If the propeller had been assembled at the factory a re-balancing should not be necessary.
8 Inspection

All operations, with the exception of 8.1 Daily inspection, in this chapter must only be conducted by a competent person as described in chapter 13

8.1 Daily inspection

Daily inspection has to be carried out from introduced personal. The introduction for the daily inspection has to be given from Hoffmann personal or by a competent person as described in chapter 13

Check blade creep lines

Check blades and blade tipping for cracks or other damage. If installed, check additional erosion protection (metal, rubber strips) for looseness or damage. The silicone sealing of the blade and the whole hub must not be damaged.

**ATTENTION**

Check blade surface for bubbles in the Irathane or paint which may indicate internal over-stress or structural damage, especially if the blade shows signs on the tip indicating contact with foreign objects, which may have got between the blade and the shroud. Contact factory.

Check for loose screws and broken lock wires and all visible hub parts for corrosion and damage.

If something will be found inform a competent person as described in chapter 13. This person will contact Hoffmann Propeller if necessary.

8.2 250 hour inspection

250 hour inspection has to be carried out periodically up to the overhaul time.

Repeat daily inspection.

Check visible hub parts for cracks and corrosion or other damage. Check the torque of the bolts, stop nuts and screws (1.2, 1.5, 1.6 HO-E214U or 1.5, 1.3 HO-E214P) by applying the specified torque (see Chapter 5). Do not release the torque before. Check the sealing compound around the hub and the blade ferrule. Use new sealing compound if the existing is loose or broken.

Record the results of this inspection and store it with the log book of the propeller.

8.3 Inspection of the blades without Irathane coating

The inspection of the composite blades is easy and reliable. Critical vibrations will be indicated through the plastic covering of the blade surface. No sudden failure can occur with these blades because of the wood material, even if cracks exist. Following subsections will be important for determining whether cracks are critical or not.
8.3.1 Carefully inspect the area between blade body and metal ferrule around the blade root. Blades are sealed with CM 10 in this area. With such blades no crack in the sealant or separation from the ferrule or the blade body is allowed. If a crack is detected in this area, the propeller has to be removed immediately from service for special inspection at the factory.

Fig. 8 - 1 No separation permitted. Contact Hoffmann

8.3.2 Fine cracks along the blade tipping or along the end of the bronze fabric, also on the starting point of the blade tipping and on the bronze fabric near the blade root are not dangerous. Sometimes such cracks occur and are a normal indication for the different elongation of the different materials. During maintenance period such cracks should be covered with paint to prevent penetration of moisture.

Cracks in the FRP-covering, so that the wood is exposed, require immediate repair.

Fig. 8 - 2 Possible cracks at leading edge - no concern
8.3.3 Fine cracks in the paint surface or in the metal tipping across the blade axis are indications for vibration. If such cracks occur, the factory should be informed for decision. No sudden blade failure is to be expected because of the vibration dampening wood core which carries the load.

![Metal tipping cracked](image)

**Fig. 8-3** Cracks in the paint crosswise to blade axis. Contact Hoffmann.

8.3.4 Take a look at the complete propeller. Check the leading edge protection for cracks and the trailing edge for possible splitting by impact damage. It is normal that the painting erodes on the metal sheeting at the leading edge. At present no material is known to withstand the high force of fine particles hitting the tip area of the propeller.

8.3.5 Damaged fibre reinforced cover:
Nicks from particles are not important as long as the plastic protection of the wood core exists. Air bubbles up to about 15 mm (0.6 inch) diameter are unimportant as long as the diameter does not increase during service. Scratches and nicks should be protected during normal maintenance using water resistant paint.

8.3.6 If cracks in the metal sheet of the blade tipping arise, the blade tipping has to be replaced by the factory or by Hoffmann authorised service stations. Nicks and bulges are unimportant if they are not sharp, otherwise cracks may arise. In any case the wood core shall be protected against moisture.
8.4 **Inspection of the blades with Irathane Coating and Polymere Strip**

Inspection is basically the same as without additional erosion protecting material. Blade Irathane coating should be inspected for sharp cuts which must be repaired in accordance with paragraph 10.2, this inspection should be carried out in conjunction with paragraph 8.1.

If a Polymere leading edge erosion strip is found to be lifting, it can be re-bonded using CM9 in accordance with paragraph 10.4. If a strip is heavily eroded, such that the Irathane coating beneath it is visible, it must be replaced as instructed in 10.4.

8.5 **Corrosion-Control Disassembly**

Periodic tear down inspection of the hub assembly should be carried out at time intervals as specified in paragraph 8.7 or after indication of abnormal load (like green water or etc.) to the propeller. Once disassembled, crack detection of the hub forging should be carried out using a technical procedure approved by Hoffmann. Reassembly must be carried out in accordance with Chapter 5 of this manual.

8.6 **Additional Periodic Inspection**

New propeller / engine combinations may require additional periodic inspections, partial disassembly and inspection. Such inspections must be done by the factory or by Hoffmann authorised service stations. Their results will be used to determine the overhaul periods (TBO).

8.7 **Time Between Overhaul (TBO)**

The recommended time between overhaul (TBO) will be published in the Hoffmann Service Bulletin No. SB E23 latest issue. Overhaul has to be carried out by the factory or by Hoffmann authorised service stations.

8.8 **Over speed**

A special inspection and overhaul is required if the max. designed propeller - speed has been exceeded by more than 10%.

If the over - speed was more than 20% of the max design propeller - speed, the propeller has to be removed from craft. Repair is not possible. These propellers have to be marked as rejected.
10 Maintenance and repair

All operations in this chapter must only be conducted by a competent person as described in chapter 13.

10.1 Hub

During the periodic inspection, critically areas of the hub should be free of corrosion and any kind of damage.

The other surfaces of the hub little corrosion and damage (like scratches etc.) are allowed and should be protected by CM 10 or equivalent.

To make the decision of critical or not critical corrosion or damage a long time of experience in propellers will be necessary. In any case you can contact Hoffmann for advice.

10.2 Repair of Irathane Coated Blades

Surfaces with sharp cuts from particles which opened the Irathane coating must be repaired at the next possibility according to the figure below.

![Fig. 10-1 Repair of Irathane Coated Blades](image)

1) cut and grind Irathane
2) clean using MEK
5) apply CM 4 using brush

4) apply CM 5

3) apply CM 3

FRP-COVER

WOODEN CORE

Preliminary, minor repairs on blades may be done with CM 10 until there is time to use Irathane.
NOTE:
Damage protruding into the fibre covering may be field repaired only up to 3 cm².

NOTE
Damage through the fibre covering into the wood is acceptable for field repair only up to 0.5 cm².

NOTE
The leading edge protection has to be replaced before the underneath material will become porous by erosion.

10.3 Major Repair

All damage not described under minor repairs are considered major repairs. They have to be performed at the factory or in a Hoffmann approved service station. Re-balancing is required.

10.4 Bonding instructions for leading edge erosion strips (if installed).

NOTE:
The nickel erosion strip has to be adapted to every Hoffmann blade model, that has been Irathane painted. Therefore these strips can only be fitted to blades that have this finish. When ordering strips the blade model is required.

10.4.1 Materials required (for one propeller)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK-231(-)</td>
<td>nickel erosion strip</td>
<td>4 each</td>
</tr>
<tr>
<td>100A107326/1, (B5050)</td>
<td>moulded erosion strip</td>
<td>4 each</td>
</tr>
<tr>
<td>604016079/6, (B 2594 / 1)</td>
<td>flat erosion strip</td>
<td>8 each</td>
</tr>
<tr>
<td>CM 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CM 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CM 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120 grit abrasive sheet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>masking tape</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEK solvent</td>
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</table>

If the leading edge protection has to be fitted to the blade the first time, contact Hoffmann for information.
10.4.2 Position the nickel erosion strip on the tip, ensuring a 0.5 mm extension over the blade tip.

10.4.3 Apply masking tape around the strip, leaving a 3 mm gap.

10.4.4 Remove the strip and with a 120 grit abrasive roughen the surface of the Irathane to remove the shine.

10.4.5 Slightly roughen the bonding surface of the erosion strip using a 120 grit abrasive and clean the bonding surface of both, the strip and the blade, using MEK.

10.4.6 Thoroughly mix CM 9 per instructions given on the cans. Apply an even coat to the prepared blade and strip bonding surfaces.

10.4.7 Assemble the strip to the blade, ensuring a 0.5 mm protrusion at the tip and secure it in this position using masking tape, ensuring good adhesion on the face and camber side.

10.4.8 Fill the 0.5 mm overhang with CM 9. Air dry for 24 hours minimum at +20°C. Remove masking tape, clean off surfaces and check for sound bond.

10.4.9 Position the moulded strip inboard of the nickel erosion strip, ensuring that the outboard end is hard against the nickel strip. Secure in this position using masking tape.

10.4.10 Position flat strips one under the other inboard of the moulded strip, ensuring no gap at the mating joints. Secure in this position using masking tape.

10.4.11 Apply masking tape around the three strips, leaving a 3 mm gap.

10.4.12 Carefully cut the masking tape which secures the three strips and remove all three.

**WARNING**

MEK (Methyl Ethyl Ketone) weakens the paint of the propeller blade and the sealing. Use a cloth dampened with solvent!
10.4.13 Roughen the surface of the Irathane to remove the shine and highly roughen the bonding surface of all three strips. Clean all bonding surfaces using MEK.

**CAUTION**

CM 8 is an impact adhesive. Therefore it is important to place the strips accurately.

10.4.14 Thoroughly apply CM 8 (if applicable) per instructions given on the cans and apply an even coat to both, the blade and strip bonding surfaces. Allow the adhesive to get touch dry, then apply a second coat and let it become touch dry.

10.4.15 Starting with the moulded strip very carefully position it hard against the nickel strip and squarely on the blade. Repeat this procedure for the two flat strips.

10.4.16 Using a hand roller carefully roll out the adhesive to obtain a smooth surface.

10.4.17 Allow to air dry for 12 hours minimum at +20°C.

**NOTE:**

If time is not available to install the strips with CM 8, CM 13 can be used as an alternative. The curing time for this adhesive is only minutes, but needs more skill for correct installation to the blade.

10.4.18 Following the drying period carefully remove any excessive adhesive. As necessary, apply masking tape along the edge of all strips, leaving a 3 mm gap and apply CM 10 to seal the edges finally. Remove masking tape. Allow to dry for 4 days minimum at +20°C before returning the propeller to operation.
10.4.19 Balancing the propeller.
After repair or replacement of the propeller leading edge erosion strips or replacement of one blade, the propeller has to be statically re-balanced or/and dynamically on the craft.

10.4.20 For balancing use Marvel Precision Balancing equipment kit 7BAL162 and propeller mount adapter 7A063, or equivalent.

10.4.21 Perform static balancing according the balancing equipment Manual.

![Fig 10 - 2 Balancing](image)

10.4.22 Balance to 10 gm or better use balance weights 1.8 and screws 1.9 and install it to the right place. Record the weights and position and store it by the propeller log book.
## List of Consumable Materials (CM)

**NOTE:**
The consumable materials have to be ordered from Hoffmann
Use all materials according to the manufacturer's instructions.

<table>
<thead>
<tr>
<th>CM 1</th>
<th>WEICON ASW 450 (or equivalent)</th>
<th>To lubricate stainless steel threads (can be purchased locally)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM 2</td>
<td>DWF</td>
<td>Anti Corrosion Spray</td>
</tr>
<tr>
<td></td>
<td>PX 1</td>
<td>ARDOX (alternatively)</td>
</tr>
<tr>
<td></td>
<td>PR30B</td>
<td>Etch Primer</td>
</tr>
<tr>
<td>CM 3</td>
<td>PR 143 R</td>
<td>9122 Epoxy Primer</td>
</tr>
<tr>
<td></td>
<td>Hardener 143R</td>
<td>2000 Catalyst</td>
</tr>
<tr>
<td></td>
<td>T 17</td>
<td>2000 Thinner</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Primer for Irathane on Epoxy or Polyurethane blade finish</td>
</tr>
<tr>
<td>CM 4</td>
<td>Irabond</td>
<td>UU52A / 52B use cover CM 3</td>
</tr>
<tr>
<td>CM 5</td>
<td>Irabond</td>
<td>UU55 (alternatively)</td>
</tr>
<tr>
<td></td>
<td>Irathane 155</td>
<td>Anti Erosion Coating</td>
</tr>
<tr>
<td></td>
<td>Part A P155</td>
<td>(same supplier as CM 4)</td>
</tr>
<tr>
<td></td>
<td>Part B C155</td>
<td></td>
</tr>
<tr>
<td>CM 6</td>
<td>Black-26 APU</td>
<td>Mix with CM 5 if black surface is desired</td>
</tr>
<tr>
<td>CM 7</td>
<td>EC 19 (or equivalent)</td>
<td>Cleaner</td>
</tr>
<tr>
<td>CM 8</td>
<td>3M Scotch- Grip 1300 (L)</td>
<td>Bonding of additional leading edge protection</td>
</tr>
<tr>
<td>CM 9</td>
<td>Ay 105 (or equivalent)</td>
<td>Araldite Resin</td>
</tr>
<tr>
<td></td>
<td>Hy 953 F (or equivalent)</td>
<td>Araldite Hardener</td>
</tr>
<tr>
<td>CM 10</td>
<td>JFM 801 B2</td>
<td>To seal blade / ferrule and additional leading edge protection</td>
</tr>
<tr>
<td></td>
<td>PR1422 A2</td>
<td></td>
</tr>
<tr>
<td>CM 11</td>
<td>Sikka 221</td>
<td>Seal Blade/Hub interface</td>
</tr>
<tr>
<td>CM 12</td>
<td>Polyurethane Topcoat</td>
<td>To paint hub assembly</td>
</tr>
<tr>
<td>CM 13</td>
<td>Truloc Superset 45</td>
<td>Quick alternative in compare with CM 8</td>
</tr>
<tr>
<td>CM 14</td>
<td>PR 1221 A2</td>
<td></td>
</tr>
<tr>
<td>CM 15</td>
<td>RTV 109</td>
<td></td>
</tr>
<tr>
<td>CM 16</td>
<td>Calypsol H443</td>
<td></td>
</tr>
<tr>
<td>CM 17</td>
<td>RTV 157</td>
<td></td>
</tr>
<tr>
<td>CM 18</td>
<td>IS 802</td>
<td></td>
</tr>
<tr>
<td>CM 19</td>
<td>Weicon</td>
<td></td>
</tr>
</tbody>
</table>
12 **Storage, shipping and Inspection after shipping**

12.1 **Shipping**

Careful packing is the best protection against damage during shipment. Therefore the propeller will be shipped to the client in a special container. The blade tips and trailing edges should be sufficiently protected and the propeller should be fixed on the blades near the hub or on the hub mounting bolts.

12.2 **Storage**

Propeller shouldn’t be stored standing on the tips. If storage is required, the best is the use of the original packing. Avoid extreme temperature changes. Normally the propeller is not protected for a storage period of more than 6 months in rooms with dry, normal temperature.

The aluminium parts are protected by chromatic acid anodising, the steel parts by cadmium plating and the blades by paint or/and Irathane.

No preservation is required for the blades. The metal parts can be protected with standard preservation mediums, if long term storage is required.

In cold weather condition, the propeller shall not be stored in rooms with large temperature changes or near to heating systems.

For storage limitations see Service Bulletin No. SB E23 latest issue

12.3 **Inspection after shipping**

Inspect the transport boxes for visual damages. If visual damages will found report this damage and report this by the acceptance of the boxes. Contact Hoffmann Propeller for instructions.


13 **Training**
Instructions as described in several Chapters in this manual must only be undertaken by competent persons as specifically trained and certified by Hoffmann Propeller. This training should be audited and recertified every 3 years or after a major change of the manual or propeller design.
14 Cutaway drawing and special tools

14.1 Cutaway Drawings

<table>
<thead>
<tr>
<th>Propeller model</th>
<th>Drawing Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>HO- E 214 P</td>
<td>EP20- 86</td>
</tr>
<tr>
<td>HO- E 214 U</td>
<td>EP20- 192</td>
</tr>
</tbody>
</table>

14.2 Special Tools

- HO-E214P and HO-E214U
- Torque wrench to torque bolts and nuts (range up to 200Nm, 1770 inlbs.).
- Blade angle protractor, to set the blade angles
Fig. 14 - 1 Cut away drawing