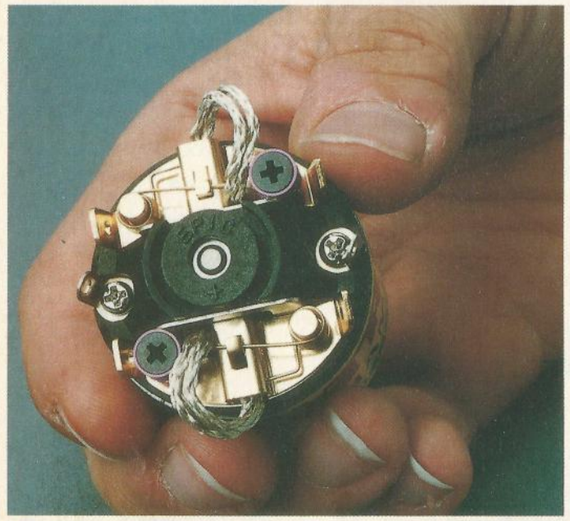
Maintain it!



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With a guide to how motors work and how to get the best from them and a pictorial guide to cleaning is RCMC's motor expert Pete Winton.

Every Racing Special we include an article on the care and use of electric motors – because it is so important. This years is no exception. A slightly worn bearing, some chassis misalignment, or badly set suspension – all of these will eventually come to light because the car becomes difficult to drive. Electric motors wear only slowly, and the effect of their worsening performance is difficult to detect. Follow our guide for more power all the time.

All you need

All motors have two primary characteristics which must be known before a proper choice

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1. The endbell of a typical motor.
2. Un clipping the brush springs.
3. Removing the brush springs.
4. Carefully slide out the brush.
5. Both brushes released from the endbell, if badly worn consider replacing.

can be made. Motors develop torque, which is their ability to get the car on the move; and power, which is their ability to keep it moving against the forces of friction and air resistance.

Internal combustion engines develop their torque in about the middle of their speed range. Electric motors develop torque at the very bottom of their speed range. This is why an electric motor generally needs no gearbox. Underground trains and milk floats are two examples of very heavy vehicles powered by electric motors which need no gearbox. The gearbox on a car, with its five or so ratios is there to ensure that the torque from the engine can be multiplied to get the car on the move. An electic car has one fixed gear ratio in its gearbox.

Turn up!

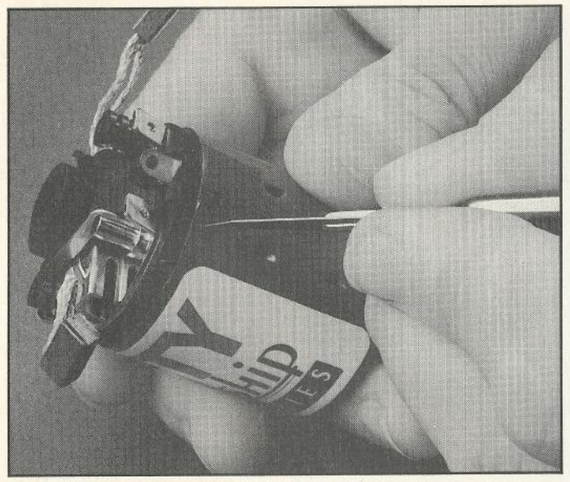
Electric motors for 1/10 off road cars are identified by the number of turns and the number of wires. Copper wire is wrapped around an iron pole (three poles in most motors) and this makes the electro-magnetic field which reacts with permanent magnets.

The less wire on the pole, the more current is passed, and the more torque and power the motor can develop. If one wire is wrapped round the pole, the motor has certain characteristics. If two or more wires are used, the torque and power characteristics change.

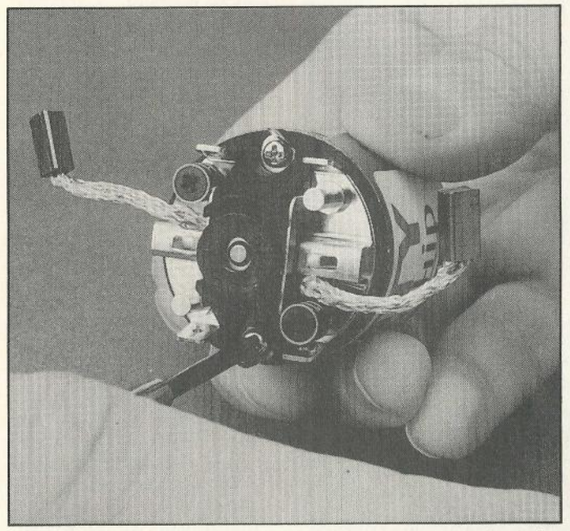
We refer to the amount of wire as the number of turns, and the number of wires as single (one), double (two), triple (three) and quad (four). A 16 turn triple has 16 turns of wire around each pole, and has three wires wound at once.

Broadly speaking, the less wire, the more current the motor needs, but this does not mean more speed. So, an 11 turn double should be faster than a 14 turn double? Not always!

Unlike the internal combustion engine, electric race cars have a limited supply of fuel, or energy. Whether a very powerful motor is fitted or a less powerful one, the same energy source is used – we fit the same pack of cells.

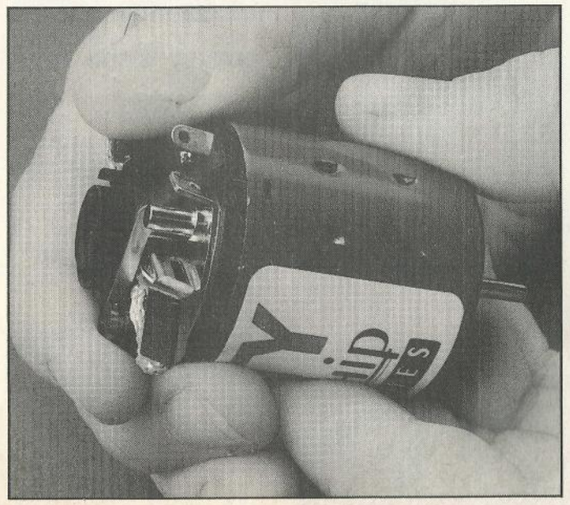


▲6 *Mark the can clearly so that it goes back together as it came apart.*



▲7 *Unscrew the endbell screws slightly to allow it to twist.*

Carefully turn the endbell on the can until it is released. 8▼



Ratios

To obtain the best performance from a powerful motor the gear ratio must be changed so that the motor will only use the energy available during the race. An 11 turn motor requires a gear ratio around 12 to 1, so for every time the rear wheel turns round once, the motor turns round 12 times. A supposedly less powerful motor, say a 14 turn, needs a gear ratio around 9 to 1. For every once the wheel turns, the motor only turns 9 times.

There is a trade off between the more powerful motors and the less powerful. The 11 turn motor geared at 12:1 will give us more acceleration, thus reaching its top speed more quickly. Although the 14 turn motor gives less acceleration, it will probably reach a very similar top speed.

Trade off...

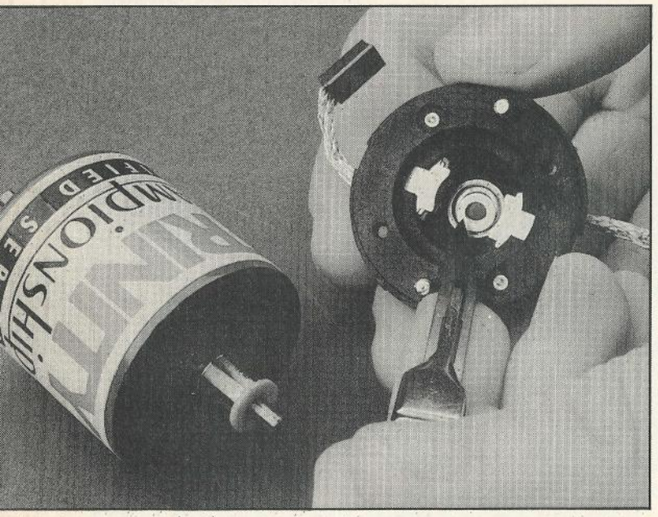
The trade off is in the amount of power you as a driver can handle. The more powerful motor makes the car more difficult to drive. Anytime you spin, or slide sideways, time is being lost, and anytime lost will reduce your laps in the race.

The wear and tear on tyres, gearbox, speed controllers and batteries from a more powerful motor is much greater than with a less powerful motor. What counts for more than power is efficiency.

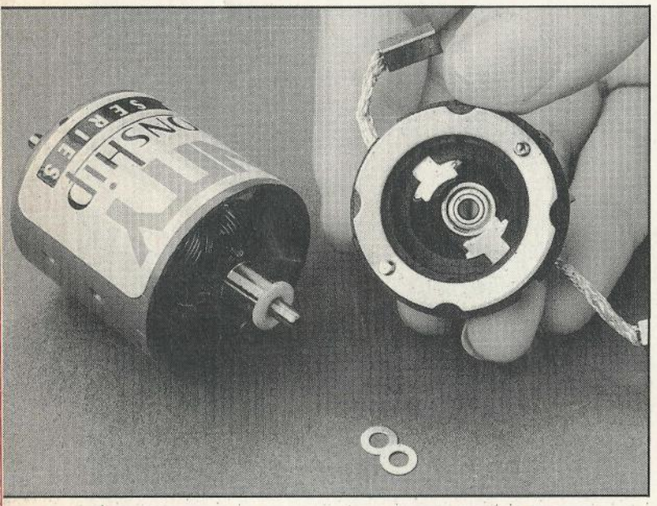
At its most efficient, the best electric motors in the R/C car classes convert 80% of the energy they consume into useful energy driving the rear wheels, or all four wheels. Dirty or worn bearings, worn brushes, or out of true commutators all contribute to reducing this figure to as low as 60%.

If the more powerful motor gives the driver a 5 % advantage, but due to neglect it is only 65% efficient, more is lost through a badly maintained, but less powerful motor.

The choice of all cub racers should be motors of 14 to 17



Inside you will find that the spacer washers often hide inside the endbell – keep an eye on them and where they go.



Above; Remove the washers and lay them in the order they are removed. Below; Carefully pull out the arm and look for washers on the far end.

turns, with a selection of doubles and triples. These motors are easier to maintain, last longer, and give the sort of performance most of us can handle.

Double wins are the workhorse motor, giving an excellent spread of torque and power. They offer almost seamless acceleration right up to top speed, and pick up quickly when the throttle is opened.

Triple winds offer slightly less torque, but are strong on power.

Fast drivers

So many drivers use very powerful 11, 12 or 13 turn motors, and then use some device (torque limiting speed controller for example) to reduce the torque on acceleration. This is a waste of time. Better to use a 14 or 15 turn motor and be able to use all the power all the time.

How the motor is cared for is very important, but its use in the car has a bearing on how often care – maintenance is needed.

In the car, the most important aspect is the gear ratio. On almost all R/C cars, certainly on the competition models, the gear ratio can be changed. The gear that fits on the motor, the pinion, and the gear that fits on the gearbox, the spur, can be changed. This alters the gear ratio. Principally, it alters the number of times the motor turns to give one revolution of the rear wheel.

Gear ratios will depend on the weight of the car (2WD or

> ...In the car, the most important aspect is the gear ratio...

4WD) the type of track (short/long/open/twisty) and the track conditions (wet/dry/slippery/grippy). Despite all this there is probably one ratio which works for a given motor in the majority of conditions.

LRP recommend their orange AE motor for 2WD on an overall ratio of 10.2 to 1 (10.2:1). This ratio should never be varied by more than 1/2 to suit the track

conditions. From 9.7:1 to 10.7:1 the motor should work. This applies to all motors not just LRP.

If you need to vary by more than 1/2 a ratio, then the motor is not suitable for the track, or your driving style. 9.7:1 would be for long fast tracks giving higher top speed. 10.7:1 might suit short twisty tracks giving better acceleration.

The timing

The timing of a motor is important. LRP expressly forbid altering the motor timing as this is set at the factory. As a general rule there is no need to adjust the motor timing, but on certain occasions it can help.

On slippery tracks it is worth advancing the timing and running a higher gear ratio. Going from (say) 10:1 to 9.5:1 with an increase in timing tends to reduce the torque (and hence wheelspin) at low revs thus making the car easier to drive.

Short track

On shorter tracks it is worth retarding the timing and going to a lower gear ratio, from (say) 9.5:1 to 10:1. This is okay providing there is grip, but on a short slippery track a 17 turn motor will be much easier to drive than a 14 turn, so look to motor choice first.

Never keep going to higher and higher ratios with the same motor (from 10.5:1, to 10:1 to 9.5:1 for example) because the car is too slow and lasts the race easily. Eventually the motor will overheat causing serious damage to the commutator and magnets. If a motor is obviously too fast (or too slow) change the motor, not the gear ratio.

It is the choice of gear ratio that is important, but so equally is the choice of motor. Take care with both.

Run in

New motors should be run in on a four cell pack. Run the motor until it is warm, let it cool, and run it again. Repeat until the brushes have clearly started to bed in to the shape of the commutator.

Drive gently on the first run, not too much acceleration and no brakes. After that make sure the motor is kept clean and any dust or dirt is cleaned off after every run. Check the brushes and remove any dirt with a cotton bud soaked in motor cleaner.

Change motor brushes after every 15 or 20 runs. Every second brush change have the armature re-trued by an expert. Check the bearings and clean them if they do not run true and freely.

Jurgen's choice

We asked Jurgen Lautenbach of LRP for his recommendations on motors. Jurgen's advice is:

*** Never change the timing of an LRP motor.**

*** Follow the gearing instructions with the motor.**

*** Let the motor run once in a while on 4 cells to clean the commutator – no sprays or cleaners.**

*** True the commutator only when performance is going down, not after every heat.**

*** Have a motor service done once in a while, but only by an experienced hobby shop or driver.**

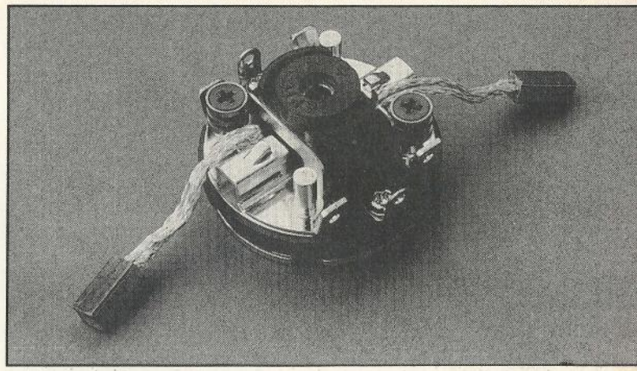
As to motor types, we would guide you as follows:

Single winds – Rather out of fashion these days as they are all power and little torque. Not an off road wind, but all standard motors are 27 single turns.

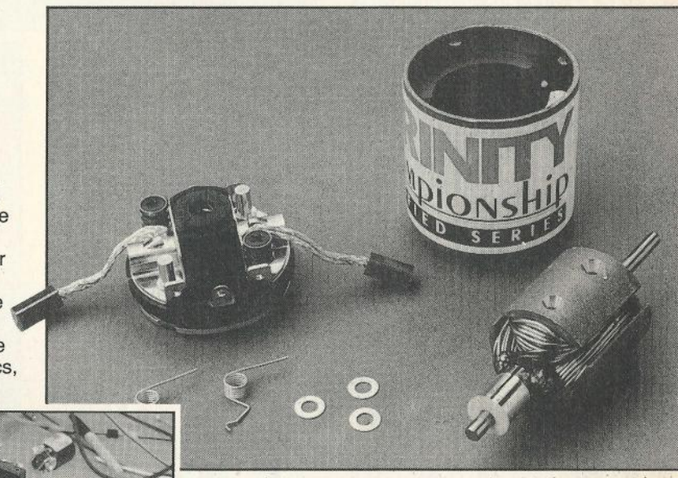
> ...Never change the timing of an LRP motor...

Double Winds – The workhorse, every driver should have one. We would recommend a 14 turn double of any make geared about 9.8:1 for 2WD and 10.2:1 for 4WD. Don't play with the timing, just get out and drive it.

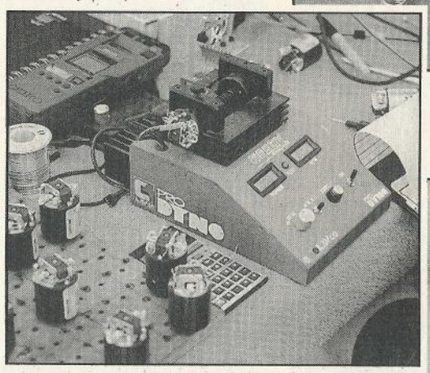
Triple winds – More single than double in characteristics, but many people like them.



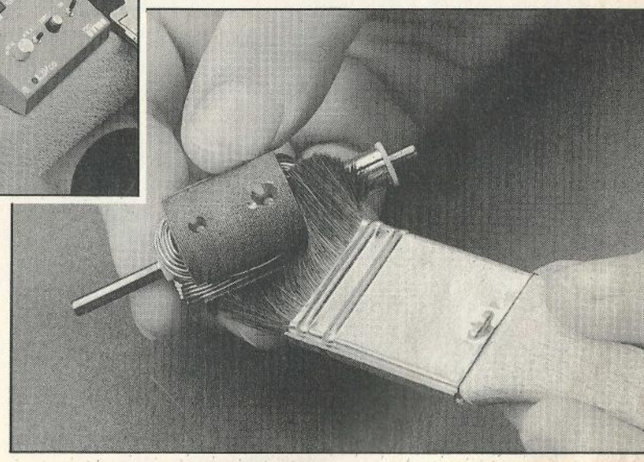
The endbell ready for the bearing to be checked and brushes replaced if needed.



Mike Reedy used the Lavco motor tester to gain the ultimate at top meetings.



The components of the motor – lay them out on a clean surface so that you know where they go! Below; Give the arm a careful clean to remove dust.



Go well in trucks where their power helps keep the brick-like aerodynamics on the move. We would recommend a 16 or 17 triple geared about 9:1 for those slippery tracks using 2WD. Not really a 4WD

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motor.

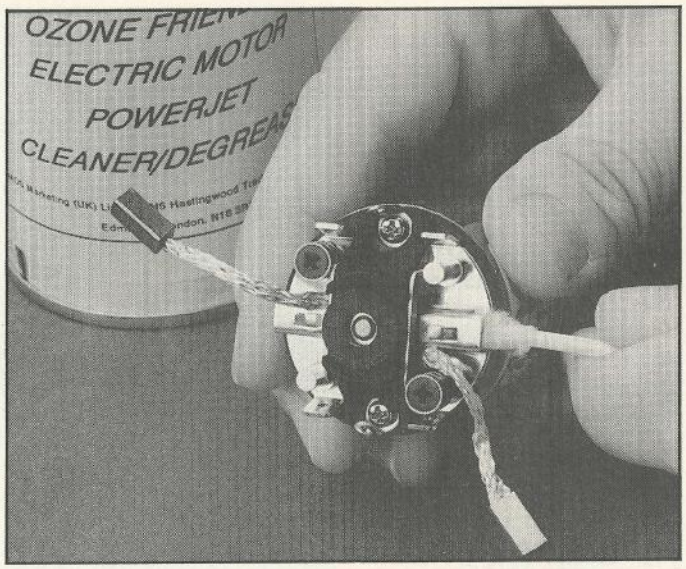
Quad winds – Fast making a comeback for their very smooth characteristics. Here we venture into the ultra-quick so try a 12 quad on about 11.5:1 2WD and 13:1 4WD. For this motor you need grip, skill, and preferably 1700 SCR cells.

Get this out of shape at speed and the spares bill will rocket!

Jurgen recommends two of his LRP motors

- for 4WD LRP Blue SE geared 11.8:1
- for 2WD LRP Orange AE geared 10.2:1

Parma recommend two of their motors



- for 4WD Parma 11 double geared 12:1
- for 2WD Parma 12 triple geared 11:1

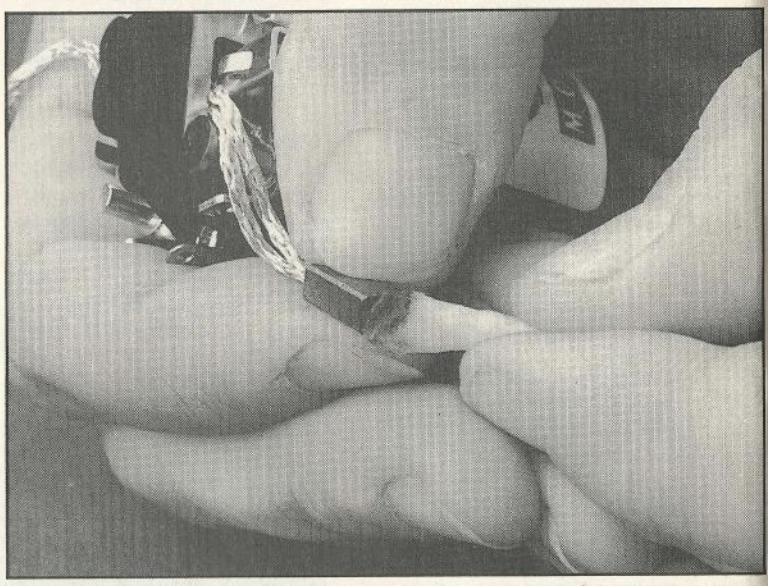
Twister recommend two of their motors

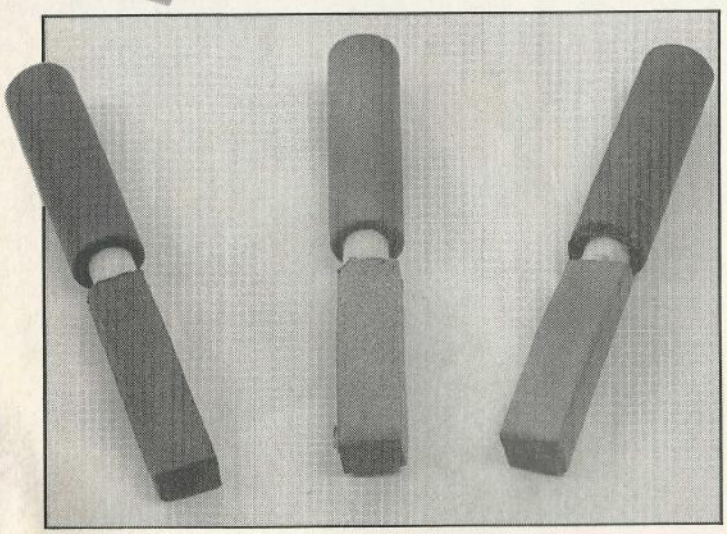
- for 4WD Twister 14 triple geared 10.6:1
- for 2WD Twister 14 single geared 9:1

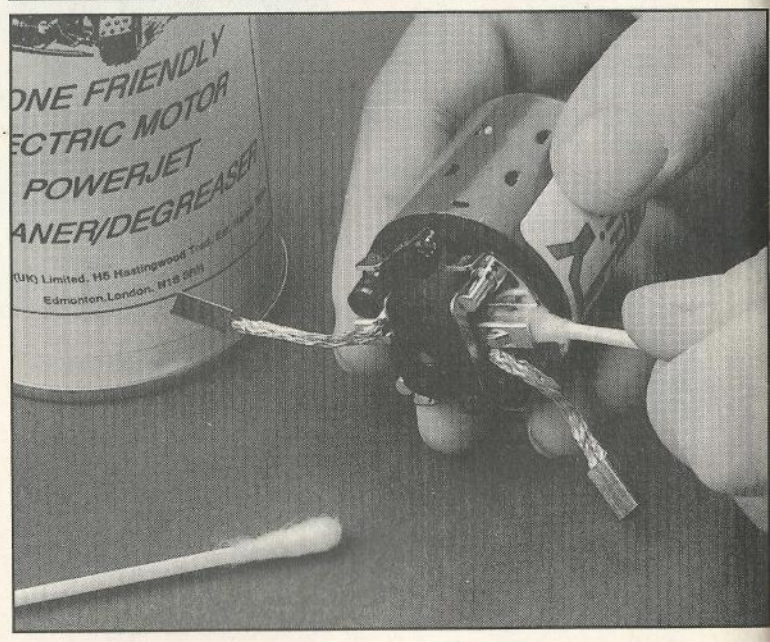
Always remember that the way you drive has far more to do with lap times than the power of the motor. Top National drivers using standard motors will always beat the average club driver with their hot modified simply because they have more skill.

Choose wisely, drive skillfully and happy motoring!

Above; Cleaning the arm quickly can be done with a cotton bud and cleaning fluid. Right; Give the brushes a clean at the same time.







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Left; Soft cleaning sticks can be used but a strip down and proper clean will give better performance.