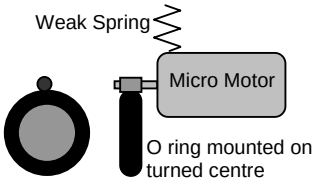
Nigel Lawton 009

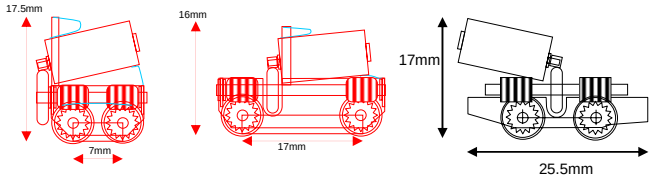
Micro Motor and Friction Drive Application Notes

Suitability
I recommend the use of a micro motor only when a larger motor cannot be fitted. In the context of 009, HOe and HOn30 this tends to mean that a micro motor is on only appropriate for very small diesel mechanicals and possibly some smaller bogie-type vehicles where space does not allow a more conventional solution.

Principle of Operation
I claim no novelty in these designs. The friction drive design was suggested to me as a concept by a fellow modeller and several others contributed to the discussion which led to me adopting this particular approach. The gearing used in this type of chassis is made up of two stages of reduction, firstly a friction drive and secondly twin worm and gear sets. The friction drive takes the motors rotation and reduces to a lower speed on a lay shaft. Worms mounted on the lay shaft drive gears on the drive wheels.



The Principal of the friction drive.



Various examples of how this may be combined with a worm drive

Reduction ratio
The reduction ratio of simple O-ring and metal shaft type friction drives is simple the ratio of the two circumferences. This in turn works out to be the ratio of the two diameters (circumference = pi x diameter).

Choosing the right amount of reduction
Its tempting to make the reduction ratio as high has possible. This will give you excellent low speed running, however the downside is that the top speed will be slow and potentially noisy. If you run the motor up to its full rpm in the 30,000 rpm region the commutation is well over 1,000Hz and this will generate what is best described as a scream. Its better the keep the motor rpm down allowing smooth slow running with a reasonable top speed, although it should be stressed that for many locos this will be a lot slower than those achieved by commercial chassis. The recommended range of reduction is from 30:1 to 100:1, my personal preference being in the region of 60:1.

Vehicle Weights
My friction drive chassis typically weigh less than 6g. The get good contact with the track the weight of the complete vehicle needs to be over 20g, preferably in the range 30g-40g. To some extent electrical pickup improves with increasing weight however this must be balanced against the increased load and hence power consumed by the motor. A maximum weight in the region of 50-60g for the complete vehicle is suggested. I have run a chassis with as much as 130g weight for short periods of time demonstrating that the motor is well capable of moving such a load. However this is more than is absolutely needed for good electrical pickup and traction and is likely to lead to the motor overheating. There is no room in smaller locos for such mass in any case.

Typical mainly whitemetal small 4 wheel diesel body kits such as those by Chivers and Meridian weigh in the region of 30-40g. Typical larger diesels and steam loco body kits weigh over 50g.

Running Voltage and dropper resistors
The micro motors I supply are nominally rated at 6V and should not be run connected directly to the 0-12V control voltage. The voltage should be dropped via a simple series resistor; I have found that 150 ohms is about right for most uses although this typically drops a little more than 6V. Its worth noting if, despite this you decide to run the motor direct from the controller and keep it ‘turned down’ that only more modern electronic controllers actually vary their voltage output, older ‘rheostat’ or variable resistor designs will be unlikely to work well with these small motors and may apply voltages significantly higher than the stated 12V. Even electronic controllers often have non-linear outputs so you can’t just assume that 50% on the knob is 6V; in my experience its likely to be much higher.