

# LUBE RATIONALE

by Leon Bennett

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What's it for? Rubber lube is at best a sticky, goopy sort of stuff and rubbing it into our motor strands isn't one of life's better moments. Worse, this task must be done thoroughly, or else the motor may very well "explode" in the model bringing us great disappointment. The obvious 'what for' answer is that lube reduces the chafing resulting from motor strands rubbing upon one another whenever a motor is wound or unwound. While true enough, lube does something else that is likely more important: it permits the storage of greatly increased amounts of energy within the wound motor.

Consider this case. Suppose we wind a dry (unlubed) motor to a safe level of turns, and then release it, measuring the energy available. Next, suppose we lube the same motor, and wind in exactly the same amount of turns. Upon release, does it offer the same amount of prop-turning energy? More? Less?

The answer is more - very much more - as the number of turns begins to approach the motor's bursting point. How much more? Experiments show that roughly twice the energy is delivered by a well-lubed motor as compared to the same motor, dry. Why is that? Because a rubber motor is really a torsional spring. Its stored energy depends upon the winding torque and the number of turns. More torque, or more turns, mean more energy delivered. One way of picturing this relationship is to measure the winding torque and then plot it as torque vs. turns. The area under the resulting curve (see graph below) represents the energy. More area means more energy.

Curve I represents the dry motor, curve II the motor treated with one type of lube, and curve III the motor treated with yet another, and better type of lube. At a low number of turns, say 20, there's no practical difference between the curves. Lubing is pointless. Starting at about 30 turns, lubing begins to payoff in the form of more energy stored for a given value of torque. Moving to higher torque, for example at about half the maximum torque (10 inch-ounces), the area under curves II and III is roughly twice that under curve I. That means that the lubed rubber has stored about twice as much energy as the dry rubber. Going to still higher torque values, a new factor emerges: the lube type itself begins to matter. Lube III is better than lube II (what you usually see when silicone based lubes, like Dow 33 are compared to more traditional types, liquid soap and glycerin mixtures - Ed).

