NORTH AMERICAN
COMMERCIAL TIRE RESOURCES INC.

Radial Versus Bias Tires

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Radial Versus Bias Tires

Guizhou Tyre Co., LTD. produces two types of tires for Off-The-Road applications, Radial and Bias. There are many differences in the construction of these two types of tires. Each construction has advantages in certain applications. In order to select the appropriate tire for a specific application, an understanding of the two constructions is required. The following will explain the differences between the two constructions.

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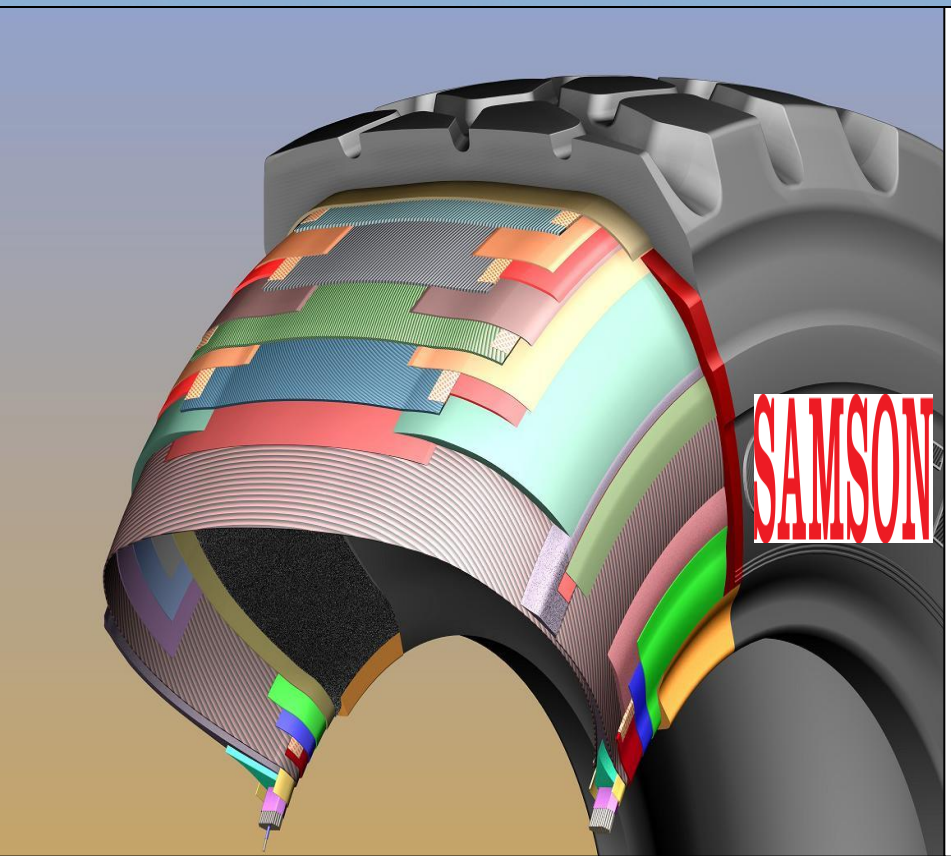
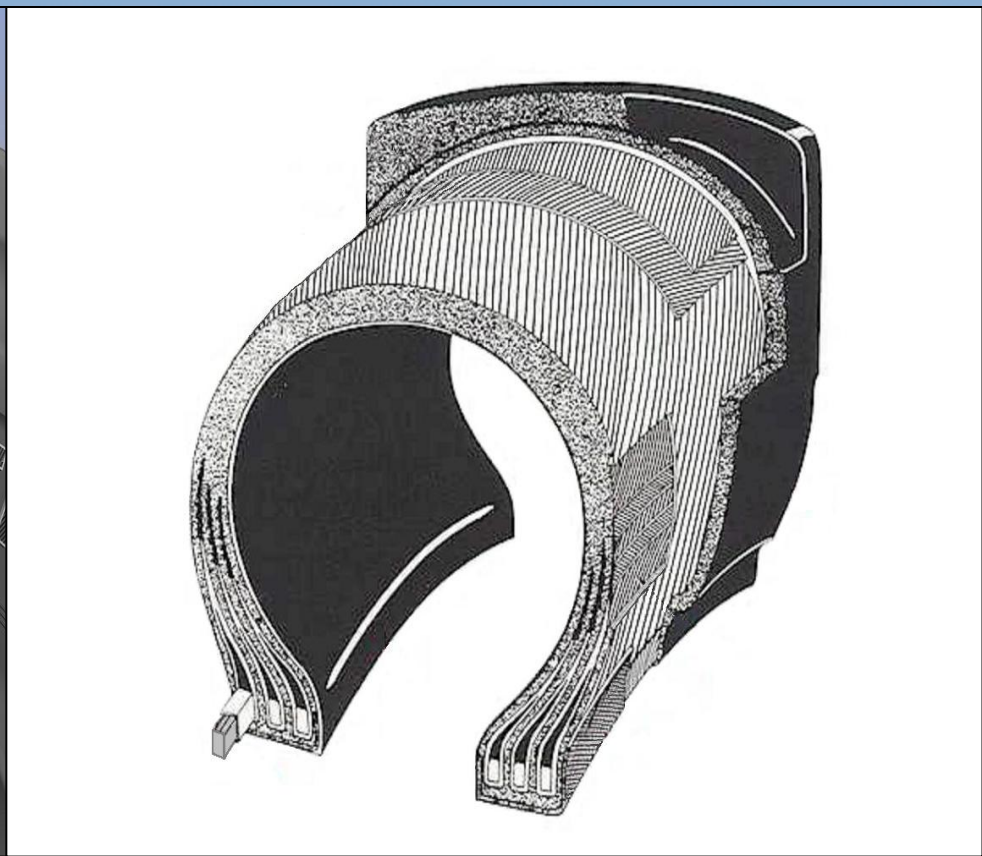
Radial Versus Bias Tires

Radial



Bias



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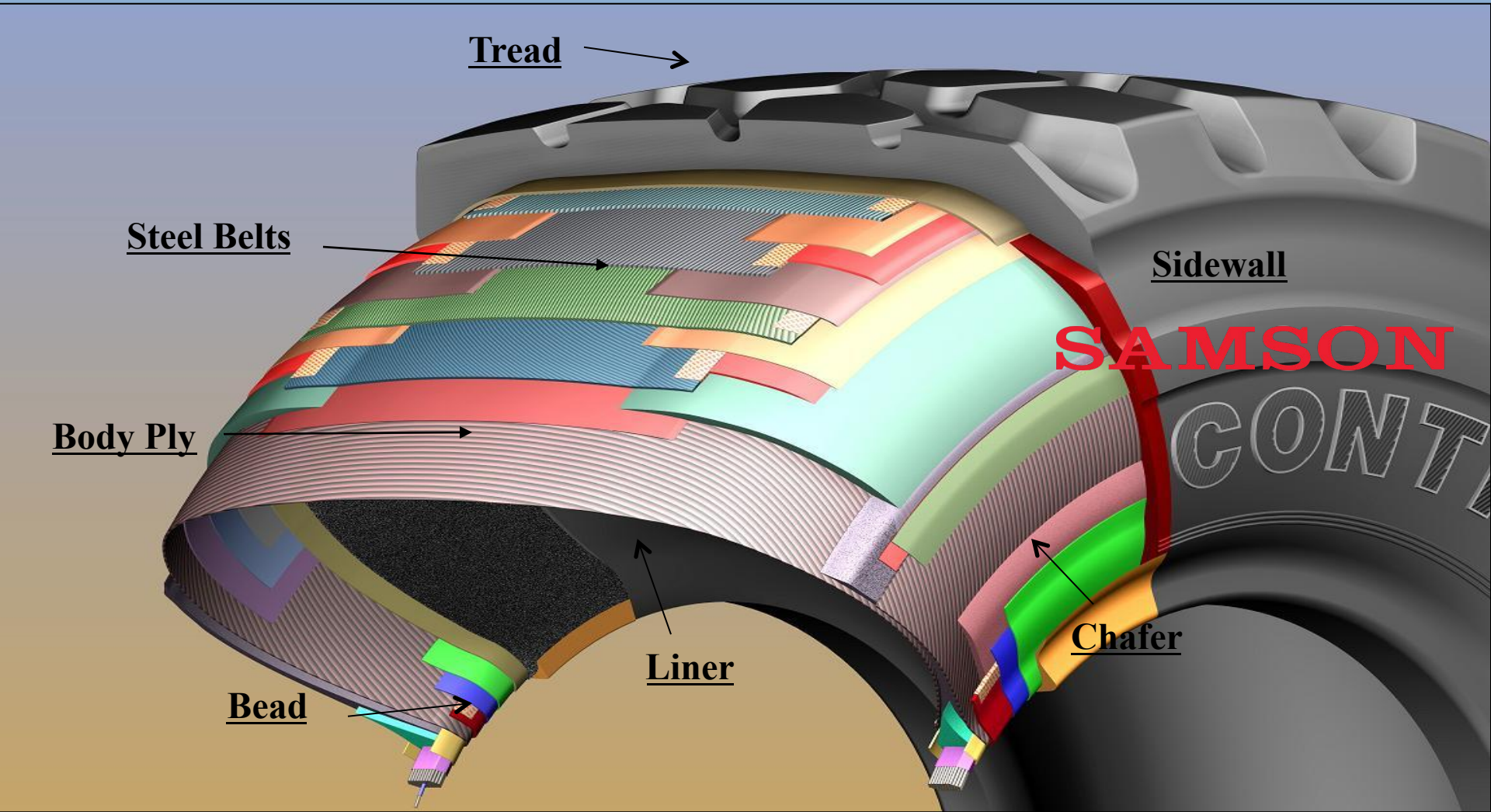
Radial Tires



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Radial Components

The tread of a tire consists of specially compounded rubber which can have unique characteristics ranging from wear resistant, cut resistant, heat resistant, low rolling resistant, or any combination of these. The purpose of the tread is to transmit the forces between the rest of the tire and the ground.

The sidewall is a protective rubber coating on the outer sides of the tire. It is designed to resist cutting, scuffing, weather checking, and cracking.

The chafer of a radial tire acts as a reinforcement. It increases the overall stiffness of the bead area, therefore restricting deflection and deformation and increasing the durability of the bead area. It also assists the bead in transforming the torque forces from the rim to the radial ply.

The liner is an integral part of all tubeless pneumatic tires. It covers the inside of the tire from bead to bead and prevents the air from escaping through the tire.

The bead of a radial tire consists of one bundle of bronze coated high tensile strength steel wire strands which is insulated with rubber. The bead is considered the foundation of the tire. It anchors the bead on the rim. The end of the ply of a radial tire is wrapped around the bead.

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Radial Components

The body ply of a radial tire is made up of a single layer of steel cord wire. The wire runs from bead to bead laterally to the direction of motion, the design is called “radial”. The body ply is a primary component restricting the pressure which ultimately carries the load. The body ply also transmits the forces(torque, torsion, etc.) from the belts to the bead and eventually to the rim.

The belts are layers of steel cord wires located between the tread and the body ply. The steel wire of the belts run diagonally to the direction of motion. The belts increase the rigidity of the tread which increases the cut resistance of the tire. They also transmit the torque forces to the radial ply and restrict tire growth which prevents cutting, cut growth and cracking.

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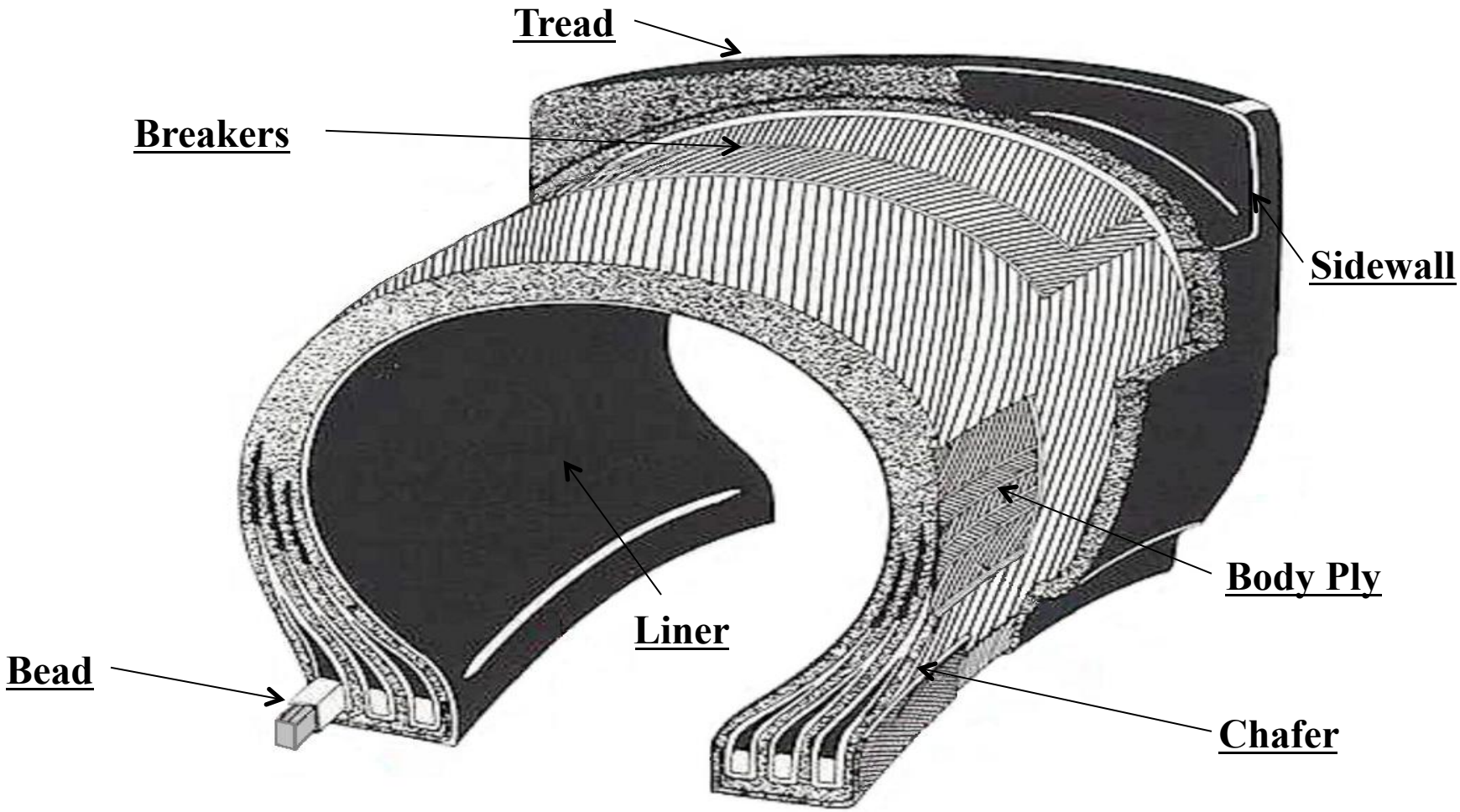
Bias Tires



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Bias Components

The tread, similar to a radial tire, of a tire consists of specially compounded rubber which can have unique characteristics ranging from wear resistant, cut resistant, heat resistant, low rolling resistant, or any combination of these. The purpose of the tread is to transmit the forces between the rest of the tire and the ground.

The sidewall is a protective rubber coating on the outer sides of the tire. It is designed to resist cutting, scuffing, weather checking, and cracking.

The chafer protects the bead and body from chafing (wear from rubbing) where the tire is in contact with the rim.

The liner is an integral part of all tubeless pneumatic tires. It covers the inside of the tire from bead to bead and prevents the air from escaping through the tire.

The bead of a bias tire consists of bundles of bronze coated high tensile strength steel wire strands which is insulated with rubber. An OTR bias tire bead usually has two or three bundles. The bead is considered the foundation of the tire. It anchors the bead on the rim.

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Bias Components

The cord body is also known as the carcass. It consists of layers of nylon plies. The cord body confines the pressure, which supports the tire load and absorbs shocks encountered in service. Each cord in each ply is completely surrounded by resilient rubber. These cords run diagonally to the direction of motion. The transmit the forces from the tread down to the bead.

The breakers are sometimes referred to as belts. The breakers provide protection for the cord body from cutting. They also increase tread stability which resists cutting. Breakers can be made of nylon or steel wire.

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Radial Versus Bias Performance

	Radial	Bias
Vehicle Steadiness	-	+
Cut resistance – Tread	+	-
Cut Resistance - Sidewall	-	+
Repairability	-	+
Self Cleaning	-	+
Traction	+	-
Heat Resistance	+	-
Wear Resistance	+	-
Flotation	+	-
Fuel Economy	+	-

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Radial Versus Bias Cost

Numerous influences affect the overall cost of a tire. The initial cost of a radial tire is higher than that of a bias, however the cost per hour depends on the application. An application which has a high risk of sidewall damage, such as loader applications, would greatly benefit from bias tires. On the other hand, it is advantageous to place a radial tire in an application where good traction is required on vehicles driven at high speeds, such as articulated dump trucks. In order to choose the best tire for an application, knowledge of the application must exist.

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Tire & Rim Association

Guizhou Tyre Co., LTD. follows all the policies of The Tire and Rim Association. The company maintains an active position in setting the standards developed by T&RA. The company, as a guiding philosophy, follows those standards.

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Tire & Rim Association

The purposes of The Tire and Rim Association, Inc., include the establishment and promulgation of interchangeability standards for tires, rims, and allied parts for the guidance of manufacturers of such products, designers and manufacturers of motor vehicles, aircraft, and other wheeled vehicles and equipment, and governmental and other regulatory bodies.

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TRA OTR Tire Code
Classification & Nomenclature

Tire classifications are based on Application Type and Tread Type

Application	*Code*	*Max. Speed*	*Max. Distance (one way)*
Compactor	*C*	*5 mph*	*Unlimited*
Earthmoving	*E*	*40 mph*	*2.5 mi.*
Grader	*G*	*25 mph*	*Unlimited*
Loader and Dozer	*L*	*5 mph*	*250 ft.*
Industrial	*IND*	*---*	*---*

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Tread Type

Examples of Tread Patterns & TRA Classifications

Rib Pattern

E-1

Traction Pattern

E-2
L-2
G-2

Rock Pattern

E-3/E-4
L-3/L-4/L-5
L-4S,L-5S

Floatation Pattern

E-7

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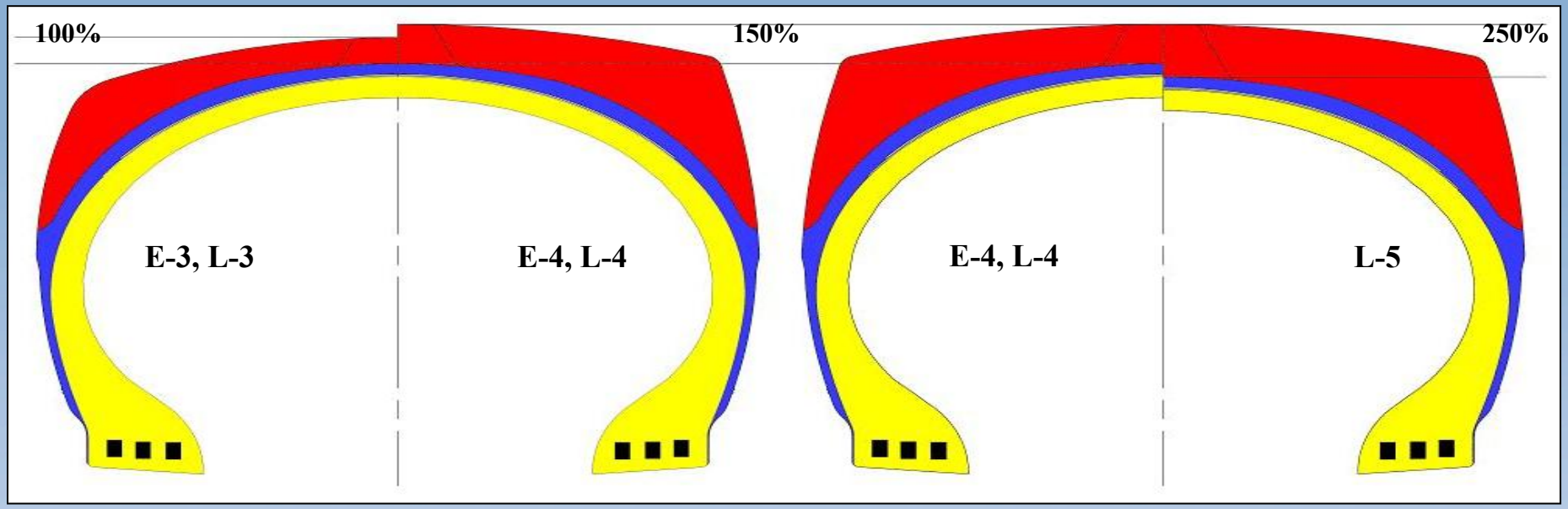
Tread Depth



Regular Tread **Deep Tread** **Extra Deep Tread**

There are various types of tread depths: Regular, Deep Tread and Extra Deep tread. The depth of the Deep Tread is approximately 150% of the Regular Tread. The depth of the Extra Deep Tread Is approximately 250% of the Regular Tread.

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"E" Tires

"E" Tires are referred to as haulage tires in OTR earthmoving applications. These tires transport material over unimproved surfaces at speeds up to 40 mph and for short distances up to 2.5 miles. These tires are used primarily on end-dumps, articulated dumps, and scrapers. These tires should reference the 30 mph load and inflation table titled "Off-The-Road Haulage Service". These tires should not be used in loader applications.

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"E" Tires

An **E-1** rib design tire is normally used on free-rolling axles. **E-1** tires are used mostly on steering axels of bottom dump vehicles or types of straddle carrying material handling equipment.

An **E-2** traction type design is an all-wheel position tire. The tire is designed with a one-to-one lug to void ratio that provides the tire with good traction power in sand and soft soil materials. **E-2** type tires are most commonly used on self loading type scrapers.

The **E-3** tires are lug type designs that have a two-to-one lug to void ratio. These rock designs offer good resistance to rock type damage plus good traction. **E-3** tires are primarily used on end dumps, bottom dumps, articulated dumps, and scrapers. The tires can be used on all axle positions. These tires with its regular tread also offer good heat resistance for use in operations where long-haul distances and high speeds are encountered.

The **E-4** rock type designs feature tread depths which are 150% of the regular E-3 tires. Because of their heavy tread mass, these tires give extended life and exceptional resistance to rock type damage. These tires are used primarily on all-wheel positions of haulage equipment in mining and quarry type operations where short hauls and severe rock conditions prevail.

The **E-7** with its shallow rib tread is designed for use on equipment that runs in soft, sandy soil. It is also often used on asphalt spreader vehicles.

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"L" Tires

"L" Tires are referred to as loader and dozer tires in OTR applications. Most loader type tires, because of their extreme heavy construction, are limited to very slow speeds and very short haul distances. In Loader service, "L" tires should not exceed 5 mph and should not travel farther than 250 ft. In dozer service, "L" tires should not exceed 250 ft. although travel distances varies. These tires should reference the 5 mph load and inflation table titled "Off-The-Road Slow Speed Service".

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"L" Tires

"L" tires are also often used in Load and Carry applications. This type of service utilizes a loader which picks up and transports material at speeds up to 15 mph and for distances up to 2000 ft.

For load and carry service, please refer to your Tire & Rim Association Manual.

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"L" Tires

The **L-2** traction design tire gives maximum traction in sand and soft soil conditions. These designs provide good traction and tread cleaning action.

The **L-3** rock design offers good traction and rock resistance in general purpose loader operations.

The **L-4** rock design because of its heavy tread mass, gives improved rock resistance and tread life over the L-3 type loader tire.

The **L-5** rock design is the most popular type of loader tire. Its extremely heavy tread mass offers improved rock resistance and extended tread life in severe rock conditions.

The **L-5S** solid design offers a massive tread for the ultimate in resisting rock damage and penetration. Because of its smooth design, shoulder lug tearing in severe rock loader and underground applications is eliminated. This type of design also offers the best performance when protective chains are used in hot slag and land fill type operations.

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Dual Marked Tires

Guizhou Tyre Co., LTD. has also developed certain tires which are suitable for both haulage and loader applications. These tires carry a “dual” marking. For instance, the 23.5-25 Advance / Samson Rock Crusher E-3/L-3, can be used as a loader tire and a haulage tire. It therefore is marked as both E-3 and L-3. It is imperative that the appropriate load and inflation table is referenced. The correct table to reference depends on the application. Tires marked E-3 should not be used in L-3 applications unless dual marked, and visa versa.

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Tire Pressure

In a pneumatic tire, the contained air pressure carries the load. The tire casing contributes very little to the overall load carrying forces generated by the tire. If the inflation pressure is allowed to drop, excess deflection causes increased heat generation and directly effects the overall durability, and life of the tire. Pressure maintenance is a critical part of OTR tire Know How.

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Tire Pressure

Guizhou Tyre Co., LTD. as well as the Tire and Rim Association does not recommend a cold inflation pressure for all Off-The-Road tire applications, including pressure adjustments, which exceeds 145 psi. Under no circumstances should a cold inflation pressure exceeding 145 psi be recommended!!!!

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SKID DEPTH

The skid depth is also known as the Tread depth. The skid depth is a measurement of the depth of the main void as it crosses the centerline of the tire. It is measured perpendicular to the surface of the tread. However, many tires have a solid center or a center tie-bar which make it impossible to measure the skid depth at the centerline. Manufacturer's commonly provide a scribe at the bottom of the void to indicate where the measurement should be taken. Some manufactures have also moved the scribe further out to the shoulder in order to create a false impression that the original skid depth is greater than it actually is at the centerline.

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SKID DEPTH