Tsunami 2 Installation into a Precision Scale HOn3 K-28

By Chuck Graham Photos by the author

Photo 1. D&RGW 476, a Precision Scale K-28, leads a passenger train eastbound out of Chama. The locomotive is now equipped with a Tsunami 2 DCC sound decoder.

Some of us have gotten spoiled by Blackstone, who have produced some great HOn3 locomotives, complete with DCC and sound. I say spoiled, because in our homes we also have a fleet of DC brass locomotives in boxes, gathering dust. Some are unpainted but most are DCC-free with no sound. Speaking for myself, I had nearly 10 of these languishing beauties.

But now, some of them are returning to the rails, complete with DCC sound, thanks in part to the new Tsunami 2 TSU-1100 steam decoders from Soundtraxx (P.N. 884001). This decoder has quite a few new features, but its smaller size is a big plus when trying to cram it into a small tender. Other relatively new DCC accessories, such as smaller “sugar cube” speakers, have also helped. A list of parts is at the end of this article.

In this article, I will describe how I installed a Tsunami 2 DCC decoder into a Precision Scale brass K-28. I confess that taking apart a brass loco terrifies me – that after spending a lot of money, that I wouldn’t be able to get it back together without damaging it. While I’m still anxious while doing an installation, I don’t let that stop me anymore. And if you have the same fears, I encourage you to tackle the project head-on.

Initial preparations and planning the installation. Despite one’s hopes, installing DCC into a locomotive does not necessarily fix running problems. So, begin the project by lubricating the worm gear, axle bearings and the running gear, and making sure the locomotive runs smoothly at low speeds on DC. I used LaBelle 106 on the worm gear and ACT-3753 conductive lubricant (recommended for Blackstone locomotives) on the axle bearings and running gear. Everything seemed fine at this point, although running problems surfaced later (see below).

Since most of the components must be fit into the tender, the first step is to remove the tender shell to find how much space resides inside. The first surprise was how much usable space

was lost to the diagonal sheet for the coal bunker, which made it difficult to fit a 1st generation Tsunami decoder (P.N. 826104) and a mega bass speaker as originally planned (Photo 2).

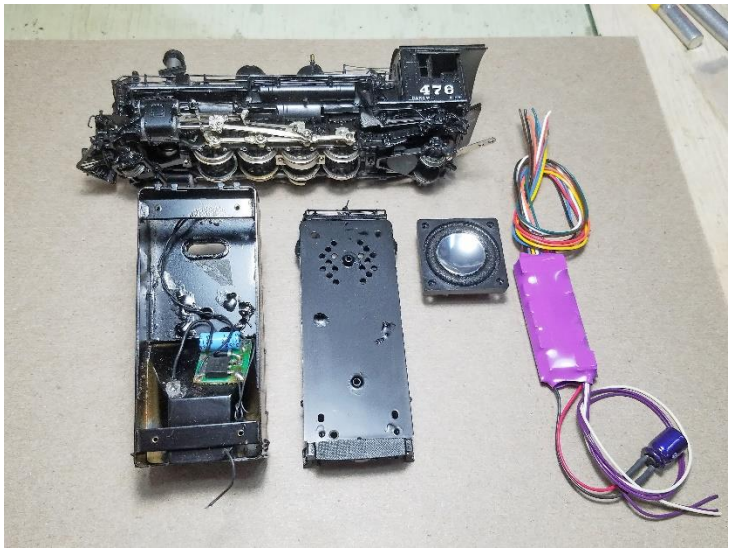

Photo 2: The original installation plan called for using a Tsunami 1st generation decoder and a 1" square mega bass speaker – but only with major surgery to the tender would these components fit. Switch to Plan B.

So, I went to a Plan B: installing the smaller Tsunami 2 decoder with a smaller oval speaker, which required making a styrene speaker enclosure to project the sound. I also added a KA 2 Keep Alive to maintain loco power over dirty track and other causes of momentary power loss.

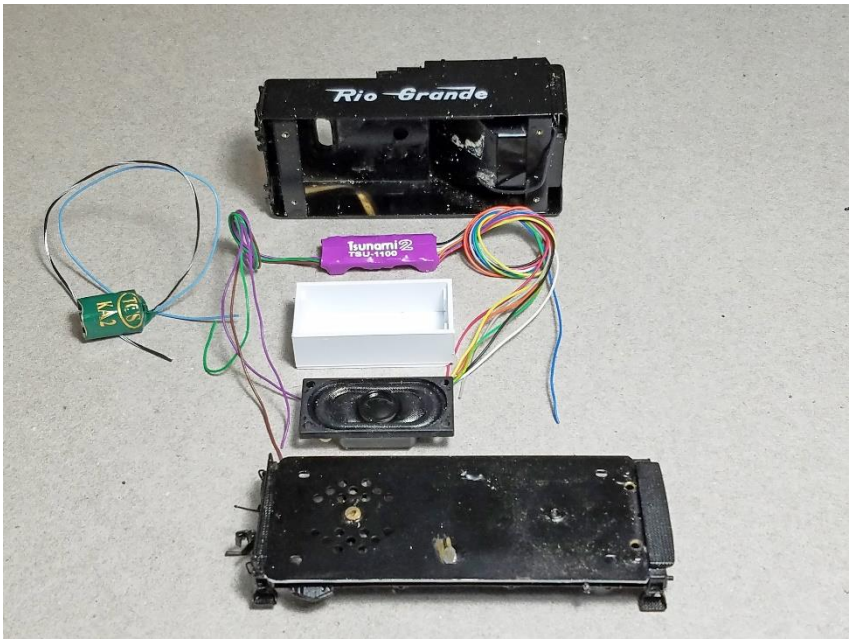

Photo 3: The Plan B components – Tsunami 2, oval speaker with scratch built styrene enclosure, and a KA 2 Keep Alive. The KA 2 is very effective at preventing stalls due to momentary loss of power, and is highly recommended.

Another consideration is the wiring connections between the locomotive and the tender. A basic installation will require 5 conductors to the loco: two for motor power, two for a front headlight, and one for power pickup from the drivers to the tender. The latter could use the tender drawbar, as originally wired for DC operation, but I chose to use wire instead. The next choice is whether to permanently wire the tender and loco together, which means that storage in the original box is probably no longer possible; or use a multi-conductor connector which can be pulled apart when stored in the original box. I chose the latter. The one I used is a 6-pin TCS #1477 micro connector with colored wires. It is quite small!

Locomotive modifications. First, the boiler was removed from the loco frame by removing several small screws, and the boiler weight was removed to reveal a directional headlight circuit board attached to weight. The headlight leads were unsoldered from the circuit board and the board was popped off the weight with a small screwdriver. The headlight is 1.5V (checked with a battery), but the decoder output is 12 V, so a 1 KΩ, 1/8 W resistor is required to prevent blowing the bulb. The resistor and a white wire was soldered to one headlight lead, and a blue (common) wire to other lead. All solder joints were insulated with shrink tubing. Some of the weight on the top was removed with a file to give space for the new headlight wire connections.

Next is connecting the TCS 6-pin connector wiring harness to the motor and loco frame. The Mashima can motor is already electrically isolated from the frame, and was measured to draw 90 mAmps running and 210 mAmps stalling, well below the 1 Amp current limit for the decoder. The wires to the motor and tender drawbar were unsoldered and discarded. Using the TCS 6 Pin connector, thread the wires under the cab floor and above the rear horizontal brake rod to keep the wires properly suspended, with 3 wires on each side of the tender drawbar screw to keep the connector located on the centerline of the loco. Feed the 6 wires through a 2mm long piece of 1/8” shrink tubing and locate this “cable tie” just forward of the tender drawbar screw. This keeps the wires loose but gathered between the wheels of the trailing truck (see Photo 4).

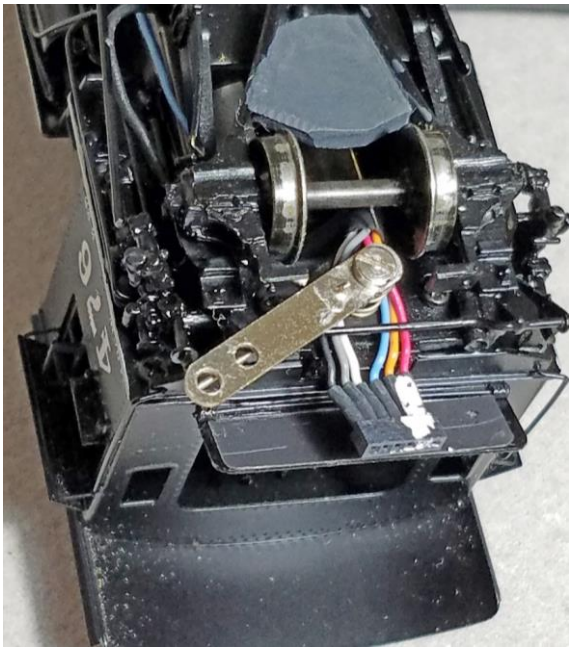

Photo 4. The colored wires of the 6-pin connector (female end) pass both sides of the tender drawbar screw and are re-gathered above the trailing truck by a short section of shrink tubing. From there the wires bend upward and gathered into two groups according to function.

Similarly, feed the red, orange and gray wires through a 7mm piece of 1/8" shrink tubing. Feed the white, black and blue wires through a 7mm piece of shrink tubing. These wires are now grouped according to function. The gray and orange wires are cut, ends stripped, tinned and soldered to the motor connections, while paying attention to polarity. The red wire is connected to the locomotive frame (pickup from drivers on the right rail). This connection is insulated with Liquid Tape; the exposed motor lead connections are covered with electrical tape.

The white and blue wires are connected to the white and blue wires from the headlight, with about 2+" excess length. The black wire is not used, so it was cut off and left as a spare conductor. This completes the wiring connections and modifications to the locomotive. Check to make sure that the boiler fits back over the motor and gearbox – the clearance between these is rather tight.

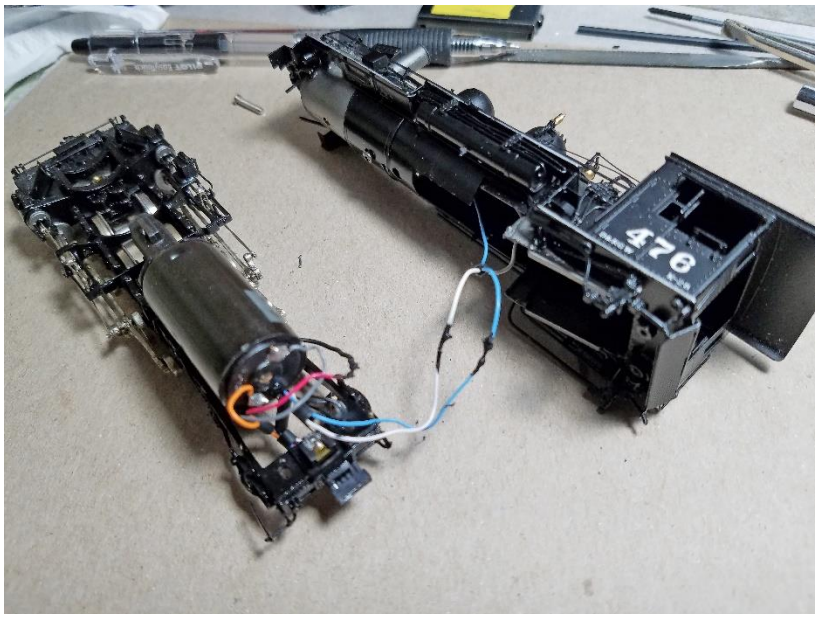

Photo 5. The wiring of the locomotive is completed, with the top of the 6-pin connector visible. The clearance when reattaching the boiler to the frame was very close.

Tender modifications for harness wiring. The tender came with a single hole in the floor for the DC wire from the locomotive headlight. A second hole is needed to handle wires from the 6-pin connector. After removing the tender trucks from the tender floor/frame, I drilled a 5/64" hole on the other side of the drawbar pin so the two holes are mirror images of each other, and de-burred the hole by hand-turning with a larger drill, to avoid fraying the wires in the future. Next I unsoldered the backup light leads from tender's directional light circuit board and popped the board off the tender shell with a small screwdriver. Then, using a Dremel cutoff wheel and a file, I ground down the oversized nub for the rear tender truck screw which protruded above the floor and interfered with location of a speaker. Similarly, I ground down the other soldered pegs of underside details (air cylinder, etc) and pegs of topside details.

Also using the Dremel cutoff wheel, I cut and removed the center portion of the forward brass bar that has the threaded holes for attaching the tender shell to the frame (this bar is just above the coil of colored wires in Photo 3). I made these cuts a few mm from the threaded holes, leaving the holes for reattaching the tender shell. This was done to make room for the wires which will come through the floor from the 6 pin connector. Note: I did not foresee the need to

do this until reassembly after the installation was complete. The tender shell would not fit tight against the floor until this bar was partially removed.

Speaker installation and DCC wiring in tender. Originally I wanted to use a Soundtraxx 1" Mega Bass speaker was chosen, but I discovered that there was insufficient room left for the Tsunami 2 decoder and the KA2 Keep-Alive, so I opted for a smaller Soundtraxx oval speaker. This speaker needed an airtight enclosure to project sound forward, so I constructed a box of 0.040" styrene sheet, glued together with MEK. The exterior measured 38mm x 18mm x 12mm, and had short posts in each corner to support the speaker which just fit into the opening. Two #61 holes were drilled through the end to take the speaker wires (purple) from the decoder. The fit of the speaker enclosure, KA2 and Tsunami 2 inside the tender was checked again before proceeding. One end of the enclosure had to be beveled to fit against the sloped coal bunker inside the tender shell. Finally, the purple wires from the decoder were soldered to the speaker terminals, the speaker glued into its box with Tacky Glue, and any holes in the enclosure was filled with either plastic putty or Tacky Glue. The speaker enclosure (avoid the speaker cone) was glued to the tender floor with Tacky Glue, just forward of the brass rear mounting strap of the tender shell. Let cure in place.

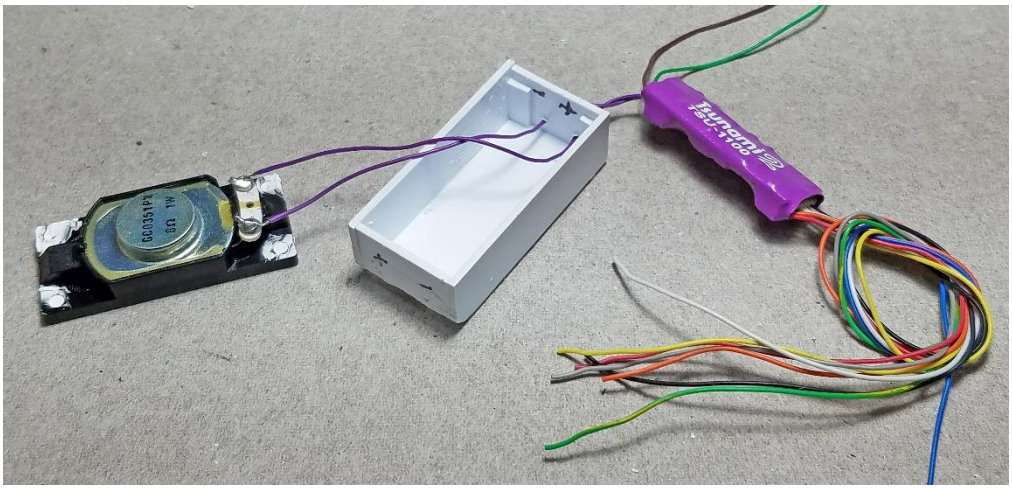

Photo 6. The speaker requires an airtight enclosure, made of styrene, to project sound. The speaker has been wired to the decoder, and will be glued (speaker cone up) inside the enclosure. The speaker assembly in turn will be glued facing down over the holes in the tender floor.

Three of the 6 wires from the 6 pin connector to the locomotive were fed through each of the two holes in the tender floor. The black wire was trimmed, as it is not needed but kept as a spare conductor. The other wires from the 6 pin connector and the decoder were trimmed of excess wire, and each color was joined – the white (headlight), gray and orange (motor) and red (right rail pickup) wires – using shrink tubing to insulate the connection.

Photo 7: The male end of the 6-pin connector and the 6 conductors were fed through the two holes in the underside of the tender (shown after reassembly of the tender).

The KA 2 Keep Alive was wired to the decoder, with the white/black wire of the KA 2 soldered to the decoder's yellow/green wire, and the connection was insulated with shrink tubing. One lead of the rear backup light (1.5V lamp) was soldered to a 1 KΩ, 1/8 W resistor and the yellow decoder wire. The blue wire (V+ common) from the decoder was soldered to several wires, including the 2nd lead to the backup light, the blue lead of the KA 2, and the blue wire from the 6 pin connector, with the connection insulated with shrink tubing. This completes the tender wiring. The loose wires were tied up with short strips of Kapton tape so no wires will stick out from under the shell when reassembled, and using the 4 small screws, the tender shell was reattached to the frame.

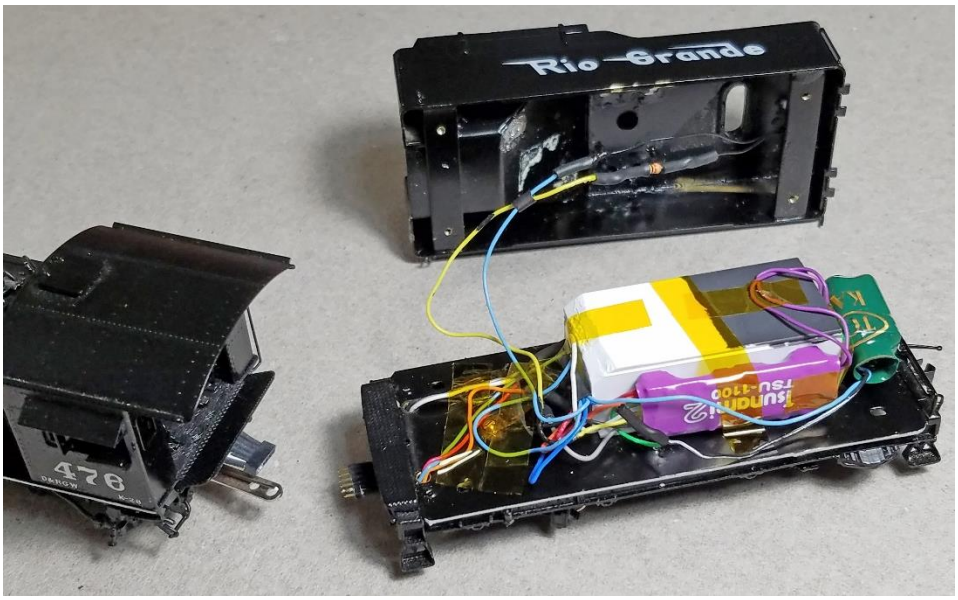

Photo 8. The completed wiring of the tender, with the two wires and resistor going to the backup light. Part of the speaker enclosure's top was painted black in case the tender's water hatch is opened. Note the two brass bars on the shell for attaching the 4 tender screws: the loose KA 2 can slide over the rear bar during reassembly, but the front bar was found to squish the 6-pin

wires. The center section of the front bar was removed to accommodate the wires, after this photo was taken.

Reassembly, basic programming and testing. I reassembled the boiler and loco frame, keeping the wires hidden behind the motor. Using small needle nose pliers, I plugged the 6 pin connector together and reattached the metal tender drawbar. Then I put the loco on the programming track and set the loco's long address to 476. I moved the loco to the test track or main line and checked for correct direction, sound and light functions. Note: the loco ran in reverse instead of forward, but the lights were correct. Changing CV 29 from 034 to 035 (as read on the programming track) corrected the direction but the lights now were reversed. At this point, I disassembled the loco and reversed the wires to the motor, and this corrected the problem: both direction and lights were now correct. Polarity makes a difference!

The following basic CV settings were set for the K-28 Class of D&RGW locomotives.

CV No.	CV Name	Value	Setting
120	Whistle	018	D&RGW # 473
123	Exhaust Chuff	001	Medium exhaust 2

Other CVs can be changed to achieve other operating, sound and lighting effects as desired.

Testing on the layout. The real test was to run the loco on a challenging section of track: for me, that's the start of the grade and a 22" radius curve east of Chama on my home layout. I immediately discovered three problems, only some of which had shown up while testing on DC:

- Intermittent short circuits
- Occasional stalling with wheels spinning
- Trailing truck derails on outside of curve (engineer side) when going in reverse, especially at the interconnect between the lift-out section and the start of the grade

I began the troubleshooting by removing both pilot and trailing truck (0-8-0 mode), and found all three problems went away. Then I reinstalled the pilot truck (2-8-0 mode), and found that only the intermittent shorts returned. The problem turned out to be the pilot was shorting against the frame when going left, and adding black electrical tape to the underside of the frame solved it. I then reinstalled the trailing truck and removed pilot truck (0-8-2 mode); the trailing truck derailed in reverse, but no other problems surfaced. Adding more weight to the top of the trailing truck did not correct the problem. Finally I reinstalled both pilot and trailing trucks (2-8-2 mode), and two problems were apparent: stalling with wheels spinning returned and the trailing truck derailments continued. What was the problem?

After trying a number of "cures" without success, I set the loco on the sheet of plate glass (a very flat surface) at my workbench, and began to test for vertical play and clearance, using materials of known thickness. I found that I could slide a 0.020" thick metal scale ruler under the pilot wheels without lifting the drivers, but I could not under the trailing truck; I could only slide 0.010" styrene under the trailing truck without lifting the drivers. In comparison, my #453 Blackstone K-27 could fit 0.020" under pilot truck, and much more than 0.020" under the trailing truck. This increased vertical travel could also be seen by pushing down on the cab roof and seeing if the front of the loco rises significantly – it should. Conclusion: the tolerances on the PSC #476 are too tight for my quality of trackwork. It was prone to wheel-slip at small, almost imperceptible, vertical transitions which Blackstone locos could easily negotiate. The remedy was to grind off some of the trailing truck and the underside of the firebox area to permit the trailing truck to have more vertical travel and horizontal (side-to-side) travel. So, I put the loco in a cradle and carefully removed some of those beautiful details on the brass trailing truck and firebox using my Dremel cut-off wheel. Grind, reassemble, test, and repeat until the problems went away – and they did.

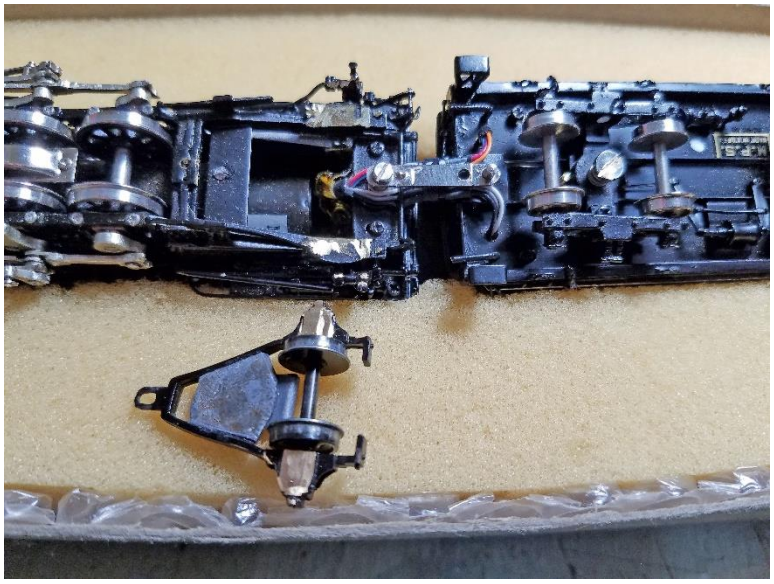

Photo 9. Grinding off some of the casting details on the firebox underside and the trailing truck (exposing shiny brass), thereby increasing both horizontal and vertical travel of the trailing truck, finally fixed two nagging operating problems. After some black paint, most viewers will never know…

Wrap-up. So, you don't have to stare at boxes of DC locos on the shelf and wonder what to do. I urge you to jump in there and give a DCC installation a try. While it may have its challenges, it is very satisfying when complete.

Parts used.
Precision Scale Co. K-28 #476, HOn3, factory painted
Tsunami 2 DCC decoder, TSU-1100-Steam 2 #884006
Train Control Systems TCS #1477 6-Pin micro connector with colored wires
Keep Alive KA2 capacitors (Train Control Systems, TCS)
Speaker, oval #810113 (16 x 35mm, 8 ohm, Soundtraxx)
Scrap of sheet styrene, 0.040" thick, for speaker enclosure
Resistors: 1 kΩ, 1/6 watt (TCS). Preferred is 560 Ω, ¼ watt
Extra decoder wire, in colors red, white, gray, brown, blue, and black, if needed.
Liquid Tape (electrical insulation, Plasti-Dip Internat'l)
Shrink tubing for insulation, 1/8" diameter
Kapton tape, ¼" wide (TCS)
Glue: Allene's Tacky Glue; styrene cement (MEK)