New skeg on my Leisure 27 “YELLOW DREAM”

After buying my Leisure 27 last year and “YELLOW DREAM “was lifted at the end of the sailing season a nasty crack appeared at the joint between the skeg and the hull.

When I started wiggling the skeg I noticed some movement in the joint so there might be a more serious defect.
However because inside the boat the bolting was fine there had to be some kind of detaching between the steel skeg frame and the grp skeg.
Looking at the joint I could clearly see some previous repair had been made, however not very professional.

I could have made a new repair for the bond between hull and skeg but I rather decided to remove the skeg and either repair or rebuilt it.

Because I wanted to demolish the skeg anyway I started with the removal of the outer grp covering. Using an angle grinder this proved to be quite simple. I started making cuts at the front and around the grp area.
After that the grp covering could be pulled off surprisingly easy revealing the foam core. There appeared to be almost no constructive bonding between the internal steel structure and the upper grp laminate. Most of the bond was the PU foam filling which is off course not a very strong bonding agent.

After this I started cutting the joint with an angle grinder just above the upper steel plate of the skeg.
After cutting the joint I removed the nuts from the bolting.
After that some firm wiggling ad hammering loosened the skeg until it came off quite easily.

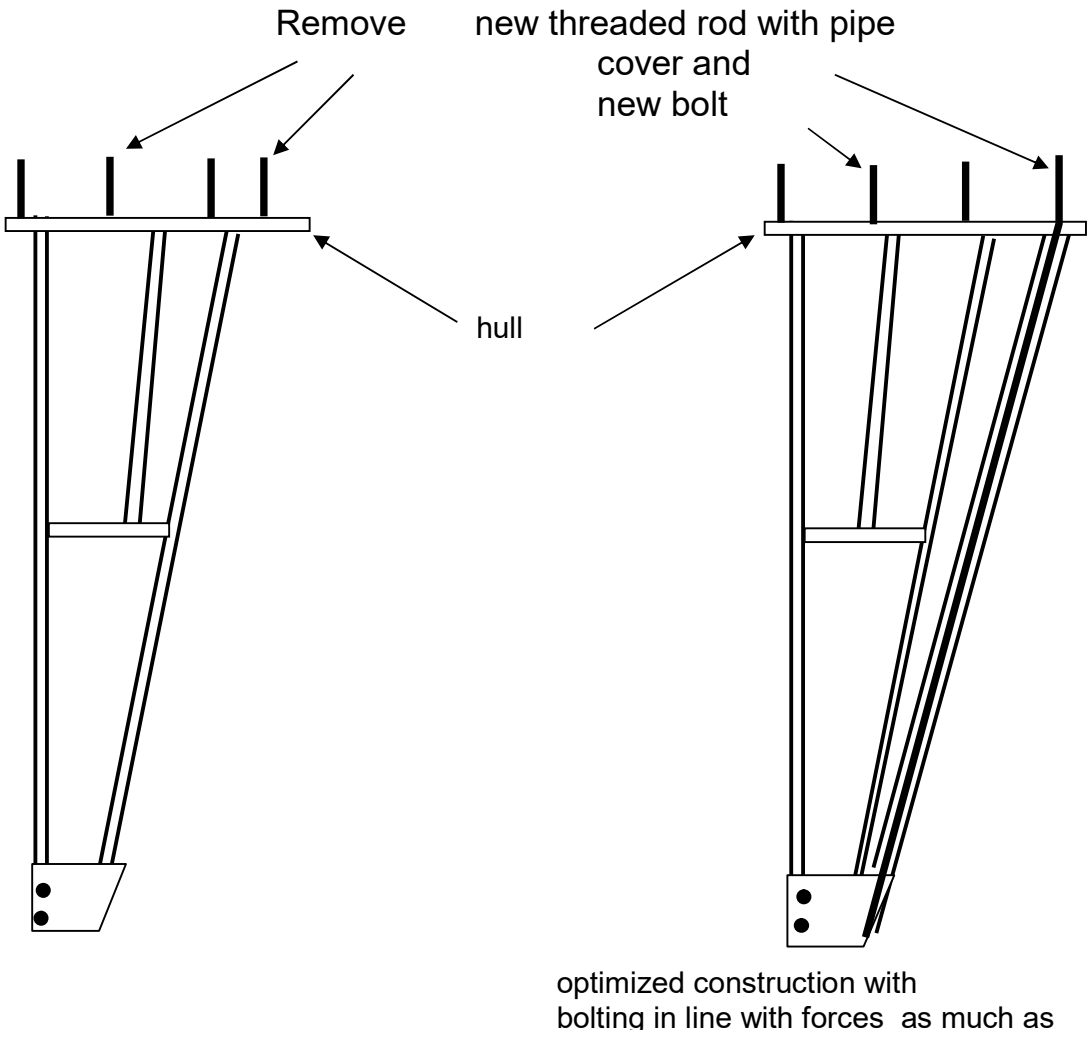
At home I proceeded to further demolish the skeg in my garage (which in fact is since long not a garage anymore..) to reveal the internal steel frame. After having removed all the foam I could see that only the after part of the grp (the part just in front of the rudder) had a real bond to the steel structure. Therefore in case of for a grounding or dry out the forces on the grp laminate eventually will lead to a loosening of the laminate. At the end this also will lead to the cracks on the hull joint.
That way water will ingress into the foam and further weaken the structure and eventually lead to corrosion of the steel structure especially in seawater.
Against most thoughts also a stainless steel structure will be exposed to corrosion because of lack of oxygen in this enclosed structure! This kind of (crack) corrosion may even go faster and is also called “oxygen starvation corrosion” which also can lead to problems with a stainless steel propeller shaft in a (sea)water lubricated stern tube .

When the boat is at the boatyard during winter frost will also contribute to a further damage.

Lucky enough in my case the steel construction did not show any corrosion so I just had to rebuild the grp laminate. At least, that's what I thought.
However, having a closer look at the frame unmasked
A misalignment of part of the bolting and the steel pipes that form the main structure of the skeg. Because of this misalignment forces put on to the skeg cannot be transferred by the bolting to the hull directly but can deform the hull plate as shown in this case.
So, apart from rebuilding the grp part I also had to improve the steel construction. I removed two of the bolts (as can be seen in the pictures) And replaced them as close to the pipes as possible. I also added an extra rod made from a threaded rod of 12mm covered with a pipe. This way the total skeg surface area will be larger which will reduce the typical weather helm of the Leisure 27. The rod was welded to the lower skeg plate and secured by a nut under the upper hull plate which was ten secured by a tag weld. This way all forces from this front rod, which is most affected by grounding, are lead into the hull directly.

original construction with bolting
not in line with skeg construction.
leads to bending of hull plate.

This will become the improved skeg frame construction.



The following pictures show the actual progress of the frame modifications.

1):
Useless bolt removed and new threaded rod added

2):
Threaded rod before covering with pipe

3):
Final construction of skeg frame

Now everything was ready to built up the grp hull of the skeg.
The main construction details can be seen in the following drawings.

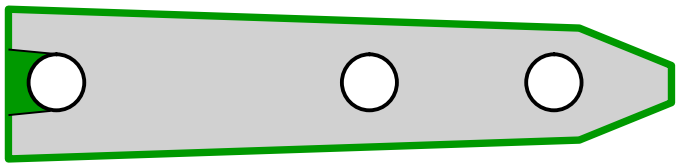
Construction of grp laminate and filling

GRP laminate 3-4 * 300 grams alternating CSM/fabric
Use iso-NPG polyester or , preferrably, vinylester resin or epoxy.

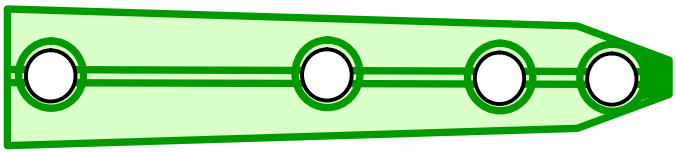
glassfibre filled bonding paste

Original PU

closed cells PU foam or (better) PVC foam (e.g. divinycell) ; shape by sanding into right



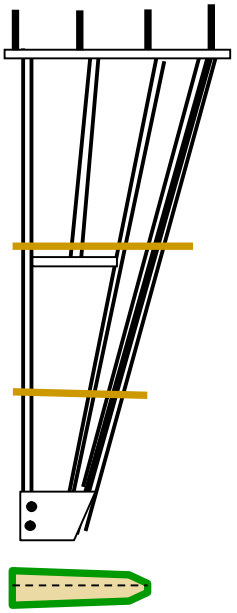
original construction with no serious bond between steel frame and grp skeg-hull leads to delamination and cracks



optimized construction with good bond between grp and steel frame to avoid deformations leading to cracks

Construction of grp laminate and filling

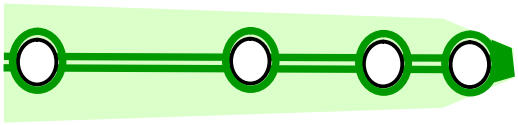
1):
laminate bonded to
and around steel
structure



2):
Add plywood ribs for bond of
laminate
on frame and outer skeg hull
Laminate ribs at steel structure

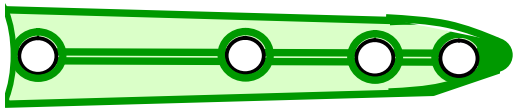
1-2):
Steel frame with inner laminate and grp covered wooden ribs

The First laminate layer is attached to the frame and wooden ribs. After this the foam filling has to be attached.



3):
Glue foam sheet on to laminate

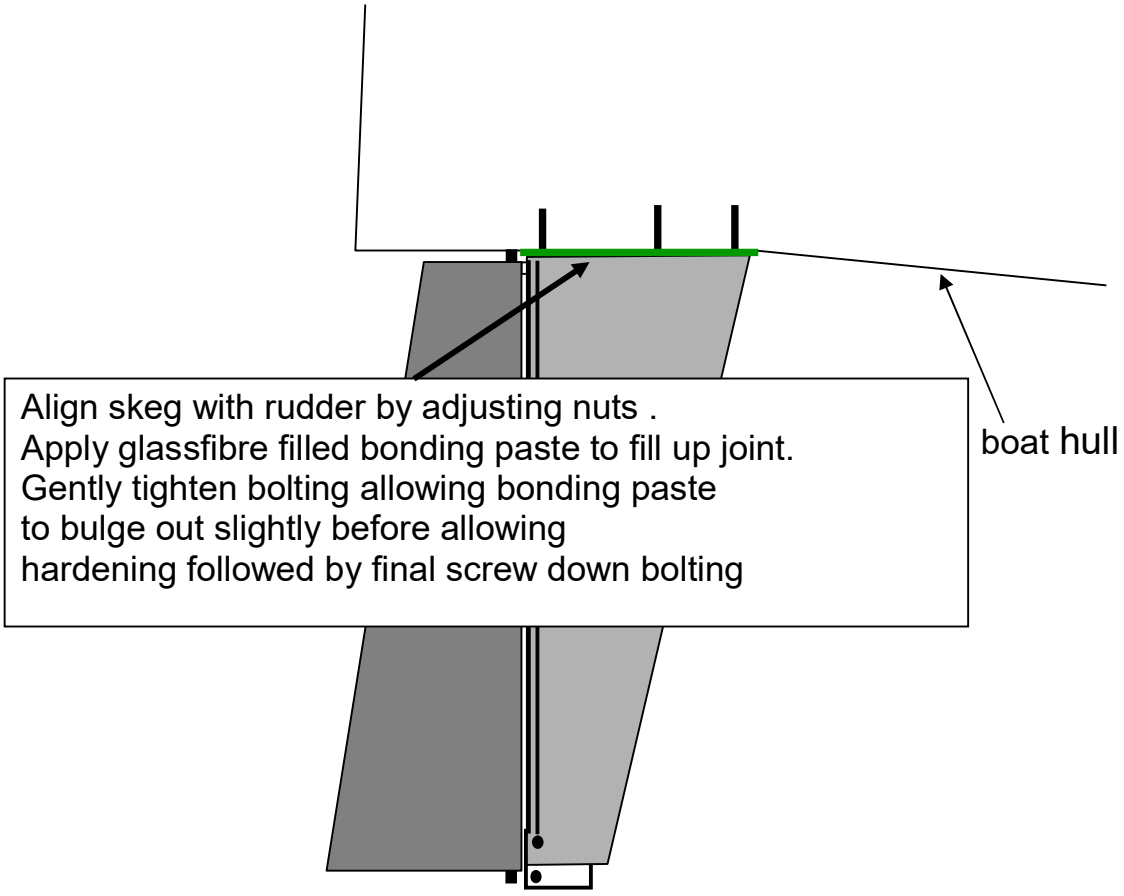
3):
foam core glued in place,
ready for outer grp laminate



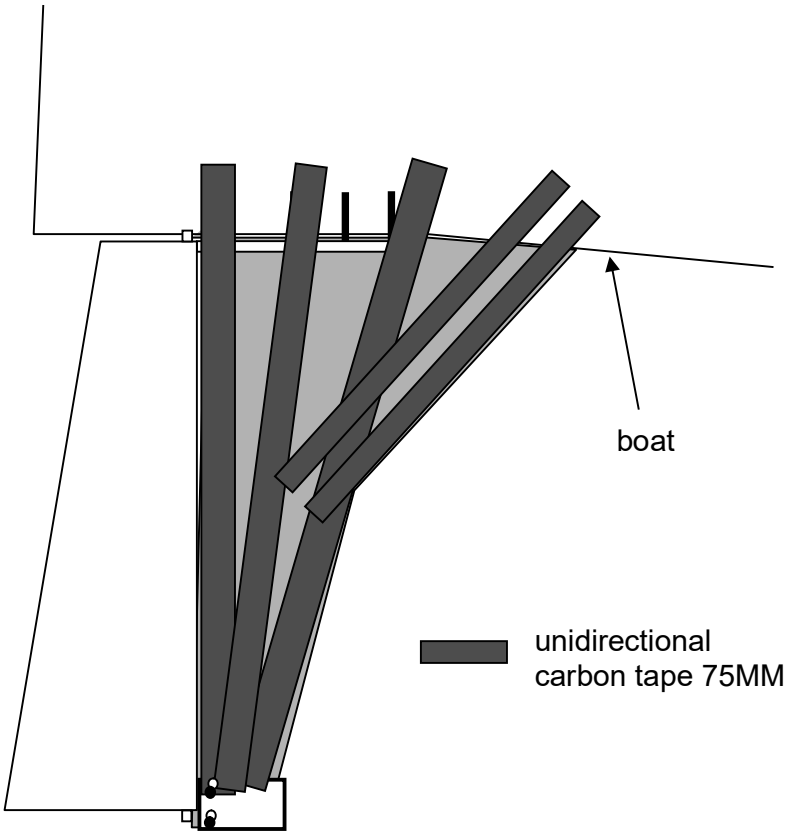
4):
Round off to smooth shape
and
laminate outer hull of skeg

5):
Skeg with outer
laminate,
ready for attaching to
hull

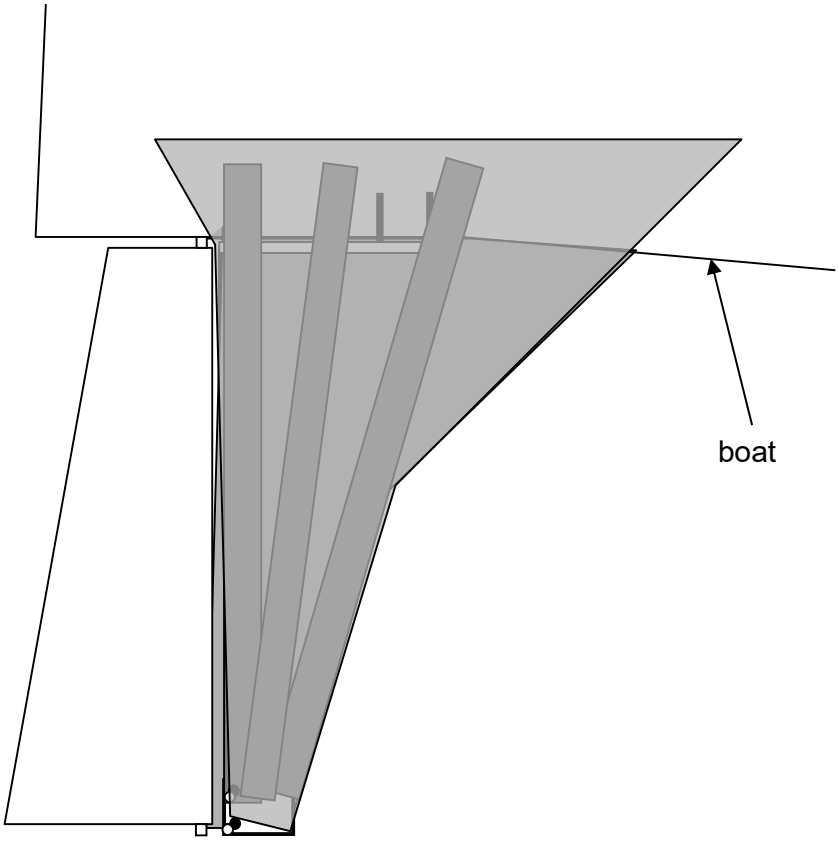
Now the skeg is ready for attaching it on to the boat.
On the following sketch you can see the way this will be done.



6);After hardening of the joint unidirectional carbon is used to achieve the bond to the hull without the risk of cracks because carbon is virtually stretch free



7):After the carbon is applied a final layer of glass fiber fabric is laminated on to avoid damage to the carbon fiber when sanding or with minor scratches.



cover up with 200 grams/m2 glass

6): ATTACHING TO BOAT HULL

Thew new skeg is now firmly attached to the boat hull and will later be covered with epoxy coat before applying antifouling.