Pyrometer Tips

A. Proper Depth and Location

In order to get consistent and relative tire temperature readings you must be sure to insert the probe as near to the cord as possible. You must also insert the probe to the same depth at all locations at each and every tire. Temperatures should be taken at 3 locations on each tire. Take one reading at the outside approximately 1.5" from the edge, one reading in the middle, and one reading approximately 1.5" from the inside edge. Do every tire the same way at the same depth and location.

As you insert the probe deeper into the tire you will find more heat. If you insert the probe half way in at one location and then all the way in at another location you will get temperature differences due to the different depths. You are trying to see relative numbers based on how the tire is heating due to camber or loading changes. Improper depth can confuse the true issue.

By inserting the probe to a depth down near the cord you will also use the surface rubber to momentarily insulate outside elements such as brake and engine heat away from your true temperatures. Further, by getting down near the cord you will also measure heating that is caused by an elastic stretching of the rubber. If your probe is too shallow you will not see the heat generated by the pulling of rubber from the tire carcass.

Another thing to consider when using a probe type pyrometer is that rubber is a poor conductor of heat. The metal probe will suck the heat out of an insertion hole very quickly as the metal probe transfers heat quicker than the rubber. At the first tire in a temperature session you should pre-heat the probe by inserting it in the rubber a few times before taking your readings. Once the probe is pre-heated you will get faster, more accurate and relative results.

Be careful not to leave the probe inserted too long in any one location. You need to measure the temperature rise at its maximum point and no more. If you wait too long the insertion point will start to cool, giving you inaccurate readings.

Pyrometers with an anticipation feature speed up the temperature taking process and automate the procedure so that your readings are taken as quickly as possible. You simply insert the probe and immediately hit the read button. The pyrometer will calculate the rate of temperature rise and automatically lock in the highest reading. The pyrometer will then prompt you to move to the next location. Pyrometers with anticipation complete all 12 temperatures in nearly half the time of conventional pyrometers.

B. Adjustable Tip Probes

If you use a pyrometer with an adjustable tip probe you can set the probe to match the rubber gauge (thickness) for the different tracks that you run. The adjustable tip allows you to bury the needle of the probe all the way to the housing to insure that you are at the same depth each time. Repeatability increases dramatically and the relativity is better because you are always down near the cord with your probe tip.

C. Getting to the Tires Quickly

You should always get to your car as quickly as possible to take tire temperatures. Each time the tires roll across the pavement the cooler pavement is sucking heat from the tires, which can skew your readings. You should even have your car stop at the nearest safe place to the track and have a crewmember waiting to take the readings.

D. Camber Adjustments

Your pyrometer is a tool to see if you need to make a camber adjustment. I like to see the infield edge of the front tires run 10-15 degrees hot. 10-15 degrees gives you an indication that you are running the maximum amount of camber that will not give you excessive tire wear. You should always monitor the wear in conjunction with your pyrometer readings to insure that you do not wear out the edge of your tires prematurely.

I. Too Much RF Camber

Sometimes teams are running more RF camber than necessary as they are fooled by their pyrometer readings. If you are running an excessive amount of RF camber the pyrometer might only show the inside edge at 20 degrees hot. What you may not see is that if you reduce camber stand the tire up the inside edge may stay 20 degrees hot. Too much of a good thing so to speak.

Start with a proven camber or your car builder's recommendation. Slowly add camber so that you can see the gradual heating of the inside edge. When you run excessive amounts of RF camber the tire is no longer able to stretch the contact surface between the sidewalls. The rubber cups and bunches at the inboard edge due to the excessive camber causing artificial heating, a loss of grip, and premature wear.

II. Too Much LF Camber

Because the LF has less load than the RF, you can sometimes see a visual clue that you have gone too far with the camber. The outside edge starts to show a strange beveled angle that is about 3/4" wide right at the outside edge. Instead of cleanly rolling the rubber off the outside edge the tire gets tipped so much when turned that it chews off the very outer edge.

I would rather have slightly less than optimum LF camber than too much. The tire performance will stay all day as compared to excessive amounts. Excessive amounts of LF camber chews off the outside edge resulting in poor performance after just a few laps. The car will not reach optimum speed and the performance of the LF will fall off very quickly.

You should strive to adjust the camber to the maximum limit without overshooting. Correct adjustments will help the car turn better on both long and short runs.

III. Too Much Stagger

On occasion you can see too much rear stagger in your tire temperatures. Sometimes the infield edges of the rear tires are noticeably hot. Depending on the tire wear characteristics of a given track, I might tone down the rear stagger to even out the edge temperatures to insure that the car is good on a long run. Judgment must prevail, as this is not a hard fast rule. Simply another variable to consider.

E. Taking Advantage of New Tires

New tires are a big investment. Whenever a new set goes on the car I put more value in the tire temperatures from the sticker tire run and make sure that I get good temperature readings. When the tires are new they will have more friction and generate more heat than at any other time. The additional heat and added friction can provide subtle clues that may not be seen with worn tires.

Further, new tires are not worn down on any part of the contact patch. Therefore, your readings are not skewed by an area on the tire that has already been ground off. New tires have more friction so the tires are less likely to slide or spin. The temperatures more closely reflect the heat

generated by tire loading. Looking at the effect tire loading gives you an indication of what the car will do in the future. Hopefully the car is already fast for the main event, but the new tire temperature opportunity might guide you into adding a touch of bite or putting in more stagger based on what you learn from your readings.

Be prepared and insure that you get a good temperature reading when new tires go on the car.

F. Averaging

Temperature averaging is a good tool when your car is fast and only needs fine tuning. Tire temperatures are of little value when your car is in left field. If you car is handling poorly than the front tires will slide early in the turn and the rear tires will slide on exit. The sliding overheats the tires and can make the temperature sheet look balanced.

Temperature readings are more valuable as you get faster and faster. You can use the temperatures to assist you in fine-tuning the chassis. You might see something in the numbers that lets you look into the future allowing you to make a fine adjustment that improves the handling of the car on a long run.

Some memory pyrometers calculate the temperature averages for you. These devices really save a lot of time and allow you to use averages as another tool to fine tune your racecar. You can also use a simple calculator to accomplish the task.

Averaging Tips

By using historical information and common sense you can learn to see potential problems in your tire temperatures. Below are some scenarios based on tire temperatures and some potential cures.

Left Average is abnormally cooler than Right Average

1. Lower the panhard bar
2. Smaller sway bar or less sway bar load
3. Softer right side springs or stiffer left side springs
4. Less stagger
5. More left side air pressure or less right side air pressure
6. Less left side shock rebound

Rear Average is hotter than Front Average

1. More front spring rate if car is unstable in
2. Less rear spring rate unless car pushes on exit
3. More sway bar or more sway bar load if loose in the middle and on exit
4. Lower panhard bar
5. More front air pressure if center of tire is cool
6. Less rear weight if loose on entry and not loose on exit

Front Average is hotter than Rear Average

1. Less front spring rate if car is stable on entry
2. More rear spring rate unless car is unstable on entry
3. Less sway bar or less sway bar load if car is tight in the middle and on exit
4. Raise panhard bar
5. Less front air pressure if center of tire shows hot

6. More rear weight unless car is loose on entry or in the middle

Cross LR to RF is Hotter than LF to RR

1. Less diagonal weight
2. More stagger
3. Smaller sway bar or less load
4. Raise panhard bar
5. Less LR spring rate unless car is loose on exit
6. Less RF spring rate unless car is loose on entry
7. More LF spring rate
8. More RR spring rate unless car is loose

Cross RR to LF is Hotter than LR to RF

1. More diagonal weight
2. Less stagger
3. Bigger sway bar or more load
4. Lower panhard bar
5. Less RR spring
6. More RF spring
7. Less LF spring unless car is unstable on entry
8. More LR spring will help hook up on exit

The temperature averaging suggestions are merely a starting point intended to provoke thought. There are more variables than listed above. Driver feedback, track conditions, racecar type are all factors that can cause variances in the suggestions listed. Real racetrack specifics need to out way generalities.

G. IR Versus Probe

Probe type pyrometers are better for use on tires if used properly. Infrared type pyrometers measure only the tire surface and do not get inside the rubber to find the true results. The rubber down at the cord is insulated away from the outside elements providing for more accurate readings. Rubber at the cord is also heated due to elastic stretching of the rubber. Probes can reach in and see this heat.

Infrared pyrometers measure only the surface. The surface will be cooler as heat is dissipated off the surface very quickly due to the outside air cooling and simply rolling across the cooler track temperature. Typically the surface temperature is 20-40 degrees cooler than temperatures taken with a probe. Infrared temperatures will also be affected by artificial brake heat and engine heat.

You can use the infrared pyrometer for tire temperatures but it is a compromise. Your camber temperature curves will not be shown with as much clarity. Temperature differentials will be more dramatic with a probe allowing you to be more precise in your camber adjustments.

Infrared pyrometers do work well for surface temperatures such as track temperature, cockpit temps, header temps, brake temps, and the like. Probe type pyrometers do not work well for surface temperatures.

H. Summary

Used properly tire temperatures will allow you to see what the racecar is going to do on a long run as the tires heat and wear. You will be able to see through what might be covered up by the extra grip from your new tires as racecars always feel better when the tires are fresh.

You can learn to anticipate what the car is going to do on long runs by using temperature averaging as a tool. Temperature averaging is of little benefit if the balance of the car is dramatically off. Remember your readings have more meaning as the car approaches optimum handling. Temperature averaging is of most benefit when your car is already very fast and you are looking for that final edge.