

# Lionel Motor Binding Repair

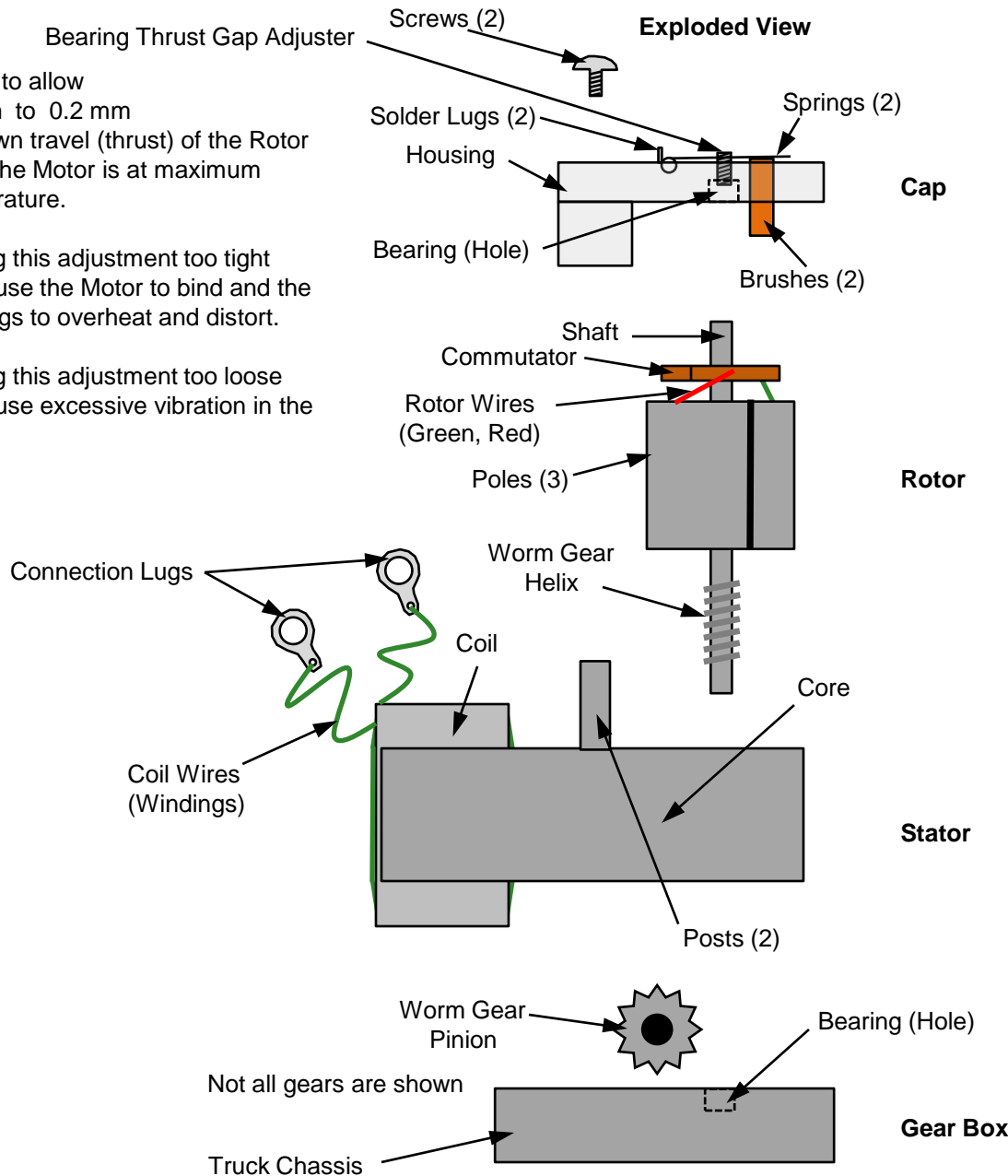
## Motor Parts

### Exploded View

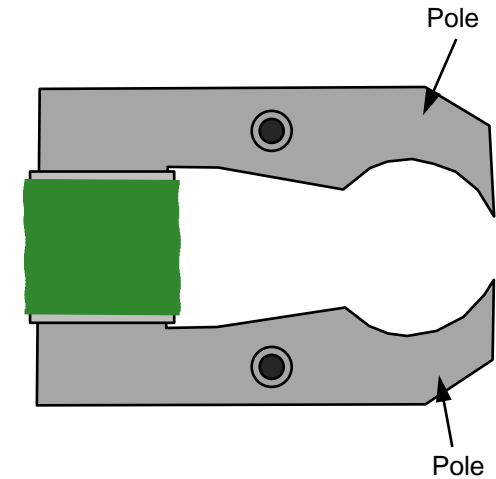
Adjust to allow  
0.1mm to 0.2 mm  
Up/down travel (thrust)  
of the Rotor when the  
Motor is at maximum  
temperature.

Making this adjustment  
too tight will cause the  
Motor to bind and the  
Bearings to overheat and  
distort.

Making this adjustment  
too loose will cause  
excessive vibration in  
the Motor.



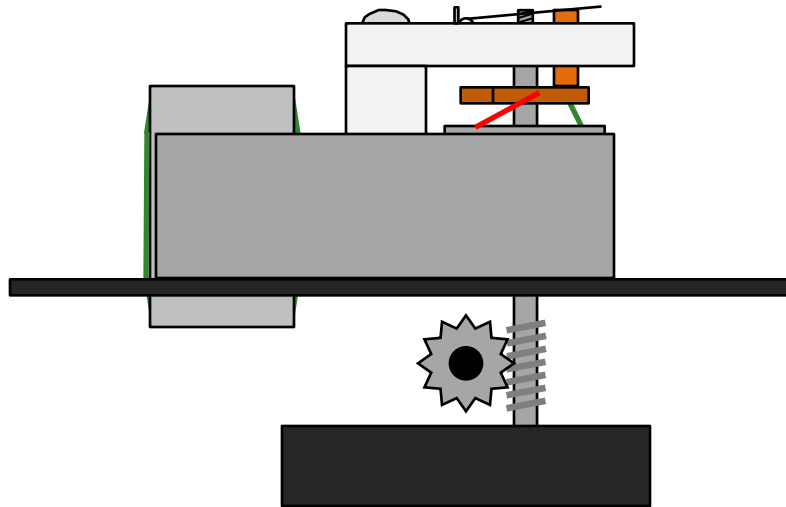
To get the motor to maximum temperature:  
Run the motor at 75% voltage with the maximum  
expected load (hottest day, steepest grade, and  
highest number of rolling stock) for 10 minutes,  
then let sit (all power off) for one minute. This is  
because the spinning of the Rotor actually cools  
the Motor by convection. The Motor reaches  
maximum temperature only a short time after  
stopping in these worst case conditions.



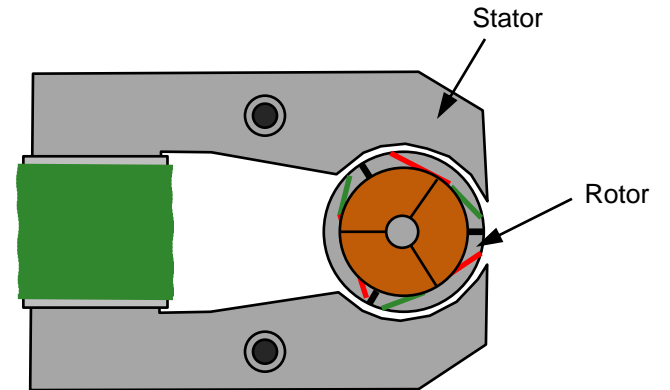
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## Motor Assembly

Side View



Top View  
(Cap and Gearbox  
not shown)



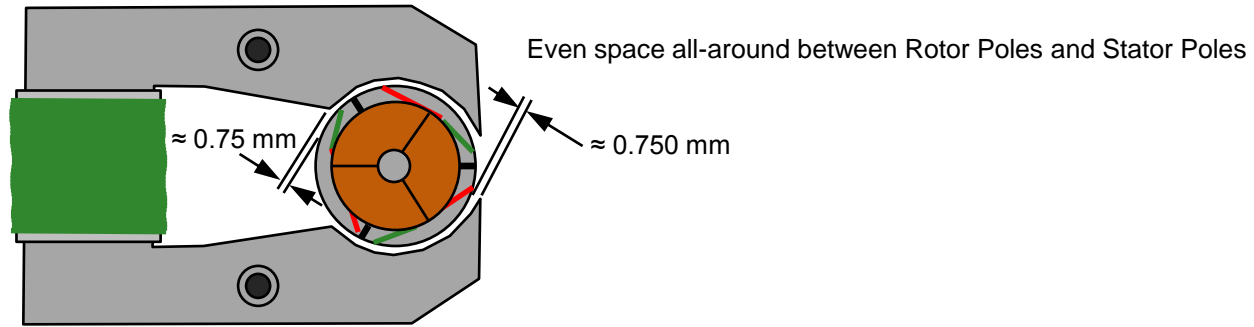
Interconnecting wires not shown

# Lionel Motor Binding Repair

## Rotor Alignment

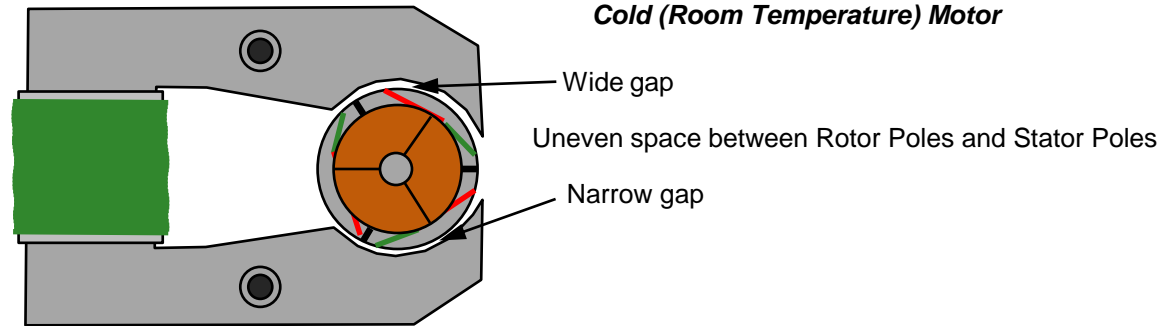
**Normal**

***Cold (Room Temperature) Motor***



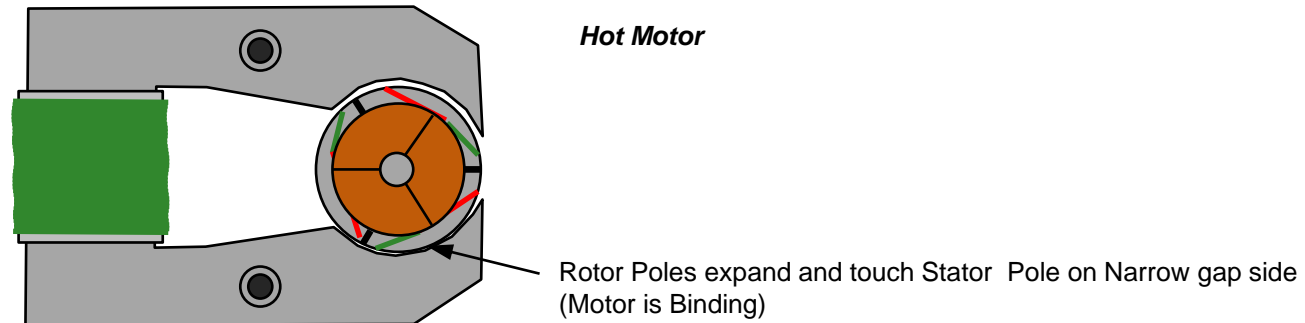
**Faulty**

***Cold (Room Temperature) Motor***



**Failure**

***Hot Motor***



# Lionel Motor Binding Repair

## Root Causes

Three causes of Rotor misalignment:

1. Stator Distortion due to heat/cool cycles
2. Post Vertical Bend due to heat/cool cycles
3. Bearing Wear
4. Cap Distortion due to heat/age

Any one or more of these can contribute to Rotor misalignment, however, Cap Distortion is the most prevalent.

## Lionel Motor Binding Repair Corrective Action

Sand the inside of the Stator Poles smooth (remove no more than 0.100 mm) to increase the gap between the Stator and Rotor. Block off all gear areas to keep debris out of the gears. Wash away debris with 97% Isopropyl Alcohol and blow away any residue with Compressed Dry Air (CDA).

Gently tap the posts to new angles to move the Cap (and thus the Rotor) away from the closest side of the Stator. Only a very slight bend (virtually undetectable to one's eye) to the posts is all that is normally required. Note, bending the posts may cause some tightness in the Rotor at the bearings. If the posts were bent only slightly and the Motor seems to run well at slow speeds, the bearings should resettle to the new alignment configuration. This may require several Heat/Cool cycles of the Motor to completely settle the bearings.

Push apart the Stator Poles no more than 0.100 mm. This requires special mechanical tools that are expensive and not normally found in a hobbyist's workshop.

If the Bearings are worn (determined by loose and/or excessive wobble of the Rotor), the Bearings may be over-drilled out slightly, scuffed inside, and filled with metal reinforced epoxy (J-B Weld 8265S). Then new Bearings hole are drilled into that epoxy. This requires precision milling machines that are not normally accessible to the general public. It is best to replace the entire Cap Assembly if the upper bearing is worn, and replace the Truck Chassis if the lower bearing is worn.

### Last Resort:

Sand the outer surface of each Rotor Pole smooth (remove no more than 0.075 mm) to increase the gap between the Stator and Rotor. Wash away debris with 97% Isopropyl Alcohol and blow away any residue with Compressed Dry Air (CDA). The metal from each pole must be removed evenly from all 3 poles to maintain dynamic (spin) balance of the Rotor when the Motor operates. A slight imbalance may be tolerated since the Motor does not spin at extremely high speeds and the relatively small diameter of the Rotor does not amplify imbalances.