



Marine Composites

Webb Institute
Senior Elective

Structural Failure Case Histories

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Stiffener Failures

Tabbing Failure



J Boats



Tony Guild

Stiffener Failure



Eric Greene



Tabbing Failures



Tony Guild



Tony Guild



Eric Greene



Eric Greene



Unfilled Core Kerfs



ortolancat



Roby Scalvini



Crashed Racing Powerboats

Marine Composites
Structural Failure Case Histories





Racing Sailboat Damage

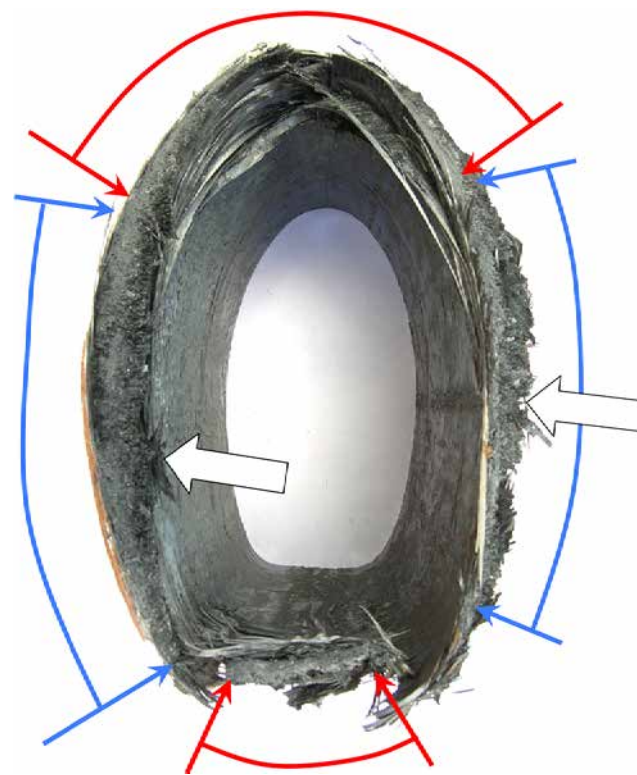
Marine Composites
Structural Failure Case Histories





Mast Failures

Eric Sponberg analysis of carbon fiber mast failure



The break showing eroded edges (red regions) and frayed fibers (blue regions with white arrows)

This is the other end of the same sample. Note the area of extreme thinness (white arrows) and air pockets in the laminate (red ovals).

<http://www.sponberg yacht design.com/FourMastFailures.htm>



Stanchion Failure

Laminate cracking and failure at stanchion bases



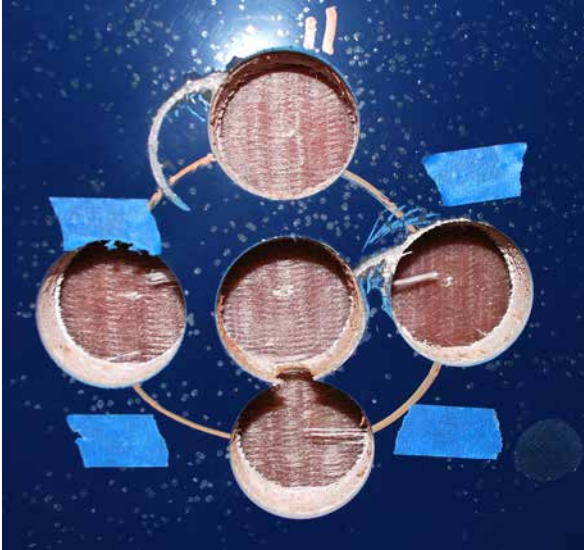
Boat US



Pbase.com



Excessive Hole-Saw Destructive Testing





Thermal Damage



Bruce Pfund



Eric Greene

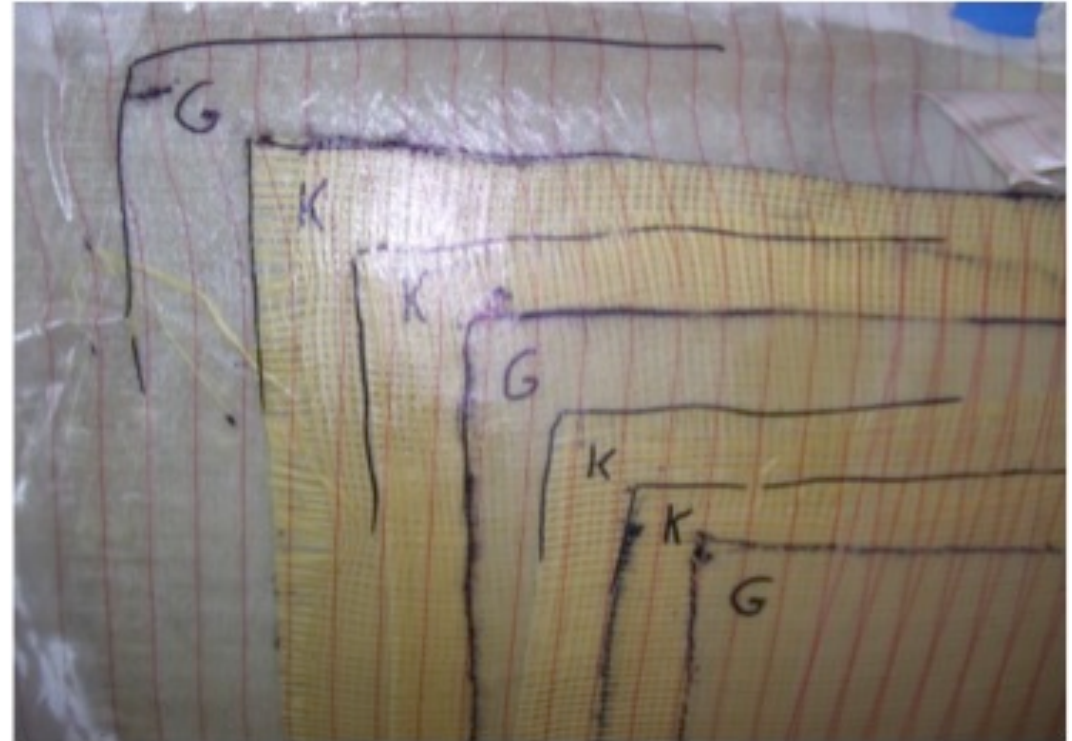
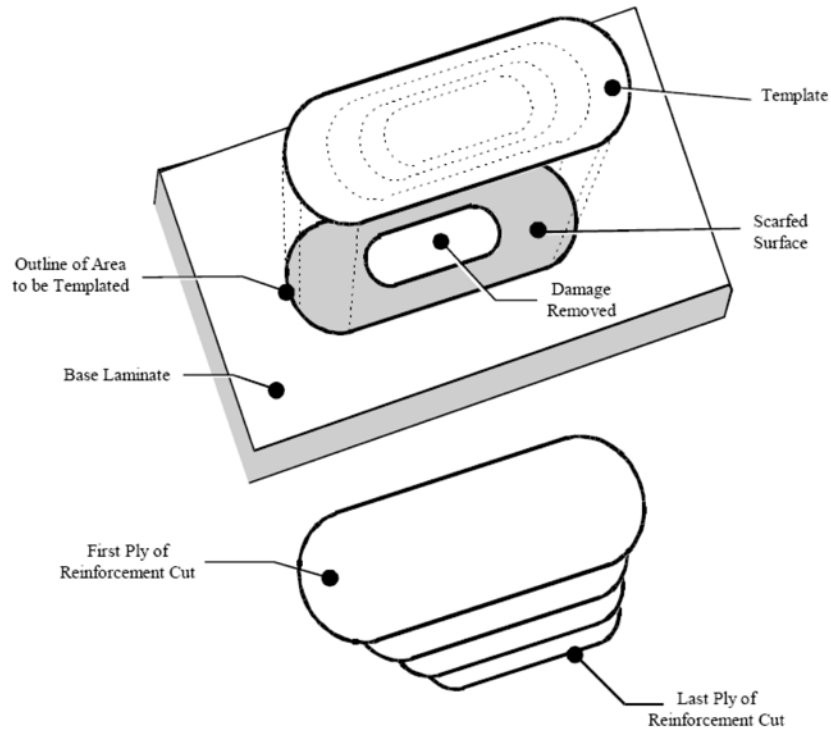


Grounding Damage





Grounding Damage Repair



- Background
- Existing Construction
- Repair Procedure
- Laminate Quality Requirements
- Repair Documentation



Repair Procedure Summary

1. Clear away any loose or fragmented laminate.
2. Completely cut away the damaged laminate.
3. Remove the PVC core material.
4. Mark the perimeter of the scarf zone.
5. Grind back to the scarf perimeter.
6. Remove at least 2" (50 mm) of paint and primer from the edges of the scarf line.
7. Remove portion of the inside laminate as per steps 1-4.
8. Vacuum the composite dust and wipe the area with acetone.
9. Perform a final inspection of existing laminate.
10. Apply wax around the outside perimeter of the repair area.
11. For inner skin damage, fabricate a backing plate.
12. Attach the backing plate to the interior laminate.
13. Cut repair reinforcement material.
14. Where there is interior skin damage, laminate this skin first.
15. Ensure that each layer is completely wet out.
16. Use peel ply material on top of layers being cured.
17. Use core bonding compound to bed core.
18. Consolidate using a vacuum bag..
19. Fair final core surface to be flush with old core.
20. Laminate outer skin.
21. Repeat Steps 1 through 20 for each distinct damage area.
22. Cover entire repair area with two layers of 1.5 oz/ft² mat.
23. Post cure repair area using a tent heated to 150°F for 6 hours.

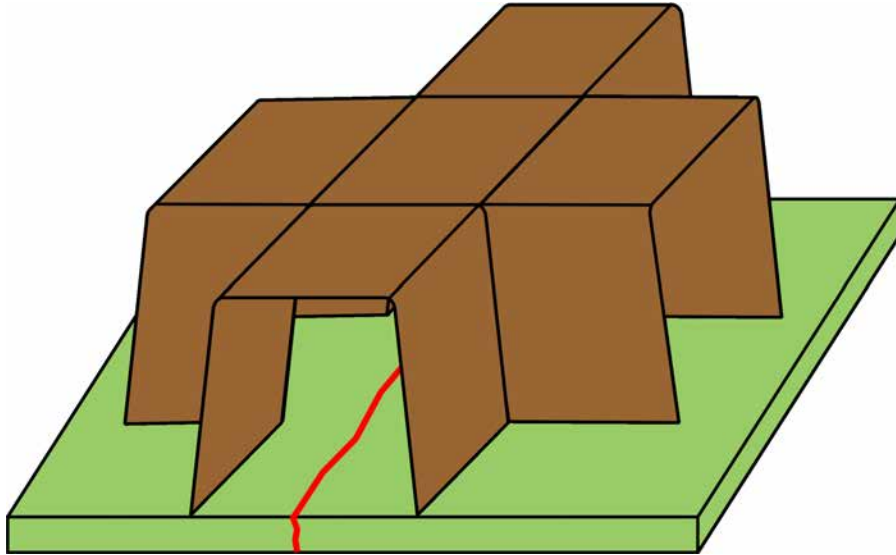


Failed Transverse Stiffener



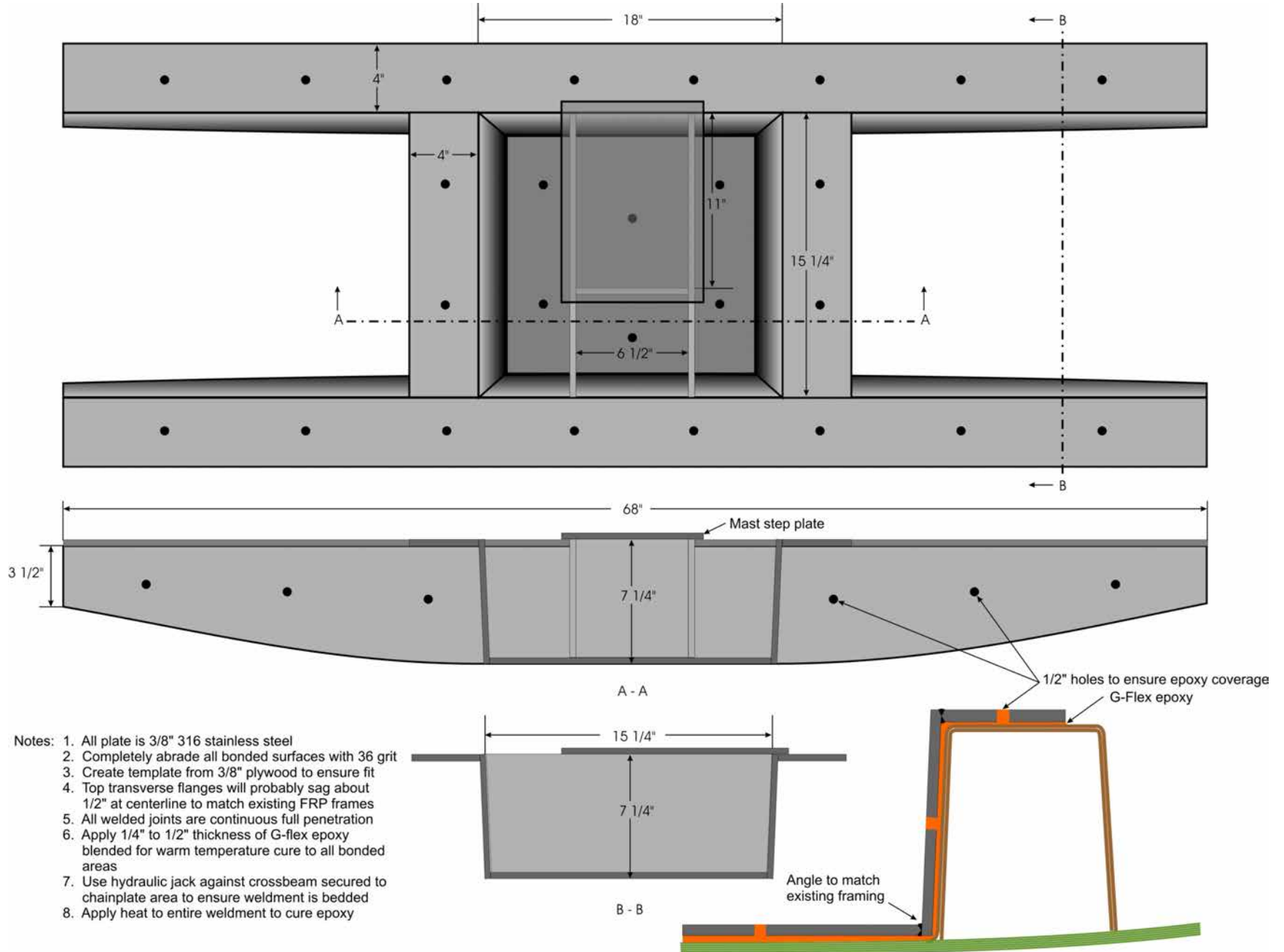


Failure at Stiffener Junction





Stainless Steel Structural Grid



- Notes:
1. All plate is 3/8" 316 stainless steel
 2. Completely abrade all bonded surfaces with 36 grit
 3. Create template from 3/8" plywood to ensure fit
 4. Top transverse flanges will probably sag about 1/2" at centerline to match existing FRP frames
 5. All welded joints are continuous full penetration
 6. Apply 1/4" to 1/2" thickness of G-flex epoxy blended for warm temperature cure to all bonded areas
 7. Use hydraulic jack against crossbeam secured to chainplate area to ensure weldment is bedded
 8. Apply heat to entire weldment to cure epoxy

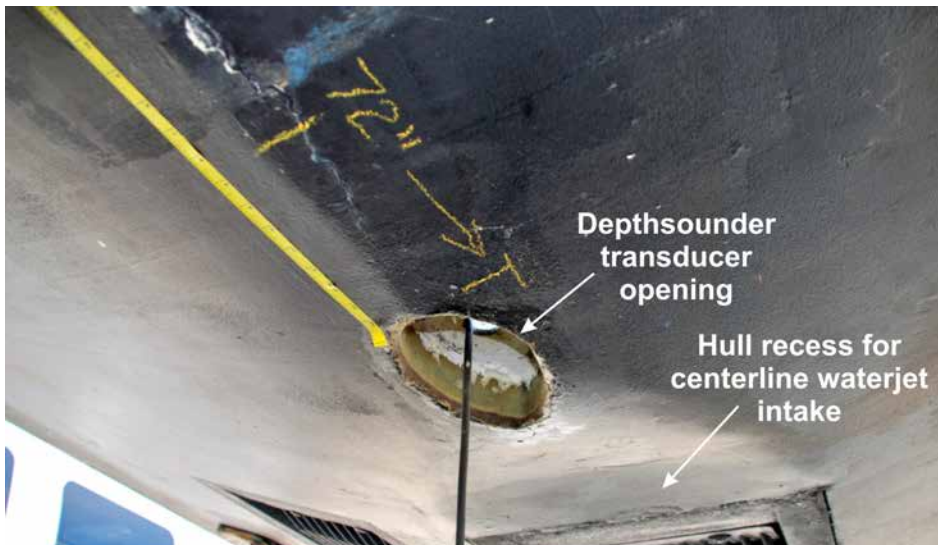
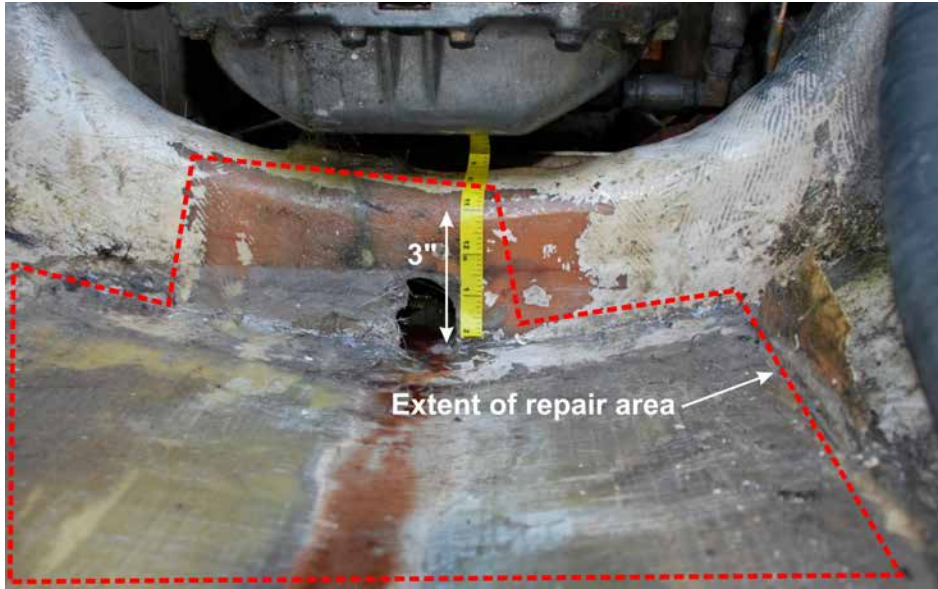


Fit and Install S.S. Grid



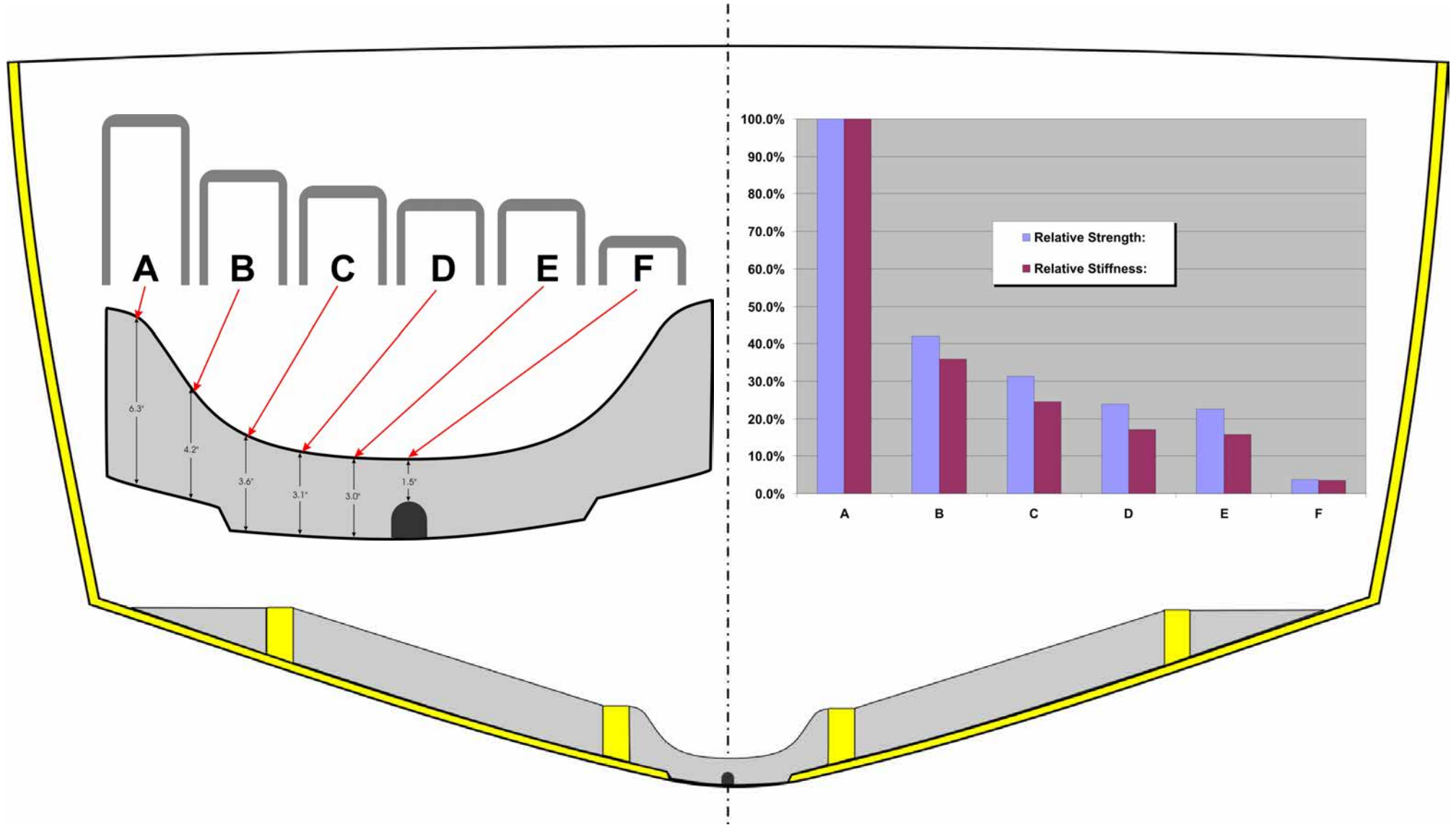


Failed Engine Girder





Transverse Frame Scantlings



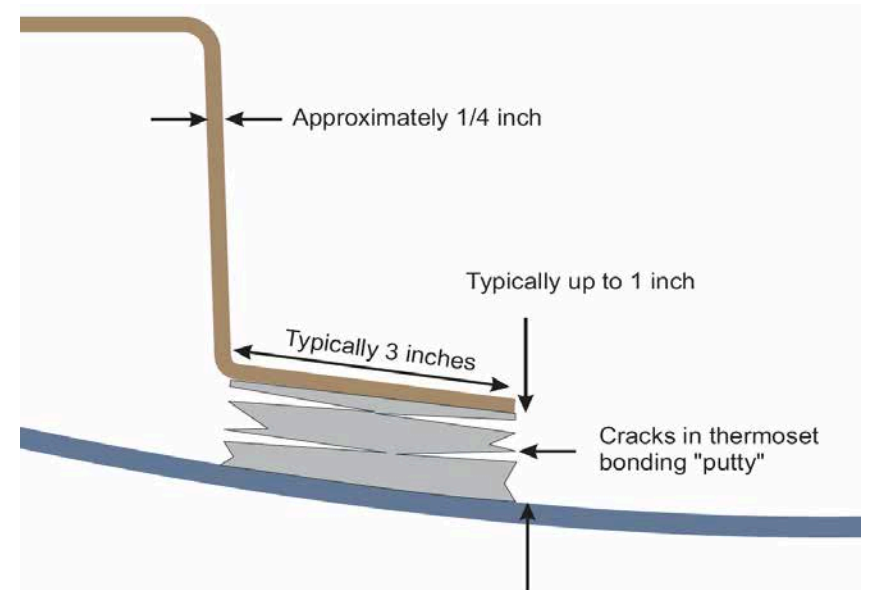
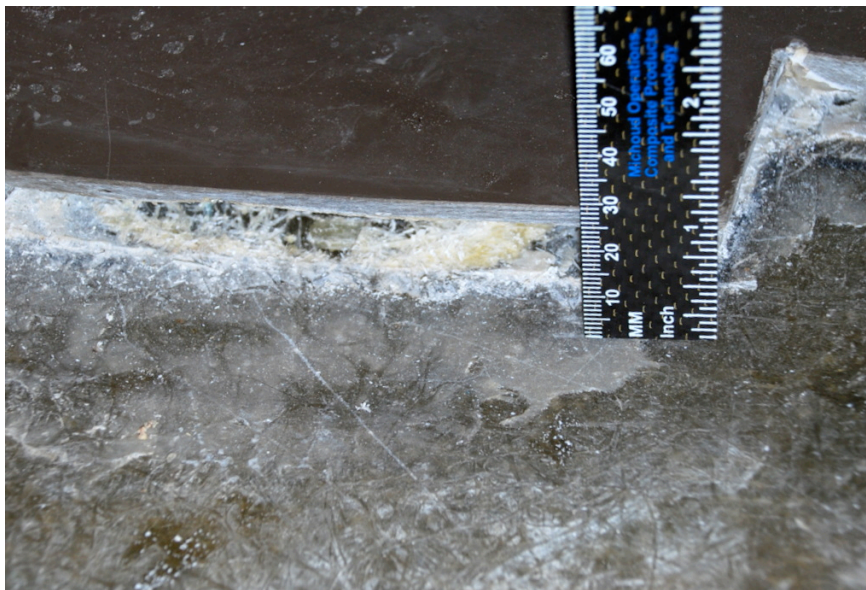


Rebuilt Engine Girders





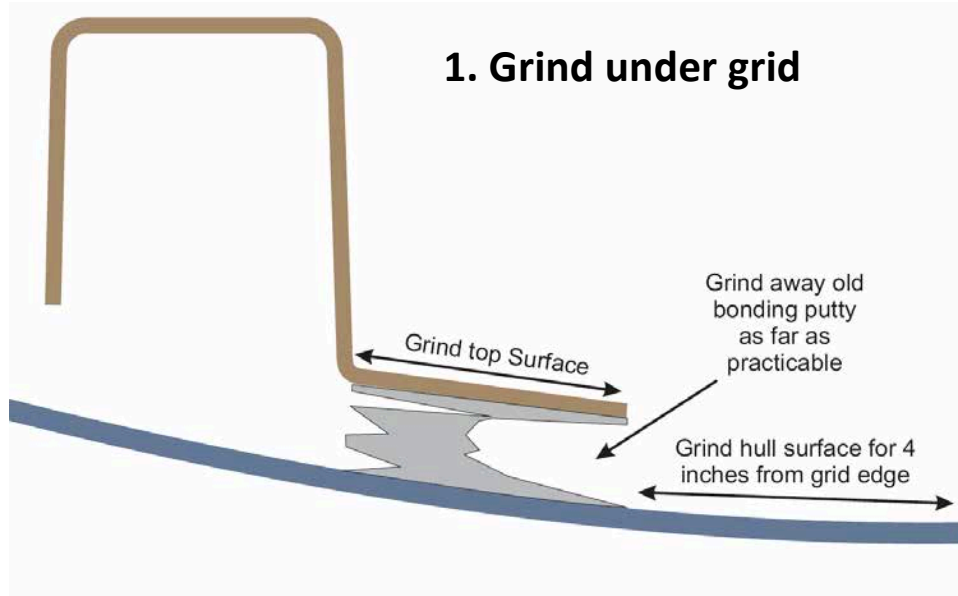
Disbonded Structural Grid



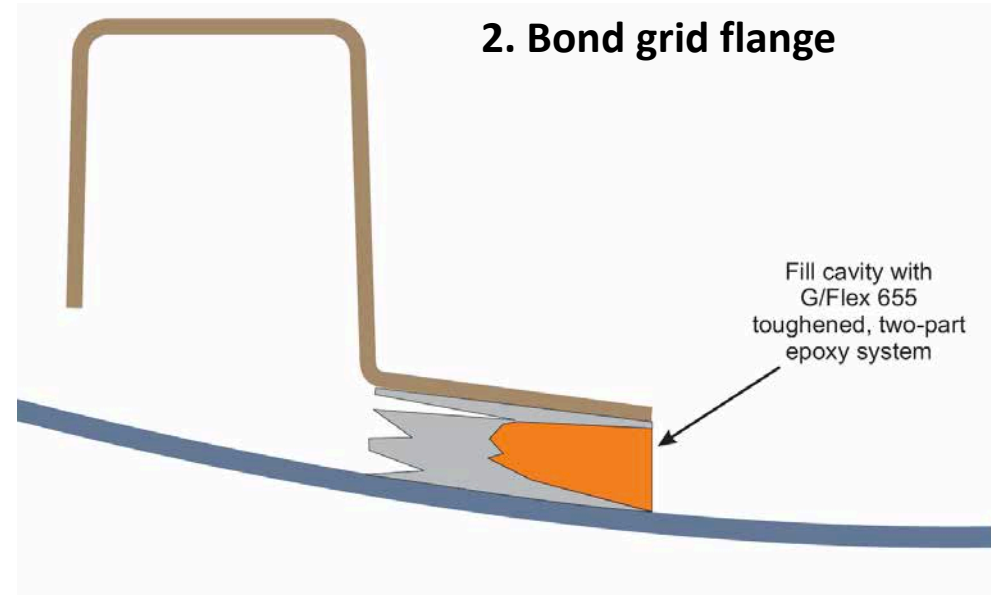


Grid Repair Procedure

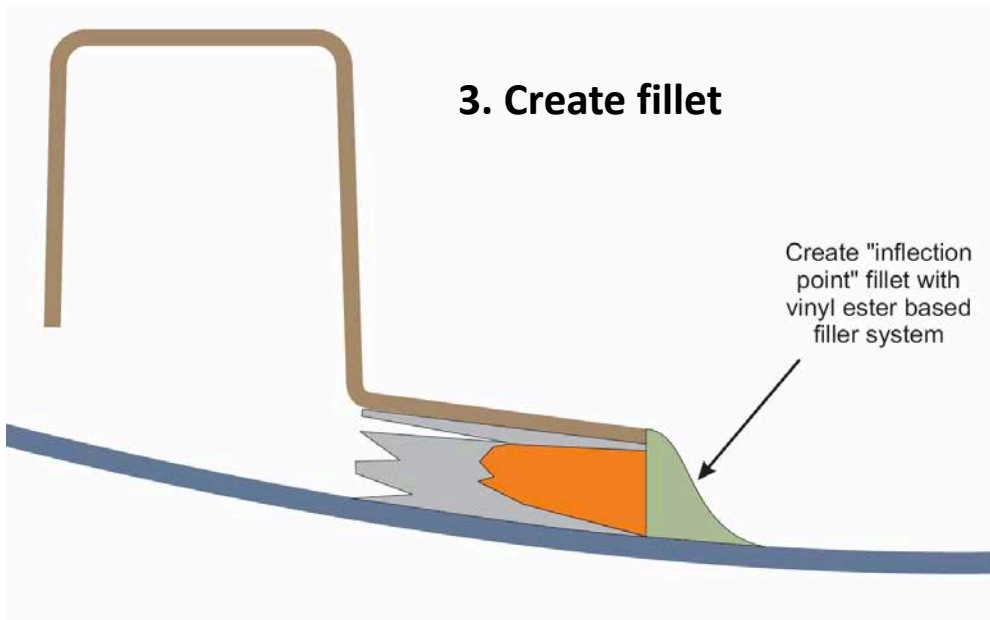
1. Grind under grid



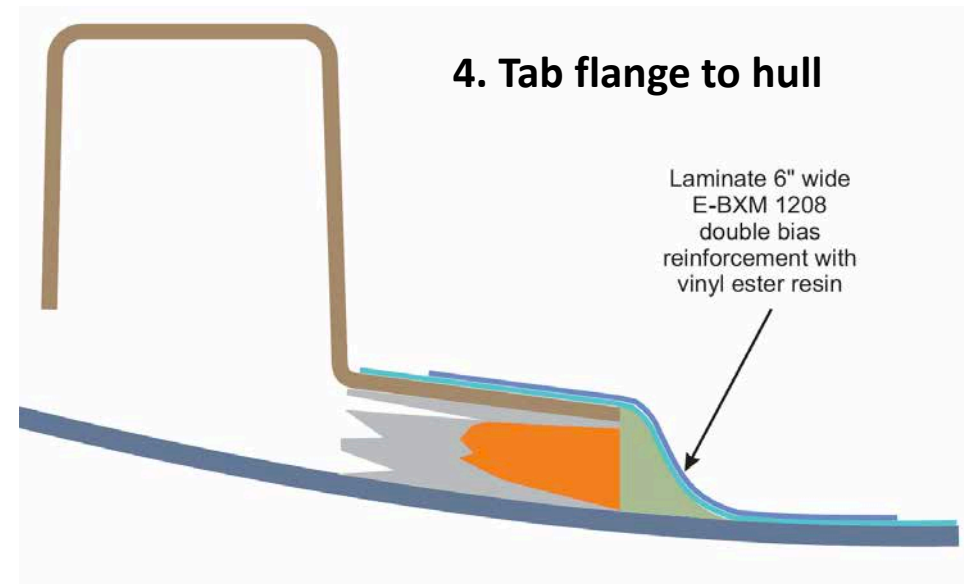
2. Bond grid flange



3. Create fillet



4. Tab flange to hull





Repaired Grid





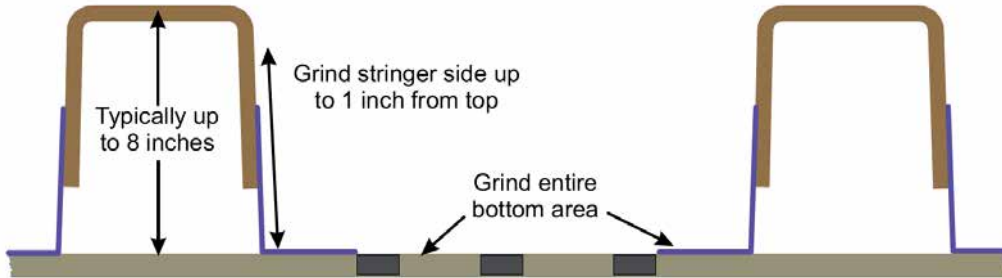
Fractured Keel Stiffeners





Keel Stiffener Repair

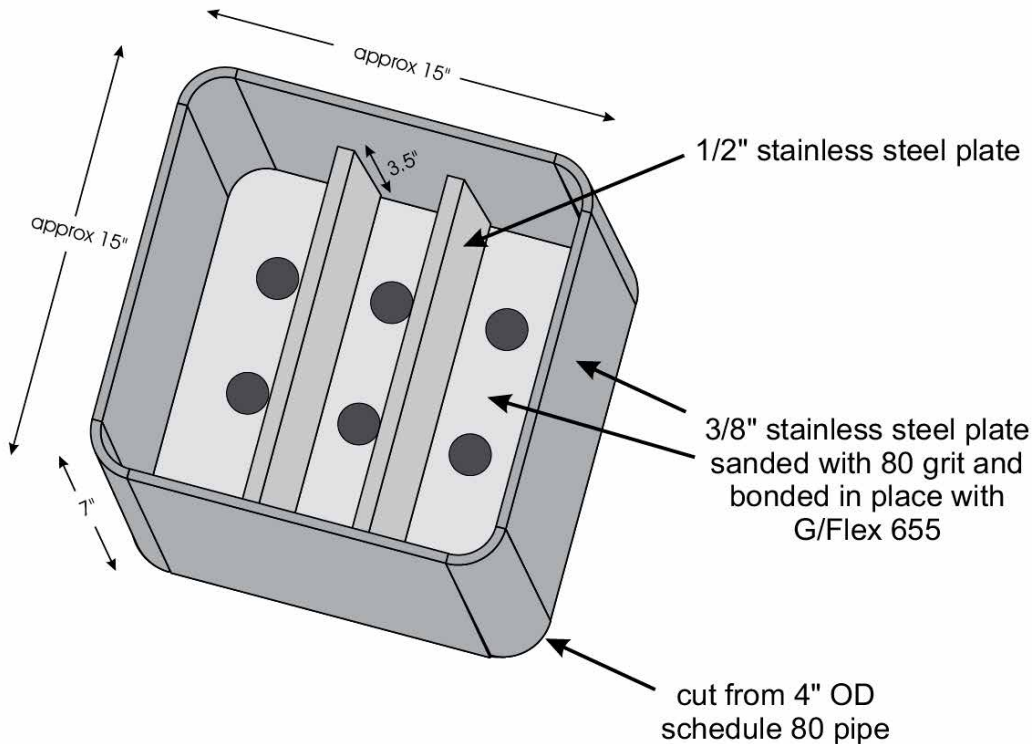
Prepare Area



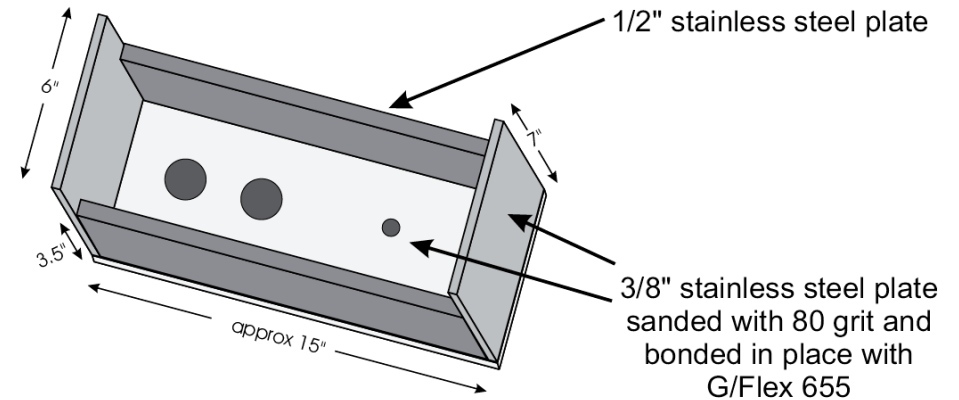
Tabbing Reinforcement



Forward Keel Box



Aft Keel Box





Repaired Keel Stiffeners





Damaged Rudders





Carbon Fiber Mast Failure



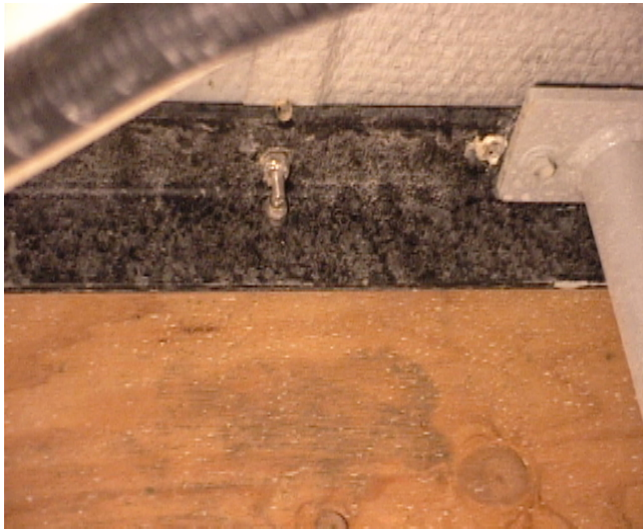
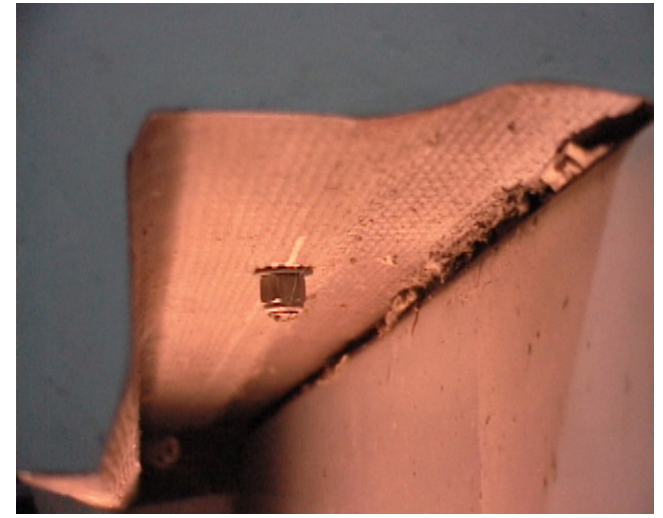
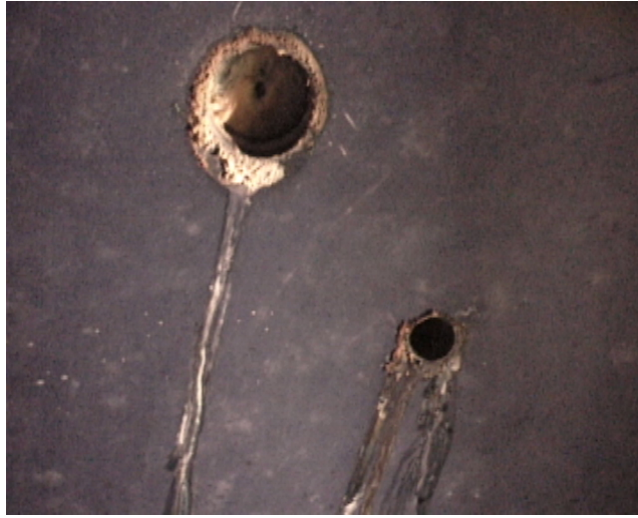


Moisture Ingress





Moisture Ingress





Core Water Damage

