Steam Locomotive Operating Procedures

SVLS Locomotive 1973

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Steam Up

These procedures have been developed to help both the novice and experienced engineer prepare the museum steam engine for service. While some deviation due to personal preference is expected, in general, following the steps in order will give satisfactory results.

0. Move the engine to the steaming bay you wish to use. When the engine is in position, chock the #2 driver on the engineers (right) side of the engine to prevent unwanted movement. Move the throttle lever full forward and center the reverse lever. You will also need:

    a. The gray tool box
    b. Water hose with fittings (currently on the yellow hose)
    c. Air hose
    d. Grease gun
    e. Rags
    f. Battery

1. **Grease.** The engine has 17 zerk grease fittings. Seven of the fittings are under the engine: 6 journal boxes and the eccentric strap of the water pump. The others are located on the side and main rod ends and cross head wrist pins. Use no more than ¼ pump stroke! The boxes, strap, rod ends and pins are already full and grease pumped out is wasted and messy. Wipe the underside of the engine, removing any excess grease from the boxes, strap, and anywhere else that needs it.

2. **Water**.

    a. Engine: Screw the water fitting into the left or right blow down cock. Be sure the opposite cock is closed! Pour 2 oz. of boiler treatment into the hose, and then connect it to the fitting. Turn the faucet handle on ½ turn. Open the injector handle to allow air in the boiler to vent. When the sight gauge shows ¼ inch of water, close the valve on the hose and close the injector handle. (The water level will rise to about 2/3 of a glass and then drop back to about ½ of a glass as operating pressure is reached).

b. Tender: Ensure that the tender drain valve is closed. Pour 2 oz. of boiler treatment into the tender and then fill with water to within 3 inches of the top of the tender. Any higher than that will cause the water to splash out of the top deck which is not sealed.

3. **Air**. Connect the air hose to the left side of the engine and open the valve on the air blower line just enough to be heard. This will purge the firebox of any propane gas. Check that the upper manifold blower valve is closed.

4. **Propane.** Install the handles onto the gas pressure regulators on the propane car and tender. Open the main propane tank shutoff valve approximately 1 ½ turns and set the tank regulator to 35 psi. Leave the engine burner regulator off and light the burners. If the burners do not light, check that the left valve is fully open and adjust the right valve until it does. Once lit, continue to adjust the valve until you have a steady 1 to 1½ inch tall pilot flame from all slots. Turn the handle on the tender flow regulator until the pressure gauge indicates approximately 1 psi. Adjust the blower volume just enough to prevent flames from coming out around the firebox.

5. **Oil.** Oil the valve motion and fill the cups on the upper cross head guide bars (use chain saw or 30wt. non-detergent motor oil). Top off the cylinder oil tank located above the right upper cross head guide bar (use 600wt cylinder oil).

6. **Blower.** When the boiler pressure reaches 40 psi, slowly open the steam blower valve to clear condensed water from the line. Close the air blower valve and adjust the steam blower volume to control the burner flame blow back. Disconnect the air.

7. **Pressure.** Allow the boiler to continue building pressure until the safety pops at 110 psig. Observe the pressure gauge, the safety should reseat at 105 psig. The other safety is set to pop at 113 psig. Due to the high relief of the low-pressure safety, it may not be possible to pop this safety. As stated earlier, the water level in the sight glass should have risen and lowered to ½ a glass. If the level is higher, it may be necessary to do a short blow down to prevent priming.

8. **Test.**

a. Injector: Open the tender water valve. A steady stream of water should come from the injector over flow line. Quickly open the injector steam valve all the way. If the injector does not pick up, (steam coming from

the over flow) open the water valve until it does. If water pours from the over flow line reduce the water flow until the injector picks up. While it is not a good practice to use the injector when the boiler is not working steam, it may still be necessary to use it to bring the water level up to ½ glass if needed. Shut off the injector after the test.

b. Brakes: Open the brake valve and ensure that the brakes set. Close the valve and check that the brakes release

c. Sight Glass: Open the blow down valve on the sight glass. The gage should immediately empty. Water and steam must blow from the drain line Close the upper valve, water will continue to blow from the drain. Now close the lower valve. All flow from the drain should stop and the gage should be empty. Open the upper valve, steam should now flow from the drain. Open the lower valve and close the drain, the water level should quickly refill the glass. If the glass does not react as stated there is a problem. The engine is unsafe to use. Shut off the fire and start the shut down procedure. Fill out a Bad Order card and notify the Train Master. A full blow down should only be necessary once a day. After that simply opening the drain valve while waiting in the station will be sufficient to check of proper operation.

d. Battery: If not already done, hook up the leads to the battery and test the head light circuit. After the test, turn the light off.

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9. **Rollout.** Before moving the engine, be sure the air and water lines are clear, the cylinder relief valve is in the closed (cocks open) position, and the wheel chock is pulled. Set the reverse lever to the forward position and slowly pull the throttle back. Check that water and steam are being ejected from all 4 cylinder relief cocks. Move the engine onto the turntable, and then onto the departure track. Once clear of the turntable, install the tender foot pegs and climb aboard. Exercise care when departing the round house. The track is on a grade and usually greasy. Heavy-handed throttle control can cause the drivers to slip. As a general rule the headlight should be on when the engine is in motion. During daylight hours it is difficult to tell if the light is on. Turn the center light shield over so that the bulb is visible, this will serve as a pilot light.

10. **Switching.** The final task to perform is making up your train. While

switching, it is recommended that the blower remain on and the cylinder cocks open. The reverse lever should be operated in full gear for maxim power and smooth starts.

Operation

There are too many variables, such as, ambient temperature, wind, condition of the rails, load, grade, etcetera, to be able to create a step-by-step guide on how to operate the steam engine. With that said what follows is a body of recommended practices, which have been compiled from members who are current on the locomotive.

1. **Waiting on Spot.** While standing in the station, waiting for your train to be loaded, you should have the blower adjusted to prevent flames from the firebox rolling up around the cab sides. If the boiler pressure rises with the main burner set to a spot fire, reduce the pilot burner or open the fire door. If necessary use the injector to put water into the boiler, being careful not to over fill it. The idea is to prevent the safeties from lifting. Of course you can always turn around and yell at the stationmaster! The brake valve should be set to keep the train from moving while passengers load. The reverse lever is centered in the quadrant and the cylinder cocks should still be open from your last movement into the station. The head light should be off.

2. **Departure.** When you are given permission to depart, acknowledge the order with the appropriate whistle signal. Turn the head light on. Release the brakes and move the reverse lever to the corner notch. Slowly bring the throttle back until the engine starts to move and adjust it for a smooth start. Now is the time to adjust your firing valve to its initial setting. In warm weather try 6 psig, in cold try 8 to 9 psig. By now you will have started in to the cut at the east end of the station, because it is a blind curve and the junction of the freight main and engine terminal I strongly suggest sounding the whistle general warning (- - o -). Be prepared to make an emergency stop if an approaching train does not yeld the right of way. The cylinders will be hot by now and no longer blowing water from the cocks so you can close them by opening the control valve.

3. **Trip Setup.** Run at reduced speed until clear of the turnouts in the upper Boxcar yard. As you start down the trestle grade check the water glass to see if the engine needs water. You should have already decided how you

are going to manage your water, the injector, the mechanical pump, or both. The pump, once set, offers the advantage of automatic water feed but tends to over fill the boiler unless closely monitored. Additionally, since the water entering the boiler is cold it requires more fuel to maintain pressure. The injector, on the other hand, pumps water heated to about 200 degrees but will reduce pressure when in use and is easy to forget. Further it can be tricky to use if you cannot see the over flow pipe. That being said, the injector, is preferred.

4. **Arrival.** The rest of the trip is a combination of train handling, and engine management. As you start into the grade at Meadow towards the pond bridge I suggest making a brake application to control train speed. Kick the brakes off as you cross the bike trail and continue up the grade. When you pass Cordova Junction start setting up for the station stop. Open the blower valve to prevent flames from leaving the firebox. The burner should be adjusted to maintain pressure. After the train is unloaded, open the cylinder cocks. Leave them open while you pull forward to the passenger loading point. Turn the head light off. Repeat!

Shut Down

The goal when shutting down the engine is to drain the boiler and then dry it as much as possible, before putting it away.

1. **Dropping the fire** The boiler should not be blown down until the pressure has dropped to 40 psig or less. To save time, the fuel can be shut off in the station. This must be done at the main tank shut off valve. Next, remove the pressure regulator handle. Now turn the burner regulator handle to 0 psi and remove it. Leave the blower on for a short time, to purge any gas that may be left in the firebox after the fire goes out, and then turn it off. When you are cleared, proceed to the upper car yard and put your train away. From the upper yard, back down the main line and onto the roundhouse departure track stopping short of the turntable. Open the tender drain at this point.

2. **Blow down** When the boiler pressure reaches 40 psig or less, the blow off cocks can be opened to start the blow down. If not, wait for the pressure to

drop or run the engine back and forth on the departure track until the gage drops to 40 psig. As a courtesy to others, do not allow the water from the blow off to spray other people or equipment.

3. **Pressurizing the boiler** When the boiler is empty, close all valves, install the special air fitting into the nearest blow off cock, and connect the air line. Open the cock until the boiler is pressurized (usually about 90+ psig) and then close it. Disconnect the airline, place the reverse lever in forward gear and slowly open the throttle, being careful not to allow the drivers to slip. Run the engine up and down the outbound lead several times in order to remove as much condensed water as possible from the cylinders. After the cylinders are dry, connect the airline once more and open each of the auxiliaries, blower, injector, brakes, water glass blow down valve, and whistle to clear them of water. When no moisture can be seen close them again.

4. **Drying the boiler** The final step in drying the boiler is connecting the ejector. The ejector consists of two parts, the ejector body, which is composed of a brass T-fitting and a ball valve, which controls the airflow to the ejector. Disconnect the ejector from the valve (they should be stored connected together) and screw it into the closest blow down cock. Reconnect the valve to the ejector and install the airline. With both blow down cocks open, turn the valve handle approximately 1/8 turn to start the ejector. The ejector creates a negative pressure in the boiler and will draw dry air in from the outside as it pulls the moist air out. Allow the ejector to operate for about 5 minutes and then close the opposite blow down cock. Open the water glass drain valve and leave it open until the inside if the glass is dry. Continue with the rest of the auxiliaries until they are all open again. At this point the question of how long is this to be done arises. The draining water from the tender is your timer. When the flow of water stops, rock the tender to remove that last bit of water from it.

5. **Clean up.** While the ejector is drying the boiler and the tender is draining you can start wiping down the engine, tender, and tank car. There should be a can of End Dust in the train masters locker for that purpose. As you clean, inspect the consist for any loose, damaged, or leaking parts. Report any discrepancies to the Train Master. If you find any condition that you feel may be unsafe and should be inspected before the engine goes out again, fill out a **Bad Order** card and place it on the engineers seat**.** Again, be sure to notify the Train Master as soon as you can.

6. **Wrap up.** Once the tender is empty, shut off the air to the ejector, remove it and return it to the tool kit. Coil the water and air hose around the propane tank car's regulator guard. Move the engine into the roundhouse. Disconnect and remove the battery from the tender and connect it to the charger. Make a final check to insure that all tools and supplies are secured and then lock the tool cabinet and roundhouse.