BOLER DOOR FIX

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PREFACE

We have to understand the properties of fiberglass to be able to deal with its shortcomings in order to work with this material. Firstly, fiberglass (Reinforced Fiber Resin) provides a clean, reasonably strong light weight membrane for protection from the elements. Fiberglass itself is not structurally strong unless is reinforced with wood or metal components embedded into the layers of glass during the layup process. Another method of adding strength to fiberglass is to mould ribs or troughs into the glass shape itself rather then leaving a perfectly smooth surface.
The following discourse is only for general information. Some of it will become more obviously useful later in this discussion.

METHODS OF PRODUCING FIBERGLASS SHELLS OR SHAPES

(a) HAND LAYUP- The chop strand matte blanket or roven woven blanket is laid in a mould and coated with resin. Roven woven blanket is used more so in boat hulls. Chopped strand more in one off, or small production runs.

(b) SPRAYED COPPED STRAND LAYUP- The chopped strands are loose fibers and are sprayed in to a mould with a special spray gun that mixes the resin with the strands while spraying. This method is used mostly for large production runs such as shower enclosures, bath tubs, etc.

(c) DOUBLE MOULD PRESSURE MOUNDING- The chopped strand matte is laid in a mould, the resin applied, and then the other half of the mould is closed over it and pressure is applied. This method is used on some snow mobile hoods, motorcycle parts, race car parts etc. It provides a nice smooth in side surface which the previous methods do not.

(d) EXTERIOR FINISH- In all of these methods a mould release wax is applied to the mould and then a color gel coat is sprayed into or over the mould. This layer is only about 4 one thousandths of and inch thick. It is added to give color and protection to the outside surface of the shell. It also protects the under laying fiberglass matte and resin from deteriorating from the ultra violet light in sunlight.

(e) ULTRA VIOLET DEROGATION- All plastics are susceptible to deterioration from sunlight. Some companies do provide a UV inhibitor in their FG products. The gel coat will protect the under layers for many years but eventually it will keep get a chalky finish to it. There are a number of products on the market to rejuvenate the gel coat but they will eventually lose their effectiveness. Then comes the time to switch to paint. You will see many products discussed on the RV Forum.

ATTACHING FITTINGS AND DEVICES TO FIBERGLASS SHELLS

(a) MECHANICAL FASTENERS- The most common types are:
    (a) Pop-rivets
    (b) Screws
    (c) Bolts and nuts
    (d) Adhesives

(b) **POP-RIVETS-** are used by many fabricators over the years for attaching items to fiberglass shells. They are used extensively in snowmobiles etc. They are used by many fabricators because they give good mechanical connection, are light, cheap, and quick to install. The one big disadvantage that I have seen over the years is using them in application like the FG Travel trailers. Once the mandrel has been pulled through, there is now a conduit right through the middle of the rivet that allows water to pass through. Hence many people find their floors and other areas rotting out. When a company is producing hundreds of units, using pop-rivets is one way to keep the time/cost element down.

(c) **SCREWS-** are used on many occasions into fiberglass but, should not be only into the fiberglass shell. They have a tendency to rust away and they should always only be used when there is embedded wood or metal to screw into. You will read on the forum where people have found the embed wood has rotted because water made its way in.

(d) **BOLTS AND NUTS-** These are the most ideal way to fasten items to fiberglass. The only disadvantage may be that when using them is it is advisable to use a small soft plastic washer under the head of the bolts to prevent leakage. See note below.

(e) **ADHESIVES-** There are a number of modern adhesives available that are excellent for bonding FG to FG, Metal to FG and so on. FG Resin is good in some applications, 2 part epoxies are good and one of the best I have found for metal to FG is a product called Silaflex 291 used for gluing aluminum boats together rather than welding them. It is strong and water tight.

Note:
Case in point, the Boler we bought had always been stored inside or undercover and did not appear to have ever been in a rain storm. Therefore no signs of leakage. On one of our early outings we got hit with a heavy rain storm. Of coarse the rivets on top leaked all down the cabinets. I made it my prime goal to replace every pop-rivet with pan head stainless steel bolts with soft plastic washer to seal them. We have been in a couple of rain storms since and I closely inspected everywhere and found not one drop of water.

Another point is, where ever possible use stainless steel nuts, bolts, screws and washers. Many steel fittings on the inside and outside I removed had rusted and stained the lining or gel coat. All have been replaced with stainless steel, aluminum or plastic parts.

1/11/2009

DESIGN FAULTS OF THE BOLER TRAILERS

There are two main design faults that show up in the Boler design. Generally it is a good design for its time in the early 1970s and has endured well. They are:

(a) **FRAME-** The frames of the Boler where fabricated of too light a gauge of rectangular tubing, thereby prone to cracking and breaking at the front as it enters under the body. The other place for problems has been near where the torsion bar axle was mounted to the frame. I can understand the designer's intent to keep the trailer light enough to be able to pick it up buy tongue and move it around. Many people use these on rough back roads for fishing and hunting trips and have come to grief because of a broken frame. In my opinion I don't believe the designer really intended these to be used other than on paved roads.

(b) **DOOR-** The doors where designed to be self supporting with a minimum of structure inside. They are of a two piece construction, the outer skin at least a 3 ply layup to an average thickness of 1/8" The inner skin is hardly more than a single layup and is only about 1/16" thick. On the inside there are only 5 horizontal wooden strips which act as spacers to keep the two skins apart. The two skins are bonded together to form a light door about 1 ¼" thick.
I think the designers were relying on the bonding of the two skins to keep the doors shape. What they didn't seem to realize is, over time, without any structural frame inside, fiberglass has a tendency to flatten out. They also provided no strength or support around the door latching unit or the window. I have looked at numerous Bolers and I can't recall seeing one on which the door didn't have the tendency to flatten at the bottom. With no inner frame the inside skin being so thin would get cracked easily. I had to do a lot o repair to the inside skin. Because of a lack of vertical frame in the door this allows the fiberglass curve to flatten.

After studying this for quite awhile I decided the best fix was to split the door panels and embed a welded square aluminum tube frame made to the shape of the body.

Figure 1

Fig. 1 Shows the two skins separated. We can see where the 5 horizontal wooden spacer strips where located. Note also, all the rivet holes on the flange of the inside skin flange. One of the previous owners had someone try to break into the Boler by pulling on the top of the door. This broke inner skin at the bottom of the window. The repair job was by some one who didn't

know how to work with fiberglass. They did a thin layup over the break and when that didn't give it enough strength they pop-riveted on aluminum angles. After I removed the angles the fiberglass just peeled off. After I cut the skins apart the inside skin fell in to several pieces. The simpler way to break-in would have been to remove the two hinge bolt and lift the door off.

Some owners on the forum claim that by removing to square tube stiffener on the hinge side of door opening and changing the bend it, that will make door fit better. I do not believe that would be to successful as the tube ends at the seat level approx. 16" off the floor. That is usually area of the door that tends to try and flattens out is below that.

REPAIRING BOLER DOOR

STEP 1- Remove the two ¼" hinge bolts and nuts. Set the door on two saw horses with the outside skin down. Have a carpet or blanket on the horses to protect the gel coat from getting marked up.
Remove all the hinge parts from the body and the door. Scuff the aluminum hinge casting and paint with Krylon fast dry lacquer. Clean the brass gimbals and check that the springs are in good condition. Replace the pivot bolts with Stainless Steel- ¼"x 2 "long- ¼"-20NC bolts an SS nylok nuts. Be sure to add a SS washer under the nut and head of the bolt. These prevent marking and binding on the hinges. For remounting the hinges to the door and body. (Fig 2) I replaced the 4 door side hinge bolts with ¼"-20 NC x ¾" long SS counter sunk head bolts and the inside body bolt are ¼"-20 NC x ¾" long SS Dome head bolts with 1 ¼"diameter SS fender washers. Used the large washers on the inside is important spread the loading stresses of the door over the fiberglass shell better.
Put all the hinge parts into a Zip Lock bag and set aside.

Figure 2

STEP 2- Remove the window, door latch mechanizium, strike pales etc. Clean up any parts, bag and set aside.

1/11/2009

STEP 3- Using just a hack saw blade of a fine toothed keyhole saw; saw around the perimeter in the fillet where the inner skin meets the outer side. Once you have done this you can carefully pry the skin off the wooden spacers. Then using an old wood chisel, tapping lightly at the end of the spacers you can pry them off. If there are any cracks or breaks on the inner skin now would be a good time to do a glass layup over the on the inner face. With mini grinder, knock off any bumps and ridges so you have a reasonably smooth surface on the inside of the skins. Wear a dust musk when ever you do any grinding or sanding on fiberglass. Set the skins aside. Any surface FG you are going to do a lay-up on must be first roughened up with coarse sandpaper.

STEP 4- Find a long piece of cardboard from something like a fridge or furniture carton, about 6 feet long by about 18" wide. With help of a spouse or a friend have them hold the cardboard against the door opening and trace the body profile. Do both sides to get a comparison? On ours it was ¼" or less difference. Set the template aside.

STEP 5- I next went to Princess Auto and bought their 12 ton tubing bender. I had already purchased my aluminum tubing. At that time they where $269 plus taxes so just over $300. About a month after I did the bending they had them on sale for $139. As seen as I really didn't need to do any more bending I returned it for the full price I paid, no questions asked. So the bender was free! The kit comes with 6 die sizes so I used one for about 1 ½" or 2" pipe so that square tubing would lay in it without twisting. I felt that using the smaller sizes it would have a tendency to twist, and you don't want that.
Do NOT attempt to do the major bends all in one shot or you will crack the tubing. Just keep moving the tubing back and forth and bend a little at a time. Keep checking the shape against your template and the body.
Fig 3 shows the template, welded frame and tubing bender.
Once you are satisfied with the shape is close enough the body shape, set those aside for now. You can now cut your cross members, spacers. reinforcing plates hinges tabs and miter the top pieces. I added cross bar each side of the door latch and 1/8" alum. plate to mount my door stop to. I also added some cross bars around the window opening so the new window I was instating would not collapse the skins. For the hinge mounting I added 2 tabs made from ¼" alum. Having the hinge bolt only through the outside skin is another reason these doors won't hang properly after awhile. Eventually the holes get elongated and the door moves on the bolts. Make sure on the width that it will fit nicely inside the flanges of the inner skin.

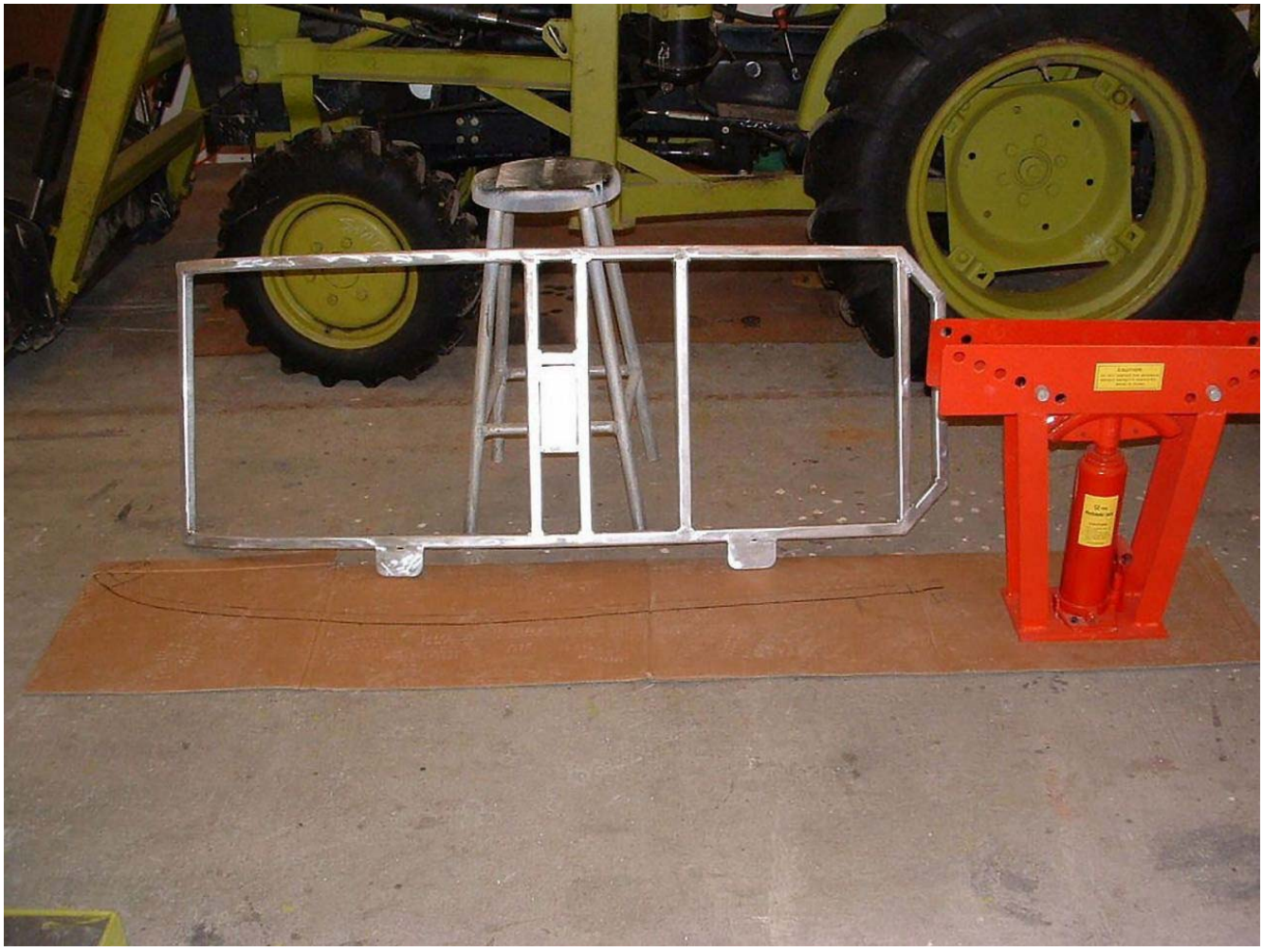

Figure 3

STEP 6- This shows the fist fitting after welding up the frame. (Fig 4) It had a slight twist to it which I attempted to get out but the frame was so strong I couldn't budge it. I thought OK I will live with it. It is amazing how much the skin flattens with nothing holding it. I had turned in my leased Argon tank I had for welding aluminum on my wire feed welder not long before this so I had to take the frame to a shop. He charged me $50 for his weld up.
Be sure to drill ¼" drain holes in each cross bar about 1 1/2" from each end. Many owners report their doors being full of water. Many say the doors where filled with various materials that where just saturated. The two main areas for leakage on the doors are;

(a) Around the window
(b) Around the door latches.

The one big problem I have found with these solid shell trailers is that the manufacturers seem to provide no gaskets or seal where there are penetrations of the shell. I have started a program where I have been removing every fitting etc. and installing rubber gasket under them. More of which I will mention later. I opted to not put any kind of material in my door, feeling that it serves no practical purpose or then sound or heat insulation.

Figure 4

STEP 7- The assembly. One of the biggest things I had concerns about was how was I going to put all this back together. I felt adhesive was the best why, but which one? I talked to a number of people and I tried several different construction adhesives that just didn't do the job on test pieces I tried. Then, I was in my favorite little marine supply store and told the owner the problem I was having bonding alum. to the FG. He grabbed a tube off the shelf and said "Try this, they glue alum. boats together with it rather than welding." That was when I discovered Silkaflex 291. The best damn adhesive I have ever seen. I did a test piece, left it over night and the next day put it in the vice and tried to get the 2 pieces apart. No way!

After I had checked the frame and door skins for the final fit, (Fig. 5) with a caulking gun I applied a ¼" wide bead of Silkaflex to the alum. frame. I than laid it on the outer door skin, double checked the location and then I used every clamp I had in the shop.

Figure 5

Leave the clamped up skin and frame overnight. The clamps can be removed and set aside ready for bonding the inside skin on. Note that previously I have cut the vertical stringer at point for mounting the latch mechanizium. (Fig 6)
You will see where a small amount of the Silkaflex squeezed out.

STEP 8- Next apply a ¼'wide bead of Silkafex to the frame, clamp up and again leave over night. After removing the clamps the next morning you can put them away, you won't need them again.

STEP 9- Now you have to roughen up the fiberglass all around where the two skins come together with 100 grit sand paper. Once done, blow off all residue or wipe down with lacquer thinner.
Now cut the fiberglass matte in to strips about 1" to 1 ½". Mixing small amounts of resin, apply the strips along the seam, making sure you soak the matte well. Always use fresh hardener. Old hardener will never let the resin set. I used do a hot mix when I am glassing by adding a few more drops of hardener to the resin. You have to work a little faster because it sets up quicker. Do the whole perimeter and let set over night.
The next day you can start sanding the new glass and applying Bondo filer to get a nice smooth fillet at the join. It may take a couple of applications to get a smooth fillet, just take your time till you are satisfied. It will be worth it.
I used a small wooden dowel with the sand paper wrapped around it. You can use 100 grit sand paper as you will have to use a primer on the door after you have got it all smooth.

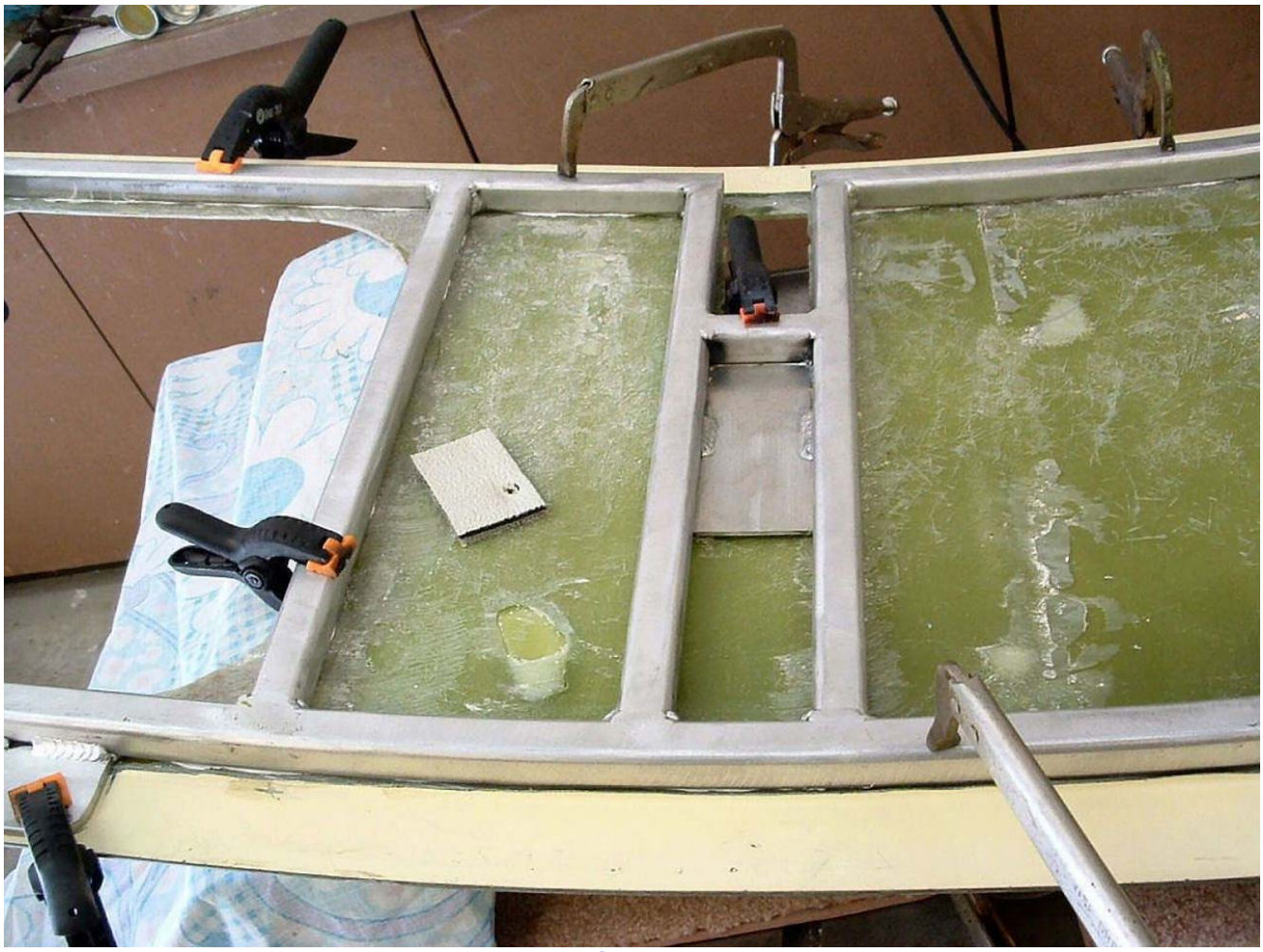

Figure 6

Fig 7 -Shows the door with the first stage of the glass and Bondo. I also had to glass in some pieces for the new radius cornered window I was installing. The where numerous holes where the pervious owner had mounted a screen door spring and chain to stop the door from swing back against the body. It didn't work! There were also holes where the curtain rod where mounted. I repaired the cracks above the door latch.

Figure 7

STEP 10- At this stage I drilled the holes in the alum. hinge tabs and threaded them for the new 1/14"-20 NC hinge bolts. I then counter sunk them on the inside. You do not want to have the bolt heads protruding. Because of the ¼" thick tabs the door is of coarse going to sit that far off the body because of the offset of the hinges. After I finished all the prep work I sprayed all the inside of the door and the top half outside. The bottom portion was pretty good condition. I left it to dry overnight and mounted the hinges the next day. I added rubber gaskets under the hinges to prevent leaks past the hinge bolts and stop marking my new paint. With the hinges now fastened to the alum. tabs there is no way the door can move at that point now.
Note: The hinges are numbered 1 & 2; the number 2 hinge goes to the top.

Figure 8

Fig 8 -Shows the out side with the fist coat of primer. I use Krylon White Primer as the cream color paint I found did not cover well unless I used primer. That is the proper way to go anyhow. I was able to find a very close matching paint, one at Canadian Tire and another at Lordco Automotive; I was not able to find a close color match for the lower body color. The better of the two was the one from Lordco. Both paints are a fast dry lacquer.

STEP 11- I hung the door with out over tightening the body hinge bolts to check for fit. I try to keep an even space between the door edge and body. As the body opening is not perfect all you can get is the best mean fit. When I was satisfied with the fit I tightened up the inside bolts.
I then installed the new window, door latch and strike guard handles and door stop and edge guard.

1/11/2009

Step 12- Now I could determine how much of a weather seal I needed. I found The Taco Marine Weather and Hatch seal was just perfect. I picked the 5/8"x 3/8" size. (See bill of materials) It worked well beyond my expectations.

The door was now so air tight I had to crack the vent or a window open slightly to close the door. I mounted the seal to the body rather then the door as it was originally. The reason being I did not have to cut it at the hinges thereby having a gap for another potential leak.
This pretty well finishes the project.
The rest is just detailing.

Figure 9

Fig 9 -Shows the finished door. Notice I added the plastic handle on both sides. I felt by using the handle on the door latch itself, they only being castings, that they may have a tendency to break. They are not available any more and I was lucky to pick up a brand new one for $95
I also added the door stop with the rubber cup and stand off pin so the wind would not slam the door back against the body and break the door and hinges. It is not meant to swing that far. Where the rubber cup it mounted is where I added the alum. plate. Everything that is attached to the door now is backed up by metal.

Note: I you are reusing you old window, when you go to reinstall it be sure to use 1/8"x 3/4"gray poly butyl tape. NOT putty tape. It is available at any RV supply.
You can also detect the color mismatch where I removed the table rail.

Figure 10

Fig 10 - Shows everything mounted except for the curtain rod.

Figure 11

Fig 11 -The new curtain rod mounted.

Figure 12

Fig 12 - I fabricated a new sticker guard for the latch from 1/16” SS sheet and polished it. Now that I had an alum. frame inside I had something to pop-rivet it to. Originally the plates where only pop riveted into the fiberglass.
I had to make it a little longer. Before I remounted the door latch I cut a rubber gasket from an old bike tire tube. I made one for inside and outside. Originally there was nothing on the outside, just another potential leak point.
I applied some chrome plastic edging all around the door to prevent chipping the edge. As this is where the most traffic is, it becomes the most likely place to get damage.

Figure 13

Fig 13 – I added a piece of Taco Weather seal at the edge of the threshold, 3/4”x 1/2” It is self adhesive.

Figure 14

Fig 10 & 14 - To finish off the door opening I used a white flexible edge trim by Trimlok (See bill of materials)
I also used the same product on the edge of my front rock guard. This shows the profile.

CONCLUSIONS

All in all, I am very pleased with the end result. I now have a door that is super strong, doesn't leak water or air. And when you swing it closed it make that nice sold sound "SNICK" like a car or fridge door closing.
There are only a couple of things I might have done different in hindsight, one, would to be add some 1" high density blue Styrofoam in the frame cavities, it would help with heat conservation and noise reduction. Also it does not retain water if you ever do get leakage. And, two I think I would have put a longer window in. The only thing that I can see wrong after 2 years is I think the door hinges have slipped a little so that the door is not quite cantered in the opening any more.
My fix, I think will be to fabricate two aluminum angle brackets that will go under the bolts inside and the flange would push against the square tube at the door opening. I would take the bolts right out , reposition the door and then install the plates and then tighten the hell out of the bolts. That would spread the stress loads even better over the shell and there should be no way the door could sag again.

My total hours of actually working on this where not likely over 20 hours. But because I let paint and adhesives set for 24 hours it seems like a lot longer.

1/11/2009

I believe my total cost was no more than $150, which included the aluminum tubing, welding, spray paint, primer, SS bolts, Fiberglass kit, Bondo, weather stripping, etc.

BILL OF MATERIALS

ITEM	Q"T"Y	DESCRIPTION	SOURCE	APPROX COST
1	1	20' length- 1" sq. x 1/8" wall aluminum tubing	metal fabricators	$50
2	1	1/8"x4"x8" aluminum plate	metal fabricators	scrap
3	2	¼"x 2"x3" aluminum plates	metal fabricators	scrap
4	1	Auto body Fiberglass repair kit	Canadian Tire	
5	2	Cans, Krylon White Primer # 41315		$12
6	3	Cans, plasti-kote Car Colour # 7202-	Lordco	$21
7	1	Can, Bondo	Canadian Tire	
8	13'	Trimlok Edge trim- White ½"x 3/16"- # 100B1X3/16	Marine supply	
9	13'	Taco Weather Seal #V30-0109 3/8"x 5/8"	Marine supply	
10	4	¼"-20 NC x ¾"SS counter sink head bolts	Marine supply	
11	4	¼"-20 NC x ¾"SS Dome head bolts	Marine supply	
12	1	Cartage- Silkaflex 291 bonding agent	Marine supply	$13

If you know some one with a tube bending machine that will be a big plus, however you could buy one at Princes Auto and after you are finished with it, return it. Just keep all the packaging.
If you have your own mig welder and can weld aluminum that would be a saving there.