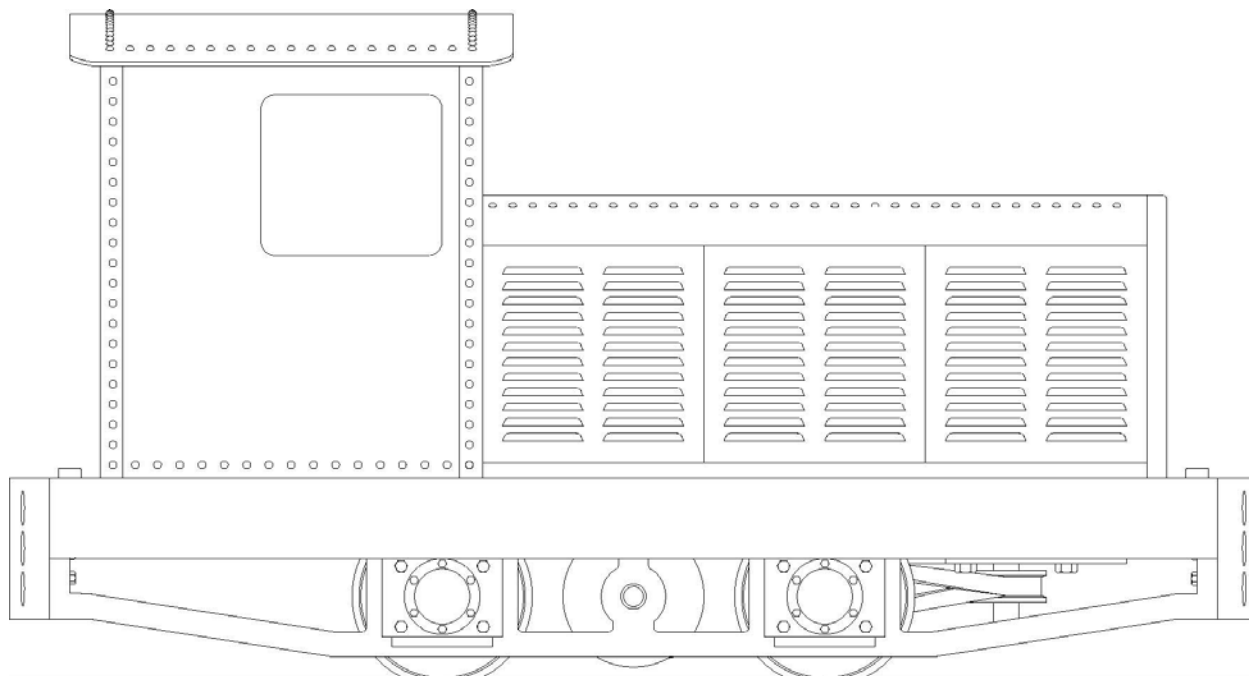


1930's Industrial Locomotive Owners Manual



- Scale Model of 1930's Era Gas-Mechanical Industrial Locomotive
- Steel Frame and Riveted Steel Body – No Plastic – Yet Highly Detailed
- 12 Volt, Industrial Duty Motor (not surplus or converted) Operates from a Standard Deep-Cycle Battery (available locally)
- Solid State Speed Control – Overload Protection – Controlled Acceleration and Positive Deceleration Under Motor Control
- Operates from a Hand Held Remote Control – Locomotive Stops if Remote is Unplugged
- Key Lock Switch Prevents Unauthorized Use
- Main Circuit Breaker, Fused Electrical System and Reverse Polarity Protection for Maximum Safety
- Interlocked Safety Controls – Speed Control Must Be Set To Zero Following Any Power Interruption (battery replacement, key off, overheat detection, hand control unplugged) Before Locomotive Will Move
- Safe Mode Selectable With Key Switch – Requires Continuous holding of Button Or Locomotive Will Stop Until Speed Control Is Reset To Zero
- Two Stage (belt and chain) Drive to All Wheels – Maximum Speed Set for Safe Operation at Home While Allowing Reasonable Speed at Club Tracks
- Full Spring Suspension Follows Uneven Track – Self Aligning Ball Bearings On All Wheels
- Completely Painted – Ready to Run

Real Trains®

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Safety and Notices

Danger

- Read and understand all information before operation
- Improper operation can cause serious injury – This scale model is intended for operation only by a properly qualified engineer
- Do not allow children to operate or ride unless under adult supervision
- Locomotive must never be allowed to operate unattended
- Batteries contain acid and can leak or explode if used incorrectly – See information obtained with purchase of battery and/or battery charger for full information

Caution

- The model is very heavy – Use at least two persons when lifting or moving the locomotive
- During sustained operation the motor and/or headlight can become hot enough to cause burns – Avoid touching hot surfaces
- The engineer (operator) must ride in a secure seat on a car immediately behind the locomotive – This car must be attached to the locomotive with a drawbar or safety chain so that the car cannot become disconnected
- Do not ride on the locomotive for any reason
- Do not operate the locomotive when ill, drowsy, or under the influence of alcohol or drugs

Warning

- The locomotive is not waterproof – Exposure to moisture can cause major damage and is not covered by warranty – Do not operate in rain or where sprinklers are running – Do not operate through flooded areas
- When through operating, even overnight, the locomotive must be stored in a dry, protected area – Select an area suitable for electronic equipment (such as a television) – A shed having an open side, room without a solid floor, or covering with a tarp or plastic is not acceptable
- Always store the locomotive with the battery removed, even if only over night
- Use care whenever operating the locomotive – Take time to become familiar with its operation and the track where operating – Use only low speeds and light loads until familiar with all aspects of operation
- When operating on tracks with other trains take time to learn operating rules, signals, and other policies that will make operation safer
- If the locomotive operates in a way you do not understand, or if it makes a sound or smell that is unusual, immediately stop, turn off the power and remove the battery – Do not resume operation until you are sure that all problems have been resolved

Initial Setup

Unpacking

The locomotive is shipped in two boxes. The smaller box (the one this manual was in) contains all of the parts except for the main assembly of the locomotive. When unpacking this box be sure to examine all packing materials so that no parts are missed. You should have the following items in this box:

- Cab roof with quick reference card attached
- Hand control unit with attached cord and plug
- Six hood side doors
- Battery cable
- Keys (2 for master switch, 1 for safe mode control switch)
- Spare fuses (1 each of 1, 3, 7.5 and 10 amp ratings)

Certain locomotive options that you ordered may be installed in the locomotive, may be enclosed in this box, or may be shipped separately. Some other items that are part of a train set may also be shipped in this box.

The larger box may be opened by cutting the tape on the top flaps and tearing the glued surfaces apart. On units shipped by truck or ocean freight you will also find a piece of plywood that must be removed by pulling it upward at the corners. After the box is opened and inspected for damage, and you can see what is inside you may want to cut the box around on all four sides slightly above the bottom so that the top part can be removed (do not cut it if damage is found). This reduces the amount of lifting that is needed to remove the locomotive. To continue unpacking remove the two hex nuts on the bolts located to each side of the locomotive. Carefully remove the cross piece held down by the nuts and its related packing material. The locomotive is ready to be lifted out at this time.

<p>CAUTION – The locomotive is heavy, more than 100 pounds, and requires at least two persons to lift. Use great care whenever it is moved. Place it on a surface capable of supporting the weight. Use blocks under the wheels to prevent rolling.</p>
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As soon as all parts are unpacked inspect them for any damage. Shipping damage must be reported to the shipping company as soon as possible. Vibration in shipping can cause fasteners to loosen, check all parts before operating.

Initial Assembly

Certain items must be packed separately from the locomotive to insure safe shipping. This section describes the steps necessary to install them on the locomotive and to prepare it for operation.

Drive Belt Tension

The drive belt is installed at the factory and the entire locomotive is test ran for several hours. We do not readjust the belt tension after this because we are unsure how soon you will operate

your locomotive. You should plan on adjusting the belt tension immediately before the first time you operate the locomotive. See later in this manual for procedure.

After the first 1 to 2 hours of actual operation (running time, not time on a clock) or after setting unused for some time, you should check the belt tension and adjust it if necessary. Repeat this periodically until you find that no additional tension is needed. After this check once or twice a year.

When the locomotive is ran with no weight on the wheels it is normal for the belt to slightly rub on the front axle. This will stop as soon as you place the locomotive on the track.

Hood Side Doors

There are six hood side doors, three on each side. To install the door hold it along the side of the hood with the top edge upwards and the louver side outwards. Tilt the base of the door outwards so that the top edge will slide upwards into the channel along the bottom edge of the hood. Use care, especially at first when the fit will be tight, to prevent damage to the paint. Slide the door up until the bottom edge can be swung inwards into the channel that is provided to hold the bottom. Then lower it into the channel.

We have found that it is usually easiest to install a door near the center of the hood and then carefully slide it to the front or the rear instead of trying to install it at the end. With doors installed at both ends the center one can be installed.

Removal of the doors requires the same steps in reverse. The doors can be removed anytime access is needed to the space behind them.

Hood Louvers

The louvers at the front of the hood come installed. You will note that they pivot to open or close, each moving individually. As part of initial assembly you should make sure that they are open at least half way or the motor will not get the air flow needed for proper cooling.

Couplers and/or Drawbar

Couplers and a drawbar are offered as options with the purchase of the locomotive. If you have ordered either of these they will be packed in the smaller box that makes up the shipment of the locomotive. They are not installed to prevent them from moving and causing damage during shipment.

If you are installing your own couplers or drawbar they must be the correct size to fit the coupler pocket provided at each end of the locomotive. This pocket is designed for a standard size coupler shank that is not more than 3/4" in height. The shank must have a 3/8" hole located at least 1 3/4" behind the enlarged front of the coupler and the shank must not extend more than 1/2" further beyond the mounting hole. If your coupler or drawbar is thicker than this you should reduce its thickness by filing, grinding or machining as required. If a coupler is thinner install washers both above and below the shank on the mounting bolt to center it in the opening. Do not install washers if using a drawbar as they must be free to move. If a hole is not provided

drill a hole as required to accommodate the mounting bolt. It is very important that any material that extends inward more than 1/2" beyond the center of the mounting bolt be removed at least from the front coupler so that it does not interfere with the motor mounting.

To install a coupler or drawbar remove the mounting bolt provided with the locomotive. This bolt is installed only partially in place and can be unscrewed with a proper size hex bit. When replacing this bolt it should be screwed fully into place but do not over-tightened.

Hand Control

The hand control plugs into a matching connector located at the right end of the control panel within the cab. The cable should be routed so that with the control outside of the cab the cable enters through the window opening in the right side of the cab. Look at the connector and note that "keys" (raised ribs) are located on the outside of the plug that must be aligned with similar recesses in the connector. Rotate the connector so that it is properly aligned and then carefully plug it in. Do not force.

Battery

You must provide a group 27 size, 12 volt battery. We recommend a "deep cycle" type of battery because they provide the longest operation period. Combined deep cycle and marine batteries may also be used. Both of these types of batteries include terminals that are threaded and come with wing nuts for connection. Standard automotive batteries may also be used but terminal adapters will have to be purchased from the battery dealer.

Battery Cable

Before the battery is installed in the locomotive the battery cable should be installed on it. The cable is designed to fit the threaded terminals on deep cycle batteries. Connect the red wire of the battery cable to the terminal on the battery marked "positive", "pos", or "+". Connect the black wire to the terminal marked "negative", "neg", or "-". If your battery is not marked this way or if you have any questions please ask the dealer where the battery was obtained.

The battery cable includes a red indicator light that will light if the cable is installed backwards. This backwards connection can do extreme damage to your locomotive if it is plugged in this way. Whenever connecting a cable to a battery make sure that the red indicator is not lighted. We strongly recommend that the cable always be installed on the battery while the battery is outside of the locomotive and the cable is not plugged in.

With the cable properly connected you may install the battery in the area at the rear of the cab. Turn the battery so that the side with the terminals is facing towards the front of the locomotive and carefully lift the battery into the cab. See later sections for steps that follow this.

Cab Roof

Please note that the cab roof has a quick reference card attached to its lower surface. Please use this card whenever you need information and do not have access to this manual. The roof is installed by placing it on the top of the cab with the flanges inside of the cab.

Basic Operation

This section is intended to provide basic operating information to run the locomotive. It is not intended to teach you how to operate a train, especially in a complex environment such as running at a club track. Please apply common sense, go slow, and develop a feeling for what can and cannot be done and practice to become a better engineer.

Before We Begin

NOTICE – A locomotive that has become wet due to rain, snow, sprinklers, or condensation must never be operated until completely dry or severe damage can occur to the electronics contained within it.

It is very important to pay attention to the operation of your locomotive at all times. Become familiar with all sounds and motions. If at any time anything (sound, smell, motion) happens that you find unusual in any way you should immediately stop, disconnect and remove the battery, and do not operate until you are sure you understand and have fixed any problems.

Preparing For Operation

Connecting Battery Cable to Battery

The battery must have threaded studs with wing nuts, for other types of batteries purchase adapters from battery dealer. Install the cable only when it is unplugged from locomotive and with battery removed from cab. Connect red wire of cable to battery terminal marked +, positive, or pos., securely tighten wing nut. Connect black wire to other terminal, tighten wing nut. Verify that red light on battery cable is NOT lighted.

Installing Battery in Locomotive

Remove cab roof and carefully place on padded surface. Orient battery so that terminals are towards front of locomotive and carefully lift and place into cab. Verify that master key switch and circuit breaker are off and that red light on battery cable is NOT lighted. Plug battery cable into “Battery Input” connector on control panel until latch snaps into place. It will fit only one way. Do not force. Verify that green indicator #1 has lighted. Replace roof on cab.

CAUTION – Batteries emit flammable and corrosive fumes, do not hold the battery against your body and wash your hands after handling and before touching your face or eating

Prior to Operation Steps and Checks

Route cable from hand control through window opening on right side of cab. Align plug from hand control with connector on control panel and plug firmly into place. Check hand control to make sure that speed control, headlight switch, and brake switch (optional) are in center (off) positions. Turn circuit breaker to on position, verify that it remains in on position, do not force or hold in on position. If circuit breaker turns off (trips) use troubleshooting guide to locate problem. Verify that green indicator #1 remains lighted and that indicator #2 is now also lighted.

Insert key into master switch and turn one-quarter turn clockwise to on position. Verify that all four green indicators are lighted.

Safe Mode Operation

Safe mode is intended to provide increased safety whenever the locomotive is being operated by someone who may need additional help in focusing his or her attention. This mode requires one of the two red buttons on the hand control to be held continuously during operation, releasing the button will cause the locomotive to coast to a stop. Operation may only be resumed by returning the speed control to center (off) position and pressing and holding one of the buttons. Either or both red buttons may be pressed at any time, you may change between them at any time.

To enable safe mode insert the key in the safe mode switch and turn it to the on position, remove key. To turn safe mode off, use the key to turn the switch to off.

Normal Operation

Starting with the speed control at its center or off position (line on knob directly to the left or “nine o’clock” position), to move forward turn the speed control in a clockwise direction. To go in reverse turn the speed control in a counterclockwise direction. To increase the speed, turn the knob farther from the off position (see diagram on next page).

Always move the speed control slowly and carefully. Rapid changes can cause the train to move so suddenly that you or your passengers may not be able to remain seated. It can also cause damage to the locomotive.

The speed of the locomotive will change as you go up and down hills, if the locomotive slows to the point of stopping immediately turn the speed control to off and reduce the load by pulling less cars or carrying fewer passengers

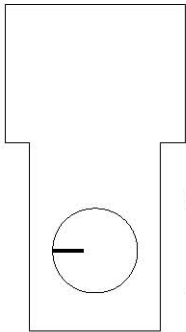
Acceleration (to go faster)

To increase speed, turn the speed control away from the off position up to the point at which it stops. If turning the speed control does not increase speed the load (number of cars, passenger weight, steepness of grade) is already requiring the maximum effort of the locomotive.

<p>CAUTION – Limit your speed and load until thoroughly familiar with the operation of your locomotive</p>

Deceleration (to slow down)

To decrease speed, turn the speed control towards the off position. To slow more you may go through the off position and apply drive in the opposite direction for even more braking force. Use this with care, as it is possible to cause the wheels to slip.

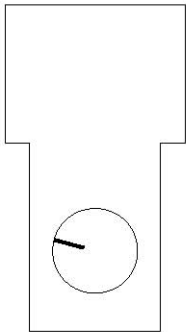


Zero Speed

Speed control is interlocked, you must always return the speed control knob to the zero speed position before starting. There is a detent when the knob pointer is at the nine o'clock position.

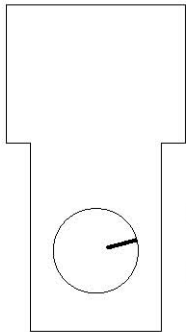
Speed Control Operation

The speed control will be locked off if the battery is discharged, the battery is disconnected, the circuit breaker is off, the main key switch is off, the 1A fuse is blown, the hand control is unplugged, or the motor thermostat is open. To reset the system you must turn the speed control knob to the zero speed position.



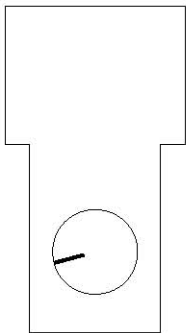
Minimum Speed Forward

Turn knob clockwise to go forward. It will "click" and move out of detent. Continue turning clockwise to go faster.



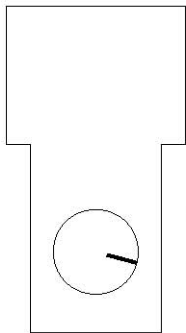
Maximum Speed Forward

Knob reaches stop at maximum clockwise position. Do not force beyond this position.



Minimum Speed Reverse

Turn knob counterclockwise to go backwards. It will "click" and move out of detent. Continue turning counterclockwise to go faster.



Maximum Speed Reverse

Knob reaches stop at maximum counterclockwise position. Do not force beyond this position.

Using the Headlight

The locomotive is equipped with a very bright sealed beam headlight. During night operation you should be considerate of others also operating at the same time and take care not to "blind" them with the brightness of the headlight. Use the dim position when in yards or approaching others.

To turn the headlight on at full brightness move the lever upwards (toward the top of the hand control) from the center position. To turn the headlight on at reduced brightness move the handle downwards from the center position. For off, move the handle to its center position.

Sounding of Horn

To sound the horn, partially press the button, release to stop. If you fully press the button the horn will sound until you again fully press the button.

Sounding of Bell (option)

To start the bell ringing, press and release the button once, to stop it press the button a second time

Connection of Train to Air Brake System (option)

A maximum of one car having compatible air brakes may be connected to the locomotive. Connect the car to the fitting on the rear pilot beam of the locomotive. Apply brakes and test system before depending on its use in operation

Operation of Air Brakes (option)

To apply brakes move the lever upwards and hold in this position until the amount of braking desired is reached, then release switch handle. In the center position the brakes will gradually release, move the lever upwards periodically maintain braking. For parking, move the lever downward (where it will stay), move lever back to center to release brakes before resuming normal operation.

Sound System (option)

Sound system horn and bell operation is the same as described above. Other sounds are automatically produced.

After Operation

Never leave the locomotive without turning the master switch to the off position and removing the key.

If leaving for a longer time, also turn off the circuit breaker.

At the end of the day disconnect and remove the battery. Place the locomotive in a safe location that is at least equivalent to the conditions in a residential garage. Sheds having an open side or structures without a solid floor are not acceptable storage locations even for a short period of time. Exposure to rain or sprinklers must be prevented by storing the locomotive properly.

Tarps or plastic covers allow humidity to rise up out of the ground under the cover and condense on the locomotive and will result in severe damage. Do not attempt to protect the locomotive in this way.

Troubleshooting

If anything unusual happens, anything that does not match the information given in the operation section, or anything that you do not understand, you should refer to the information that follows.

For each of the following there is a problem listed followed by one or more conditions that could cause the problems and the step that you should take to correct that condition. These steps are listed in the order in which they should be done starting with the first listed.

Problem	Condition	Steps to Take (in order)
Locomotive seems to have little power when first placed on track	Belt tension is too loose	Tighten belt
Red Light on Battery Cable is On	Cable is connected backwards	Reverse connection to battery If plugged in to locomotive damage may have resulted
All Four Green Indicators are Off	Battery is not connected	Check battery cable
	Battery is discharged	Charge battery
	Battery is defective	Replace battery
	System is damaged	Have locomotive serviced
Only Green Indicator #1 is On	Circuit breaker is off	Turn on, do not hold or force on
	System is damaged	Have locomotive serviced
Circuit Breaker Will Not Remain On	Battery is connected backwards	Reverse connection to battery Damage may have resulted
	System is damaged	Have locomotive serviced
Green Indicators #1 and #2 On, Others Off	Master power key switch is off	Turn on
	Fuse marked "1A" is blown	Replace fuse
	System is damaged	Have locomotive serviced
Any Fuse Repeatedly Blows	System is damaged	Have locomotive serviced
Green Indicators #1 thru #3 On, #4 Off	Motor has gotten too hot	Turn speed control to off and wait for motor to cool until indicator #4 comes back on
	Indicator repeatedly goes off	Reduce load on motor, check front and sides of hood to make sure air flow is not restricted

Problem	Condition	Steps to Take (in order)
Headlight Does Not Light in Both Bright and Dim Positions	Hand control is not connected	Check connection
	Fuse marked "3A" is blown	Replace fuse
	Lamp is burned out	Replace lamp
	System is damaged	Have locomotive serviced
Headlight Lights in Only One Position	System is damaged	Have locomotive serviced
Horn Does Not Sound	Hand control is not connected	Check connection
	Fuse marked "7.5A" is blown	Replace fuse
	System is damaged	Have locomotive serviced
Horn Sounds but Bell (option) Does Not	System is damaged	Have locomotive serviced
Sound System (option) Does Not Make Any Sounds	Hand control is not connected	Check connection
	Speed control at stop position	Speed control must be turned away from stop position when power is first turned on to make sound system start up, turn back to stop when done. Caution – locomotive may move
	Fuse marked "7.5A" is blown	Replace fuse
	System is damaged	Have locomotive serviced
Air Brake System (option) Does Not Respond	Hand control is not connected	Check connection
	Fuse marked "10A" is blown	Replace fuse
	Air is leaking out	Check entire system for leaks
	System is damaged	Have locomotive serviced

Operation Checks and Routine Maintenance

Your locomotive requires certain checks and service on a periodic basis. Failure to do this when required can prevent normal operation and may result in damage not covered by warranty.

Belt/Chain Guard Removal and Replacement

A guard is provided under your locomotive to protect the drive system from dirt and objects on the track, and to prevent access to moving parts by unauthorized persons. Only remove the guard when the battery and/or optional weight are removed.

CAUTION – Do not operate the locomotive without the guard in place. If testing or repairing with the guard removed be sure that all individuals present understand the dangers of the moving parts exposed. Do not wear loose clothing around the moving parts.

If you have a raised track that is open between the rails you may remove the guard with the locomotive setting upright on its wheels. Otherwise you must lay the locomotive on its side for access. To turn the locomotive on its side you must remove all loose components. This includes the cab roof, hood doors, battery and weight (optional, see weight instruction sheet for instructions on removal). Then place a soft pad on a surface that will support the weight of the locomotive and lift the locomotive on to the pad on its side. Add supports or blocking (or have someone hold it) so that the locomotive remains securely on its side.

You will see two self-locking nuts at each end of the guard. Remove these nuts using a 3/8” wrench (or deep socket, extension, and ratchet) and slide the guard away from the main deck of the locomotive and off. Replace by using the same method in reverse.

Belt Adjustment

The drive belt must be adjusted for proper tension on a periodic basis. This should be checked when you first are ready to operate the locomotive. It should also be checked after a few hours of operation on a new belt and approximately every 2 to 10 hours thereafter. When you find you are not having to change the tension you may go to a longer period of time between checks. A belt will stretch less and less with time until you do not have to adjust it any more.

The belt should be tight enough so that it does not slip in operation. However, too much tension will overload the bearings and damage them. Reasonable tension can be tested by pressing one finger against the belt with moderate pressure and noting how much the belt moves. Normal tension is approximately 1/8” to 1/4” of movement when pressing fairly hard with one finger.

Adjust the belt tension by removing the guard as above. Using a 1/2” open end wrench, slightly loosen the four bolts on the motor mounting plate. Then slide the motor and mounting plate to change the belt tension. A lever, pry bar, or large clamp can be used to help pull the belt tighter. If the belt cannot be tightened enough within the movement allowed by the motor mount you should loosen the belt and remove one or more links from the belt to shorten it. To remove the links see the instructions for belt replacement which explains how to disconnect and reconnect the belt to itself. Tighten the bolts when the tension is correct.

Jerky Movement or “Clunk” Sound When Starting

If the locomotive is operated in a very quiet area (such as test running in your shop) you may hear a sound of the motor momentarily starting then stopping when moving the speed control away from the off position. If the locomotive is blocked up so that the wheels are not in contact with the track you may also notice a small movement. There are two reasons for these actions; each is explained in the two paragraphs that follow. You do not need to read or understand these reasons, you only need to understand that these actions are normal and do not harm the locomotive. With the locomotive on the track and under load these actions are typically not noticed even though they may still occur.

To allow reliable operation of the hand held control without concern for the length of the cable the signal for desired speed is transmitted digitally from the hand held control to the control panel. This is done with a pulsed signal where the width of the pulse controls speed and direction. When you move the speed control from off it is possible that once in a great while you are doing so in the middle of a pulse. This results in only part of a pulse being transmitted and this narrower than normal pulse causes the motor drive circuit to start at the wrong speed or direction. Since there are 60 pulses per second this error is corrected $1/60^{\text{th}}$ of a second later and normal operation follows.

We have also found that, especially during testing, it is possible to move the speed control in such a way that a small bounce occurs moving out of the spring loaded off detent position. What happens here is that the springs that provide a detent push the knob slightly up or down in speed against the force of your hand. This results in more change than you planned and can start and then stop the motor before you have moved the speed control to the point that you expect the motor to run.

Cleaning

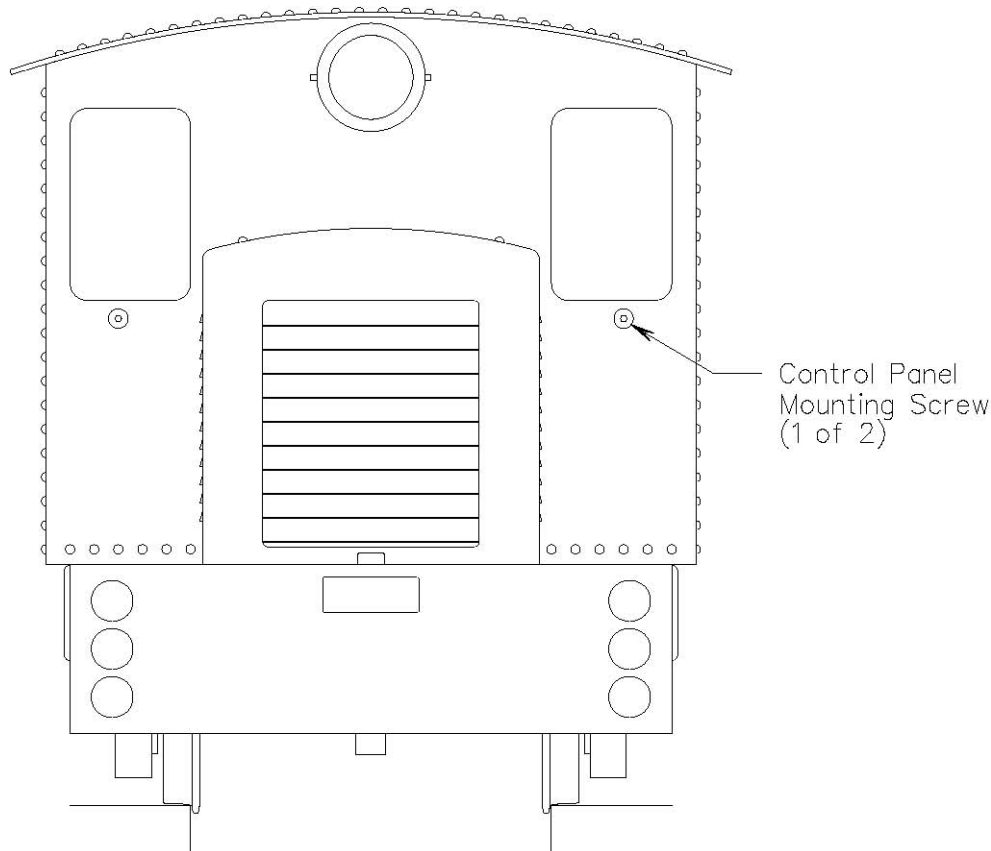
Clean the locomotive using a soft cloth slightly dampened with a detergent and water solution. Do not get any parts wet with liquid water. Dust may be blown off with clean compressed air but be sure that the air does not contain grit or oil. Do not use solvents of any kind for cleaning.

Repairs

Control Panel Removal and Replacement

The control panel contains no user replaceable items or adjustments and is normally never necessary to access. In the event that the troubleshooting guide indicated the need for service you will need to remove the control panel. This panel is fully connectorized and may be removed for repair or return to the factory.

To remove the control panel remove the cab roof, unplug and remove the battery and its cable, and remove any keys in the switches. Using a 1/8" hex bit, remove the two screws shown in the drawing. Tilt the control panel rearward being careful to not damage the paint. Unlatch and unplug the black colored connector going to the motor (it unplugs in the same way as the battery cable but is a smaller connector). Unplug all other white connectors by pulling them directly apart. Do not twist or rock the connectors or damage may result. Remove the panel from the cab.



Replacement follows the steps above in reverse order.

Fuse Replacement

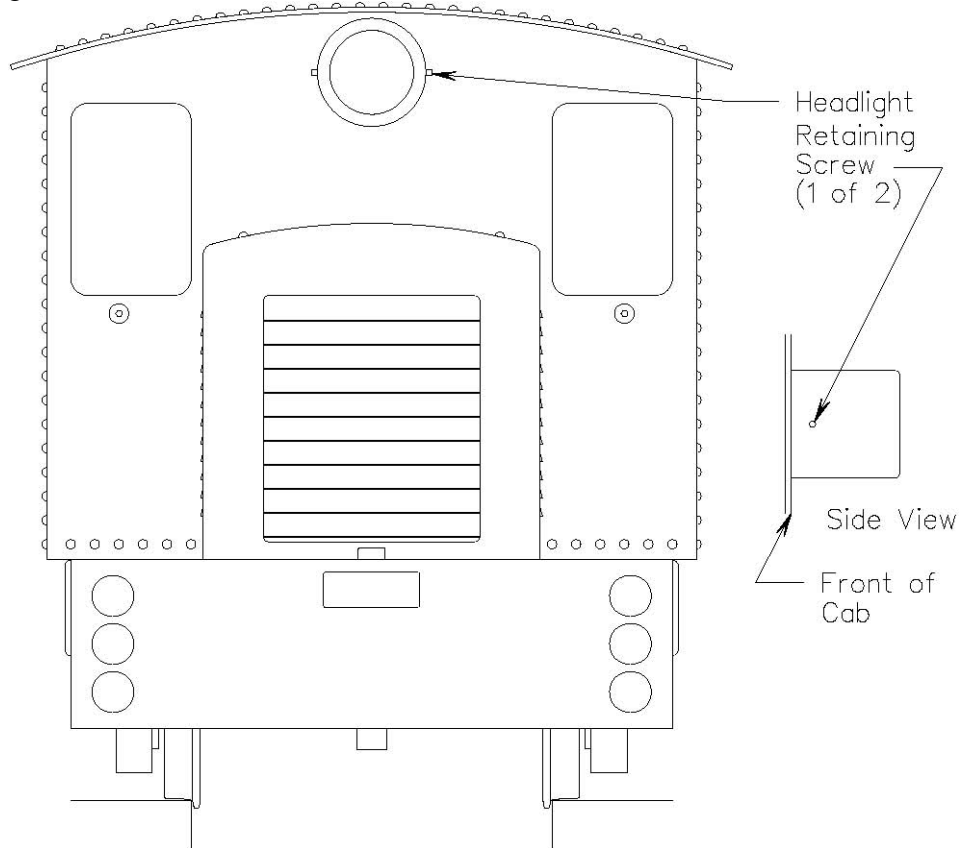
The fuses may be removed by pulling directly upwards, out of the connector in the panel. Test fuses with an ohmmeter or other conductance tester, or by replacing with a known good fuse. Replacement fuses are available from automotive supply stores. Use only a fuse of the same

ampere rating as a replacement. Never increase the fuse rating; repeated blowing indicates a problem that must be corrected.

CAUTION – Replace fuses only with those of the same rating and type. Do not attempt to bypass the fuses or to use increased ratings.

Headlight Bulb Replacement

To replace the headlight bulb first loosen the two screws on each side of the main headlight body (see drawing). Do not loosen the screws inside of the cab.



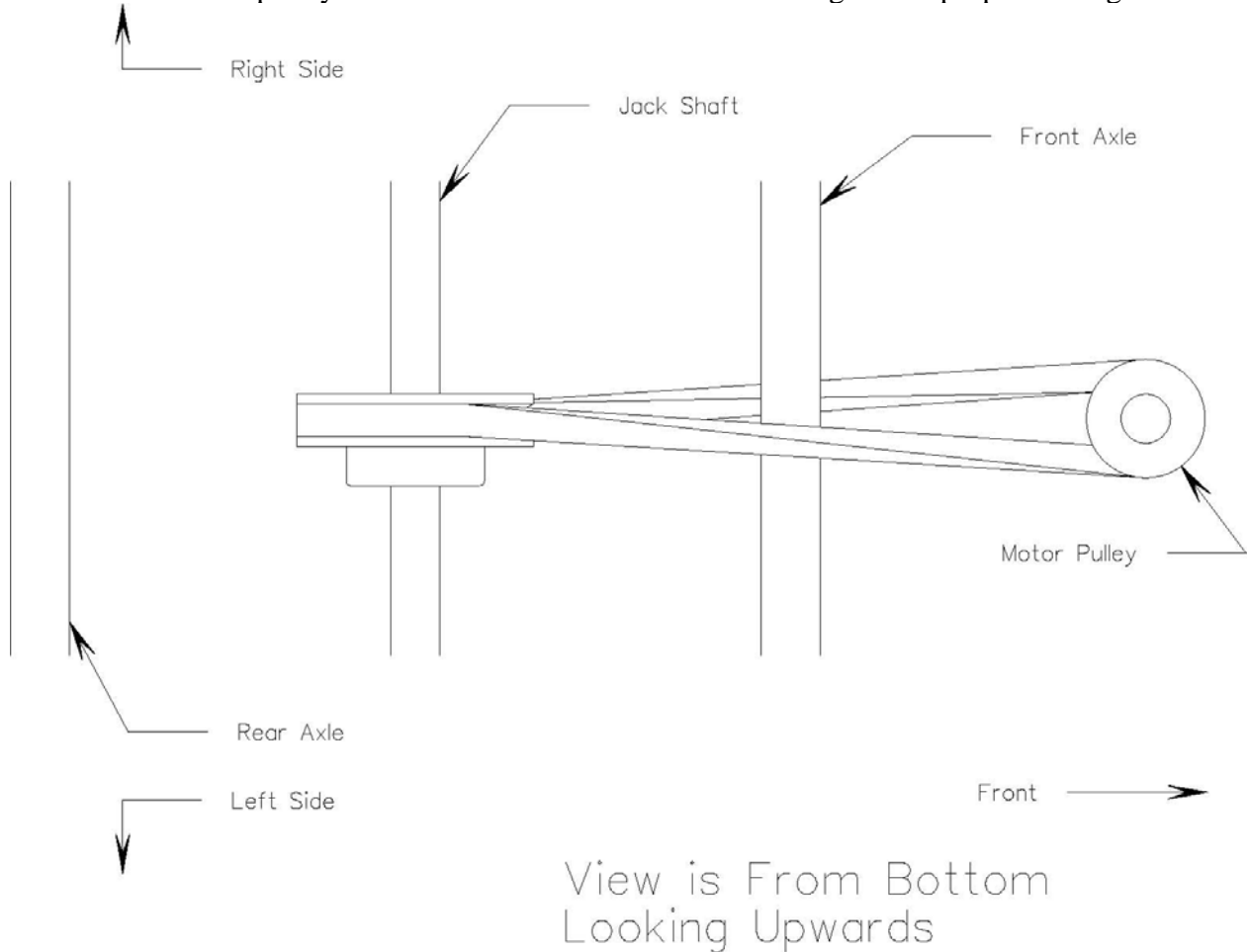
When unscrewing the two screws use a 1/16" hex bit. It is not necessary to remove the screws from the headlight body but it will not do any harm if they are removed. As the screws are loosened you will feel the headlight body unlatch from the base. Be sure to hold it so that it cannot fall. Pull the body away from the base and remove the bulb from the body. The bulb may be unplugged from its socket by pulling it directly outward. Use care to not pull on the wire leads or to break the bulb.

Inspect the socket and the o-ring seal at the front of the headlight body and replace if necessary. Replace the bulb and reassemble in reverse order of disassembly.

CAUTION – Do not use headlight lamps rated at more than 20 watts under any condition. Do not use lamps without the cover glass over the front that protects the inner lamp from contact. Do not touch hot lamps or expose to water.

Belt Replacement

Replace the belt when it is worn out or damaged. Worn out is defined as so narrow that it runs against the bottom of the pulley instead of the sides (and will slip even if tensioned). Be sure to note which way the belt runs around the pulleys. The belt that leaves the left side of the locomotives motor pulley runs below the front axle. The drawing shows proper routing.



Remove the guard as explained in the prior section. Loosen the motor mount bolts and move the motor mounting plate towards the jackshaft. Remove the belt from the motor pulley. It is easiest to detach or attach the belt links if the belt is turned inside out (so that the inner surface faces outward). You will note that the belt has small “T” shaped tabs sticking through its inner surface. Turn one of these one-quarter turn (you may use smooth jaw pliers if necessary) so that it will go through the slot in the links below it. With this one tab detached, turn the belt one-quarter turn at the link next to the detached one so that it separates at that point. Remove the belt.

Install a new belt using the reverse of these steps. Tension as discussed in the prior section. Be sure to check the tension of a new belt after approximately 2 hours and 10 hours, as it will change during its initial operation.

Chain Replacement

To check the chain remove the guard as discussed in a previous section. When a chain wears it becomes longer and its looseness will be noticed in operation. If the change in length is equal to one link or more the chain should be replaced. A chain that is broken, significantly longer than the other chain, unusually stiff, or rusted should also be replaced. Unless the other chain is almost new it is generally better to replace both chains at the same time.

The chain may be replaced with the correct length of #35 roller chain and connecting link. Be sure to replace the guard when finished. A small amount of oil may be applied to the chain but excess amounts will attract dirt.

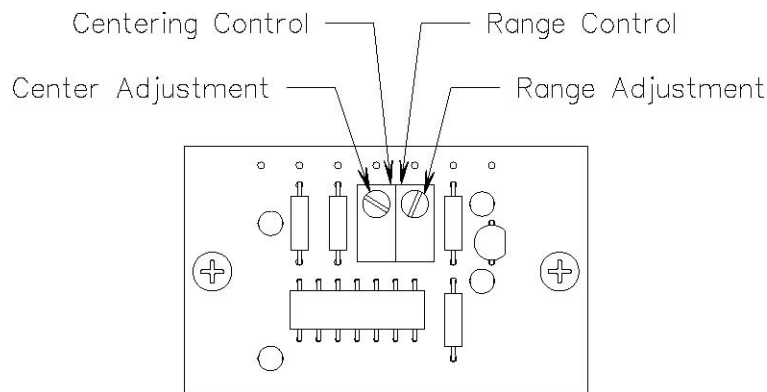
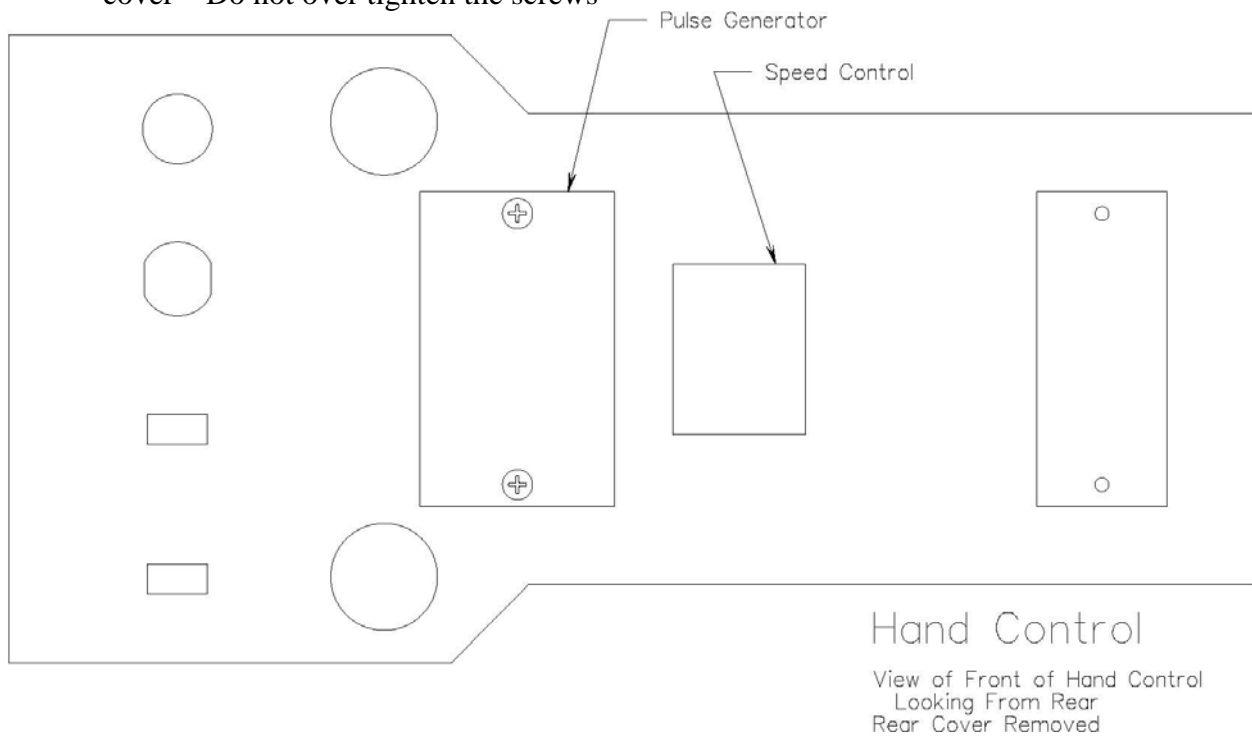
Uneven Amount of Movement Needed Before Movement in Forward versus Reverse

It is normal for there to be a small difference in how far you must turn the speed control knob to begin movement in a forward direction versus a reverse direction (either may be larger). When running on the track under load this is probably not something you will notice since when movement starts depends on many factors; uphill versus downhill, differences in rolling resistance by direction, curves in track, etc.

If the difference is large enough to bother you it may be corrected by an adjustment detailed in the steps that follow. Please realize that you must be very careful while making this adjustment since it requires opening of the hand control. Do not allow the internal parts of the control to touch any metal objects, make sure you are not in an area where you can accumulate a static electric charge (such as on a carpet), use the proper tools, do not force anything, and if you are uncertain stop and get help.

- This should be done in a quite and safe area
- Securely block the locomotive up so that the wheels are free to turn. Be very careful to make sure that the support will hold the weight of the locomotive and that it will not allow it to move.
- Install and connect the battery, connect the hand control, turn on the master switch and circuit breaker and make sure the locomotive operates
- Remove the six screws that hold the back of the hand control on using a Phillips screwdriver
- Notice how the cable enters the hand control and how the back is assembled then carefully lift the back away from the front
- Using the drawing showing the entire hand control, locate the pulse generator board
- Using the detailed drawing locate the centering control adjustment screw on the pulse generator. This screw turns but does not move up or down, you make the adjustment by turning it with a very small screwdriver
- With the speed control knob in the off position gradually turn it to the slowest forward running position, you may hear silence, a humming sound, or movement of the wheels
- If you hear silence, turn the knob to a faster position until you start to hear a hum, note how far you must turn the knob to get this amount of hum
- Repeat the two steps above for the reverse direction

- If the amount of movement of the speed control knob is significantly different for forward and reverse you may adjust the centering control to make the two more equal. Turn the adjustment only a small amount. If you find the difference is getting larger you are turning the adjustment in the wrong direction. Then repeat the three steps above. Turn more or in the other direction until you are close to having them the same (perfection is not possible)
- Make sure the cable is in the notch at the top of the hand control and reinstall the back cover – Do not over tighten the screws



If the error seems unusually large, such as actually starting in the wrong direction, you should make this adjustment as soon as possible. If the adjustment required is very large you may want to do a complete recalibration as discussed in the next section.

Pulse Generator Calibration

To do a complete calibration of the pulse generator requires the use of an oscilloscope. If you have access to this equipment use the procedure that follows. If you do not want to make an

adjustment under these conditions you may return the hand held control unit (only) to the factory for recalibration. If the locomotive is under warranty this will be done at no charge (you pay shipping to us). In other cases please enclose \$20.00 US or provide a credit card number to pay for the service and return shipping costs. Note that this will return the control to original specifications and may not provide perfectly even movement amounts, as would calibration to your locomotive using the steps given above.

Use the information above to locate the centering and range adjustments. With the hand control connected to an operational locomotive and its back removed connect the oscilloscope probe to the yellow wire that runs from the pulser board to the speed control. Connect the ground of the oscilloscope to the battery negative lead. Set the oscilloscope to display the pulse width on a scale of 1 or 0.5 ms per division.

- With the speed control set in the off detent, adjust the centering control to produce a pulse width of exactly 1.5ms.
- Turn the speed control to full reverse (counterclockwise) and adjust the range control to produce a pulse width of slightly less than 2.0ms.
- These two adjustments interact slightly so repeat the steps above until a constant range is obtained
- Check to see that the pulse is approximately 1.0ms at full forward.

This completes the procedure. You may still want to make slight adjustments from the values set in this step to exactly match your system by using the procedure in the prior section.

Paint Touch-Up

Touch up paint is available as listed in the parts list. Small chips can be filled in using a small brush. To match the surface finish of the locomotive on larger areas requires spraying. Be sure to clean the surface before applying the paint. Clean up your equipment using lacquer thinner after painting.

Replacement Parts List

Part Name	Part Number	Quantity
Fuse, 1 amp	15L1-0901	as required
Fuse, 3 amp	15L1-0902	as required
Fuse, 7.5 amp	15L1-0903	as required
Fuse, 10 amp	15L1-0904	as required
Headlight lamp including o-ring	15L1-0910	as required
Drive belt	15L1-0920	as required
Roller chain and connecting link	15L1-0921	as required
Wheel and axle assembly, 7 1/2" gauge, includes bearings and sprocket	15L1-0931	as required
Wheel and axle assembly, 7 1/4" gauge, includes bearings and sprocket	15L1-0932	as required
Wheel and axle assembly, 4 3/4" gauge, includes bearings and sprocket	15L1-0933	as required
Jackshaft assembly, includes bearings, sprockets, and pulley	15L1-0934	as required
Motor, includes pulley, thermostat, noise suppression board/cable and power cable	15L1-0940	as required
Motor brushes, one pair	15L1-0941	as required
Control panel, includes keys	15L1-0950	as required
Master switch key	15L1-0951	as required
Safe mode key	15L1-0952	as required
Battery cable	15L1-0953	as required
Hand control with cable and plug	15L1-0960	as required
Horn and cable	15L1-0970	as required
Belt and chain guard, includes nuts	15L1-0980	as required
Touch up paint, locomotive black	15L1-0990	if needed
Touch up paint, ATSF silver	15L1-0991	if needed
Touch up paint, reefer white	15L1-0992	if needed
Touch up paint, MOW gray	15L1-0993	if needed
Touch up paint, Santa Fe red	15L1-0994	if needed
Touch up paint, Great Northern big sky blue	15L1-0995	if needed
Touch up paint, Denver and Rio Grand new orange	15L1-0996	if needed
Touch up paint, Burlington Northern green	15L1-0997	if needed
Touch up paint, Canadian National yellow	15L1-0998	if needed

Warranty

REAL TRAINS guarantees all locomotives manufactured by it to be free from defects in workmanship and materials when operated under normal conditions and in accordance with procedures set forth in this manual. There is no warranty on locomotives that have been modified, neglected, abused, or improperly operated or maintained. Normal wear items, specifically motor brushes, bearings, belts, chains, sprockets, pulleys, wheels, springs, light bulbs, connectors, switches and potentiometers are excluded from this warranty.

The motor is covered by a repair or replacement warranty provided by its manufacturer. Determinations of warranty coverage applicable by this manufacturer shall be final in determining warranty coverage to be provided. The speed control module is covered by a repair warranty provided by its manufacturer. This warranty covers all repairs except deliberate abuse but may require the payment of a standard service fee. This manufacturer's determination of warranty coverage shall be final.

This warranty shall in no event be in effect for more than twelve months from the date of shipment to its initial owner. This warranty is not transferable. **THIS WARRANTY SHALL BE IN LIEU OF ANY OTHER WARRANTY EXPRESS OR IMPLIED, INCLUDING , BUT NOT LIMITED TO, AN IMPLIED WARRANTY OR MERCHANTABILITY OF FITNESS FOR A PARTICULAR PURPOSE.**

REAL TRAINS will repair or replace, at its option, any covered locomotive or parts thereof, which has been found to be defective and is within the warranty period, provided that the locomotive or parts are shipped, with previous factory authorization, freight prepaid to REAL TRAINS plant in Yucaipa, California, USA. All return shipments are made F.O.B. factory. REAL TRAINS is not responsible for removal, installation, or other incidental expenses incurred.

REAL TRAINS liability under this warranty shall be solely limited to repair or replacement of the locomotive or parts within the warranty period, and REAL TRAINS shall not be liable under any circumstances, for consequential or incidental damages, including, but not limited to, personal injury or labor costs.

Under no circumstances will REAL TRAINS be responsible for any expense in connection with any repairs made by anyone other than the factory unless such repairs have been specifically authorized in writing.

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