

Performance Tires

The Right High-Performance Tire is an Integral Part of Your Car's Potential

By Robert Eckhardt



PHOTO COURTESY OF MATT ADAMS VSE

High-performance tires will make any kit car perform better. If you race and don't use racing slicks, you must use a Z-rated tire. The excessive heat caused by hard cornering and breakneck speeds will cause a lower-rated tire to fail.

High-performance vehicles demand high-performance tires to perform at their maximum potential. There are many good tires available for the high-performance kit car. How do you know which is best for your car? There is really only one way, and that's to drive your car with each different tire. We all know that isn't possible. It's also not practical, because each tire needs to be tuned to the car's suspension for maximum traction.

The construction of the tire varies among manufacturers. Therefore, each tire will respond differently to the chassis setup. The camber, caster, and toe settings must be maximized to the performance limits of each tire. This is why tire shootouts are not necessarily an accurate way to evaluate the performance of tires. The same tire will respond differently on two different chassis, depending on setup. The size of the tire and rim also makes a tremendous difference in how the tire performs.

So, where is the kit car builder supposed to start? The first place is the car's manufacturer. They should have designed the suspension around a specific type and size of tire. Armed with that information, the creative builder will probably want to modify his choice of tires to maximize his performance advantage.

The choice of tires for a kit car is

different from most street cars for a number of reasons. First, if you're using a donor car, you have changed the weight of the vehicle and its load requirements by removing the steel body and replacing it with a fiberglass body. Second, a bigger, more powerful engine was most likely installed. This mandates a change to a larger tire size to handle the increased traction requirements caused by excessive horsepower. Third, you're going to drive the car faster than is prudent. We never promote driving faster than the legal speed limit, but we realize that it's difficult to resist the temptation to unleash a lightweight, high-horsepower, sleek-bodied rocket ship once in a while.

Understanding that the flesh is weak, we want our readers to be as safe as possible on that lonely stretch of ribboned asphalt. For that reason, we will discuss the latest in high-performance Z-rated tires. A Z-rated tire should be used if the car will see speeds in excess of 150 mph. They are required if the car is going to be raced. Many people say, "I'm not going to race my car so why should I spend the extra money on a Z-rated tire?" The answer is simple—safety.

To be honest, if you bury the throttle only rarely on a long, straight stretch of highway and run the car up to 150 for 60 seconds, an H-rated tire will probably handle it. It's not advisable,

but the tire probably won't blow up. However, if you're going to race or going to take a run up a mountain road, Z-rated tires are required. Heat is the enemy of the tire. Excessive high-speed cornering, hard braking, and wheel-spinning acceleration all generate tremendous amounts of heat. As good as today's tires are, excessive heat can cause a tire failure.

TIRES AND WHEELS

Even though this article is not about wheels, the tire and wheel must work together to give the performance and look you desire. When purchasing new tires, it's advantageous to move to a larger-diameter wheel because it gives a racy look without having to lower the car. It's important when purchasing new tires and wheels to keep the same rolling diameter as the stock wheel and tire combination, because the rolling diameter controls things like the ABS brake system and speedometer readings.

It's possible to keep the overall rolling diameter the same by matching the larger-diameter wheel to a lower-profile tire. The tire's profile or aspect ratio is the relationship between the sidewall height of the tire to its tread width. The profile of the tire is part of the size information molded into the side of the tire. For example, a 195/60R14 size tire means that the section width

or tread width is 195 mm; the 60 is the profile or aspect ratio; the R denotes a radial tire; and the 14 is the tire's inside diameter or the size of rim that will fit that tire.

Most drivers want to increase the width of the tire tread because that puts more rubber on the road. More rubber generally equates to more traction. However, do not overlook the aspect ratio of the tire. Depending on the tire manufacturer and the tire's construction, different tires with the same tread width and wheel diameter can have different aspect ratios. For example, there are 195/75R14, 195/65R14, and 195/60R14 tires available. The shorter-profile tire is stiffer and will give the car more steering responsiveness and better lateral stability. It will also have a harsher ride than the larger-profile tire. This is one of the important decisions in determining which tire and wheel combinations to buy. Do you want ride comfort or performance?

PLUS SIZING

The concept of plus sizing is generally credited to the Pirelli Tire Company. The concept allows for the use of larger-diameter wheels paired with lower-profile tires. The overall rolling diameter remains the same, but the look and performance are increased. Everyone agrees that a wheel looks better than the sidewall of the tire.

Because plus sizing allows the new tire and wheel to retain the overall diameter of a stock wheel and tire, there should be no interference with the inside of the fenderwell. This is not the case if the wheel's offset and/or backspacing are changed. Offset and backspacing are terms that are often interchanged but, in reality, are different. The offset is the distance from the hub's mounting surface to the centerline of the wheel. If the mounting surface is on the centerline of the wheel, it has zero offset. If the hub surface is toward the backside of the wheel, it has a negative offset. This gives the wheel a deep-dish look as seen from the outside of the car. A positive offset wheel would have the mounting surface toward the outside or front of the wheel. It brings the wheel's ribs or spokes to the outside of the wheel. This style wheel is popular on newer cars.

A wheel's backspacing is a little different. It's measured by placing a straightedge across the back of the wheel and measuring to the hub's mounting surface. This distance is important because it ensures that the wheel does not interfere with the suspension, brakes, or frame. The second reason it's important is it can change the steering geometry and cause the wheel bearings to wear excessively.

By moving the wheel more to the

outside, it will give the car a wider track and improve handling. However, do not go too far outside or the tire will rub on the fenderwell. In addition, the farther the mounting surface is off the centerline of the wheel, the more difficult the steering effort and the greater the tire wear. A large offset or backspacing will place a heavy lateral load on the wheel bearings that may cause a failure.

WHEEL WIDTH

The width of the wheel, as measured from the inside of the tire mounting lips, plays an important role in choosing a tire that fits and how the tire's tread lies on the road. For instance, a tire designed to mount on a 10-inch wheel will have the tread lie flat on the ground. The same tire on an 8-inch wheel will crown. This allows only part of the tread to make contact with the road. There will also be excessive lateral movement of the tire sidewall and a dramatic reduction in adhesion to the road.

Most of the major tire companies are involved in racing, and racing plays a major role in a company's research and development. What the tire manufacturers learn on the track is transferred to their passenger-tire line. Race-tire development ultimately improves the safety and durability of street tires.

You probably don't think much about the tires on your car. As long as they don't go flat, you don't think about them at all. That peace of mind can be directly linked to race-car tire development. Is racing the only way to develop new tires? No, but it might be the fastest way. A Winston Cup car in a 500-mile race can put 40,000 miles of wear on the tires in a short period of time.

WORLDWIDE RECOGNITION

The tire is an integral part of the overall performance package of the vehicle. The desire to win races is the driving force behind the tire manufacturer's reason to keep improving the tire. Racing is a fantastic environment to accelerate compound development and construction improvements. The rubber compounds used in racing and street tires are a science all unto their own. The polymers that go into the tread compounds are what ultimately develop the tire's grip. Those formulas go beyond top secret. Goodyear is one company that does not patent or trademark its tire formulas because it wants to keep them secure inside Goodyear. Only certain people have access to those formulations. It's one



PHOTO COURTESY OF YOKOHAMA



PHOTO COURTESY OF TOYO

There is a new classification of tire making its way to the market—the ultra-high performance tire. It offers superb traction under all weather conditions. It's designed to offer maximum performance without sacrificing ride comfort. The AVS Sport from Yokohama features a unidirectional Y tread pattern. It offers excellent water shedding abilities and maximum rubber contact with the road.

High-performance tires will have as much rubber on the road as possible. That's why there are fewer water-channeling grooves in these tires. The thinking is that traction is limited when it's raining, so the tire cannot be used to its potential anyway. Most of this style tire have large shoulder blocks that ensure excellent cornering capabilities.

of those “if I tell you, I’ll have to kill you” scenarios. Those polymers are constantly going through development and improvement. They’re looking to enhance the racing tire’s ability to be more heat resistant, more durable, more resistant to cuts, and have more adhesion. All of these things are also important to a street tire. Therefore, if the tire companies can develop tire compounds that work well on the track, some of that same development will carry over to the street performance market.

TIRE CONSTRUCTION

The other area of technological development is in the construction of the tire; that is, the materials used in the sidewall and to reinforce the tread. This is what gives the tire its shape and how it responds to cornering forces. The racing environment is an accelerated durability test. When a tire can withstand those high loads and forces at high speeds, it teaches the engineers things about failure modes and failure thresholds of the reinforcement materials used in all tires.

The internal construction of a racing and street tire is very similar. They both have a carcass ply, sidewall reinforcement, and are anchored to

the wheel by a wound bead of steel. The carcass ply is capped with belts. Those belts act as reinforcing agents. They are the muscles of the construction that respond to driver and road inputs. The whole tire is then capped with the tread.

The belts and carcass for street tires and racing tires are made from different materials. If both tires were side by side, the construction would be very similar. The basic pieces are all similar, up to the tread.

Typically, the tread is where the variations start. The racer is not interested in any compromise. He doesn’t want any grooves in his tread; he wants maximum rubber against the pavement. That works fine as long as there is no rain, snow, or sleet. The street driver must deal with rain, snow, and sleet, so they have to have some way for the contact area to evacuate those elements. Therefore, there are tread designs or patterns on street tires.

Sometimes, when the uninitiated see a racing slick, they think the tire is worn out. They don’t understand that the grooves do not generate traction. That’s the job of the tread

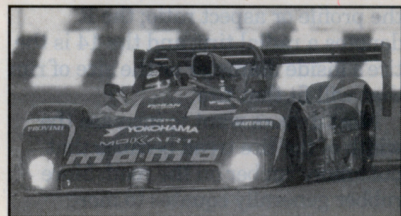


PHOTO COURTESY OF YOKOHAMA

All of the top tire manufacturers use racing to further the development of their tires. The Daytona 24-Hour race produced a win for Ferrari and Yokohama. The racing tire designs do find their way to the high-performance street tires.

compound. Racers want the maximum amount of tread compound on the road. The grooves in street tires are just there as a necessity to remove water from the tread surface.

Today’s street tires offer as good or better traction than racing tires did 10 years ago. It’s the improvements in the rubber compound and tire construction that earn the credit for the better tires. The new rubber compounds offer more adhesion and better mileage. The sidewall construction keeps the tire flat on the road. It used to be that when you went into a corner, the vehicle and outside tire would roll so much that

READING THE SIDEWALL

The sidewall of the tire holds a wealth of information about the tire. Beyond the company name and tire brand name, there is the DOT serial number, the tire size, and the speed rating. Other useful information includes the construction of the tire, the maximum load capacity, the wear indicator, the ISO index and speed symbol, the ply material composition, and the Uniform Tire Quality Grading (UTQG) ratings.

The tire size will show the tread width, the aspect ratio, the type of construction (which is usually a radial), and the rim diameter the tire will fit. It may also show the load index and speed rating. For instance, on a 215/70R14 tire, the 215 is the tread width measured in millimeters. The 70 is the aspect ratio. The aspect ratio is determined by dividing the sidewall height by the tread width. The R stands for radial and the 14 is the wheel diameter measured in inches.

Generally included in the tire size is the speed rating or performance rating for that tire. It represents the maximum speed that tire can safely turn. The maximum speed of the tire should match the maximum speed of the vehicle on which it’s installed. The tires are rated in a laboratory under controlled conditions with the tires at the optimum inflation. If the tire on the street falls below the optimum inflation,

it will not be able to run safely at its rating. This is why it’s critical to check the air pressure weekly. An improperly inflated tire will affect the tire’s handling characteristics, its adhesion to the road and, thus, its performance.

The most common speed ratings are:

- S (with a maximum speed of 112 mph);
- T (with a maximum speed of 118 mph);
- H (with a maximum speed of 130 mph);
- V (with a maximum speed of 149 mph);
- W (with a maximum speed of 168 mph);
- Z (anything above 168 mph).

The DOT and NHTSA require tire manufacturers to test and rate their tires for treadwear, traction, and temperature resistance. This UTQG information is molded into the sidewall. It’s designed to be a means of comparison so consumers have a basis to choose between tires.

The treadwear indicator is expressed as a number. It represents a comparison to a government standard test result of 100. If the number on the sidewall is 220, it means it will wear 2.2 times better than the government standard.

The traction grade is represented by the letter A, B, or C. It represents the tire’s ability to stop on wet pavement. The C grade is the lowest or has the least amount of traction. A racing slick would have a C rating if it were rated, because it has no grooves to channel the water out from under the tire. This test represents only straight-line braking and not any cornering traction.

The third grading subject represents a tire’s resistance to heat generation and its ability to dissipate heat. It also uses A, B, and C letter grades. The C grade is the lowest, and all street tires must meet this minimum standard. The A grade means a tire doesn’t generate a lot of heat and dissipates heat quickly. Sustained high levels of heat can cause the tire to degrade and reduces its life. Excessive heat can cause the tire to separate or explode. Improperly inflated tires (either over-inflated or under-inflated), overloading, and excessive speed can cause dangerous heat buildup and possible tire failure.

The maximum tire pressure shown on the sidewall is not the recommended driving tire pressure. It represents the weight-carrying or load rating for the tire. The proper air pressure is listed in the owner’s manual or on the placard located on the door post.

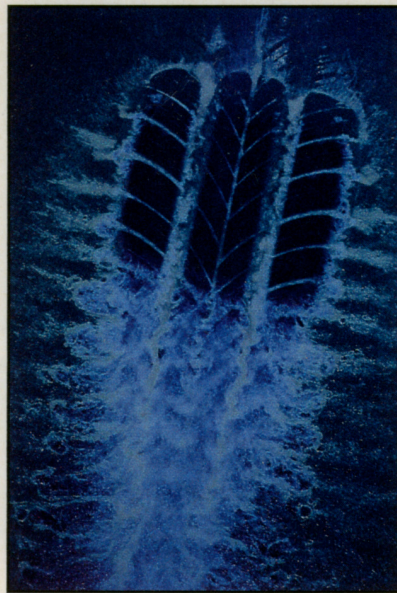


PHOTO COURTESY OF GOODYEAR

A tremendous amount of testing goes into channeling the water out from under the tire. This technology is refined on race tracks all over the world.

the inner shoulder of the tire came up off the ground. With today's new tires, that doesn't happen.

FLAT CONTACT PATCH

The newer race-bred construction allows the tire to be compliant enough to keep the tread contact patch firmly planted, flat on the road. Now as you go into the corner, the sidewall deflects as the tire tries to roll under the car. With all the deflection, the contact patch stays flat on the road and generates the grip required to get around the corner. This same thing happens on the race track. Only there, it's called traction.

There are racing groups who do race in the rain. Formula 1 and IndyCars are just two that come to mind. In those racing series, the tire



PHOTO COURTESY OF TOYO

Toyo's entry into the ultra-high performance market is the Proxes FZ4. It features a unidirectional tread pattern with double V-shaped grooves for excellent water drainage. With the large shoulder blocks and small center blocks, the tire offers directional stability and sharp cornering. Plus sizing is possible, with many tire sizes available, all the way to a 225/35ZR18.

manufacturers are testing rain-tire tread patterns. They want to learn what patterns evacuate water efficiently so that the tread rubber can remain in contact with the road. The new street rain tires were developed from racing rain tires. That's one direct transfer of technology from racing to the street that has saved lives.

High-performance tires are expensive. The good news is, when you take proper care of them, they last a long time. If you take your driving to the max, make sure your tires will get you back.



PHOTO COURTESY OF GOODYEAR

Goodyear's new line of ultra-high performance tires is called Eagle F1. They replaced the two-ply polyester carcass with a single ply of high tensile strength steel. It improves handling and steering response. The unidirectional tread design evacuates water so well that it received an AA wet-traction rating.

SOURCES

Goodyear Tire and Rubber Co.
Dept. KC
See your local Goodyear dealer

Toyo Tire
Dept. KC
6415 Katella Ave.
Cypress, CA 90630
800/678-8250

Yokohama Tire
Dept. KC
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Fullerton, CA 92834
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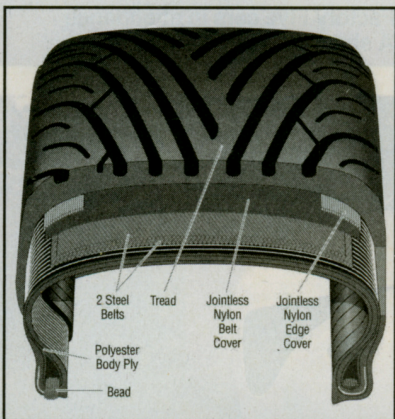


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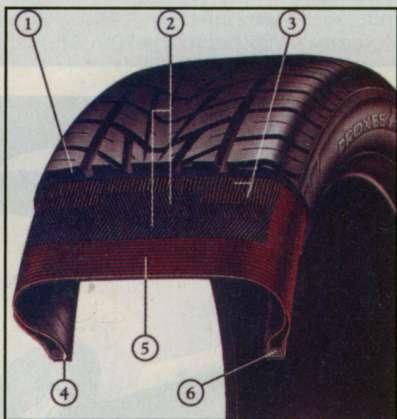


PHOTO COURTESY OF TOYO

Here are three examples of the new ultra-high performance tires. The cutaways show how each company approaches its tire construction. There are similarities in the layout, but what isn't seen is the chemical makeup of the belt materials and the tread rubber.