ASSEMBLY INSTRUCTIONS

SHEFFIELD #1 SECTION HANDCAR

1:12 SCALE (1" = 1')

Thank you for purchasing this handcar kit from Alameda Car Works. We've tried to make assembly simple and enjoyable. The instructions describe all the various operations (completely and clearly, we hope). At this point, instructions often say, "Read the instructions completely before beginning." It's a nice idea, but if you're like us you won't be able to resist jumping right in. So instead, we'll ask that you read and understand each paragraph completely before proceeding with that operation. We also recommend that you read one or two paragraphs ahead to get a feel for where you're going. You can use the little check boxes ❍ to mark off the steps as you complete them. The square boxes ❑ are extra detailing ideas that you can use if you're feeling ambitious. If you have any questions about the assembly, please feel free to contact us.

You don't need a complete machine shop, but you will need a few tools. The kit can be built with hand tools, but a hand-held rotary tool (like a Dremel™ or Foredom™) will be a big help. Besides the usual assortment of screwdrivers, hobby knifes, and files, You'll need the following sizes of drill bit: 1/16", 3/32", 1/8", 3/16", and #55 (0.052"), #56 (0.046"), and #57 (0.043"). A caliper of some sort (dial, digital, or even vernier) will be indispensable for making measurements and identifying sizes of brass material. And finally, you may want to invest in a 00 socket wrench for tightening the miniature hardware that holds the frame together. If your local hobby shop doesn't carry these small wrenches, you can purchase one from www.microfasteners.com or jimorrisco.com.

Much of the kit is assembled with various glues. First, you'll need cyanoacrylates. Cyanoacrylate (CA) is the fancy name for what is generally called super glue. CA glues come in a wide variety of formulas. You'll need some thin CA (regular super glue, thin and fast-acting) and some thickened CA (thicker and slower). We use Pacer Technologies' ZAP and ZAP-A-GAP, but any good quality hobby CAs will do fine. As you may already know, thin CAs are very effective at bonding skin to almost anything. Don't glue yourself to the parts.

You'll also be using epoxy for some of the steps. We suggest using a clear or translucent epoxy with a working time of 10 minutes or more. (Most "30 minute" epoxies have about a 10 minute working time.) The longer work time means you won't have to rush the assembly. Faster epoxies tend to be much too brittle anyway. We also strongly recommend using a name brand epoxy (3M, Devcon, Loctite, etc.). It's important that the epoxy bonds be strong and resillient. And buy a fresh cartridge. Don't use epoxy that's been sitting around for a year or two. We use 3M's DP-110 and can recommend it highly. (No, we don't get any promotional considerations from Pacer or 3M. Yes, you can get DP-110 through us if you don't have a local source.)

All the various types of hardware included in the kit are shown in Figure 18. A parts map for the etched parts is also included at the back of the drawings. OK, enough talk from us, get the stuff out of the box and get started. And remember to have fun…

GEARS

❍ File the flat surfaces of the gear pieces (Figure 1) with a fine mill file. You can lay the file on the bench, place the stainless steel gear parts on the file, and rub them back and forth. This is to remove any metal that the laser might have spluttered onto the face of the parts. Also use a small round file to clean out the small center hole in the spoked drive gear and in the smaller pinion gears. Ream out the center holes in the drive and pinion gears and the two hub pieces with a 1/8" drill bit.

❍ Glue the pieces of the drive gear (the larger gear) together first. You'll glue one ring at a time to the spoked center. Line up the teeth and clamp the parts together. Three clothespins work really well for clamping these. Check the alignment carefully, looking at the teeth all the way around the gear.

❍ Glue the parts together with thin CA. Put a couple of drops of glue at the junction between the ring and the spoked gear and tilt the assembly to make the glue run all the way around the seam. Repeat for the other ring on the opposite side of the spoked center. Make sure the teeth are matching and square. If you get the parts together and you don't like the alignment, cut the gear apart with a hobby knife chisel blade (e.g. an X-Acto #17 or #18). Work quickly, the bond gets stronger with time for the first 10 or 20 minutes. Acetone or CA debonder may help to get the parts apart.

❍ If you have access to a drill press, you can make a simple jig to help assemble the gear segments. Drill a 1/8" hole vertically into a flat piece of wood or particle board. Put a 1" or so length of matching brass rod into the hole. By sliding the gear segments onto the rod and down

against the perpendicular wood surface you can assure that the gear will be square to its shaft.

❍ Add the hub to one side of the spoked piece. You can use a piece of 1/8" brass rod to check alignment. By eyeball or jig, make sure the rod is at right angles to the surface of the gear assembly. Also make sure you don't glue the rod to the gear. Use a tiny drop of thin CA to fix the hub to the gear, remove the rod, and then add more glue to secure the joint.

❍ Repeat the process for the smaller pinion gear. As above, you can use a piece of 1/8" rod to maintain alignment. Make sure the rod is at right angle to the surface of the gear assembly (either by eyeball or jig) and keep the teeth matched and square. Clamp the four segments together. Glue with CA applied in the valleys between every third or fourth set of teeth. Capillary action will take the glue into the spaces between the layers. Remove any excess glue with the edge of a paper towel. You can use a wire brush to make sure there's no dried glue between the teeth on either gear.

❍ Add the hub piece to one side of the pinion the same way you did with the drive gear.

❑ First detail note: The real gears were cast, not fabricated. You can simulate this by putting small fillets between the rings, the hub, and the spokes on the drive gear and between the hub and gear on the pinion. Use your favorite filler material (we use body or glazing putty) and wipe any excess away before it hardens (Figure 1).

FRAME PARTs

❍ Find the longitudinal frame members. The two plain ones are the side sills (Figure 2). The two that include the gallows frame are the center sills. Deburr all four thoroughly. Use a fine file to remove any burrs and slightly round all the edges. Be careful, the laser cut edges can be sharp. Make sure you remove any little drops of metal that have spluttered onto the surface of the parts. Also file away any prominent laser cutting marks from the cut faces. This is most important on the surfaces that will be visible on the finished model. Basically, the visible surfaces are the entire gallows frame, the unnotched surfaces of the sills and cap strips, and the notched side of the crossmembers. Also use a file to clean and square up the shallow notches where the frame parts interlock.

❍ Locate the five crossmembers and deburr them as well. Likewise, repeat the process for the two cap strips and for both diagonal braces (Figure 2).

❍ The ends of the center and side sills were used as handles when setting the car on and off the rails. Use a flat file to round the handle ends of all four sills (Figure 3). You can aim for a radius of about 3/64". Smooth and symmetrical are more important than the actual radius. Rounding the ends is much easier if you clamp the parts in a vise while you're filing them to shape.

❍ There's a Scotch-Brite pad included with the kit. We recommend cutting it into 1" x 3" or 1" x 6" pieces as needed to make it easier to work with. After deburring the aluminum parts, scuff them thoroughly with the Scotch-Brite. Not only does this smooth the filed edges, it will also give the surfaces a little tooth that will help paint adhesion. Notice that the Scotch-Brite does wear out. Move to a different section or a new piece of pad as the abrasive gets used up. When you're done, the frame parts should have a nice brushed aluminum look and no sharp edges.

❍ Sight along the length of each frame member. Sometimes the heat generated by the laser cutting will cause a slight bend. Gently remove the bends. We use a vise to lightly hold each piece where we want the bend while we *carefully* bend the part straight. Work slowly, bend a little, check for alignment, bend again if necessary.

FRAME PART PREP

❍ You're about to drill all the assembly holes for putting the frame together. This is a good place to use a drill press if you have one. However, a drill press isn't necessary. You can drill these holes with an electric drill or a motor tool. And if you are without power tools, you can drill the holes by hand using a pin vise. (We know because we drilled all the holes on our first build with a pin vise, just to be sure it was possible.) No matter which method you use, use a sharp bit and lubrication. WD-40 or isopropyl alcohol (rubbing alcohol) are appropriate lubricants for drilling aluminum. Clear the chips frequently while you're drilling, especially if you're drilling by hand. Also, no matter the method, hold the parts in a vise while you're drilling them. And always use protective eye wear when using motor tools.

❍ All these holes need to be drilled perpendicular to the top surface of the parts. Laser-like precision isn't necessary, but the holes do have to be reasonably square to the parts. If you're not using a drill press, go slowly and check alignment frequently.

❍ Centerpunch and drill #55 in the center of the notches in all four sills, the five crossmembers, and both cap strips. We recommend using a little magnification (like an OptiVisor) to ensure that the centerpunches are in the centers of the notches (Figure 3). As you'll notice, the middle hole in each center sill will have to be drilled from the bottom, the side away from the notch. Use a small square to transfer the location of the notch to the bottom side of the sill, then centerpunch and drill.

❍ While you're drilling the center sills, ream the five laser drilled holes in each gallows out to #55. As usual, keep the drill as perpendicular to the part as possible.

❍ Deburr all the holes after drilling. Straighten the frame parts again if needed after drilling and deburring.

❍ Figure 5 shows the assembled frame from the top and bottom. You'll notice we've numbered the crossmembers from front to back. Using these numbers makes it easier to describe the assembly. Go ahead and label the five crossmembers as shown. (We use an ULTRA FINE POINT Sharpie to write right on the parts. It's easy to remove the ink later with acetone.) Also note that the sills and cap strips aren't symmetrical. Their center notches are offset toward one end. Remember to keep those notches aligned when you're assembling the frame.

❍ Clamp the two side sills, crossmembers 1 and 5, and the two cap strips together. These are the outermost parts of the frame. Clothes pins work nicely for this. Place the clamps over the sills and the cap strips, just inboard of the crossmembers. Note that the notches in the crossmembers face down and mate with the notches in the sills. Make sure the notches seat completely into one another. Align the cap strips so they're directly above the sills. Check that the caps' and sills' center notches match. Ream the four corner holes #55. Drop an 00-90 x 3/4" RHMS into each hole as you drill it. You can temporarily hold the screws in place with bits of masking tape.

❍ Remove your clamps and slide crossmembers 2 and 4 in place. Then place crossmember 3. As you install the center crossmember, add both center sills. Trap the gallows part of the center sills on the center crossmember. Check that the middle notches in the center sills match the side sills. Replace the screws in the corners. Clamp everything back together. We've found the easiest way to do this is to clamp the sill, cap strip, and crossmembers on one side first. Get all the notches seated. Then do the other side and finish up with clamping the center sills to the crossmembers. Check that the frame is square. Work your way around the frame, reaming all the remaining holes through the cap strips, crossmembers, and the center and side sills. Again, ream #55. Don't forget to use lubrication. Make sure the gallows frames are vertical when you're reaming holes in the center sills. Drop screws into the holes after you ream them. Use 00-90 x 3/4" RHMS along the cap strip, and 00-90 x 1/2" RHMS through the crossmembers.

❍ Label *all* the parts so you can get them back together in the same orientation. The matching laser cut parts *were* pretty much identical to one another. However, once you've drilled and reamed them for assembly, they may not be interchangeable. It's important to be able to get everything back the way it was. The crossmembers should already be labeled 1 through 5 so that they go in the right order, front to back. Also mark each one's right and left end so you can orient them correctly. Label the sills left and right too. Disassemble the frame and once again deburr all the drilled holes.

❍ Counterbore the center two holes on all five crossmembers (Figure 3). The counterbore goes on the top, the side opposite the notch. Drill the counterbore with a 3/32" bit. You're doing this because most of these screw heads will be under the platform planks and so need to be flush. You can use one of the 00-90 screws to determine when you've drilled the counterbore deep enough. Go slowly, you don't want to accidentally drill all the way through the part. Deburr. (In case you've not heard the term, a counterbore is a shallow, cylindrical cutout that allows a screw's head to seat below the surface. It's like a countersink, except that the removed metal leaves a cylindrical cutout instead of a cone-shaped one.) Deburr.

GALLOWS TRUSS RODS

❍ Take a look at Figure 2. Mark the top of the gallows caps 0.3" from the outboard top corners. Mark the bottom of the center sills 2.07" from the outboard ends. Lightly centerpunch the parts at your marks; center the punch from side to side on the width of the part.

❍ Extend your marks to side of part. Using a straightedge to connect these marks, mark the angle of the truss rods on the sides of the gallows caps and sills. Drill the holes for the truss rods #55. Start each hole perpendicular to the surface at your centerpunches. After drilling in 0.030" or so (this distance is not critical) re-aim the bit to match your angled line. That first 0.030" is so the bit won't slip out of the hole when you angle the drill . Once you've started the drill, check the angle frequently. Not only do you want to keep on line for the angle of the truss rod, you want to keep the bit aligned with the gallows cap and the sill. You don't want the drill to come out of the side of the part. Drill both gallows caps and sills. As before, hold the parts in a vise while you're drilling. Deburr your new holes.

❍ Test fit a piece of 3/64" rod into the truss rod holes (Figure 4). Depending on how accurately you drilled the angled holes, you may have to ream the holes a size or two larger to let the rod slide through straight from sill to cap. (On the first car we built, we ended up reaming the holes to #54.)

❍ Use a slightly larger drill bit, say 1/8", to deburr the holes for the truss rods. You can hand hold the bit for this. Then, using the same bit, lightly countersink the holes on the top of the cap and the bottom of the sill. These countersinks will allow the #00 washers and the matching nuts on the truss rods to sit down slightly into the surface.

❍ Scotch-Brite a length of 3/64" rod. Cut four 3.75" lengths for the truss rods, deburr and square up the ends.