

# Shay - Boiler Cosmetics - Part I

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I'd been dreading dealing with the exterior of the boiler because sheet metal is involved. Also, there is very little in my reference books as how to do the jacket.

The goal is to finish enough of the boiler cosmetic details so that it can be painted and installed permanently; I'm getting tired of tearing the plumbing apart. The required tasks include

- stripping the paint.
- installing the smoke box rivet detail.
- installing the spacers that support the edges of the jacket
- installing the pads that support the domes, bell, generator and handrail stanchions.

- making the boiler jacket.
- making the bands

The first four tasks are described here. The jacket and bands are described in Part II

**Stripping:** The first job was to strip the paint. The photo shows the boiler after the stripping. The throttle gland and pivot fixture were not removed. All other plumbing was removed and the holes plugged. The cheapest stripper I could get at Wal-Mart was used (~\$4/qt and it took less than a quart.) The boiler will be blasted after all the spacers are tack welded in place.



**Smoke Box Rivet Detail:** The photo on the right shows the smoke box rivets on Cass 10. I want to simulate the row on the smoke box side of the joint to the boiler and the row adjacent to the front.



This shows the spacing to be about 3.5" and the heads to be about 1.25" diameter. The photo is of the right side side with the boiler to the left and the smoke box to the right. That is part of the smokestack base in the upper right corner.



No 2 drive screws (~0.158" head diameter) on 1/2" centers were selected to simulate the rivets. The fixture shown in the photo was used to locate the rivet holes. The fixture was made from 1/8" X 1/2" flat stock. The dozen holes in the fixture were laid out using the mill table before the fixture was heated and bent into the band. A hand drill was used to start the dozen holes in the smoke box. The last holes on each end were then drilled all the way through and an old drill though the fixture and one of the end holes was used to align the fixture for the next set of holes as shown in the photo.



The rear band of holes were located just to the front of the tube sheet weld. The holes could have been located a little closer to the front but I was concerned that moving the rivets closer to the front would increase the difference between the slope of the jacket and the slope of the top of the boiler. That is true but now I don't think it's a problem.

The marked holes for the front row of rivets are clearly visible in the photo.



I didn't want to use the hand drill to drill all the ~80 holes so I used drill press and the end of the shay transporter hydraulic table as shown in the photo. I was able to wrap one arm around the fire box area and hold the boiler at the correct angle to drill the holes. Took less than an hour to drill the holes. The holes were made with a #44 drill that proved to be too small. I later enlarged them to 3/32" which might have be too big. The #43 drill is probably a better choice,



The holes looked straight and even except for one near the top of the front. It was about 0.025" out of alignment ---- and in the most visible spot. I tapped the hole, installed a screw, filed off the head, reinstalled the drilling fixture, and then marked and drilled a new hole that was perfectly aligned. After all that I realized that the misaligned rivet would have been under the headlight and not visible.

This photo shows the rivet detail with the smoke box front and the smokestack temporarily in position.



**Jacket Spacers:** The jacket spacers were next. I'd installed 1/4" square spacers adjacent to the cab front and around the rear boiler mounts at the same time the rear boiler clamps were made. The square bars were tack welded to the boiler about every two inches using a small flux-in-wire welder. The procedure that worked best was to heat the center of the bar with the propane torch and bend the bar over the boiler. The bar was positioned and the first weld was made in the center of the bend. The 3 or 4 inch section next to the weld was then heated and, bent to shape and then welded. The weld was made at least 1" back from the end of the correct bend because it was difficult to heat the part next to the weld. Photo shows heating the rod with propane burner.



The rod being installed here provides the finished edge of the jacket so care was taken to keep it parallel with the row of rivets. The white deposits in the photo are flux residue that will be cleaned off when the boiler is blasted.



This photo shows the spacers at the joint in front of the steam chamber and at the front of the firebox transition.



**Boiler Top Layout:** Before proceeding it was decided to nail down here to place the sand dome, bell, generator and handrail stanchions. The next photo shows how things are positioned on Cass 5.



This layout is slightly different than the one Kenneth used. He has the sand dome about midway between the steam dome and the smokestack and the bell behind the steam dome. There is no generator shown on his photos. Ken uses two jacket pieces with the joint at the transition in front of steam dome. I was beginning to worry about the rear piece where I'd want good alignment with the front of the cab and also with the front of the firebox. That looked like too many constraints and I'd end up making it two or three times. After due consideration (the coin flipping process) decided on the following:

- Locate the sand dome near the front of the sloped section of the boiler as on Cass 5. This will require a small bend in the left side sander pipes so that they can pass behind the air compressor. I think my compressor is mounted slightly further back than on Cass 5.
- Position the bell midway between the sand dome and steam dome.
- Make a joint in the jacket behind the steam dome such that the steam dome is midway between the two joints. This is slightly ahead of the joint on Cass 5 shown above.
- Locate the generator behind the rear joint. This will give a little more room for the generator.
- Locate four handrail stanchions on each side of the boiler positioned as on Cass 5 (the rear one will be just behind the rear band).

**Pads:** The pads to support the domes, bell, generator and handrail stanchions were made from pieces of 6" pipe like used

for the boiler. The inside of the pipe was bored to thin the cross section to 1/4". An abrasive saw was then used to cut off the sections for the pads. The piece in the photo is for the sand dome pad. The biggggggg burner for the propane torch is being used to heat the piece. (While waiting for it to heat I started to think that all I needed was Longfellow's "spreading chestnut tree" --- wonder if an oak tree would work?)



After the piece got hot it was flattened slightly so that it conformed to the OD of the 6" boiler pipe. (I had to go back and heat it again and while waiting recalled my adult son noticed the new anvil some time back asked "is it an Acme anvil?" My thoughts then switched from shoeing horses to roadrunners.)



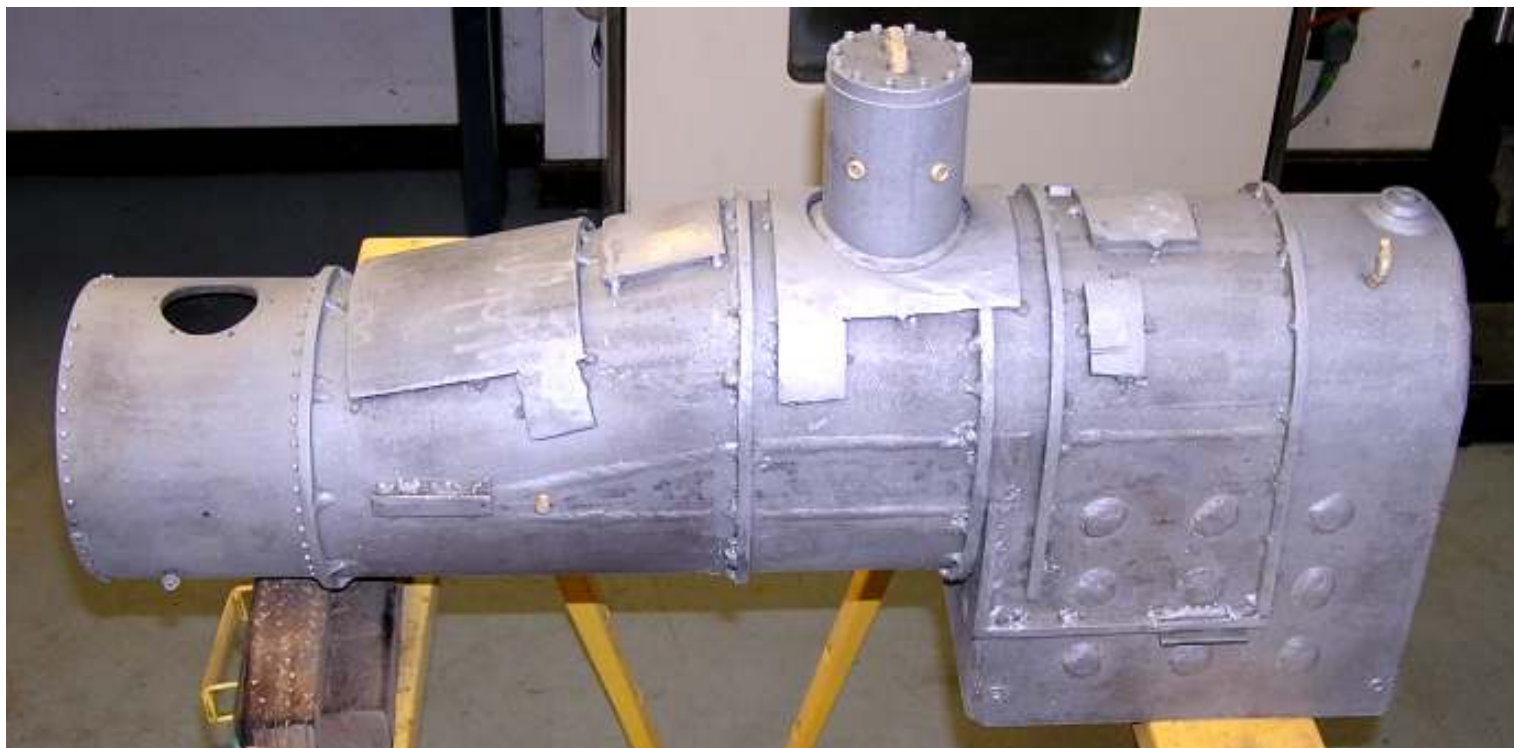
This photo shows positioning the sand dome pad. The jacked spacers on the front end of the sloped section is beyond the transition point where the straight section starts so the jacket will be more than the spacer thickness away from the boiler near the front part of the sloped section. The pad was shimmed away from the boiler as shown. The straight rod was used to make sure the the top of the pad was aligned with the spacers. The masking tape held everything in position while a couple spots were tack welded. The tape and shims were then removed and the pad tacked in a couple more spots.



The next photo show all the pads in position on the freshly blasted boiler. Note that another spacer was added behind the steam



dome for that second joint in the jacket. The exact placement of the bell, generator and handrail stanchions hadn't been decided at this point so the pads are much larger than necessary. A straight rod was used to test for high spots in the pads and any high spots were ground down to the point that they were even with the jacket spacers.



The jacket and bands are described in Part II.

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