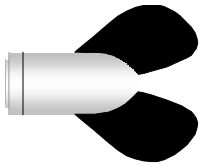
SDC ***Propellers Ltd***

Sail Drive Composite Hybrid Propellers

ASSEMBLY MANUAL

Assembly Instructions for the Propeller: V1

November 2006



CONTENTS OF THIS MANUAL

2: BORE & TAP LOCKING SCREWS

MOUNT SELECTED NOSE TO BOSS

Select the required Nose piece for the front face of the unit.

Typically: Volvo – Yanmar – Bukh – Lombardini …

Ensure a thin film of Vaseline or grease is spread over the thread – then tighten home by tapping on a screwdriver or similar to ensure the threaded nose is now in it's final position prior to boring the holes for tapping

BORE TAPPING HOLE IN BODY

The body with front nose piece is mounted in the tool and bored at the required distance for tapping.

DISTANCE = 15.00 mm AFT FROM JOIN

The hole will be bored to receive either a:

M6 tap if the locking screws are to Countersunk.
[Used when fitting a line protector shield]

M8 tap if locking screws are Pan Head

Post boring – mark the body each side on the face of the tool which will then provide the other two locations of the next two holes to be bored to end with 3 locking screws equidistant around the perimeter of the body.

C/sink if required and tap ensuring the depth leaves the screws flush – no deeper - at right angles to the body.

Remove all burrs after undoing the front piece. Remount onto the same body – now as a pair.

3: BLADE SOAK REQUIREMENT

ZYTEL absorbs water slowly over time and will change dimensions as the water absorption levels rise until a stability level is reached at saturation.

By pre-soaking the blades prior to any machining any subsequent distortion in use will be prevented.

If used in production prior to pre-soaking the distortions that will arise will make the blades stiff on their mountings and the torsion springs will be unable to restore them to the feathered position for sailing.

All blades when received from Proline must undergo the following routines prior to any use in service.

- **Trim carefully the runners off the blacks of the blades using the disc sander leaving a clean surface**
- **Bore the mounting hole by placing the blades in the tool and then drilling with the 7/8" twist drill**
- **Soak the blades in a weak Teepol solution with disinfectant added to prevent any Legionnaires disease**
- **Ensure the soak tank is warmed to > 23° C for the entire soak period**
- **Soak for a minimum of 2 months in the warm water – 3 months at room temperature**

NB: ONLY AFTER THE ABOVE SPECIFIED SOAK PERIODS MAY THE BLADES BE USED IN PRODUCTION

4: PREPARE BLADE FOR MOUNTING

BORE 7/8th MOUNTING HOLE IN BLADE

This is undertaken after trimming the runners and before the blades are soaked to bring them up to stable water content

The tool ensures the mounting hole is always bored centrally and square to the base.

A 7/8" Hole = 22.22 mm or 22 mm Clearance
This equates to 0.009"

Ensure all swarf is removed to provide a clean mounting surface for the blade and thus ensure the hole is bored at right angles to the base.

FACE UNDERSIDE OF BLADE IN TOOL

The blade is mounted in the tool and held by the tailstock pressure against the inner reference face of the tool and machined to the required depth:

THICKNESS = 15.00 mm FINISHED

This leaves an upstanding ring under the tool which has to be removed on the disc sander manually

NB: The photo here shows pre milled blade
The groove will be milled post facing

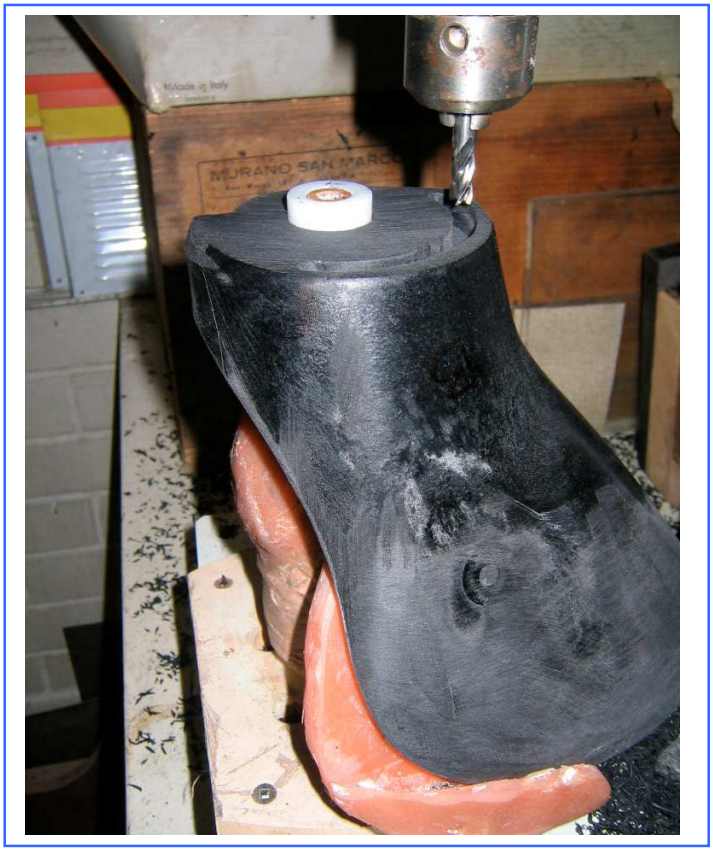
MILL VECTRAN™ RECESS IN BLADE

After mounting in the tool the 6 mm mill is inserted and descends where the work is rotated with the tool generally in two cuts.

Lift the bit to return the cutter and avoid vibrations

The depth stop governs the depth of the groove, and is set so the milling bit just clears the work to establish the upper level.

ENSURE THE UNDERSIDE HAS BEEN FACED FIRST



ROTATE BLADE ON TOOL

The blade is only rotated to a position that has been marked that will allow clearance on the rope exit of the body of the unit.

This will be marked on the tool that stops the blade rotation at the correct position.

Use 2 cuts with a 6 mm mill to end 7 mm deep

BORE 7 mm ROPE PATH HOLE IN BLADE

Mount blade in toll and drilling slowly to avoid run off bore down only until the drill cuts through into the milled groove on the underside of the blade

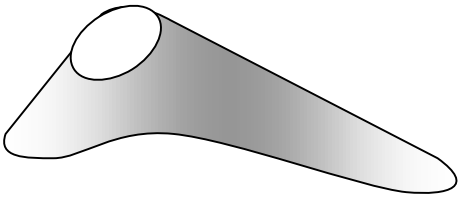
DO NOT EXCEED THIS DEPTH

FAIR PATH HOLE IN BLADE

See schematic below of area to be removed

FAIR ROPE LOOP PATH IN BLADE

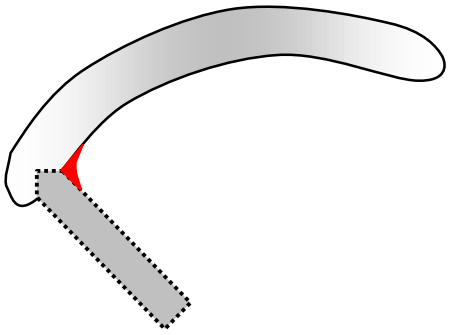
The following schematic illustrates the area that would normally be removed with the DREMEL to simply assist the splice and looped section of the Vectran™ to lie flat into the now expanded groove and not interfere with the PETP washer covering the Vectran™ and the upper blade mounting surface



FAIR PATH BETWEEN HOLE AND GROOVE

The surface where the hole exits and intersects with the groove is rounded carefully on the corner to ensure a smooth pathway for the Vectran™

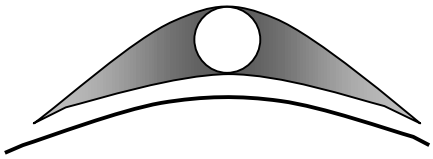
Care must be taken to ensure only the corner is removed as shown in RED which does not extend to the upper surface. It is the recessed portion only.



5: FAIR ROPE PATH IN BODY

FAIR ROPE PATH INTO BODY OF UNIT

The objective is to carefully grind using a sharp 1/8" drill in the DREMEL a smooth rope path that allows an easy transition from the hole to the blade around the corner and onto the boss as shown below



6: VECTRAN™ - TRIM TO LENGTH

TRIM VECTRAN™ TO LENGTH

The length required is taken from a section of 7 mm Challenger Braid stripped of it's outer.

Mark the length with an indelible pencil to start of the taper – and then allow for the extra taper. Prepare one end initially then reference of this.

The length is then cut with a blow torch by rolling at the same time as stretching to create a tapered end

LENGTH = 1050 mm - Clean Vectran™
Plus 2 x tapers ~ 20 mm each end

TAPER ENDS

The ends are tapered by heating with a gas torch to melt the Vectran™ which is then worked with a putty knife as it is pulled and rolled to a sharp tapered end

Any sharp spots are sanded off on the disc sander

It is important there are no projections which will prevent the insertion of the end into the open lay when the tail is terminated with a splice at each end

7: SPLICE VECTRAN ROPE TAIL

SPLICE TAIL OVER VECTRAN™

Use the tapered fid to open the lay then enter the tail to a depth of 75 mm plus the tapered section

Note the Vectran™ passes under the lead in rope then over to create a riding turn, and then down into the now opened lay.

Use a tapered object to push the tail right down

UNDER NO CIRCUMSTANCES ALTER THIS PATH

INSERT LOOP INTO BLADE RECESS

Note very carefully the rope path with the tail coming from under and then over the lead rope to create a riding turn and thus ensure a stable termination for the Vectran™.

This rope takes the entire torque of the propeller and it is critical it is locked in as shown – a technique that has been thoroughly tested and worked without any failures for over 100 hours

8: PREPARE BODY FOR BLADES

LOCTITE™ BOLT RECESS IN BODY

Ensure a light smear is placed down the hole and not on the upper surface where it will interfere with the blade surface.

Wipe the surface to ensure no Loctite™ remains.

THREAD ROPE PATH FROM BLADE

Now thread the Vectran™ into the body of the unit as shown.

Pathway is from the underside of the blade down into the rope exit hole on the blade mounting surface.

Note how the rope path goes around then under the lead in rope before coming up and over then into the splice.

UNDER NO CIRCUMSTANCES ALTER THIS PATH

TIGHTEN BOLT INTO BODY

Smear marine grease under the bolt head and under the PETP washer which separates the bolt and the upper surface of the blade containing the Vectran™

Tighten with a 22 mm AF Socket

Ensure the rope is not caught underneath.

Initiate the action by pulling on the rope and returning the blade to the fully feathered position before finally tightening home the mounting bolt.

TORQUE TO 40 Ft.Lbs OR 55 N.m EXACTLY

Check the blade motion is free by rotating and subsequently pulling on the Vectran tail as a final assembly check.

BORE 5.1 mm HOLE FOR LOCKING PIN

Mark the depth of the pin which equals 45 mm on the drill and then drill carefully cleaning as drilling progresses until the hole just exceeds 45 mm to the upper surface.

The pin must be allowed to end below the upper surface to allow the cover plate to pull down onto the knurled section without touching the pin.

INSERT LOCKING PIN TO 15 mm PROUD

Tap the pin in dry until 15 mm protrudes past the upper knurled surface.

Place Loctite™ around the pin

PRESS PIN TO JUST BELOW SURFACE

Tap gently down until it is just below the upper knurled surface

DO NOT TAP BELOW THIS TO ALLOW REMOVAL

It is important the pin is proud in the milled recess to allow access with pliers if the pin is ever to be removed subsequently for blade replacement

It must not however interfere with the cover plate

9: SETTING PITCH AT TIP

MOUNT PROTRACTOR OVER TIP

Pitch is set by altering tip angle as measured by a protractor as shown to the desired pitch.

THIS MUST BE DONE BEFORE MOUNTING THE SPRINGS AND COVER PLATES

SET PITCH ON EACH BLADE

One turn of the screw equals ~ 2" of pitch

This equates to ~ 2° of tip angle

The pitch screws are self locking

AFTER SETTING PITCH TO REQUIRED ANGLE SCRIBE THE PITCH FACE POSITION WITH A STANLEY KNIFE AS A REFERENCE MARK WITH EACH BLADE HELD IN THE MAXIMUM PITCH

NOW MARK THE END OF THE BODY WITH THE TIP ANGLE JUST SET:

Eg: T/A = 16 ° as shown in picture ...

10: VECTRAN™ PATHWAY

VECTRAN™ PATH OVER NOSE

SIDE VIEW SHOWING GUIDE PATHWAY

11: ASSEMBLY OF FRONT FACE

MOUNT FACE PIECE OVER BOSS

INSERT BOSS INTO BODY OF UNIT

TIGHTEN FRONT FACE PIECE

12: MOUNTING UNIT OVER SPLINE

MOUNT OVER SPLINE FOR TIGHTENING

Move the body back and forward relative to the spline at this stage prior to tightening the front face home

This will ensure the rope is not jammed behind the boss and is passing freely over the boss and down the 2 holes in the boss to operate the blades

13: MOUNT BLADE TORSION SPRINGS

MOUNT SPRING OVER LOCKED BOLT

This requires a 3.2 mm hole raked at an angle of 5° to accept the outer tail of the spring.

The angle ensures tension tends to hold the spring down into the hole and prevent excess pressure under the cover plate

LOCTITE™ UNDER SCREW AND THREAD

The Loctite™ is placed under the screw head and on the thread to ensure this M10 screw is firmly locked in place

Loctite™ is also smeared on the knurled section of the upstand of the bolt to provide additional friction to the cover plate bolt interface

ENSURE ONLY A THIN COATING TO PREVENT ANY BUILDUIP IN THE SPRING WHICH WILL HARDEN AND CAUSE THE SPRING TO BREAK ....

TIGHTEN SCREW USING TOOL ON COVER

This requires the cover to be rotated until the spring tail is in the 7.30 - 8 o'clock position and then held while the cover is tightened down using the Alan Key and locking screw

Wipe excess Loctite™ from the surface

NB: Later versions of the cover plates are ex PETP

TORQUE TO 20 ft.lbs or 27 N.m

FINISHED COVER PLATE WITH SPRING

Here the blade is held in the OPEN position

Note the position of the spring tail at ~ 8 o'clock

Check the operation of the blade is free at this stage before the Loctite™ hardens. This will require pulling on the Vectran™ while rotating the blade and allowing the spring to return the blade to the fully feathered position against the body stop.

14: FINAL ASSEMBLY WITH NUT

NUT RECESS WITH SPLIT PIN

The nut is recessed to accept a 3.2 mm Split Pin which has been shortened to ~ 15 mm so the tails do not interfere with the inner flats of the nut.

The Split Pin has been tapped into a hole to make the head stubby and ensure it recesses correctly

NB: SPLIT PIN HEAD MUST BE BELOW BODY

GREASE UNDER VECTRAN™ PATHWAY

Place grease under the groove in the nose of the boss that will accept the Vectran™ and around the front perimeter as shown.

This will ensure smooth operation of the unit and is essential to allow for the equalisation to occur to allow the blades to each come fully to their own pitch stops.

SCREWING FRONT FACE HOME

Be very careful in starting the thread on the front face. If aligned correctly it will easily screw in by hand.

If it is at all difficult to thread – do not force it. It will be cross threaded.

Remove it - align it correctly and start again.

Once started and nearly home the boss will need to be oscillated inside the body to ensure the Vectran™ is free and not caught behind the rear boss face

ALIGNING LOCKING SCREW HOLES

Tap the Front Face around gently using only your hand with a screw driver or similar in the 7 mm hole drilled for this purpose.

Stop when the thread in the body is correctly aligned with the thread in the Front Face.

LOCKING SCREWS INSERTED DRY

Insert the locking screws – normally M8 Pan Head but Countersunk 6 mm if the unit is going to have a Nylon Protection sleeve fitted which requires there be no protrudences on the body of the unit.

ONLY TIGHTEN THESE FINGER TIGHT

THEY WILL BE REMOVED FOR MOUNTING

THE UNIT IS NOW READY FOR MANUAL TESTING TO ENSURE FULL AND FAIR CORRECT OPERATION

15: OPERATIONAL TEST

SIMULATED OPERATION IN USE

Place both hands on the blades to simulate water pressure when in operation and using a rotational force to simulate the water pressure – rotate both hands which will initiate the mechanical action to open the blades. Do not force the blades open – allow the mechanism to do this.

ONLY APPLY ROTATIONAL FORCE TO THE BLADES

Continue as shown below to an intermediate and then final stage where the blades are fully open and up against their respective pitch stops

Blades at the half open stage …

Both blades are now fully open and up against their respective pitch stops with the pitch as set ….

IT IS IMPORTANT TO NOW REPEAT THE PROCESS ONLY THIS TIME IN THE OPPPOSITE DIRECTION TO SIMULATE THE OPPOSITE MOTION

THE SPRINGS WILL RETURN THE BLADES TO THE FEATHERED / FOLDED POSITION WHEN THEY ARE RELEASED AT THE END OF EACH MOTION