



ADVANCED
AUTOMOTIVE
ENGINEERING
EDUCATION

TIRE TECHNICAL INFORMATION





Together for Road Safety



INDEX:

- Tire safety
- Speed Symbol
- Speed Rating Characteristics
- Load Index
- Uniform Tire Quality Grading
- Replacing Tires
- Tire Maintenance
- Tire Pressure
- Tire Rotation
- Wheel Alignment
- Run Flat Tires
- Nitrogen
- Tire safety checklist

TIRE SAFETY

Introduction

The technologies used in today's tires have been greatly improved compared to the old ones. Improvements in raw materials and chemical compounds used in tires have led to tires that perform more effectively for their intended use.

Whether we're talking about improvements in compound that offer better grip in snow and ice tires or compound enhancements that provide improved wet handling, technology continues to improve tire performance. Innovations in tread patterns, sidewall design and overall tire construction have also led to product improvements in today's tires. Naturally, as types of vehicles and vehicle models continue to change, so too must tire construction and sizes.

Perhaps one of the most comprehensive technological innovations of the modern tire era is the invention of run-flat tire technology. While there are different types of run flat tires, the premise is the same: tires with run-flat technology allow consumers to travel a limited distance at limited speeds after a tire sustains complete air loss due to a puncture or cut. They are designed to allow a driver to travel to a safe location to change a flat tire.

Your vehicle's tires are engineered to perform safely, day in and day out. But to do their job right, tires need regular maintenance. This pamphlet provides the information you need to maintain your tires properly.

Proper tire maintenance is not only critical to the safe operation of your vehicle, but will also:

- Natural Factors- Provide better vehicle handling
- Help to prevent avoidable breakdowns and collisions
- Improve fuel economy
- Extend tire life

When you are driving, you have to trust yourself and your car and your fellow drivers. While you may not be driving at such high speeds, or at least you better not be, it is equally important that you take steps to make sure you are safe on the road. You may not be able to control your fellow drivers, but you can learn how to trust our own skills as a driver and learn about your vehicle. If you're not doing everything you can to be safe on the road, then the roads aren't safe for anyone.

Tire Construction

Tires perform several important functions and are the only part of your vehicle that comes in contact with the road. The entire weight of your vehicle and its contents is supported by the tire and air inside the tire.

Due to this critical role of tires, they are extremely complex in their design. While designs vary by product and manufacturer, an average tire contains over 100 separate components. Tires can include natural rubber, synthetic rubber, steel, nylon, silica (derived from sand), polyester, carbon black, petroleum, etc. The combination of ingredients and processes used by different manufacturers leads to different performance characteristics for every tire in the market today.

Understand the basics of a tire and rely on your owner's manual and professional tire retailer to explain the differences between tires and recommend the right tire for you.

Tire Functions

Tires perform four important functions with the assistance of the air contained within them:

- Support the vehicle chassis off the ground.
- Absorb shocks from the road surface.
- Transmit acceleration and braking forces to the road surface.
- Change and maintain the direction of travel.

Tire Selection

Tires have a coding system all their own that indicates key things like size, application, speed rating, tread wear factors and some others. All of this information is represented through an ordered series of numbers and letters on the sidewalls of tires. Tires are a normal wear item and eventually you'll be faced with replacing them. When you do, making the right choices can make a big difference in your satisfaction once your new tires are installed.

With a P215/65R15 tire as an example, "P" represents passenger car applications (LT=Light Truck), 215 indicates the width of the tread in millimeters, 65 represents the aspect ratio (width of the tread, divided by sidewall height), "R" means radial construction (most tires nowadays) and the 15 means the diameter of the wheel in inches. A tire may also carry a speed rating, which represents the maximum safe driving speed for a given tire. If this is the case. Speed ratings range from "K" to "Y", which represent 110 to 300 kilometer per hour respectively. (Speed-rated tires are usually used in high-performance applications.)

In most cases, cars and minivans are originally equipped with passenger car tires, whereas larger vehicles like pickups, SUVs and the like come equipped with light-truck tires. It's important to stick with the size tires and types as recommended by your car's manufacturer or in a tire application guide from a tire maker. Using tires of the wrong size can interfere with steering and suspension parts and it can affect the accuracy of your car's speedometer along with onboard control technology such as the transmission and anti-lock brakes.

SPEED SYMBOL

The Speed Symbol (SS) indicates the maximum speed at which a tire can carry the load corresponding to its load Index.

SPEED SYMBOL			
MAX. SPEED (KM / H)	SPEED SYMBOL	MAX. SPEED (KM / H)	SPEED SYMBOL
K	110	S	180
L	120	T	190
M	130	U	200
N	140	H	210
P	150	V	240
Q	160	W	270
R	170	Y	300

SPEED RATING CHARACTERISTICS

Tires have always had the ability to change an automobile's driving characteristics. Technology has given the tire an important role as a component of the automobile suspension. The speed rating of the tire is an indicator of the tire's performance capability. Improving the tire's performance capability will normally benefit an automobile's performance. Conversely, decreasing the tire's speed rating generally lowers the tire's ability to contribute to the automobile's performance. Changing from the original equipment tire speed rating to another performance level tire will probably change handling in areas such as:

- Steering Response
- Braking
- Traction
- Cornering
- Evasion/Recovery

Notes:

The speed rating is void if the tires are worn out, damaged, repaired, retreaded, or otherwise altered from their original condition. If tires are repaired, retreaded, or otherwise altered, they should not be operated at higher than normal highway speeds.

LOAD INDEX

Load Index (LI) Is a numerical code associated with the maximum load a tire can carry at the speed indicated by its speed symbol under service conditions specified by the tire manufacturer.

LOAD INDEX			
LOAD INDEX	LOAD IN KG	LOAD INDEX	LOAD IN KG
60	250	86	530
61	257	87	545
62	265	88	560
63	272	89	580
64	280	90	600
65	290	91	615
66	300	92	630
67	307	93	650
68	315	94	670
69	325	95	690
70	335	96	710
71	345	97	730
72	355	98	750
73	375	99	775
74	385	100	800
75	387	101	825
76	400	102	850
77	412	103	875
78	425	104	900
79	437	105	925
80	450	106	950
81	462	107	975
82	475	108	1000
83	487	109	1030
84	500	110	1060
85	515	111	1090

UNIFORM TIRE QUALITY GRADING (UTQG)

Quality grading is designed to make the tire purchase decision easier for you. Ideally, the system is intended to provide simple, comparative data which you can use in making an intelligent buying decision. However, the ratings are based upon test results achieved under very special conditions. As a result, misinterpreting the comparative data as it relates to your particular driving habits, conditions, etc., is a possibility. You should still rely upon your service or tire professional for assistance.

Quality grading designates the comparative performance levels of a tire based upon government-specified tests, but commissioned by the individual tire manufacturers. All tire manufacturers and brand name owners are required to grade regular and all season passenger tires in three categories:

Uniform Tire Quality Grading

- Tread wear
- Traction
- Temperature

Tread wear

The tread wear grade is a comparative rating based on the wear rate of the tire when tested under controlled conditions on a specified test. (For example, a tire graded 400 would wear two times as well on the course as a tire graded 200). The relative performance of tires depends upon the actual conditions of their use, however, and may depart significantly from the norm due to variations in driving habits, service practices and differences in road characteristics and climate.

Traction AA, A, B, C

The traction grades from highest to lowest, are AA (the highest) A, B, and C and they represent the tire's ability to stop on wet pavement as measured under controlled conditions on specified government test surfaces of asphalt and concrete. A tire marked C will have the lowest traction performance.

The traction grade assigned is based on a wet braking (straight ahead) traction test and does not include cornering (turning) traction.



Temperature A, B, C

The temperature grades are A, B, and C, representing the tire's resistance to the generation of heat and its ability to dissipate heat when tested under controlled conditions on a specified indoor laboratory test wheel. Sustained high temperature can cause the material of the tire to degenerate and reduce tire life, and excessive temperature can lead to sudden tire failure. Grades A and B represent higher levels of performance on the laboratory test wheel than the minimum required by law.

The temperature grade is established for a tire that is properly inflated and not overload. Excessive speed, under inflation or excessive loading, either separately or in combination, can cause heat buildup and possible tire failure.

REPLACING TIRES

As a tire wears, traction is reduced. A tire must be replaced when the tread has worn even with the tread wear indicator. The tread wear indicator is a small raised bar that runs across the grooves of the tire tread, marking the minimum allowable tread depth. Normally, there are six tread wear indicators spaced evenly around the tire. For optimum traction in wet or snow conditions, replace your tires before they reach the minimum tread depth.

Tire Replacement Guidelines

When replacing any number of tires on a vehicle, do not guess which tire should be installed. The vehicle tire placard or owners manual is the best place to look for the original equipment tire size, speed rating, cold information pressure and load capacity.

Replacing less than four tires

When replacing tires on a vehicle, it is recommended and preferred that all four tires be replaced at the same time for continued optimal vehicle performance. However, for those cases where this is not feasible, below are some general guidelines to consider when replacing less than four tires for a light vehicle, whether it is one or two tires. If the vehicle manufacturer has alternate recommendations, always follow their recommendations.

Replacing two tires

When a pair of replacement tires is selected with the same size and construction as those on the vehicle, the two newer tires should be installed on the rear axle unless the new replacement tires are of a lower speed rating. Generally, new tires with deeper tread will provide better grip and evacuate water more effectively, which is important as a driver approaches a hydroplaning situation. Placing greater traction on the rear axle on wet surfaces is necessary to prevent a possible oversteer condition and loss of vehicle stability.

Replacing one tire

Replacing a single tire on a vehicle can have an adverse effect on the suspension system, gear ratios, transmission, and tire tread wear. If a single tire replacement is unavoidable, it is recommended that the single new tire be paired with the tire that has the deepest tread and both be placed on the rear axle. Placing greater traction on the rear axle on wet surfaces is necessary to prevent a possible oversteer condition and loss of vehicle stability.

Tire Mixing

It is recommended that all four tires be of the same size, speed rating, and construction (Radial, Bias). In some cases, the vehicle manufacturer may specify different sized tires for the front and rear axles, but tire size designations should always match on an axle, except for the temporary use of a spare tire. If two radial tires and two bias tires are used on a vehicle, the radials must be installed on the rear axle. If the vehicle placard or owner's manual specifies speed-rated tires, the replacement tires must have the same or higher speed rating to maintain vehicle speed capability. If replacement tires have a lower speed capability than the one specified on the vehicle tire placard, the vehicle's speed capability must be restricted to that of the replacement tire. Vehicle handling could also be affected. Consult the vehicle or tire manufacturer for recommendations.

TIRE MAINTENANCE

Your vehicle’s tires are engineered to perform safely, day in and day out. But to do their job right, tires need regular maintenance. This pamphlet provides the information you need to maintain your tires properly.

Proper tire maintenance is not only critical to the safe operation of your vehicle, but will also:

- Improve fuel economy
- Extend tire life
- Provide better vehicle handling
- Help to prevent avoidable breakdowns and collisions
- Reduce exhaust emissions that contribute to environmental and health problems.

Benefits of proper tire maintenance					
	Comfort Driving	Safety	Better Handling	Fuel Savings	Prolonged Tire Life
Tires Inflation Check (cold) Once per Month	*	*	*	*	*
Tires Alignment and Balancing Check annually/Every 25000 km/When vibrations	*	*	*	*	*
Tires Rotation Every 10000 km	*				*

TIRE PRESSURE

Find the vehicle manufacturer's recommended pressures for your front, rear and spare tires. The recommended pressures are printed on the vehicle's tire information label, which is usually attached to the edge of the driver's door, the door post, the glove box or the fuel door. If you can't find the label, check your owner's manual.

Tire information placards and vehicle certification labels contain information on tires and load limits. These labels indicate the vehicle manufacturer's information including:

- Recommended tire size
- Recommended tire inflation pressure
- Vehicle Capacity Weight (VCW-the max. occupant and cargo weight a vehicle is designed to carry)
- Front and rear Gross Axle Weight Ratings (GAWR-the maximum weight the axle systems are designed to carry).

Proper tire Pressure

Proper tire pressure is critical for safe driving and fuel efficiency, but many passenger and light truck vehicles operate with under or over-inflated tires. 95% of a vehicle's weight is supported by the tire air pressure, with the tire supporting just 5%, making inflation a critical part of a tire's ability to perform. Tire inflation also has a strong impact on tread life.

Relying on a sight inspection alone is not an accurate way to measure tire pressure. Tires may be significantly under or over-inflated, yet you may not be able to tell just by looking at them.

The only accurate way to know if your tires need to be inflated is by measuring their pressure with a reliable tire gauge. Tire gauges are available at most automotive supply and hardware stores.

Under-inflation

Under-inflation is the leading cause of tire failure. Twenty-three per cent (23%) of vehicles have at least one tire under-inflated by more than 20%. Under-inflated tires on your vehicle lead to poor or delayed braking, steering and acceleration. Under-inflated tires may squeal when stopping or cornering even at moderate speeds, particularly on warm pavement.

The Effects of Under Inflation on Tire Wear and Fuel Use		
Percentage of Under Inflation	Percentage Wear Increase	Fuel Use Increase
%10	%5	%2
%20	%16	%4
%30	%33	%6
%40	%57	%8
%50	%78	%10

Operating a vehicle with just one tire under-inflated by 20% (8psi) can reduce the life of the tire by 15,000 km and can increase the vehicle's fuel consumption by 4%. Without enough air, the sides of a tire bend and flex too much. This builds up heat, which can cause serious damage and leads to sudden tire failure. It will also increase rolling resistance, which reduces tread life and increases fuel consumption.

Over-inflation

Over-inflation can be a problem too. An over-inflated tire rides on just the centre portion of the tread. The smaller contact area means reduced grip on the road, leading to a harsh ride, handling issues (such as steering and stopping problems) and increased wear on tires and suspension components.

Tire pressure monitoring systems (TPMS)

Some new vehicles are equipped with these systems, which indicate when a tire becomes under-inflated.

Some tire pressure monitoring systems provide a warning only when a tire is significantly under-inflated. The tire may then be close to failure. When a monitoring system warns that pressure is low, measure your tire pressure as soon as possible.

Make sure you understand the tire pressure monitoring system installed in your vehicle. Check your owner's manual.

Tire pressure monitoring systems do not replace the maintenance procedures recommended here.

TIRE ROTATION

Tire rotation refers to the regular practice of switching the position of each tire on the car. Tire rotation helps to equalize tread wear and is critical to gain the maximum life from your tire investment. Refer to your owner's manual for the recommended rotation interval and pattern; generally a rotation interval of 10,000 kilometers is recommended. The rotation pattern varies with different makes and models, which shows the tire locations during rotation. Some vehicles have different size tires on the front and back or directional tires. This limits the locations that a tire may take on the vehicle. When in doubt, check the owner's manual or consult a professional technician for guidance. Tire rotation time also offers a good opportunity to have the tires and wheels balanced. It is another step you can take to maximize your tire investment.

Rotating your tires

Front and back tires usually wear differently, especially on front wheel drive vehicles. They'll last longer if you rotate them.

- Rotate your tires according to the vehicle manufacturer's recommendation, found in the owner's manual. Or talk to your tire professional to find out how – and how often – the tires on your vehicle should be rotated. Common practice is to rotate tires approximately every 10,000 km.
- When mounting the wheels on your vehicle, make sure the wheel nuts are tightened to the manufacturer's specifications. The correct wheel nut tightness can be found in your owner's manual.

WHEEL ALIGNMENT

Alignment is one of the key maintenance factors in getting the most wear and performance from your tires. In addition, wheel alignment provides safe, predictable vehicle control as well as a smooth and comfortable ride a free of pulling or vibration, and improved fuel consumption. Today's modern suspensions require a precise four-wheel alignment that can only be achieved through a modern alignment system. This applies to both front and rear wheel drive vehicles.

RUN FLAT TIRES

A number of leading car manufacturers, have started to equip their vehicles with Run Flat or Mobility Tires.

This revolutionary new tire design allows the vehicle to continue moving despite a loss of pressure and is able to function even when there is little or no pressure.

These tires offer the following benefits over the conventional tire:

- Increased safety-in the event of sudden tire deflation the vehicle remains controllable
- Less inconvenience & improved safety - no need to change the tire & wheel assembly at the roadside
- Weight and Space saving-No spare wheel It is essential when using run flat tires that they are operated in conjunction with a tire pressure monitoring system, to ensure the driver is informed when there is any loss of pressure.

Run flat tires are designed to have a "get you home capability" and depending on the particular tire brand, can be operated up to a distance of 100km, provided the maximum speed of the vehicle does not exceed 80km/hr. It is suggested you refer to the particular tire manufacturer's recommendations for their specific guidelines.

NITROGEN

Nitrogen in tires is becoming a popular replacement for standard air. Nitrogen is all around us... the air we breathe is 78% nitrogen, 21% oxygen and the rest is small amounts of other gasses.

When it comes to tire inflation, nitrogen has many advantages over oxygen. With nitrogen tire inflation, improvements can be noted in a vehicle's handling, fuel efficiency and tire life through better tire pressure retention, improved fuel economy and cooler running tire temperatures, most importantly keeps you safer on the road.

Nitrogen is a dry, inert gas used to inflate airplane tires, off-road truck tires, military vehicle tires, and race car tires for improved performance, more tire mileage, better fuel economy, and increased safety.

Benefits of Nitrogen

Better tire pressure retention

Nitrogen migrates through a tire 3 to 4 times slower than oxygen. It may take 6 months to lose 2 psi with nitrogen compared to less than a month with oxygen.

Improved fuel economy

A result of having the proper air pressure which lessens the rolling resistance. Under-inflated tires have a greater rolling resistance.

Cooler running tires

Tires inflated with nitrogen run cooler than tires inflated with regular air.

Removal of oxidation

Oxygen is a highly reactive element at high temperatures and pressures. Replacing the oxygen with nitrogen helps eliminate the oxidation that damages inner liners and belt packages.

Improved retread ability

Eliminating oxidation also improves the retread ability due to more flexibility in the tire casing. Less tire aging and tire cord rust could very well increase the number of retreadable casings and also increase the number of times a casing could be retreaded.

Tire safety Tips

- Measure your tire pressure at least once a month, using a good-quality tire pressure gauge. Measure the pressure when the tires are cold. Don't forget the spare.
- Before inflating your tires, check the recommended tire pressure for your vehicle. This information is usually on the tire information label located on the edge of the driver's door, the door post, the glove box or the fuel door. This information can also be found in your owner's manual.
- Always measure tire pressure before going on a long trip.
- Once a month, inspect tires for uneven tread wear, cuts or cracks, bulges, foreign objects or other signs of wear or trauma.
- Rotate your tires on a regular basis. Check your owner's manual.
- Buy the most appropriate tires for your vehicle and your driving needs.
- When installing new tires, always make sure tires of the same type, size, speed rating and load index are on all four wheels.
- Don't overload your vehicle. The tire information label indicates the maximum recommended load.