Driver's Ed. Education
A Series of Specifics for Success
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Article #15 – "R-Compound Tires II"

Let's chase the DOT racing radial situation some more. Last month, we set many basic rules for their proper utilization.

We learned that:

** Since DOT radials are much different in construction than bias ply or even radial slick tires, the set-up requirements are *very different.* There is little, if any, overlap in data between these different tire types.

** Since they have little sidewall flex, they are optimized by camber settings, not pressure.

** They should be run at or very near the recommended pressure to protect their inner structure and maximize their performance and longevity.

** Within the recommended inflation range, pressure has little to do with surface temperature.

** Because of higher negative camber settings, the middle to inside of the tire will naturally run hotter.

** Pressure tuning primarily effects the tire's feel rather than its actual performance. However, the highest cornering potential is obtained at the high end of the pressure range because the tire is better able to handle the job mechanically.

** Don't buy a pyrometer solely to measure surface temperature differentials. Within the proper range, pressure has little effect here. They *can* be useful as a general guide to overall tire performance. Buy a minimum 3/8" probe type, not an infra-red.

** Tire wear patterns are the most accurate and dependable guide to proper set-up. Optimum settings will show very little wear on the outside shoulder.

Now that we've established some general rules, let's expand on some of those points. To say that a pyrometer is worthless is incorrect. However, their proper usage is severally compromised by circumstance. The main problem is that tire surface temperatures drop so quickly that if you don't measure them almost immediately, you've missed your window. If you've run any straightaway distance before the measurements are taken, you've already significantly altered the temperature profile. These factors make it awfully hard to get real usable data unless you have a crew and a paved surface all to yourself.

Secondly; full-bodied cars tend to alter the surface temp profile because the inner area of the tire naturally receives less cooling air than the inner portion. Once again, surface temp differential measuring came from bias ply usage, primarily on open wheeled cars.

Use your pyrometer to judge the overall effectiveness of pressure adjustments as they pertain to how hard the tire is working internally, not its surface temp differential. Since a majority of tire heat comes from the machinations of the various belts and bands in the casing, higher temps generally call for an *increase* in pressure to keep the tire supported structurally.

Somewhere out there exists a pressure setting that will not only allow the tire to work extremely hard, but allow it to do so in relative comfort temperature-wise.

Pressure is not the baseline tuning method for DOT racing radials. However, once you've discovered a camber setting that agrees with your car and gives good tire wear characteristics, pressure and a stop watch become the final building blocks in the foundation of speed. It should be noted here that any camber changes will likely require pressure adjustments for ultimate optimization. However, in the end, pressure adjustments have more to do with "what the driver likes" than anything else, as comfort generally brings a driver's fastest times… *initially.*

Many drivers today are running low pressures because they equate the feeling of safety and confidence with speed or tire adhesion. As mentioned previously, radials tend to be a little twitchy, particularly in the first laps. Lowering the pressure eases the "hard edge" feeling of these tires, giving a wider comfort threshold. But, as we've learned, they may be damaging their tires - both the mechanical and chemical makeup - and preventing them from working in a range that will give the best performance *and* longevity.

Let's say you started with 30psi cold and measured 40psi hot. You then lowered the pressure to 26psi cold and *still* measured 40psi hot; what would that tell us? It would suggest that while the car perhaps "felt better" at 26psi cold, it was actually stressing the tires *more* because of under-inflation. The missing key is temperature.

Your now trusty pyrometer (now that you know its true purpose) would have shown that the second run produced higher temperatures because the tire was working harder. While the softer pressure provided more driver comfort, it was not providing optimal internal support for the tire, thus creating more stress and heat. The car may "feel" better at low pressures, but more performance and tire wear are to be found at a higher pressure.

Obviously, confidence is a very important component of speed. As mentioned previously, the fastest drivers usually run in the upper end of the pressure scale; a range where the radial tire can feel loose or twitchy. However, the higher pressures likely allow - and even demand - the car to be driven harder so as to utilize this maximized cornering power and grip. This raises the bar higher - the commitment level as well as the rewards to be had. True, it takes a more skilled and daring driver to run in this range, but the benefits are there, both in speed and - ironically - tire life. Speed equals fun. Tire life equals *MONEY!*

Most of the R-compound tires available today have a "sweet spot" around 40psi hot. This is a pressure where they give maximum performance. However, you must remember that much more than initial cold pressure is used to get to this zone. Using well researched suspension settings in concert with pressure adjustments, you will be shooting for the proper balance between them all that gives you good tire wear, moderate cold-to-hot pressure changes, reasonable surface differentials, and good handling. Lots of parameters to deal with, but you asked for it when you bought the tires, eh?

So now you've got a good foundation under your tires. Anything else to do? YOU BET!!

But That Rubber Costs Money!..

"Removing about half the tread from most R tire's surface by having them shaved will help them last longer." Sounds ludicrous, doesn't it? Well, let's discuss why it is an absolute fact.

The main enemy of a tire is excessive heat, particularly if it is localized. Most excessive heat situations are caused by improper inflation or suspension set-up. Surface friction is not a major producer of heat; remember, the tire's surface cools quickly!

As we've learned, the surface of the tire is not where the danger lies; it's under the tread at the cap ply. This is where the tire separates or "chunks." By removing rubber from the surface, you are effectively removing insulation, or "heat sink" from the tire, thereby allowing the heat to dissipate more easily. A smaller, thinner object will hold less heat than one bearing more mass. A thinner tread surface holds less heat!

In addition, shaving a tire will improve the transient response and feedback it gives because of reduced tread squirm. A 2' steel bar is much easier to bend than a like 1' example because of the increased mechanical advantage working against it. The same applies to the individual tread blocks of a tire. A shorter tread block will deflect or squirm less than a taller one. Incidentally, this mechanical squirming of the tread produces more heat than surface friction, and it is transferred *under* the tread to the cap ply, not to the surface.

Tires on… Tires off!

Here is something that is most beneficial, but is impractical for most of us to achieve: Heat Cycling! Like many other items, race tires function best when broken-in properly. Although they feel incredible in the first laps, this is not the time to abuse them. Tires are made up of many mechanical and chemical components. These components need to be "familiarized" with each other and the task at hand to achieve maximum performance. If a tire is abused early, its performance will degrade rapidly. If it is brought along slowly, its performance will be more consistent for a longer duration.

Here's the scoop: The tires should be inflated 4-6lbs over normal cold settings (this provides added safety against mechanical damage). You then proceed to gradually bring the tires up to full operating temperature by driving increasingly swiftly, but smoothly and conservatively; no skidding, sliding, or other laying-down of rubber.

At approximately the 15 minute mark, the tires should be up to full temperature. You then proceed to the pits, remove the tires, decrease their pressure, and allow them to cool for as long as you possibly can (*at least 24 hours,* the longer the better!).

What you are attempting to achieve is analogous to the heat treating of metal. Many metals must be heated to just the right temperature, and then cooled slowly to form the proper molecular links. If you over-heat or cool them too fast, you ruin the metallurgical structure and they become very hard, but brittle.

Here's another analogy; did you know that ice that freezes slowly is much less brittle, or "chippy", than ice that freezes rapidly? If you were making hockey rink ice, this would be important. Following some of that reasoning, you should never artificially cool tires with water. As with steel or ice, if you artificially cool them (quenching), or cool them too rapidly, you "shock" the rubber and it becomes hard. You are trying to make the molecular bonds of the rubber *tough*, not hard.

Black Magic

We've covered lots of ground here. This tire thing really runs a lot like life; Trial and Error! The best you can hope for is some good solid information to help you make the right choices. It also helps that if, having good information, you are applying it to the proper area in the proper way. As a recent Pirelli ad campaign suggests, "The Wrong Equipment can Ruin a Performance!" To that, we can add that the wrong information, incorrectly applied, can ruin the equipment!

In order to optimize the longevity and performance of your DOT R-compound tires, you will likely have to increase the amount on negative camber you run. If you drive your car on the street as well, this will cause accelerated wear in your street tires and make the car wander more, particularly on crowned or well-worn road surfaces. Once again, we are left to deal with another trial and error situation where we will be looking for the best compromise between track and street tire utilization.

The answers will be there in front of you. By looking at your tires, you will see the efficacy of your settings. By interpreting the evidence presented correctly, you will know what adjustments to make to get you where you want to be. Hopefully, these articles will help clue you in to what you are looking at, how to interpret it correctly, and what to do to improve the situation. It may be only money, but seriously; Who's got money - or rubber - to burn?