IMPROVING AND MAINTAINING ENGINE PERFORMANCE
Slide Notes

1. We're going to talk about improving and maintaining engine performance

I was going to actually work on an engine for this clinic but then only 2 or 3 of you would have had a good look and the rest of you would be sleeping. I decided to do this in a slide presentation so that all of you could sleep.

Some of this material will be old news for some but new information for others.

If you leave with one new idea it was worth the time.

2. Today we are going to use an Athearn engine for our example

All engine manufacturers differ on how their engines are assembled. You may even find differences within a single manufacturer. But the techniques we will use today can be applied to all.

Here's what we'll cover today (read slide)

3. Get yourself a good set of precision screwdrivers. These cost me $1.99 at Harbor Freight.

4. First we have to remove the shell.
In our Athearn example this is quite easy. This engine has bosses on the sides of the shell that fit into slots on the frame. In this case spread the shell sides to clear the bosses and remove the shell.
Manufacturers have gotten cleaver disguising the ways they keep the shell on the frame. This goes a long way for realistic looking shells but can be challenging for repair or maintenance. Many use a series of tabs that grip to other plastic parts.
Used reserved force to remove the shell. Rest your hands on the tabletop to gently pull the shell off the frame.

5. Use the Internet for suggestions on removing the shell.
This can be manufacturers own sites . . . or tips from other modelers.
Looking for instructions on decoder installations is also a good place to find tips on removing shells.

6. My buddy had an Atlas S1 and we could not figure how to remove the shell.
Using Google we found these instructions on the Atlas site.
And if you think the instructions are confusing, try doing it without them.

7. Next we'll remove the trucks from the frame.

8. I will use one truck as an example so we don't have to run through this twice.
First we remove the worm gear cover. This is a compression fit on both sides of the cover and needs to be released from one side in order to get it off.

9. Once the cover is removed the worm gear can be removed. This is a simple slip fit on a splined shaft that goes into the flywheel.

10. The front bearing can be removed from the worm gear.
Just to the rear of the worm gear you can see a shim and another bearing. There are times where a shim can be used between the worm gear and the front bearing to smooth out the operation of the engine. Be careful that another shim does not bind the gear.

11. Now we remove the contact clip that connects the top of the motor to the truck towers coming up from the engineer's side of the truck.

12. We can now slip the truck out from under the diecast main frame.

13. Next we remove the bottom cover from the truck. Again this is a compression fitting and you must remove from one side of the cover then the other.

14. The wheel assemblies are now exposed and can be removed from the truck.

15. In the case of this truck there are two remaining top covers that must be removed and again, these are compression fittings.

16. One these are removed we can now open the truck.

17. Here's a view of the gears in place on their shafts. In the case of this engine there are only two sizes of gears used.

18. These are the parts from one truck that we have just disassembled.

19. This is a good time to examine the wheels for wear and possible replacement and is also a good time to make sure the gear has no splits. A split gear can cause poor operation of your engine and usually is detected by a noticeable click as the engine moves down the track.

20. As we are doing a thorough overhaul on the engine I remove the wheels from the gear/axle assembly using a twisting motion.

21. And remove the bearings from the axle.

22. It's now time to clean the truck components.

23. I first remove as much grease and lube as I can with a paper towel before the washing process.

To wash the parts I use a grease cutting liquid such as 409 or Fantastic and hot water and use an old toothbrush to get into all the part cavities.

I rinse the parts in warm water and them place them on a towel to dry.

This is probably a good time to mention that I keep the parts to each truck separate. This is not much of an issue for a new engine but could be for an engine that has already had some wear on the gears. You want the treat the gears as a set.

24. I use a hair dryer with the temperature set to hot and the motor set to low so I don't blow the parts off the towel. In fact I hold the dryer a good distance from the parts.

25. Once the parts are completely dry it's time for re-assembly.

I use the lubricants on the left and they have served me well.

I use the motor bearing lubricant on all contact surfaces except the gears themselves and where conductivity is not an issue.

I use the conducta lube where the parts both have to move and give me an electrical path.

I use the gear lubricant wherever I have the gears actually meshing.

I cover the actual application as we reassemble the parts.

Use all the lubricant sparingly. I use what I call a drp not a drop.

I believe these lubricants were first developed for the car hobby and were then applied to model trains.

It appears the same lubes are sold under the Atlas name for a lot more money.

26. I add a bit of conducta lube at the axle to wheel joint.

I don't want lube on the shaft that is press fit into the axle/gear assembly.

27. I load the bearing onto the axle

Why was conducta lube used at this point?

28. I press the axle/gear assembly onto the wheel.

29. Then do the same for the other side.

30. Using my NMRA gauge I press the wheels farther into the axle until I have the right dimension. You want to keep your axle pretty much centered between the wheels as this will determine the final location of the gear.

31. It's now time to place the gears back into the gear housing.

I put oil on the flange before I flip the gear over and place it on the shaft.

32. I do the same for the remaining gears.

In addition I put a little more oil on the outside flange and let capillary action draw the oil onto the shaft.

33. We're now ready to close up the gear housing.

34. We then load the completed wheel assemblies back into the side frames.

A small amount of conducta lube is used where the bearings meet the side frames. Why to we do that?

35. Time to snap the bottom cover on the truck assembly.

36 & 37. And both of the top covers

38. Now we apply some gear lubricant (silicone grease) to the main gear. This is the first time I apply the grease.

39 PLUS 1. I then use the truck to distribute the grease to the remainder of the gears by running it back and forth.

Toy cars anyone?

40. I'm adding conducta lube to this plate. Anyone know why?

41. Time to mount the main frame onto the truck.

42. Place the spline shaft into the flywheel and seat the worm gear in place.

43 44 45 46. Add oil lubricant here . . . here . . . here . . . and here.

47. I also add a small amount of conducta lube on the motor armature. This is another friction point for your engine.

48. I add a bit more silicone grease on the worm gear . . .

49. . . . Then snap on the worm gear cover.

50. Reconnect the contact clip that connects the top of the motor to the truck towers coming up from the engineer's side of the truck.

51. Another bit of conducta lube where the parts meet.

52. And reinstall the shell.

So far we have focused on the mechanical maintenance of our engine. Let's now talk about the electrical parts.

Let's look at the electrical path to get the power from the track to the motor and we'll look at the left or fireman's side of the engine.

54 & 55. The current has to flow from the track to the wheel.

56 & 57. The wheel to the wheel bearing

58 & 59. The wheel bearing to the side frame

60 & 61. The side frame to the main frame

62 & 63. The main frame to the lower motor clip

64 & 65. And finally from the lower motor clip to the motor.

On the engineer's side of the engine . . .

67 & 68. The current has to flow from the track to the wheel

69 & 70. The wheel to the wheel bearing

71 & 72. The wheel bearing to the side frame

73 & 74. The side frame to the top metal pick-up strip

75 & 76. The pick-up strip to the motor clip

77 & 78. And finally the motor clip to the motor.

Is it any wonder why some of our Athearn engines need a little nudge to get going? Can you see how important the Conducta lube is to improve this path?

What else can we do to improve electrical performance?

Here's a way to improve two critical areas.

But first I remove the Cab 'O Light feature from the engine and will replace it later with fiber optics going straight to the shell.

Back to the engine improvement . . .
You can see that I've already removed the bar that connects the top of the motor to the truck towers. I throw that piece away.

Here we remove the top contact strip from the top of the motor. Careful here, the spring placing tension on the motor brush will want to escape.

82. I like to use paste flux when I solder. The flux is a cleaning agent and will require less heat to melt the solder. I never solder without it. The paste stays where I apply it and turns to liquid the moment I tough it with a soldering iron. Apply paste to the tabs coming up from the side frame on both trucks. This is the positive lead from the engineer's side of the engine.

83. Also apply paste to the indentation on the front of the top motor clip. I like to make my electrical connection this way as it does not take away any room between the clip and the roof of the cab.

This real estate becomes very important if you decide to install a DCC decoder later on.

84. I clean the tip of my soldering iron on a wet sponge

then apply a small blob of solder on the tip of the iron and touch it to the pre-applied paste.

85. I then apply solder to the truck tabs.

86. We will eventually connect the two truck towers together.

In preparation for this I strip and twist two wires together. I then apply paste to the wires by dipping the wires into the paste.

By the way, a can of paste like this will probably last most hobbyists a life time.

87. I again take a small blob of solder and "tin" the wires.

88. Now that I have solder on the tab and solder on the wire all I have to do is touch the parts together and apply heat and I have a solid solder joint. Hold the wire steady while the solder cools.

89. If you have a nice bright silver color to your solder you have done it right. If it is gray in color it did not heat and cool properly. Reheat the joint to re-melt the solder. The solder should flow onto the part and not sit there as a bead or a blob.

90. Strip the other end of the wire, pre-tin it and solder to the other tab.

You'll notice that the spring for the brush motor decided to jump out of its hole and onto the floor. What followed this was a 5 minute hands and knees search.

91. With the spring back where it belongs we now strip the other wire, pre-tin it, and solder it onto the top motor clip.

92. Place the clip back on the engine and we have dramatically improved the electrical path. Notice some slack was left in the wires to allow for truck movement.

Although not shown in this demonstration, the same can be done for the connection to the bottom of the motor.

In fact many of the manufacturers direct wire the trucks to the motor for this very reason.

93. We have eliminated two of the most critical areas for poor electrical performance.

94. Snap the shell back on the engine and happy running.

95. Following the tips we talked about today . . .what will we get?

96. Well it won't turn your Athearn engine into a Kato. If you want a Kato buy a Kato.

97. But it will improve your starting resistance while will increasing your slow speed performance.

98. You'll improve your overall rolling resistance.

. . . dramatically quiet the drive train.

This may be a minus for those who believe a noisy engine is a poor man's sound system. But I can tell you that once you install a sound decoder in an older engine you do not want it to compete with the mechanical drive train.

100. It'll improve the electrical current path

And most importantly . . . It'll improve your enjoyment of the engine

102. This is outside the scope of improving engines

But I wanted to show you a little tool that does a great job.

Your cars will roll like there's no tomorrow.

The downside is if your layout is not perfectly flat the cars will roll where they didn't before.

103. AND IN CASE YOU WERE WONDERING . . .

And this brings up a point:

Only you can decide whether an engine is worth the effort to repair.
It may be an engine that you have heavily detailed or an engine that has nostalgic value to you.

It could even be a situation that you have more time than money . . . or more money than time.

Should I do this to a new engine?

On older engines (what's usually called new old stock) I would certainly remove the shell and check.

- orange grease, heavy grease

QUESTIONS?

NOTE: Photo journal to document dis-assembly with digital camera or movie camera.

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