

# NorthWest Short Line

## REPOWERING the:

### PFM HO RAYONIER #45 2-6-2

*made in Korea*

This cute little model locomotive has some mechanical problems that often make it less than a pleasure to attempt operating. The very small size makes for some real problems and choice limitations in providing satisfactory operation of this model. The NWSL gearboxes and universal connectors combined with a Sagami motor can make this a nicely operating model and a pleasure to have on your railroad.

Tools required: Soldering device (iron or electronic)  
Model size screwdrivers (slot and phillips (+) types)  
Hand motor tool (Dremel, etc.) with cutoff disks  
#40 drill, drillpress or hand drill

Also Useful: NWSL #45-4 The PULLER  
NWSL #44-4 The QUARTERER (or #47-4 or #46-4)

Skill required: This job assumes you have reasonable proficiency in soldering, gear pulling/pressing, wheel pulling/pressing, driver quartering, and disassembly and reassembly of mechanical devices. If not, your learning experience here can be valuable despite problems you may encounter in achieving quick and satisfactory completion. Time required: About one hour

Parts required: NWSL #10253-9 or Sagami 10153-9 square open frame motor (discont'd circa 1995)  
NWSL #482-6 universal coupler set (or #485-6 if using motor #10253-9)  
NWSL #147-6 gearbox for 3/32" (2.4mm) axle (#144-6 or #145-6 if using #10253-9)  
Silicon sealant (bathtub caulk, car window caulk, etc.)

Also useful: NWSL #10003-9 wire

1. Remove locomotive superstructure from chassis (one screw over lead truck and two screws at back/bottom of cab). Remember how all parts fit together, save screws and parts that may come loose, Remove trail truck.
2. Unscrew gearbox bottom cover plate and motor mount screw and remove the motor/gearbox assembly. These parts may be discarded to your miscellaneous parts box after unsoldering the lead wire from the motor (save the wire, it will be used).
3. This model has an unusual axle size (2.5mm) and therefore the gearbox must be carefully modified to fit. Assemble the worm onto the wormshaft. If not a press-fit, upset the shaft (knurl, lightly centerpunch, etc.) in the area where the worm will be and/or use a super bond such as ACC being careful to keep it off the shaft outside the worm. The final shaft length desired is 1/8" (approx.) on the brush end and little or none on the other end beyond the motor bearing (protect to keep cut-off grindings out of bearings). This can be cut as required after the gearbox is fully assembled.
4. Assemble the gearbox halves with the worm/wormshaft/bearing assembly in place. Install adequate shim washers for a minimum of worm end play but with worm still free to turn easily. The gearbox was made for a 3/32"-2.4mm axle but the model has the unusual 2.5mm axle so we have to do some careful modification. Place the #40 drill in your drill chuck with at least 1/2" of shank (non-fluted area) showing. Rig the drillpress or drill to run at a moderate speed. You will use this as a reamer to ream the axle slot to fit the axle. Have a driverset handy for axle slot testing. Turn on the drillpress, place the axle slot (of the assembled gearbox) on the drill shank (keep gearbox as square as possible to drill), run gearbox down drill to flute area, hold momentarily and pull away from drill. Test the axle slot on your sample driverset axle. When you have achieved a free turning fit, you're done. *CAUTION: You are widening the slot - you DO NOT want to deepen it, therefore do NOT press on the gearbox once it bottoms on the drill.* Note that it is okay if the axle 'snaps' into the slot as long as it turns freely once in proper operating location.
5. Install axle gear on driver. First - MARK the driver quarter by placing scratch (scribe, razor blade, etc.) across the axle end and hub of the driver you will remove. This line should be easy to identify (for reassembly of the driver in exactly the same location) and should be off center (to avoid reassembly 180 degrees out of quarter). An alternative is to use an NWSL QUARTERER tool for reassembly. Use a gear puller to remove the wheel and the old gear. Install the new gear using normal caution to assure it is pressed squarely onto the axle and into proper location. You may have to chamfer and/or deburr the hole edge to help the axle go in straight. Press the wheel in place.
6. Reassemble the model chassis with the regearred driverset. Install the gearbox in the model. You may have to cut away some of the brake rigging cross member to provide clearance under the model for the gearbox - just snip the wire to leave adequate clearance for the gearbox. Secure the bottom gearbox cover plate (make sure the worm and wormgear are in mesh before tightening). Press a universal coupler cup on the gearbox shaft after removing burrs or sharp edges on the shaft end that might hinder an easy, straight press-on.
7. The MOTOR will sit in the frame on its narrow side just behind the rear driver. Cut the shaft (end away from brushes) to about 1/8" length. Deburr shaft end and press on a 'horned ball' from the universal coupler set. Trial install the motor with the universal assembled. If the motor cannot move forward adequately to connect, you'll have to remove some of the backing on the rear driver (decorative) spring detail (a cutoff disk in a hand motor tool does this quickly and easily). Reset the motor in place, hook up test wires (the bottom brush lead should be grounded to the frame) and trial operate the model. Test for polarity (proper direction of travel - use another model to determine proper direction for given reversing switch setting). If wrong, then turn motor over so opposite brush will ground to frame.
8. Test for free operation, locate and remove any binds, determine proper location for motor and mark it. Drill a small hole in the old motor mount plate to the rear of the motor and feed the old drawbar lead wire through. Solder to upper motor brush. While the bottom brush tab may properly ground to the frame, a more reliable connection should be made by soldering a short wire from the brush tab to the frame (the wire can be securely grounded to the frame with the tender drawbar screw also - this avoids problems and risks of soldering to the frame).
9. Secure the motor in place with silicon sealant, bathtub caulk, shoe goo, or any of the similar bonding/caulking materials. Place a blob on the rear frame crossmember which is just forward of the old motor mount plate. Press the motor into the material (there should be enough material to make good contact with virtually the entire bottom area of the motor, but NOT enough to squeeze out and get into the motor or the model running gear). Make sure the universal is connected. Test operate the motor and reset as necessary for smoothest, quietest, free operation. Let model sit for about 24 hours while caulk cures.

10. Trial assemble the superstructure to the frame. The motor shaft must be cut to permit assembly. Determine how much shaft to cut away. Depending on your assembly space, you may have room for a small flywheel. We did not install one and doubt that space will permit a worthwhile sized flywheel.
11. Test operate, make any needed corrections. Reassemble the locomotive. On our model, we had to unsolder the front footboard assembly from the end sill, grind away the bottom rear of the coupler pocket and reinstall the footboards with railhead clearance so the model would run without short circuiting the rails. You will also have to remove (grind, cut, etc.) some of the bottom round portion of the gearbox cover plate to provide railhead clearance due to the tiny drivers. Use caution to avoid damaging the gear if/when you cut through the cover.
12. Have fun!

*Installation 7-84 by F. R. Martin*