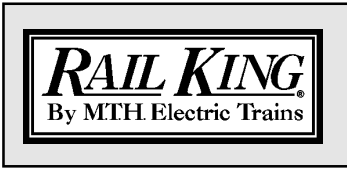


RAILKING SD-90MAC DIESEL ENGINE OPERATING INSTRUCTIONS



This RailKing SD-90MAC Diesel Engine is perfectly suited for all types of work on your railroad. It has an ABS body and die-cast floor and runs on O-31 track. This RailKing Diesel Engine contains M.T.H.'s Loco-Sound™ sound and train control system. The locomotive is easy to operate with any compatible standard AC transformer (see the compatibility chart on page 14), and is completely compatible with most other 3-rail locomotives, rolling stock, and accessories.

Please read all the accompanying instructions carefully before setting up and operating your locomotive.



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Initial Lubrication

Although the engine was lubricated at the factory, it is important that you lubricate the chassis before operation. Lightly grease the outside idler and drive gears (marked “G” in Fig. 3 on pg. 9) to prevent them from squeaking. Use light household oil and follow the lubrication points marked “L” in Fig. 2 on pg. 8. Do not over-oil. Use only a drop or two on each pivot point.

At this point, you are ready to put your engine on the track and begin running it.

Basic Operation

Throttle – Throttle up the power to your track. Give about 10-14 volts or enough power so that the engine's headlight shines brightly. Then put the engine into motion by either firmly pressing the Direction button on your transformer or remote once or dropping and advancing the throttle to put the engine in forward.

Operation Buttons

Use the operation buttons on your transformer or remote as described below.

Horn/Whistle - To sound the horn, firmly press the Horn/Whistle button. The horn will sound for as long as you continue to depress the button. It will stop when you release the button.

Bell - To sound the bell, firmly press and release the Bell button. To turn the bell off, press and release the Bell button again. The bell will continue to ring from the time you turn it on until you press and release the button again to turn it off.

Direction – Your train is programmed to start in neutral. The first direction after neutral upon start-up is forward. Firmly press and release the Direction button to allow the engine to move forward. Just as you must stop your automobile between forward and reverse, this engine will not go directly from forward to reverse; it goes into neutral between directions. If the train has been moving forward, the first press of the Direction button will put the train from forward into neutral, the second press into reverse, the third press back into neutral, and the fourth back into forward. To prevent accidental high-speed start-ups, this engine is programmed to restart in neutral each time the track voltage is turned off for 25 seconds or more.

Speed Control:

M.T.H. engines equipped with Loco-Sound have speed control capabilities that allow the engine to maintain a constant speed up and down grades and around curves, much like an automobile cruise control. You can add or drop cars on the run, and the engine will maintain the speed you set.

While the engine is programmed to start with the speed control feature activated, you can opt to turn it off. This means the engine's speed will fall as it labors up a hill and increase as it travels downward. It is also affected by the addition or releasing of cars while on the run. The engine will run more slowly at a given throttle voltage when speed control is on than when it is off.

To turn speed control on and off, put the engine in neutral, then press the transformer's Whistle button firmly but quickly one time then immediately press the Bell button two times. Repeat the 1 whistle, 2 bells code to return it to the other condition. You will want to do this during the initial neutral upon start-up if you ever couple this engine to another engine that is not equipped with speed control to avoid damaging the motors in either engine. Each time you shut down the engine completely, it will automatically turn speed control on.

Direction Lock:

You can lock your engine into a direction (forward, neutral, or reverse) so that it will not change directions. To do this, put the engine into the direction you want or into neutral, to lock it into neutral, run it at a very slow crawl (as slowly as it will move without halting), and quickly but firmly press your remote's Horn button once followed immediately by three presses of the Bell button. Two horn blasts will indicate that the engine has made the change. The engine will not change direction (including going into neutral) until you repeat the 1 horn, 3 bells code to return the engine to its normal condition, even if the engine is kept without power for extended periods of time.

Feature to Be Activated:	Button Code:
Speed Control On/Off	1 Whistle, 2 Bells
Lock into a Direction/Unlock	1 Whistle, 3 Bells

Proto-Cast and Proto-Dispatch:

When used with the RailKing Remote Lock-on (sold separately), Loco-Sound-equipped engines gain Proto-Cast™ and Proto-Dispatch™ features.

Proto-Cast: This feature allows you to play audio recordings through your engine's speakers. You must supply the audio source (a small portable CD/tape player is sufficient) and a male-to-male mini cable (1/8" plug, like that used for the headset with a portable CD/tape player) to connect your audio source to the remote lock-on. To use Proto-Cast, simply plug the mini-cable into your audio source (usually into the headphone jack) and into the "Audio" port on the right side of the remote lock-on and adjust the volume.

Proto-Dispatch: This feature allows you to broadcast your own voice through your engine's speakers. You must supply the microphone and a mini cable (1/8" plug, like that used for the headset with a portable CD/tape player) to connect your microphone to the remote lock-on. To use Proto-Dispatch, simply plug the mini-cable into the microphone and into the "Mic" port on the left side of the remote lock-on and speak into the microphone.

When these features are in use, the locomotive's own sounds (engine sounds and bells, whistles, and horns) will be muted so that only the sounds you broadcast will be heard. Because these two features are voice activated, there will be a 10-15 second delay after you stop speaking into the microphone or turn off the audio source before the engine sounds resume. To stop using the feature and return to normal operation, unplug the cable from the lock-on jack.

If using parallel tracks with multiple Loco-Sound-equipped engines, Proto-Cast and Proto-Dispatch transmissions from one track may be picked up by the other nearby engines.

If you experience popping and interference, try cleaning the track with denatured alcohol as described in the "Cleaning the Wheels, Tires and Track" section of this booklet.

Note: M.T.H. does not recommend using Proto-Cast and Proto-Dispatch at the same time.

Manual Volume Control – To adjust the volume of all sounds made by this engine, turn the master volume control knob located under the engine clockwise to increase the volume and counter-clockwise to decrease the volume (see Fig. 1).

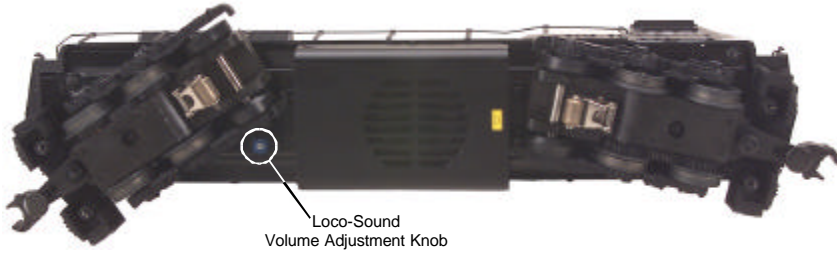


Figure 1. Location of the Loco-Sound Volume Adjustment Knob

Maintenance:

Lubrication and Greasing Instructions

The engine should be oiled and greased in order to run properly.

You should regularly lubricate all outside idler gears and pickup rollers to prevent them from squeaking. Use light household oil and follow the lubrication points marked “L” in Fig. 2. Do not over oil. Use only a drop or two on each pivot point.

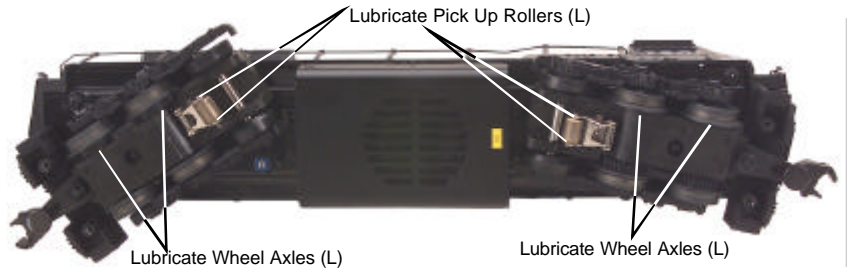


Figure 2. Lubrication Points on the Engine

The locomotive’s internal gearing was greased at the factory and should not need additional grease until after 50 hours of operation or one year, whichever comes first. Use lithium based grease and follow the greasing instructions below. Note that in some tightly packed engines you may need to move internal components temporarily in order to access the gears.

1. Remove the Phillips screws from the chassis, as seen in Figure 3, then lift the body away from the chassis. Use caution when removing the body to make sure the handrails clear the cab housing so that the paint is not damaged.
2. Remove the truck blocks from the chassis by unscrewing the black Phillips motor mount screw (labeled motor mount screw in Figure 3) on the bottom of each truck block.
3. Once the motor mount screw has been removed, pull the motor away from the truck block and lightly coat the motor worm gear and bronze drive gear (in the truck block) with grease.

4. Reassemble the truck and motor, being careful not to pinch any wires between the truck block and motor mount.

5. Repeat the procedure for the other motor and truck

6. Reassemble the chassis and body, being careful that the wires are not caught between the body and chassis, as this can lead to a short that may damage the electronics beyond repair.

It is also a good idea to lubricate the outside truck block idler and drive gears with grease occasionally. Add grease to the points marked with “G” in Figure 3.

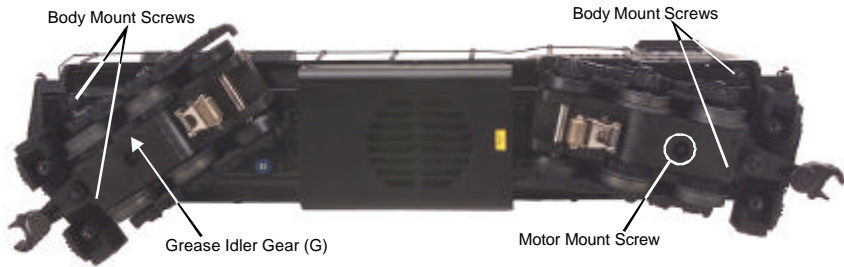


Figure 3. Greasing Points on the Engine and Locations of Body Mounting Screws

Cleaning the Wheels, Tires and Track

Periodically check the locomotive wheels and pickups for dirt and buildup, which can cause poor electrical contact and traction as well as prematurely wear out the neoprene traction tires. Wheels and tires can be cleaned using denatured alcohol (not rubbing alcohol), which can be found in home improvement stores, applied with a cotton swab.

Occasional cleaning of the track will also help to ensure good electrical contact and to prolong the life of your engine's tires. To clean the track, use a clean rag and denatured alcohol (not rubbing alcohol). Unplug the transformer and wipe the rails of the track, turning the rag frequently to ensure that you are using clean cloth on the rails.

Traction Tire Replacement Instructions

Your locomotive is equipped with two neoprene rubber traction tires on each powered truck block. While these tires are extremely durable, you may need to replace them at some point.

First, remove the truck sides from the truck block. To do this, turn your engine upside down. If there are visible Phillips screw heads between the truck frame and truck block (see Fig. 4), go to step A. If not, go to step B.

A. Remove the two Phillips screws that attach the truck sides to the truck block.

B. Remove the trucks from the chassis and the truck sides from the trucks in order to slip the new tire over the grooved drive wheel. See Fig. 4 for which screws you must remove to do this.

Once the truck sides have been removed:

1. Make sure the old tire has been completely removed from the groove in the drive wheel, using a razor blade or small flathead screwdriver to pry away any remains.

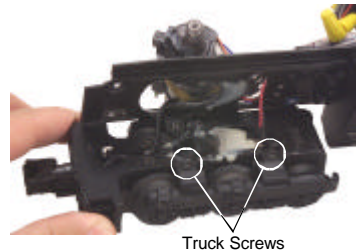


Figure 4. Screws to Remove to Access the Traction Tires

2. Slip the new tire onto the wheel. You may find it useful to use two small flathead screwdrivers to stretch the tire over the wheel.
3. If you twist the tire while stretching it over the wheel, you will need to remove and reinstall the tire. Otherwise your engine will wobble while operating.
4. Make sure the tire is fully seated inside the groove. Use a razor blade to trim away any excess tire that doesn't seat itself inside the groove properly.
5. Reassemble in reverse order.

One set of replacement tires is packaged with the model. Additional tires are available directly from the M.T.H. Parts Department (phone: 410-381-2580; fax: 410-423-0009; e-mail: parts@mth-railking.com; mail: 7020 Columbia Gateway Drive, Columbia MD 21046-1532).

Locomotive Light Bulb Replacement

To replace the light bulb in the locomotive, follow these instructions:

Follow the cab removal instructions found in the "Lubrication and Greasing" section of this booklet. Once the body has been removed, remove the lightbulb as shown in Fig. 5 and replace it.

You can obtain replacement bulbs directly from the M.T.H. Parts Department.

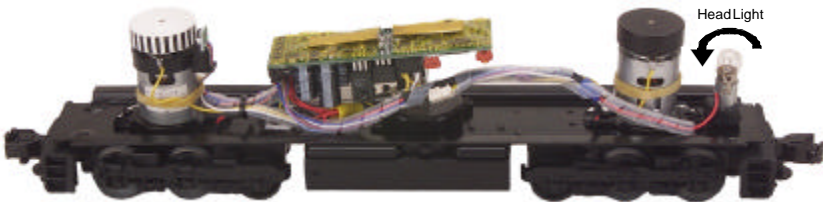


Figure 5. Location of the headlamp in the Engine.

Troubleshooting Loco-Sound™ Problems

Although Loco-Sound has been designed and engineered for ease of use, you may have some questions during initial operation. The following table should answer most questions. If your problem cannot be resolved with this table, contact M.T.H. for assistance (telephone: 410-381-2580; fax: 410-423-0009; service@mth-railking.com, 7020 Columbia Gateway Drive, Columbia MD

Starting Up	Remedy
<p>When I first turn the power on, the engine will not begin to run. I have to turn the throttle off and then on again to get the engine to operate.</p>	<p>This is normal behavior. To prevent accidental high-speed start-ups, Loco-Sound is programmed to start up in neutral anytime track power has been turned off for several seconds. See the "Basic Operation" section for more details.</p>
Horn	Remedy
<p>I can't get the horn to blow when I press the whistle button.</p>	<p>You may be pressing the button too quickly. Try pressing the whistle button more slowly, taking approximately one full second to fully depress the button.</p>
Bell	Remedy
<p>I can't get the bell to ring when I press the bell button.</p>	<p>You may be pressing the button too quickly. Try pressing the bell button more slowly, taking approximately one full second to fully depress the button.</p>
Lock-out	Remedy
<p>I can't get the engine to run after I power up the transformer. It sits still with the engine sounds running.</p>	<p>The engine is locked into the neutral position. Follow the procedure in the "Lock into a Direction" section.</p>
<p>The engine won't lock into forward, neutral, or reverse.</p>	<p>Engine speed must be below 10 scale mph (approx. 10 volts or less in conventional mode).</p>

Volume	Remedy
The sounds seem distorted, especially when the whistle or bell is activated.	Loco-Sound volume is set too high. Turn the volume control knob on the bottom of the chassis counter-clockwise to reduce the volume.

Compatibility

This engine will operate on any traditional O-31 or larger O Gauge track system, including M.T.H.'s RealTrax[®] or ScaleTrax[™] or traditional tubular track. It is also compatible with most standard AC transformers. (See page 14 for a complete list of compatible transformers and wiring instructions.)

Transformer Compatibility and Wiring Chart

Note that many of the operational commands described in these instructions require a bell button, so if your transformer does not have its own bell button, you should consider adding one to get the full benefit of the system.

Transformer Model	Center Rail	Outside Rail	Min/Max. Voltage	Power Rating	Transformer Type
MTH Z-500	Red Terminal	Black Terminal	0-18v	50-Watt	Electronic
MTH Z-750	Red Terminal	Black Terminal	0-21v	75-Watt	Electronic
MTH Z-4000	Red Terminal	Black Terminal	0-22v	390-Watt	Electronic
Lionel 1032	U	A	5-16v	90-Watt	Standard
Lionel 1032M	U	A	5-16v	90-Watt	Standard
Lionel 1033	U	A	5-16v	90-Watt	Standard
Lionel 1043	U	A	5-16v	90-Watt	Standard
Lionel 1043M	U	A	5-16v	90-Watt	Standard
Lionel 1044	U	A	5-16v	90-Watt	Standard
Lionel 1053	U	A	8-17v	60-Watt	Standard
Lionel 1063	U	A	8-17v	60-Watt	Standard
All-Trol	Left Terminal	Right Terminal	0-24v	300-Watt	Electronic
Dallee Hostler	Left Terminal	Right Terminal			Electronic
Lionel LW	A	U	8-18v	75-Watt	Standard
Lionel KW	A or B	U	6-20v	190-Watt	Standard
Lionel MW	Outside Track Terminal	Inside Track Terminal	5-16v	50V.A.	Electronic
Lionel RS-1	Red Terminal	Black Terminal	0-18v	50V.A.	Electronic
Lionel RW	U	A	9-19v	110-Watt	Standard
Lionel SW	U	A	Unknown	130-Watt	Standard
Lionel TW	U	A	8-18v	175-Watt	Standard
Lionel ZW	A,B,C or D	U	8-20v	275-Watt	Standard
Lionel Post-War Celebration Series ZW	A,B,C or D	Common	0-20v	135/190 Watt	Electronic

* Conventional Mode Only

CAUTION: Electrically Operated Product:

Not recommended for children under 10 years of age. M.T.H. recommends adult supervision with children ages 10 - 16. As with all electric products, precautions should be observed during handling and use to reduce the risk of electric shock.

WARNING: When using electrical products, basic safety precautions should be followed including the following:

Read this manual thoroughly before using this device.

M.T.H. recommends that all users and persons supervising use examine the hobby transformer periodically for conditions that may result in the risk of fire, electric shock, or injury to persons, such as damage to the primary cord, plug blades, housing, output jacks or other parts. In the event such conditions exist, the transformer should not be used until properly repaired.

Service & Warranty Information

How to Get Service Under the Terms of the Limited One-Year Warranty

For warranty repair, follow the instructions below to obtain warranty service.

1. First, e-mail, write, call or fax an Authorized M.T.H. Service Center in your area or M.T.H. Electric Trains to obtain Repair Authorization. You can find the list of Authorized Service Centers on the M.T.H. website, www.mth-railking.com. Otherwise, contact M.T.H. (at e-mail: service@mth-railking.com; 7020 Columbia Gateway Drive, Columbia, MD 21046; tel: 410-381-2580; fax: 410-423-0009), stating when the item was purchased and describing the problem. If you contact M.T.H., you will be given a return authorization number to assure that your merchandise will be properly handled upon its receipt.
2. CAUTION: Make sure the product is packed in its original factory packaging including its foam and plastic wrapping material so as to prevent damage to the merchandise. The shipment must be prepaid and we recommend that it be insured. *A cover letter including your name, address, daytime phone number, e-mail address (if available), Return Authorization number, a copy of your sales receipt and a full description of the problem must be included to facilitate the repairs. Please include the description regardless of whether you discussed the problem with a service technician when contacting the Service Center or M.T.H. for your Return Authorization.*
3. Please make sure you have followed the instructions carefully before returning any merchandise for service.

Limited One-Year Warranty

All M.T.H. products purchased from an Authorized M.T.H. Train Merchant are covered by this warranty.

See our website at www.mth-railking.com or call 1-888-640-3700 to identify an Authorized M.T.H. Train Merchant near you.

M.T.H. products are warrantied for one year from the date of purchase against defects in material or workmanship, excluding light bulbs and traction tires. We will repair or replace (at our option) the defective part without charge for the parts or labor, if the item is returned to an Authorized M.T.H. Service Center or M.T.H. Electric Trains within one year of the original date of purchase. This warranty does not cover damages caused by improper care, handling, or use. Transportation costs incurred by the customer are not covered under this warranty.

Items sent for repair must be accompanied by a return authorization number, a description of the problem, and a **copy of the original sales receipt from an Authorized M.T.H. Train Merchant**, which gives the date of purchase. If you are sending the item to M.T.H., call 410-381-2580, fax 410-423-0009, or e-mail the Service Department at service@mth-railking.com to obtain a return authorization number. If you are sending this product to an Authorized Service Center, contact that Center for their return authorization.

This warranty gives you specific legal rights, and you may have other rights that vary from state to state.