

DELFTship tutorial – Leak points

Description

This tutorial shows some of the most common causes of leak points and how to repair them. Leak points keep the program from calculating hydrostatics as soon as they become submerged. As the hull definition is also used for creating tanks, leak points in the hull model will also show up in the tanks. Tanks containing leak points are not allowed.

In short every edge should be connected to two faces. If that is not the case then the edge is considered to define the boundary of the surface. Examples are the sheerline when no deck has been fitted, or a transom that not has been closed yet. All points on the boundary of the surface are considered leak. Think of the sheerline becoming submerged, water would rush over the edge. Exception to this rule are edges on the centerplane of the ship. They should always be connected to 1 face only since the hull is symmetrical and DELFTship automatically includes the virtual other half of the model. By including the virtual starboard side of the model edges on the centerplane are in fact also connected to two faces, one physical face and one virtual face.

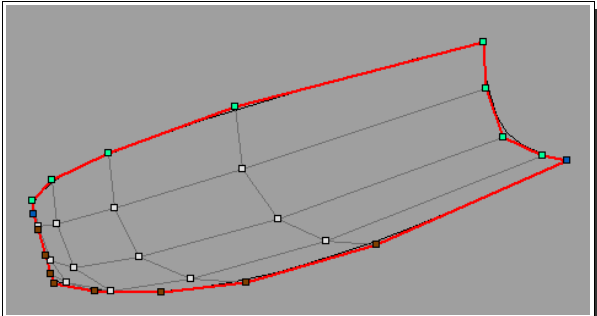
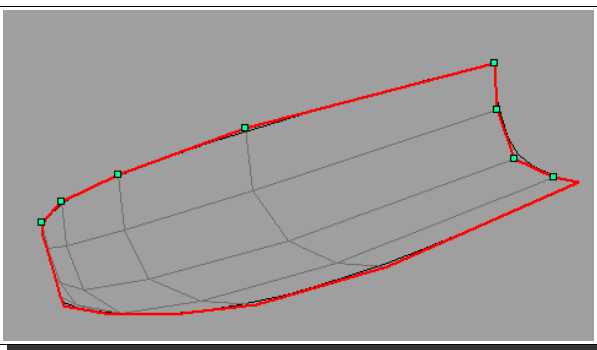
Now what is a leak point?

- **A leak point is a point not located on the centerplane and connected to an edge with only one face attached.**

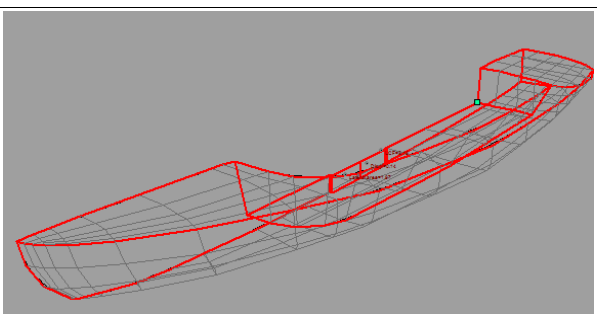
To solve the problem the boundary edge has to be identified and connected to a neighboring edge if possible. Remember that leak points are not always a bad thing. Leak points located on the sheerline of a small dinghy for example correspond to the reality. In this particular case the leak points can become a problem though if you need to calculate intact stability at large angles of heel. The solution would be to add a (temporary) deck to make the model watertight.

For a more elaborate description on leak points the reader is also referred to the DELFTship manual.

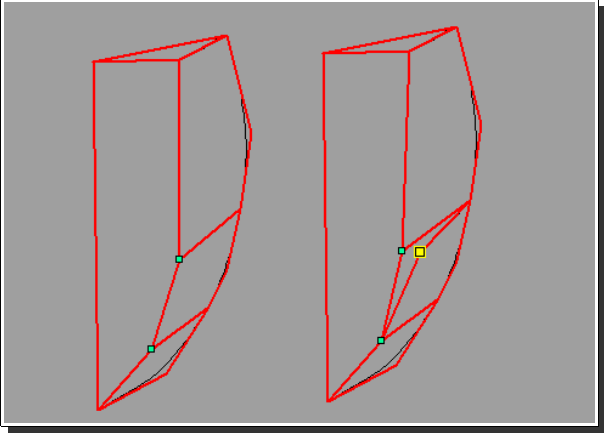
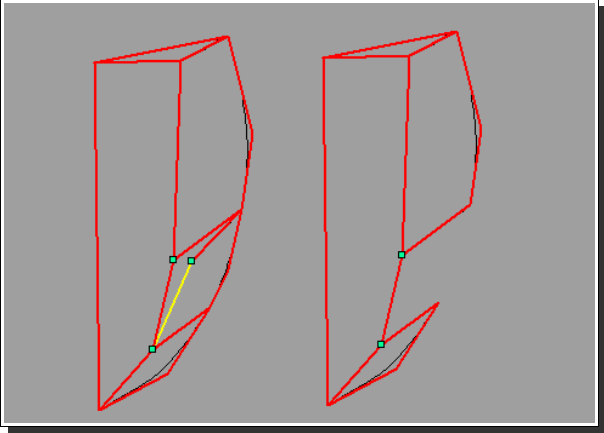
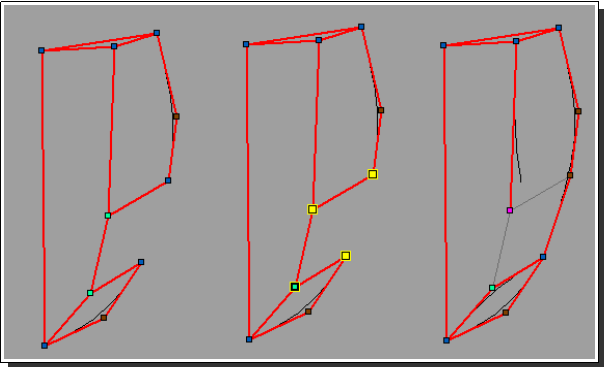
1. Identifying leak points.

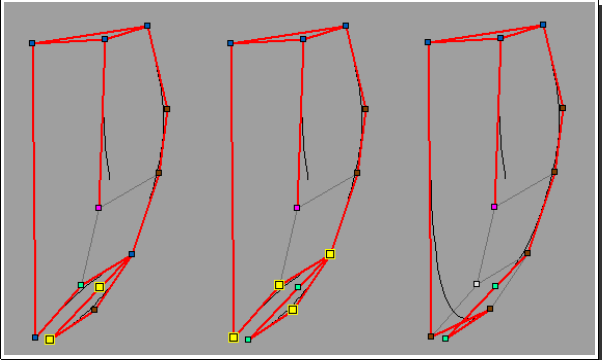
Description		
This step shows how to identify leak points in the first place since that is the first step on the road to a solution.	<p><i>Turn on the controlnet of your model by selecting Display => Controlnet from the mainmenu if the control points are not visible.</i></p> <p><i>Leak points can be recognized by the color that is used to draw them on the screen. The light green points are leak points. Sometimes locked points (drawn in grey) can be leak also!</i></p>	
In version 3.2 and later of the program it has become easier to identify leak points since it has the possibility to suppress the drawing of normal points.	<p><i>Select Display => Leak points only from the mainmenu to hide the normal points from your control net. Only the leak points are drawn now, so every point that you see is a leak point, regardless of its color.</i></p> <p><i>The image to the right shows that the model contains leak points on the sheerline and at the stern where the transom would be fitted.</i></p>	

2. Leak points on the centerplane

Description		
Often leak points can be found on the centerplane. In almost any case this is caused by incorrect placing of the Y-coordinate of that particular point.	<p><i>Click on the leak point. The coordinate window appears displaying the X, Y and Z coordinate of the point. Make sure that the value for the Y coordinate is exactly 0.000</i></p>	

3. Removing double edges

Description		
<p>Another common error is the positioning of two different points on the same location in space. If that is the case one of the points must be removed and its geometry connected to the other point</p>	<p><i>The model to the right shows part of the bow of a kayak. The model has been created to check the volume of a buoyancy tank. The leak points are caused by the fact that the bulkhead is not properly connected to hull.</i></p> <p><i>One of the first things you should do after having selecting a leak point is to move it (for example by using the arrow buttons on the coordinate window or the cursor keys) to check if a crack appears in the geometry. This is shown on the right side of the illustration. You can see that the bulkhead is not properly connected to the hull. There are two edges connected to the yellow point that are double.</i></p>	
<p>One of the edges causing the problem is removed.</p>	<p><i>Select one of the double edges and delete it. The connected face will be deleted also resulting in a hole in the model.</i></p>	
<p>The geometry is fixed by adding a new face in place of the old one that properly connects all the edges again.</p>	<p><i>Select Display => Leak points only from the mainmenu to turn on the display of all the control points again.</i></p> <p><i>Select the four points with your mouse in counter clockwise order. Not that the bottom left selected point is drawn differently than the top left selected point! This indicates that there are two points on exactly the same location. The selected point is partially obscured by the other point that is drawn on top of it.</i></p> <p><i>Add a new face to the four points by selecting Edit => Face => New from the mainmenu.</i></p> <p><i>The presence of the double point is confirmed by the fact that after having</i></p>	

	<p><i>added the new face still one leak point remains.</i></p>	
<p>This final step shows a special trick to avoid loosing part of your geometry when deleting items.</p>	<p><i>To fix the last leak point we could delete the lower panel of the hull. But by doing so we would lose the foremost control point of the bottom.</i></p> <p><i>Here's a better solution:</i></p> <p><i>Select the two aft most points of the lower hull panel and increase their y-coordinate. Now select the four control points forming the new lower hull panel and add a new face.</i></p>	
<p>Now we have two lower bottom panels in our hull. The old one is removed and the knuckle lines are restored.</p>	<p><i>Select the aft edge aft the old lower bottom panel and delete it. The lower bottom panel connected to this edge will be deleted by the program also.</i></p> <p><i>All that's left to do is to restore the knuckle lines. The resulting model is free of leak points.</i></p>	