

Tire Diameters

By Brian Burke

When mounting different tires on your vehicle, it is desirable to maintain the same overall diameter as the original tires. This will help to prevent clearance problems, and will also preserve the accuracy of your speedometer and odometer.

The diameter is calculated from the tire size which is molded onto the sidewall of the tire.

For example: 195/70R14

195 – the width of the tire (in millimeters)

70 – the aspect ratio of the tire (the ratio of the width to the height)

R – radial tire

14 – the diameter of the wheel (in inches)

Please note that the following calculations are approximate. I don't know how closely the different tire manufacturers adhere to specifications. Different brands may have slightly different dimensions. Depends on how exact you need to be!

Also please note that these calculations will provide tire diameter for an unmounted tire. When a tire is on a car, the bottom of the tire (the part touching the road) will be flattened a little due to the weight of the car. This will reduce the distance between the hub and the ground. So the "rolling diameter" of a tire is less than the unmounted diameter. Depending on why you want to calculate the diameter, this may be important to you.

To Calculate the Diameter of a Tire

$$\text{diameter} = \text{wheel diameter} + \frac{\text{tire width} \times \text{aspect ratio}}{1270}$$

EXAMPLE: Tire size 195/70-14

195 = tire width

70 = aspect ratio

14 = wheel diameter

$$\text{diameter} = 14 + \frac{195 \times 70}{1270}$$

$$\text{diameter} = 14 + 10.75$$

$$\text{diameter} = 24.75 \text{ inches}$$

To Calculate the Required Aspect Ratio to Meet a Particular Diameter

Lets say your original tires are 195/70-14 as in the example above. So the original tire diameter is 24.75 inches.

Maybe you would like a wider tire, like a 235. What aspect ratio should you use so that you maintain the same overall diameter?

$$\text{aspect ratio} = \frac{(\text{desired diameter} - \text{wheel diameter}) \times 1270}{\text{tire width}}$$

EXAMPLE: What aspect ratio do I need on a 235-14 tire if I want to maintain a diameter of 24.75 inches?

$$\text{aspect ratio} = \frac{(24.75 - 14) \times 1270}{235}$$

$$\text{aspect ratio} = \frac{10.75 \times 1270}{235}$$

$$\text{aspect ratio} = 58.1$$

You should use a 235/60-14 tire

To Calculate the Speedometer Error

Perhaps you want a different tire that will not be the same diameter as the original tires. Maybe you have a friend that will give you a set of 235/70-14 tires. You really want to use them because they are FREE. But what will that do to your speedometer?

You first need to calculate the diameter of the original equipment tire, then calculate the diameter of the optional tire. Then apply this formula:

$$\text{actual speed} = \frac{\text{speedometer reading} \times \text{new tire diameter}}{\text{original tire diameter}}$$

EXAMPLE: The diameter of the original 195/70-14 tire is 24.75 inches. The diameter of the 235/70-14 tire is 26.95 inches. When my speedometer reads 45mph, how fast am I really going?

$$\text{actual speed} = \frac{\text{speedometer reading} \times \text{new tire diameter}}{\text{original tire diameter}}$$

$$\text{actual speed} = \frac{45 \times 26.95}{24.75}$$

$$\text{actual speed} = 49\text{mph}$$

When the speedometer reads 70mph:

$$\text{actual speed} = \frac{70 \times 26.95}{24.75}$$

$$\text{actual speed} = 76$$

To Calculate the Odometer Error

What will the different tire size do to my odometer reading?

$$\text{odometer error} = \frac{\text{new tire diameter}}{\text{old tire diameter}}$$

EXAMPLE: What will be the odometer error for the preceding example?

$$\text{odometer error} = \frac{\text{new tire diameter}}{\text{old tire diameter}}$$

$$\text{odometer error} = \frac{26.95}{24.75}$$

$$\text{odometer error} = 1.089$$

So when your odometer increments 1 mile, you have actually traveled 1.089 miles.

What happens after 20,000 miles?

$$20,000 \times 1.089 = 21,780 \text{ miles}$$

When your speedometer reads 20,000 miles, you have actually traveled 21,780 miles.