Rubber Lube Compendium

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Recently published in the May/June 2013 issue of Tailspin,
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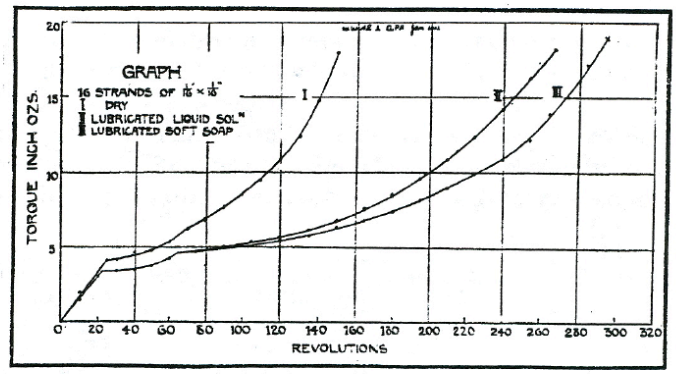
This article was complied by your editor from two pieces published in the January/February 2003 and the September/October 2004 issues of the Flying Aces News. It is well worth reading for those clubsters who lube their motors religiously but really don't have a full understanding of why they do it other than they were told it was a must procedure when they first got involved in the hobby.

What's it for? Rubber lube is at best a sticky, gooey sort of stuff and rubbing it into our motor strands isn't one of life's better moments. Worse, the task must be done thoroughly, or the motor may well "explode" in disappointment. The obvious 'what for' answer is that lube reduces the chafing resulting from motor strands rubbing upon one another whenever the 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.

How's that? Well, consider this case. Suppose we wind a dry (unlubed) motor to a safe level of turns, then release it, measuring the energy available. Next, suppose we lube the same motor, and wind in exactly the same amount of torque. 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 approaches the bursting point of the motor. How much more? Checking the table below, we find that we have roughly **twice the energy** delivered by a well-lubed motor as compared to the same motor, dry. Why is that? A rubber motor is really a torsional spring. Its stored energy depends upon the winding torque and the number of revolutions. More torque (or more revolutions) mean more energy. One way of measuring this relationship is to measure the winding torque and then plot it as torque versus revolutions. The **area under the resulting curve on the graph** represents the energy stored. More area means more stored energy.

On our graph, curve I represents the dry motor; curve II the motor treated with one type of lubricant, and curve III the motor treated with a better type of lubricant. The motor itself remains unchanged. At a low number of turns, say 20, there is practically no difference between the curves. Lubing is pointless. Starting at about 30 turns, however, lubing begins to payoff in the form of more stored energy for a given value of torque. Moving to higher torque, for example, at about half of max torque (10 inch-ounces), the area under curves II and III is roughly twice that under curve I. This means that the lubed rubber energy storage is about twice that of the dry. Going to still higher torque values, a new factor emerges: the lube type itself begins to matter. Lube type III is shown to be better than lube type II.



Let's talk more about the classic problem of finding an optimum rubber lube. For as long as I can remember, and I have been in the hobby for a very long time, we have been assailed by dubious claims for magic elixirs, each guaranteed to energize a rubber motor while lengthening its life. Mostly, the motors ignore the magic and blow themselves to bits anyway, in the same old fashion way we are familiar with. Why? Is there something drastically wrong with the lube formulas or, is it all nonsense?

We need two different qualities in a rubber dressing. First, the lube must act to lower the friction between the rubber strands as they are twisted. One automatically thinks of oil for this purpose, but unfortunately most oils attack rubber. As an extreme example, there's engine oil. Dousing your rubber motor in SAE 30 and letting it stand results in the motor cross section actually increasing in dimension while turning cheesy. After a few weeks of this treatment, the rubber motor will no longer store energy - it's ruined.

This brings us to the second quality, rubber protection. The motor must be protected from whatever is serving as the lubricant as is demonstrated above. To avoid attacking the rubber, most of the lubes in the good old days were soap based. As the soap was suspended in water, making it easy to apply, it was necessary to prevent freezing and evaporation in shipping and storage. An additional storage problem was that the soap solution turned moldy. Glycerine was found to be useful as an additive and, when combined with salicylic acid (a mold fighter) could solve all these problems. There were many commercial lubes on the market that contained all these ingredients in the good old days that functioned fairly well and that sold for a reasonable price.

Naturally, human nature being what it is, led many of us to attempt brewing up our own concoctions in the kitchen with varying degrees of success. One description of a good finished lube back in the day stated that it "should be of a thick consistency, something between a jelly and a thick soup, and should have a most unpleasant slimy feel, like nothing else on earth:' A few old time modelers, gifted at practical chemistry, could prepare a good lube, one that was even better than store-bought products. However, the odds didn't favor success. Certainly, cooking up this stuff to the proper level wasn't easy, for the formula was vague and the glycerine potion always uncertain in its friendliness. In short, the good old days were truly terrible.

Today, a very good soap type lube can be easily purchased from any supplier. As for an alternative, there's much to be said for castor oil, nowadays made without odor and available cheaply at any drug store. Silicone oils and grease have many fans as well, for these tend to retain their viscosity ratings despite drastic changes in temperature. **The catch with silicone grease is a need to rub it in very carefully because it does't flow. Any area left bare remains bare. which can haunt you later on.** The single worst explosion I've ever experienced came after applying a silicone grease lubricant Admittedly, many other factors are pertinent, and it could well be that something else went wrong. As a practical matter, I'm sticking with my favorite, castor oil.

My ratio of rubber explosions to successful flights has remained constant over the years. I must say, however, that some explosions I've experienced, such as midair bursts or bursts at 25% turns on a fresh new motor, are hard to explain. A certain degree of fatalism is necessary in this hobby. Either that or it's back to the stove and the cooking pots.