

Gunwale (Canoe Rails) Repair Guide

Wood Gunwale Repair

Canoes with fine woodwork are a tradition at Mad River Canoe. The rails, seats and thwarts on your Mad River Canoe are native Vermont straight-grained ash, chosen for its resiliency, strength and aesthetic appearance. Unlike aluminum or plastic materials, white ash will not kink upon impact and cause undue damage to the canoe hull.

There are more options involved in repair of wood gunwales than with vinyl or aluminum, making this section a bit longer than the corresponding instructions for other types of rails. Don't let the length of this document intimidate you - here's an overview of this section to help you plan your repair strategy:

General Information - Everyone should read this section.

Pre-installation preparation - Everyone should read this section.

Gunwale replacement instructions - How to replace both rails of your canoe.

Replacing Gunwales with inset decks (including complete deck replacement) - If your canoe has inset decks you will likely have to replace them when you replace your rails. The other option is:

Short-splicing method to preserve original inset decks when rerailing - You may cut the existing inwales of your canoe to avoid replacing your existing deck. The new inwale must be carefully spliced to the section of existing inwale.

Installation of a 4' splicing section - If you have damage to a small section of gunwale, you can splice in a replacement section on the inside, outside or both.

General Information

Ordering replacement ash gunwales

Rails can be ordered from an authorized Mad River [dealer](#). Replacement ash rails are available for all Mad River Canoes. Due to their length, ash rails cannot be sent UPS. One alternative is to ship by common carrier (via truck) but this is expensive (.00 - 0.00) and is sent freight collect (payment due upon delivery). The best alternative is to coordinate an order for replacement gunwales with a boat delivery to your dealer. If this can be arranged there is no freight charge for gunwales.

A full set of rails has four pieces: two inside (inwales) and two outside (outwales) strips. The rails are not pre-bent or pre-drilled, but are flexible enough to follow the shape of the canoe by just clamping them to the hull.

It is possible to replace a single outwale or inwale or the gunwales along one side if desired. Specify what rail you need (inwale or outwale). For best results, however, it is recommended that you replace a complete set of gunwales. A better job results if all the rails are of the same age

and moisture content. Older rails, especially if they have not been reoiled, will be brittle and can break more readily than new ones soaked in a penetrating finish such as Gunwale Guard.

It is necessary to order rails longer than the length of your canoe to accommodate the curvature of the hull. To rerail a 14' or shorter canoe you will need 15' gunwales, 15' or 16' canoes will require 17' gunwales, etc.

Specify your canoe model and hull material when ordering gunwales.

Wood gunwales for Royalex canoes are flat sided and are installed flush to hull on each side with top of hull material exposed in center. Gunwales for composite or laminate canoes "cap" the hull with a kerf or lip to cover and conceal the sharp edge of the cloth laminate. Fiberglass and Kevlar canoes feature kerfed (lipped) outwales. If your boat is Kevlar/Airex, the inwales are kerfed. The gunwales on older Kevlar/Airex canoes are difficult to break loose as these rails were glued to the hull as well as screwed. Use caution in breaking the glue joint as damage to hull can result. If you can't. break the glue joint, it would be best to bring or ship the canoe to one of our Authorized Mad River Canoe Repair Centers.

When replacing gunwales, you may re-rail with the kerf inside or out, whichever is easier. It is possible to use rails for Royalex hulls on composite boats but the finish result is not quite as nice and care should be taken to sand the edge of the hull protruding between the rails. Gunwales for composite canoes will not work on Royalex hulls unless the kerf is removed.

Mad River ash gunwales can be used on canoes of other manufacturers. It may be necessary to make adjustments to accommodate existing deck designs.

Slotted inwales are available at additional cost.

Prior to 1985, Mad River Canoes were outfitted with square gunwales. At that time, Mad River switched to a rounded rail system for a more elegant, finished look and lighter weight. Replacement rails are available only in the rounded format. This system is very suitable for replacement of squared gunwales but will necessitate replacement of the decks as well.

Often, wood gunwale replacement will require replacement of decks as well.

Decks can either be inset (fitted flush with the gunwales) or capped (decks sit on top of gunwales). Replacement of inset decks is more difficult than replacing capped decks simply because the capped deck covers (hides) the ends of the gunwales whereas fitted decks require careful trimming and fitting for best results. This can be the most challenging part of rerailing your canoe.

Most of our laminate (Fiberglass, Kevlar, or Hybrid) canoes feature inset hardwood decks. These decks require additional procedures for replacement and are detailed in the body of the instructions. Decks are screwed in place when the canoe is built; (early ones were both screwed & glued). It is not likely that they can be salvaged separately from the original rails. Replacement deck blanks are available. They are rough sized and will need final shaping to fit properly. Please specify canoe model when ordering deck blanks. An option discussed below is to splice the replacement rails in place just behind existing decks.

It is possible to adapt capped decks to canoes originally outfitted with fitted decks if preferred for ease of replacement. If existing decks are in satisfactory condition, the option exists to splice the replacement rails in place just behind the existing decks.

In 1991, Mad River Canoe switched from mahogany to butternut as the material of choice for our wood decks. Mahogany replacement decks are not available. Specify which model you have in order to obtain the correct sized parts.

NOTE: In all cases, the serial number from your canoe can be very helpful in determining the original gunwale system used on your boat and determine necessary replacement components.

Pre-installation preparation

The rails are already dipped in a penetrating oil once at the factory. Additional sealing with penetrating oil such as Gunwale Guard™ before installation as well as after sanding the installed rails is recommended, especially on gunwale surface that will be installed against hull surface.

Replacement rails are finished natural. If you wish to replace stained rails, it is best to stain them to match existing rails before installing them on the boat.

In most cases, the rail screws are reusable as they are stainless steel and resistant to corrosion. It is recommended that to minimize the chances of stripping the screw heads, first back them out manually with a screwdriver and then remove with reversible drill with a #2 Phillips head bit. On the average, 80 screws are required to refasten a 16' canoe. It is recommended to have a package (12) of screws available should you inadvertently strip a few. Composite canoes use 1 1/4" screws and Royalex hulls require 1 1/2".

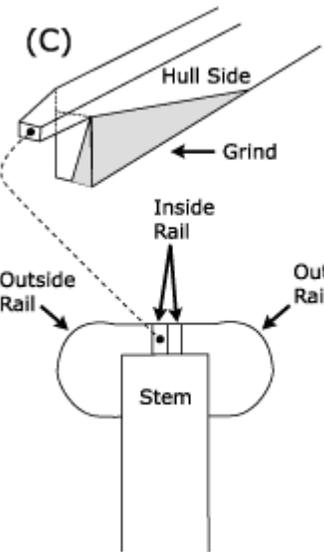
Gunwale replacement instructions

Tools Required

Variable speed reversible drill with bits:	6- 12 "C" or Welder's Clamps(2 or 3 spring clamps or bar clamps are helpful)
○ Tapered: 11/64"	
○ Straight: 1/8", 1/4", 3/16	
#8 Counter sink	20' Tape Measure
#P2 Philips Screwdriver bit	#2 Phillips Screwdriver
3/8" & 7/16" Wrenches	Wax pencil or similar washable marker
Sandpaper: Medium & Fine Grit	Saw
Gunwale Guard	Gunwale Guard Stain (if appropriate)

Procedure

1. Apply Gunwale Guard to all surfaces of new rails-follow instructions on the can. This is the time to make sure that the surface of the rail that will be against the hull will be thoroughly treated with Gunwale Guard. If stained rails are desired, stain rails prior to installation for best results.



2. Mark location of all thwarts/yokes, seats, carry handles on hull of canoe with marker. Trace outside of seat hangers to provide accurate reinstallation. All these fittings are hung from existing rails, removal of those rails will result in loss of position of original fittings.

3. Remove all thwarts/yokes, seats, etc. from canoe. Canoe will become flexible once seats and thwarts or yokes are removed. This is not a problem. If you are concerned with maintaining shape especially if gunwale replacement may take extended period of time, make a brace from a 2 x 4 notched at same width as canoe's original beam. Label and mark ends of seats, yokes, etc. right or left to ensure proper reinstallation. Attach all hardware so as not to lose any parts.

4. Run tape measure around hull under existing rail. Mark center point on each side of hull. These marks will serve as centering points for new rails.

5. Mark rail screw locations on inside of hull just below the rail, except at ends of canoe where marks will have to be made on outside of hull. 5a. If re-rail will include short-splicing inwale to preserve existing inset decks please refer to specific directions below at this time.

6. Starting from one end loosen and remove screws along one side of canoe. Leave other rail intact. You will be doing one side at a time. If the decks are mounted on top of the rails, remove the mounting screws at this time.

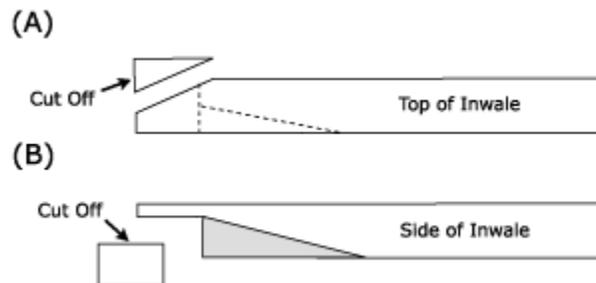
7. Remove old rails from canoe. If canoe has inset woods decks, use caution in removing old deck screws. They are 2 " long and should be removed slowly to prevent stripping of head. Clean exposed hull surfaces with GB-60 or a good household cleaner.

8. Using tape measure, locate center point of one pair of new rails. Mark point with marker on rails.

9. Position new rails on hull by aligning center marks on new rails with mark on hull. Clamp rails to hull at center point. Use of spring or bar clamps can be helpful at this point to temporarily secure rails to hull. Use C-clamps to finalize positioning. "S" hooks made from wire clothes hangers will help hold rails closer to hull at ends. Bend wire into an "S" shape, hook one curl over hull and set end of rail in other curl. Working towards one end, align rails even with top of hull (Royalex hull). For composite hulls, position rail with kerf as outwale and set so that bottom of kerf rests against top of hull. (Laminate hull). Clamp rail as needed, usually every 24-30". The use of cardboard squares inserted between the clamp and rail will lessen the compression of rail by the clamp. On laminate hulls, tamp rails on top with rubber mallet to make sure they are properly seated flush to top edge of hull. This is most important in the section of hull where rail begins to rise from center of canoe towards the ends.

10. The inwale will need to be trimmed to fit inside end of canoe. Holding the rail in place over stem of canoe, trace contour of stem of canoe onto rail so that rail will conform to hull shape. Make straight line at end of rail by sighting down to opposite end of canoe along keel line. Set saw just inside lines and trim off rail to form rounded end with straight side at center of canoe stem. If rerail job will include complete replacement of inset decks, care must be taken to ensure proper fitting of the ends of the inwales. The first inwale installed MUST be cut to fit flush against hull contour as well as along a center line INLINE to the "keel" line of the canoe. (See Diagrams

A, B, & C). The second inwale must be cut to fit against this centerline and hull contour. It is best to cut conservatively and hand shape with file or sandpaper to achieve best results. Set rail in place in hull.



11. Once at end of canoe, return to center point and repeat procedure to opposite end of canoe. Step away from canoe and sight along rail to make sure it runs fair. Adjust position if necessary.

12. To determine new screw locations, run tape measure along inside of rail and mark rail at midpoint between old screw locations marked on hull. It is recommended to drill new holes evenly spaced between the old, as it is a hit or miss proposition to accurately drill through old holes. It is preferable to drill new holes rather than enlarge existing holes. On Royalex hulls, space screw holes at 6" intervals; 6 1/2" for composite hulls.

13. Starting at center point and working towards first one end and then the other, using drill with 11/64" TAPERED bit and countersink, predrill holes as marked along the rails. Set countersink to length of screw being used (1 1/2" for Royalex hulls or 1 1/4" for laminate hulls). Be careful not to drill all the way through rail. As you approach end of canoe it will become necessary to drill rails from outside of hull when hull is not wide enough to allow drill to align properly.

(AT THIS POINT, IF YOUR CANOE HAS INSET DECKS, PLEASE REFER TO SPECIFIC INSTRUCTIONS BELOW)

14. Start screws in holes and finish seating with fitted Phillips screwdriver or drill fitted with P2 bit. Be cautious not to strip screw heads. For best results run screws to just snug with drill and finish tightening by hand.

15. Repeat steps #6-14 on opposite rail. When fitting the ends of inwale inside stem, trace not only shape of stem of hull but also mark where other inwale will contact and cut accordingly. A close fit is desirable, more so if you are fitting inset decks; it is not as essential with capped decks as they will cover this junction. An additional step to consider is to drill a 1/4" hole through junction of inwales where they contact end of hull. This hole will allow easier and faster draining of any water trapped inside hull when canoe is inverted for transport or storage.

16. Drill 1/4" holes where marked for replacement of thwarts/yokes and seats. Using original hardware, reinstall fittings. Prior to inserting bolts, dip bolts into penetrating oil as this will aid in protecting internal wood surfaces newly exposed by drilling.

17. Using 3/16" bit and countersink drill holes to reinstall carry handles (if applicable).

18. Sand top and sides of gunwales with 120 grit sandpaper. Wipe clean and wet rails with Gunwale Guard. Remove excess and spillage from hull immediately.

19. For capped decks, center decks over ends of canoe and using 1/8" bit drill, drill through original holes in decks into new rails. Insert screw immediately after each hole is drilled to prevent deck from shifting.

Replacing Gunwales with inset decks (including complete deck replacement)

Additional Tools/Materials required:

Waterproof Wood Glue

(12) 2 " Stainless #10 Screws

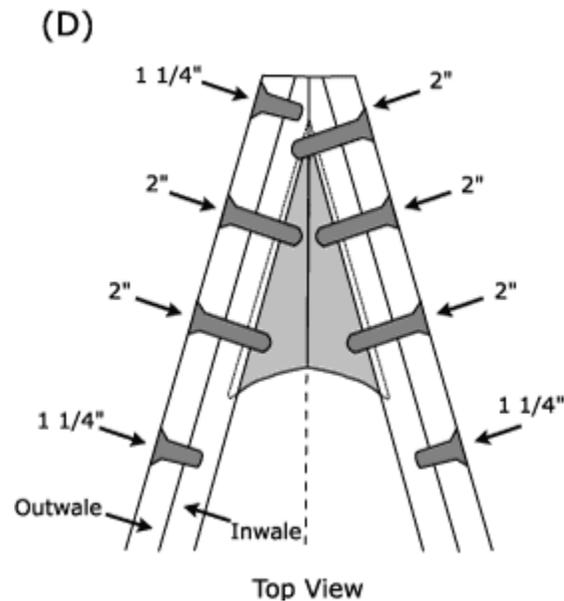
100, 120, 180, & 220 grit Sandpaper

File

1. FOLLOW THE STANDARD PROCEDURE ABOVE TO STEP 13 ONLY.
2. Treat underside of decks with Gunwale Guard and allow to dry before commencing installation.
3. As instructed above, drill and install screws to secure rails about 4' from center in either direction. Trim ends of inwales to fit inside end of canoe as described above. Leave ends of rails loose. Repeat procedure on opposite side.
4. Align the outside rails along the outside edge of the hull. Hold the decks in place over ends of the canoe and mark point on rail where deck ends. At the bow and stern drill with 11/64" tapered bit from the outside and countersink for four screws evenly spaced on each side of deck. Trim off the ends of the outwales, leaving about 1/4" overlap past end of the hull. Insert a standard gunwale screw (1 1/4 or 1 1/2") in holes nearest point of deck on one side (see Top View Diagram on Page 7) to secure gunwales while installing the deck.
5. Test fit deck by inserting deck dry. Mark any areas where fit is not correct and shave, file, or sand deck or inwale to allow proper fit.
6. If satisfied with fit, remove deck. Apply epoxy with a putty knife, coating the inside curve of the deck along both sides. Reinsert the deck and tamp into place with rubber mallet. "Lock" decks up in ends of canoes by securing a C-clamp to gunwale at junction of rear edge of deck. Epoxy should ooze from the glue joints. Remove the excess with the putty knife.
7. Leave standard gunwale screw in last hole and re-drill other holes so that drill penetrates into deck. Insert 2" screws and drive screws home. Remove standard screw set in last hole on one side (see illustration D) and re-drill and insert 2" screw and drive home. Leave short screw in place on opposite side. Repeat procedure to install other deck.
8. Make sure all of the screws are in tight. Proceed to install remainder of gunwale screws on rest of rails and remove the clamps. Resume re-rail procedure as described above as regards installation of seats, yokes, thwarts and carry handles (steps 16 - 18).

9. Trim ends of outwale on slight angle with edge of outwale against hull being further forward than outer edge. Sand or file edges of cut to relieve sharp edge.

10. Sand the decks and rail joints for a smooth finish. Start with 100 grit paper to remove the top 1/16" of the deck. Be very careful not to sand too deep so that the deck screws are exposed. Change to 120 grit for a smoother finish. Finally sand with 180 and 220 grit wet/dry sandpaper using Gunwale Guard for a smooth finish.



Short-splicing method to preserve original inset decks when rerailing

1. FOLLOW RERAIL INSTRUCTIONS THROUGH STEP 5. After seats, yokes, thwarts, carry handles are removed, lay new inwale on top of existing inwale and clamp in place. Make sure center mark on inwale is aligned with center mark on hull. Trim each end of inwale 3" short of end of deck. Release clamps and slide the new inwale into canoe under existing inwale. Align center marks and clamp in place.

2. Remove the screws located approximately 12" from end of decks. Draw a line bisecting a screw location at a 30-degree angle across the old rail. Angle should run so that end against hull will be closest to deck.

3. Making sure rails are firmly clamped to each other, pull both rails far enough away from hull to allow both to be cut with a saw. Cut both rails on line marked. Repeat procedure for opposite end.

4. Unclamp new rail and set aside. Remove old rail and clamp new one in place with outwale after coating ends with waterproof wood glue. If cut is correct, the new inwale will slide snugly in

place of the old. Drill holes and set screws as described above. Drill and set screw through old hole bisecting the splice cut.

Installation of a 4' splicing section

If you have only a small section of rail needing repair, consider using a 4' Splicing Section. Splicing sections significantly less expensive to purchase and to ship. They can be shipped UPS. Splicing sections work best at the ends of the canoe where the rails runs straight, not curving around the hull as in the center of the canoe. They can work on curved sections but care must be taken to fit splices carefully into existing gunwales and to secure them firmly. Avoid putting in multiple splice sections in any one rail.

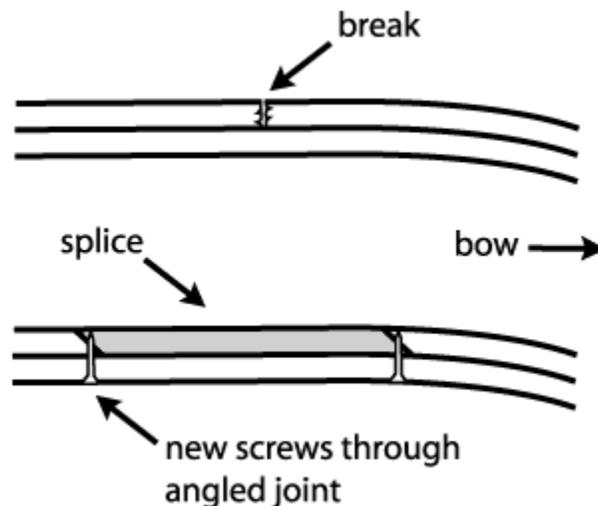
Tools/Materials required:

Saw	4 C-clamps (2 spring or bar clamps are helpful)
Phillips Screwdriver	Masking tape
Waterproof Glue	Gunwale Screws
Protractor with straight edge (in case existing fasteners are damaged)	Non-permanent Marker
Drill & 1/8" bit	#8 x 1 1/2" Self-tapping stainless steel flathead screws (2 required for each splicing section installed)
File	#8 Countersink (if repair requires redrilling of rail screws)

Replacement of individual inwale or outwale section

1. Splicing sections are 4' long. Isolate the damaged rail section and mark at points on either side where gunwale is sound. On straight sections of gunwale, the marked section can be quite short; on curved sections best results are obtained if the section to be removed is longer. Remember you are limited to a splice no longer than 42"/107cm.
2. Cut splicing section approximately 6" longer than section of gunwale to be replaced. Run a comparable length of masking tape along side of hull under existing gunwale.
3. Center and Clamp splicing section to underside of existing gunwale to be replaced. Position clamps to inside of marks on gunwale and at ends of splicing section.
4. At marks, use protractor to draw a straight line across top of gunwale at a 30° angle with leading edge towards bow (see diagram below). This will keep your paddle from catching along rail at junction of splicing section and original rail.

5. Remove any gunwale screw that bisects your angled line. Carefully cut both original gunwale and splice along line. If you are working with a kerfed gunwale, you'll need to carefully cut the kerf as well. Cut at other mark as well.
6. Remove clamps holding splice in position and back out any gunwale screws between cuts. Damaged original gunwale should be easily dislodged.
7. Test fit splice into original gunwale. It may be necessary to lightly file ends of splice to get fit.
8. Once fit is fine-tuned, apply glue to angled ends of both original gunwale and splice and put splice in place. Clamp splice to hold position. Wipe up any glue oozing from joints. Remove masking tape from hull.
9. Using 1/8" bit, drill lead hole for #8 screw through each joint, positioned so that it bisects angled cut (as shown in diagram below). Insert screw and snug tight. If concealment of screw head is desired, make countersink shallow to prevent screw from protruding from opposite side of gunwale.
10. Once glue has set, back out any gunwale screws throughout repaired section. Using existing holes as guide, drill a little distance into splicing section to allow reseating of gunwale screws without splitting new gunwale section. Be careful not to drill all the way through the new gunwale.
11. Re-insert gunwale screws and tighten to secure new splice in place.
12. Sand splice and then finish with Gunwale Guard and/or stain as needed to make appearance consistent with existing gunwale.

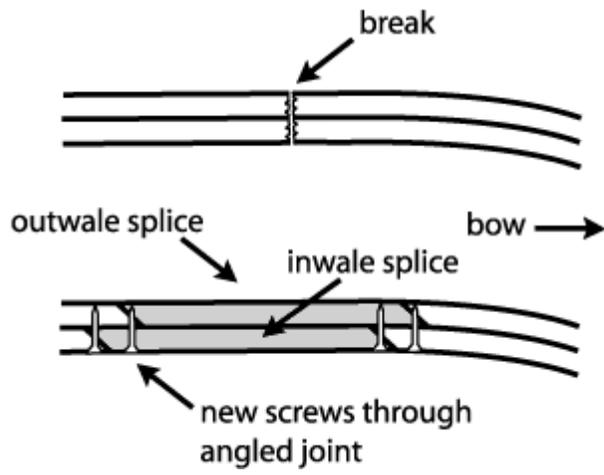


Outwale (or inwale) replacement

Replacement of both inwale and outwale section

1. Splicing sections are 4' long. Isolate the damaged rail sections and mark at points on either side where gunwale is sound. Stagger position of marks on each rail (as shown in diagram below). On straight sections of gunwale, the marked section can be quite short; on curved sections best results are obtained if the section to be removed is longer. Remember you are limited to a splice no longer than 42"/107cm.

2. Cut splicing section approximately 6" longer than section of gunwale to be replaced. Run a comparable length of masking tape along both sides of hull under existing gunwales. Tape is to protect hull finish from saw.
3. Center and clamp splicing sections to underside of existing gunwales to be replaced. Position clamps to inside of marks on gunwale and at ends of splicing section.
4. At marks, use protractor to draw a straight line across top of gunwale at a 30o angle with leading edge towards bow (see diagram below). This will keep your paddle from catching along rail at junction of splicing section and original rail.
5. Remove any gunwale screw that bisects your angled lines. Carefully cut both original gunwale and splice along line. If you are working with a kerfed gunwale, you'll need to carefully cut the kerf as well. As you get near the hull use a careful and light saw stroke to avoid scratching the hull surface. Cut at other marks as well.
6. Remove clamps holding splices in position and back out any gunwale screws between cuts. Damaged original gunwales should be easily dislodged. Remove one section at a time.
7. Test fit splice into original gunwale. It may be necessary to lightly file ends of splice to get fit.
8. Once fit is fine-tuned, apply glue to angled ends of both original gunwale and splice and put splice in place. Clamp splice to hold position. Wipe up any glue oozing from joints. Remove masking tape from hull. Once splice on one gunwale is clamped, proceed to repeat process with other splice.
9. Using 1/8" bit, drill lead hole for #8 screw through each joint, positioned so that it bisects angled cut (as shown in diagram below. Insert screw and snug tight. If concealment of screw head is desired, make countersink shallow to prevent screw from protruding from opposite side of gunwale.
10. Once glue has set, back out any gunwale screws throughout repaired section. Using existing holes as guide, drill a little distance into splicing section to allow reseating of gunwale screws without splitting new gunwale section. Be careful not to drill all the way through the new gunwale. If necessary, use countersink to "bury" screw heads as along original rail.
11. Re-insert gunwale screws and tighten to secure new splices in place.
12. Sand splices and then finish with Gunwale Guard and/or stain as needed to make appearance consistent with existing gunwale.



Splicing both gunwales