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Tires

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The friction (traction) between the tire and the road determines the handling characteristics of any vehicle. Think about this statement for a second. The compounding, construction, and condition of tires are some of the most important aspects of the steering, suspension, alignment, and braking systems of any vehicle. A vehicle that handles poorly or that pulls, darts, jumps, or steers funny may be suffering from defective or worn tires. Understanding the construction of a tire is important for the technician to be able to identify tire failure or vehicle handling problems. Tires are mounted on wheels that are bolted to the vehicle to provide the following: shock absorber action when driving over rough surfaces; friction (traction) between the wheels and the road. All tires are assembled by hand from many different component parts consisting of various rubber compounds, steel, and various types of fabric material. Tires are also available in many different component parts consisting of various rubber compounds, steel, and various types of fabric material. Tires are also available in many different designs and sizes.

Tread refers to the part of the tire that contacts the ground. Tread rubber is chemically different from other rubber parts of a tire, and is compounded for a combination of traction and tire wear. Tread depth is usually 11/32 in. deep on new tires (this could vary, depending on manufacturer, from 9/32 to 15/32 in.). Wear indicators are also called wear bars. When tread depth is down to the legal limit of 2/32 in., bald strips

appear across the tread. Tie bars are molded into the tread of most all-season-rated tires. These rubber reinforcement bars are placed between tread blocks on the outer tread rows to prevent unusual wear and to reduce tread noise. As the tire wears normally, the tie bars will gradually appear. This should not be mistaken for an indication of excess outer edge wear. A tire tread with what appears to be a solid band across the entire width of the tread is what the service technician should consider the wear bar indicator. Grooves are large, deep recesses molded in the tread and separating the tread blocks. These grooves are called circumferential grooves or kerfs. Grooves running sideways across the tread of a tire are called lateral grooves (Fig. 1).

TIRE TREAD

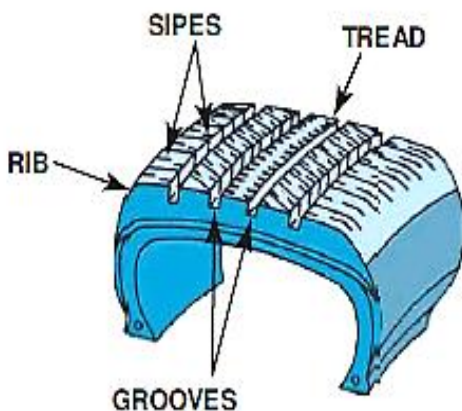


Figure 1

Grooves in both directions are necessary for wet traction. The trapped water can actually cause the tires to ride up on a layer of water and lose contact with the ground. This is called

hydroplaning. With worn tires, hydroplaning can occur at speeds as low as 30 mph on wet roads. Stopping and cornering is impossible when hydroplaning occurs. Sipes are small slits in the tread area to increase wet and dry traction.

The sidewall is that part of the tire between the tread and the wheel. The sidewall contains all the size and construction details of the tire. Some tires turn brown on the sidewalls after a short time. This is due to ozone (atmosphere) damage that actually causes the rubber to oxidize. Premium-quality tires contain an anti-oxidizing chemical additive blended with the sidewall rubber to prevent this discoloration.

The bead is the foundation of the tire and is located where the tire grips the inside of the wheel rim. The bead is constructed of many turns of copper- or bronzed-coated steel wire. The main body plies (layers of material) are wrapped around the bead. Most radial-ply tires and all truck tires wrap the bead with additional material to add strength.

Body ply. A tire gets its strength from the layers of material wrapped around both beads under the tread and sidewall rubber. This creates the main framework, or carcass, of the tire; these body plies are often called carcass plies. A 4-ply tire has four separate layers of material. If the body plies overlap at an angle (bias), the tire is called a bias-ply tire. If only one or two body plies are used and they do not cross at an angle, but lie directly from bead to bead, then the tire is called radial ply (Fig. 2). Rayon is a body ply material used in many tires because it provides a very smooth ride. A major disadvantage of rayon is that it rots if exposed to moisture. Nylon is a strong body ply material. Though it is still used in some tires, it tends to flat-spot after sitting overnight. Aramid is the generic name for aromatic polyamide fibers developed in 1972. Aramid is several times stronger than steel (pound for pound), and is used in high-performance-tire construction. Polyester is the most commonly used tire material because it

provides the smooth ride characteristics of rayon with the rot resistance and strength of nylon.

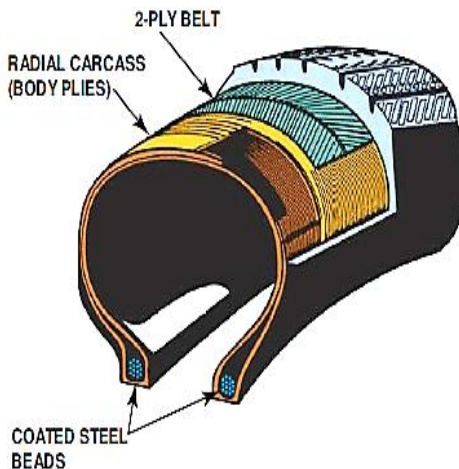


Figure 2 - Typical construction of a radial tire.

Belt. A tire belt is two or more layers of material applied over the body plies and under the tread area only, to stabilize the tread and increase tread life and handling. Belt material can consist of the following: steel mesh; nylon; rayon; fiberglass; aramid. All radial tires are belted.

Inner liner. The inner liner is the soft rubber lining (usually a butyl rubber compound) on the inside of the tire that protects the body plies and helps provide for self-sealing of small punctures [1].

References:

1. James, D.H. Automotive technology / D.H. James. – Principles, Diagnosis, and Service. – Forth edition. – 2012.