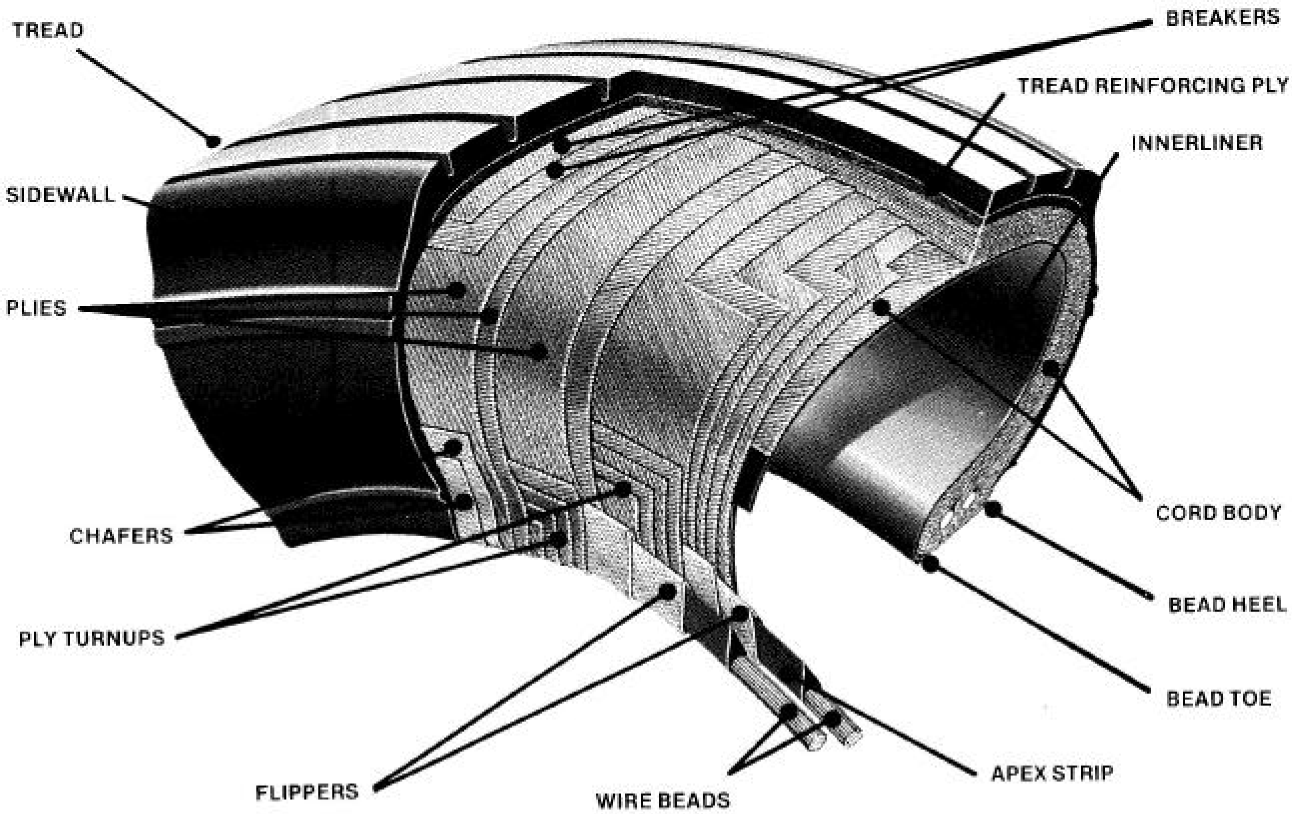
What you should know about Aircraft Tires

A Manual To Help You Get Maximum Service Life
From Your Aircraft Tires

GOODYEAR

bias-ply
AIRCRAFT TIRE CONSTRUCTION



TREAD Made of rubber, compounded for toughness and durability. The tread pattern is designed in accordance with aircraft operational requirements. The circumferential ribbed tread is widely used today to provide good traction under varying runway conditions.

SIDEWALL A protective layer of flexible, weather-resistant rubber covering the outer carcass ply, extending from tread edge to bead area.

TREAD REINFORCEMENT One or more layers of nylon fabric that strengthen and stabilize the tread area for high-speed operation. Also serves as a reference for the buffing process in retreadable tires.

BREAKERS Reinforcing plies of nylon or aramid fabric placed under the tread rubber to protect carcass plies and strengthen and stabilize tread area. They are considered an integral part of the carcass construction.

PLIES Alternate layers of rubber-coated nylon fabric (running at opposite angles to one another) provide the strength of a tire. Completely encompassing the tire body, the carcass plies are wrapped around the wire beads and back against the tire sidewalls (ply turnups).

BEADS High tensile strength steel wires embedded in rubber, the beads anchor the carcass plies and provide firm mounting surfaces on the wheel.

APEX STRIP A wedge of rubber affixed to the top of the bead bundle, serving as a filler.

FLIPPERS These layers of rubberized fabric help anchor the bead wires to the carcass and improve the durability of the tire.

CHAFERS Protective layer of rubber and/or fabric located between the carcass plies and wheel to prevent chafing.

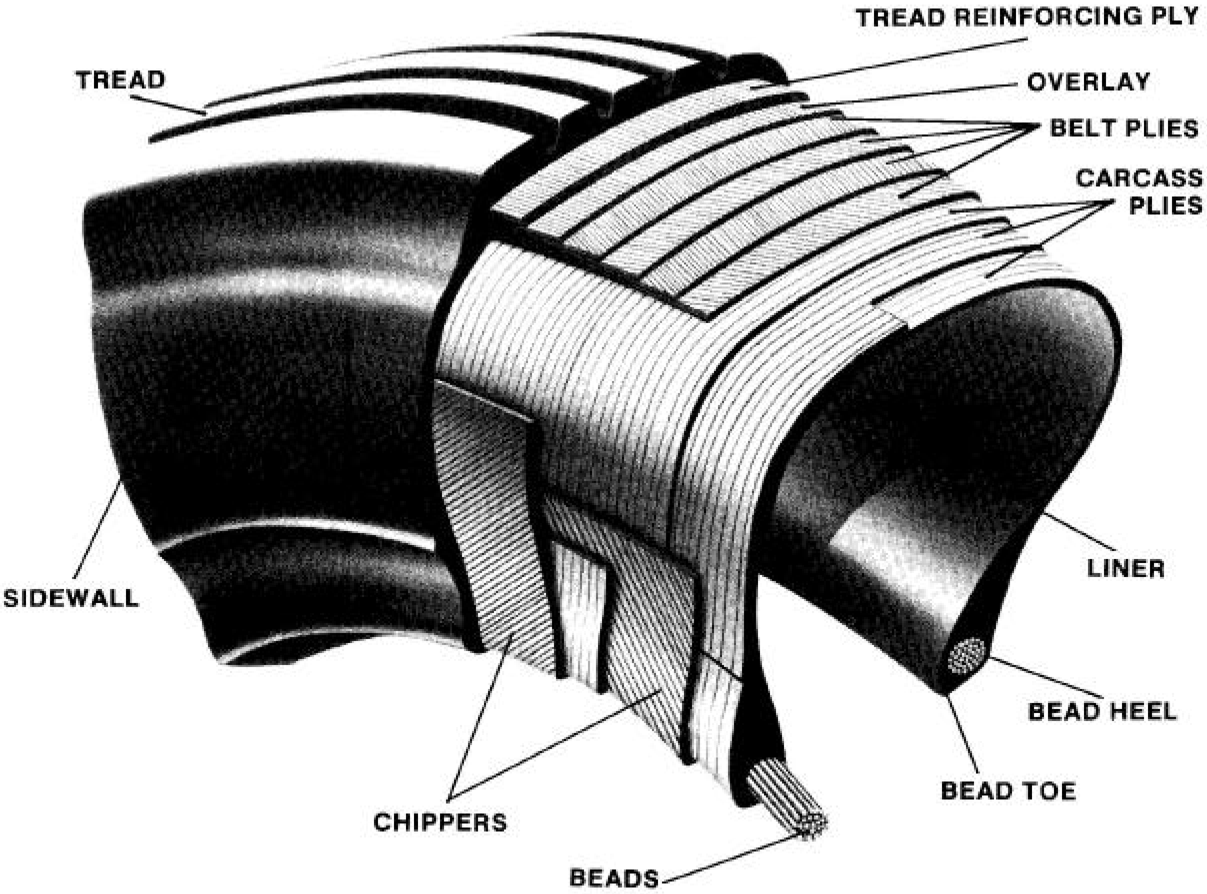
BEAD TOE The inner bead edge closest to the tire center line.

BEAD HEEL The outer bead edge that fits against the wheel flange.

INNERLINER In tubeless tires, this inner layer of low permeability rubber acts as a built-in tube and prevents air from seeping through casing plies. For tube-type tires a thinner rubber liner is used to prevent tube chafing against the inside ply.

radial
Aircraft Tire Construction

Radial tires feature a rigid belt and a flexible carcass, providing an increase in number of landings and a reduction in rolling resistance. The efficient use of high strength materials results in a lighter weight tire with improved performance.



TREAD Made of rubber, compounded for toughness and durability. Similar in form and function to the bias tire tread.

SIDEWALL A protective layer of rubber covering the outer carcass ply, extending from tread edge to bead area.

TREAD REINFORCING PLY Fabric layer(s) that strengthen and stabilize tread area and serve as a reference for the buffing process in retreadable tires.

CARCASS PLIES Layers of rubber-coated fabric which run radially from bead to bead. The carcass plies provide the tire strength in the sidewall area.

BELT PLIES A composite structure which stiffens the tread area for increased landings. The belt plies provide the tire strength in the tread area.

BEADS The beads are hoops of high tensile strength steel wire which anchor the carcass plies and provide a firm mounting surface on the wheel.

OVERLAY A layer of reinforcing fabric placed on top of the belts to aid in high speed operation.

CHIPPERS The chippers are layers of rubber coated fabric applied at a diagonal angle which improve the durability of the tire in the bead area.

LINER This layer of low permeability rubber acts as a built-in tube which prevents air from diffusing through the tire carcass.

With any aircraft, tires cannot be taken for granted. Tire maintenance costs will be at their lowest if proper maintenance practices are observed. Safe tire operation also depends on proper maintenance. In every respect, preventive tire maintenance leads to safer, more economical flying.

INFLATION PRESSURE

> **NOTE:**
> Keeping aircraft tires at their correct inflation pressures is the most important factor in any preventive maintenance program. The problems caused by underinflation can be particularly severe. Underinflation produces uneven tread wear and shortens tire life because of excessive flex heating. Overinflation can cause uneven tread wear, reduce traction, make the tread more susceptible to cutting and increase stress on aircraft wheels. It is recommended that only dry nitrogen be used for tire inflation as nitrogen will not sustain combustion and will reduce degradation of the inner-liner material due to oxidation.

Tire pressures should be checked with an accurate gauge on a *daily* basis. Ideally, pressures on high performance aircraft should be checked before each flight. Check only cool tires — at least 2 to 3 hours after a flight. Use an accurate gauge, preferably the more precise dial type. Inaccurate gauges are a major source of improper inflation pressures. Gauges should be checked periodically and recalibrated as necessary.

The inflation pressure recommended by the airframe manufacturer should be used for each tire. It must be determined if "loaded" or "unloaded" inflation pressure has been specified.

When a tire is under load, the air chamber volume is reduced due to tire deflection. Therefore, if unloaded pressure has been specified, that number should be increased by four percent (4%) to obtain the equivalent loaded inflation pressure.

ADJUSTING FOR TEMPERATURE

When tires will be subjected to ground temperature changes in excess of 50 degrees Fahrenheit (27 degrees Centigrade) because of flight to a different climate, inflation pressures should be adjusted for the worst case prior to takeoff. The minimum required inflation must be maintained for the cooler climate; pressure can be adjusted in the warmer climate. An allowance must be made for the inflation drop in the cooler climate. An ambient temperature change of five degrees F. (5°F) or three degrees C (3°C) produces approximately one percent (1%) tire pressure change.

> **NOTE**
> Excess Inflation Pressure Should Never be Bled Off From Hot Tires — All adjustments to inflation pressure should be performed on tires cooled to ambient temperature.

COLD PRESSURE SETTING

The following recommendations apply to cold inflation pressure setting:

1. "Minimum pressure" for safe aircraft operation is the cold inflation pressure necessary to support the operational loads as determined by the formula under "Unloaded Inflation" or as specified by the airframe manufacturer.
2. The loaded inflation must be specified four percent higher than the unloaded inflation.
3. A tolerance of minus zero to plus five percent (5%) of the minimum pressure is the recommended operating range.
4. If tire-in-service pressure is checked and found to be less than the minimum pressure, the following table should be consulted. In service is defined as an aircraft taxiing, taking off or landing but does not include hangared aircraft.

Tire Pressure	Recommended Action
100 to 95 percent of service pressure	Reinflate to specific service pressure
95 to 85 percent of service pressure	Reinflate & record in log book
85 to 70 percent of service pressure	Remove tire from aircraft
70 percent or less	Remove tire and axle mate from aircraft
Blown fuse plug	Scrap tire. If blown while in service (rolling), scrap axle mate also

> **NOTE:**
> Any tire removed because of low inflation pressure should be inspected by an authorized retreader to verify that the carcass has not sustained internal degradation. *If it has, the tire should be scrapped.*

MOUNTED TUBE-TYPE TIRES

A tube-type tire that has been freshly mounted and installed should be closely monitored during the first week of operation, ideally before every takeoff. Air trapped between the tire and the tube at the time of mounting could seep out under the beads, through sidewall vents or around the valve stem, resulting in an under-inflated assembly.

MOUNTED TUBELESS TIRES

A slight amount of diffusion through the carcass in tubeless tires is normal. The sidewalls are purposely vented in the lower sidewall area to bleed off trapped air, preventing separation or blisters. A tire can lose as much as five percent (5%) of the initial inflation pressure in a 24-hour period and still be considered normal.

NYLON STRETCH

The initial stretch or growth of a new nylon tire results in a pressure drop after mounting. Consequently, nylon tires should not be placed in service until they have been inflated a minimum of 12 hours, pressures rechecked, and tires re-inflated if necessary.

NYLON FLAT SPOTTING Nylon tires on aircraft left stationary for any length of time will develop temporary flat spots. The degree of this flat-spotting depends upon the load, tire deflection and temperature. Flat-spotting is more severe and more difficult to work out during cold weather. Occasionally moving a stationary aircraft can lessen this condition. If possible, an aircraft parked for long periods (30 days or more) should be jacked up to remove weight from the tires. Under normal conditions, a flat spot will disappear by the end of the taxi run.

COLD WEATHER PRECAUTIONARY HINTS When extreme drops in temperature are experienced, these precautionary tips can help provide safe, trouble-free operation:

1. Follow Goodyear recommendations on mounting as described on new tire label. Refer to Section 3.
2. Use only new O-ring seals with best cold weather properties, properly lubricated and installed.
3. Use only an accurate dial type pressure gauge.
4. Be sure that wheel bolts are properly torqued per wheel manufacturer's instructions.
5. Aircraft parked and exposed to cold soak for a period of time (1 hour or more), should have tire pressure checked and adjusted accordingly. Tires will have taken a nylon "set" and experienced a pressure drop.
6. High speed taxis and sharp turns should be avoided to prevent excessive sideloading.
7. An important fact to remember is that every 5°F (3°C) change in temperature will result in a corresponding 1% change in tire pressure.

SPECIAL PROCEDURES AFTER A REJECTED TAKEOFF

Tires subjected to above normal braking energies during an RTO should be removed and scrapped. Even though visual inspection may show no apparent damage, tires may have sustained internal structural damage that could result in premature failure. Also, all wheels must be checked in accordance with the applicable Wheel Overhaul or Maintenance Manual after an RTO.

MATCHING DUAL TIRES

When new and/or retreaded tires are installed on the same landing gear axle, the diameters should be matched within the Tire and Rim Association inflated dimensional tolerances for new and grown tires.

It is recommended that tires mounted on dual wheels have similar inflated outside diameters to ensure that each tire will carry an equal share of the load. The outside diameter of tires (new or retread) should be measured at operating pressure.

PROTECTING TIRES FROM CHEMICALS AND EXPOSURE

Tires should be kept clean and free of contaminants such as oil, brake fluid, grease, tar, and degreasing agents which have a deteriorating effect on rubber. Contaminants should be wiped off with alcohol, then wash tire with soap and water immediately. When aircraft are serviced, tires should be covered.

Aircraft tires, like other rubber products, are affected to some degree by sunlight and extremes of weather. While weather-checking does not impair performance, it can be reduced by protective covers. These covers (ideally with light color or aluminized surface to reflect sunlight) should be placed over tires when an aircraft is tied down outside.

CONDITION OF AIRPORT SURFACES

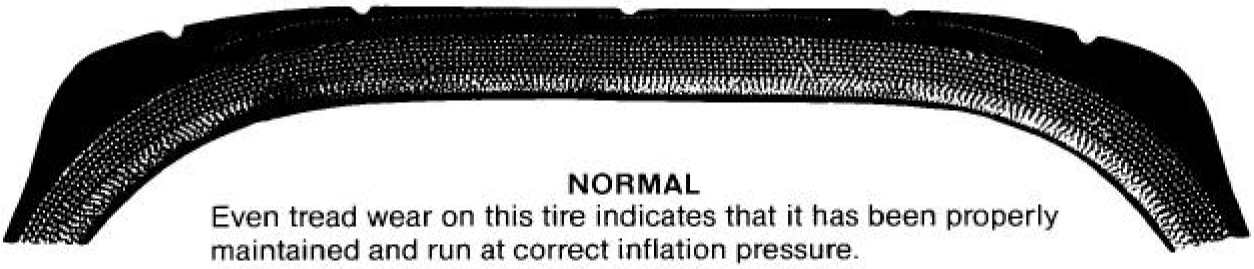
Regardless of the excellence of any preventive maintenance program, or the care taken by the pilot and ground crew in handling the aircraft, tire damage will certainly result if runways, taxi strips, ramps and other paved areas of an airfield are in a poor condition or improperly maintained.

Chuck holes, cracks in pavement or asphalt or stepoffs from pavement to ground can cause tire damage. Pavement breaks and debris should be reported to airport personnel for immediate repair or removal.

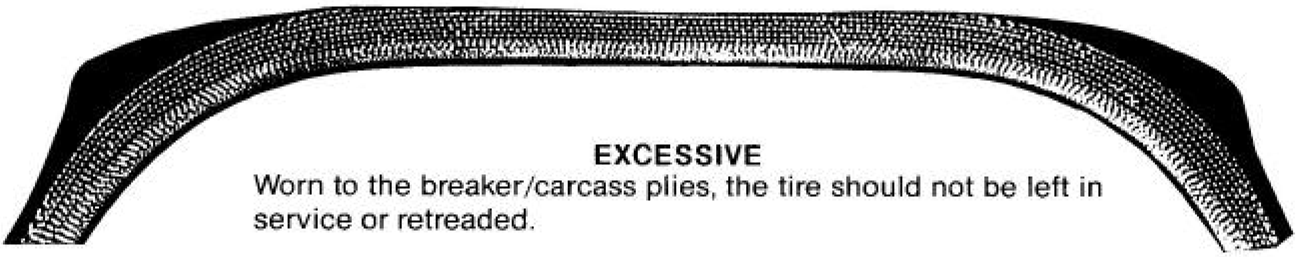
Another hazardous condition is the accumulation of loose material on paved areas and hangar floors. These areas should be kept clean of stones, tools, bolts, rivets and other foreign materials at all times. With care and caution in the hangars and around the field, tire damage can be minimized.

Many major airports throughout the world have modified their runway surfaces by cutting cross grooves in the touchdown and rollout areas to improve water runoff. Cross grooves vary in size and shape. This type of runway surface can cause a pattern of chevron-shaped cuts in the center of the tread. As long as this condition does not cause chunking or cuts into the fabric, the tire is suitable for continued service. The photo below is a typical example of chevron cutting.

INSPECTION

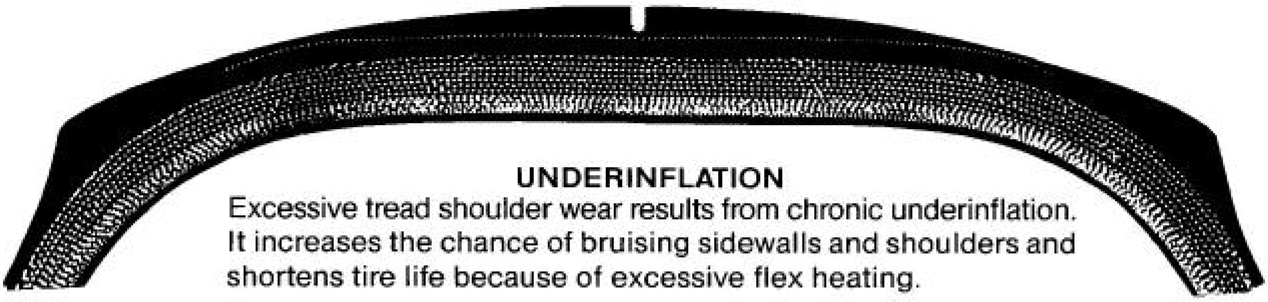


NORMAL
Even tread wear on this tire indicates that it has been properly maintained and run at correct inflation pressure.



EXCESSIVE
Worn to the breaker/carcass plies, the tire should not be left in service or retreaded.

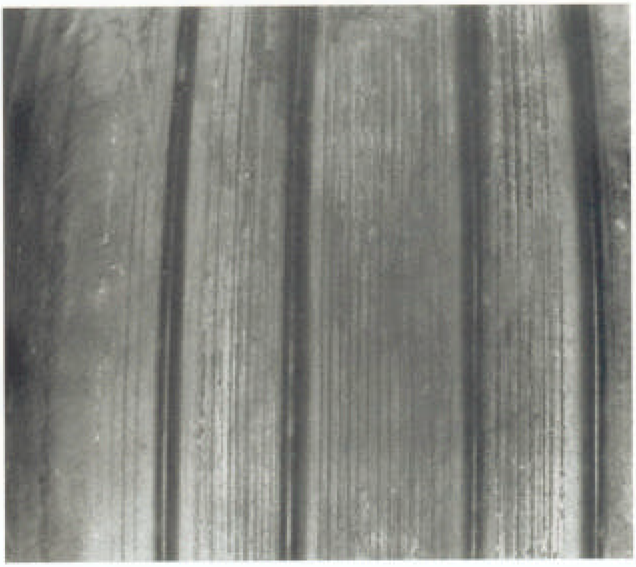
OVERINFLATION
Continuous overinflation accelerates center tread wear. It reduces traction while making tread more susceptible to cutting.



UNDERINFLATION
Excessive tread shoulder wear results from chronic underinflation. It increases the chance of bruising sidewalls and shoulders and shortens tire life because of excessive flex heating.

TREAD CONDITIONS

Cuts
Penetration by a foreign object.



Spiral Wrap
Some retreads have reinforcing cords wound into the tread which become visible as the tire wears. This is an acceptable condition and not cause for removal. The wrap reduces chevron cutting and tread chunking.

Tread Chunking
A pock mark condition in the wearing portion of tread…usually due to rough or unimproved runways. Remove if fabric is visible.

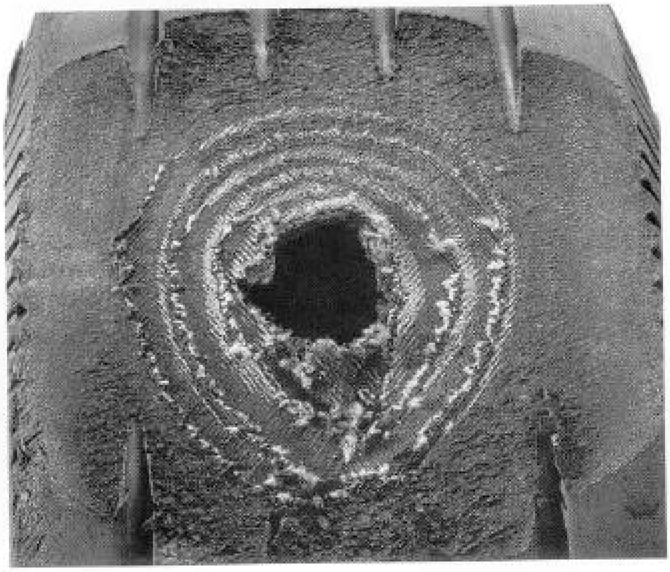
Tread Separation
A rather large area of separation or void between components in the tread area due to loss of adhesion. Usually caused by excessive loads or flex heating from underinflation. Remove immediately.

Groove Cracking
A circumferential cracking at the base of a tread groove; remove if fabric is visible. Can result from underinflated or overloaded operation.

Rib Undercutting
An extension of groove cracking progressing under a tread rib; remove from aircraft. Can lead to tread chunking, peeled rib or thrown tread.

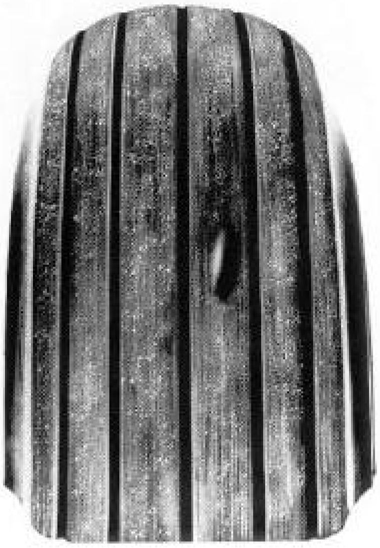
Peeled Rib
Usually begins with a cut in tread, resulting in a circumferential delamination of a tread rib, partially or totally to tread fabric ply. Remove and replace.

Thrown Tread
Partial or complete loss of tread down to tread fabric ply, undertread layer or carcass plies. Remove and replace.

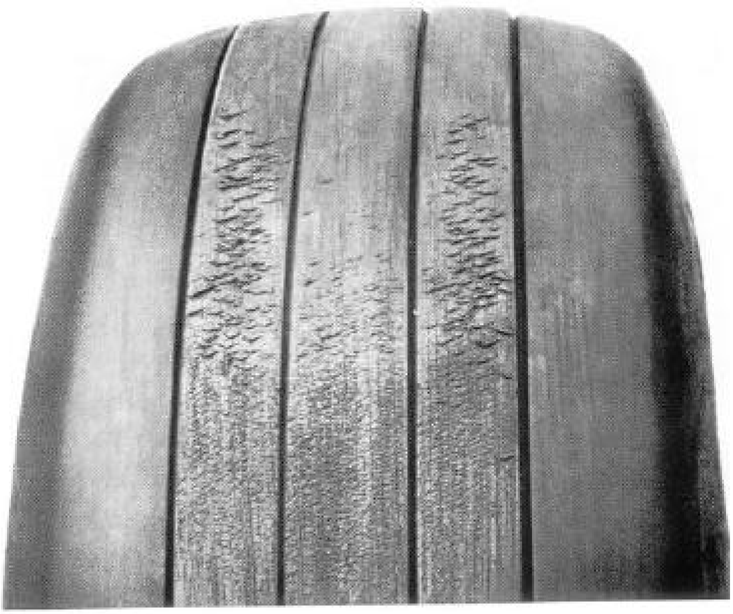


Skid
An oval-shaped flat spot or skid burn in the tread rubber. May extend to or into fabric plies. Remove if balance is affected or fabric is exposed.

Tread Rubber Reversion
An oval-shaped area in the tread similar to a skid, but where rubber shows burning due to hydroplaning during landing. Usually caused by wet or ice-covered runways. Remove if balance is affected.

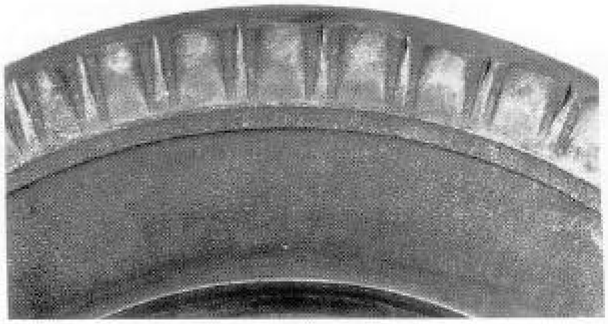


Blister
A void within the tread or sidewall rubber. Remove and inspect.

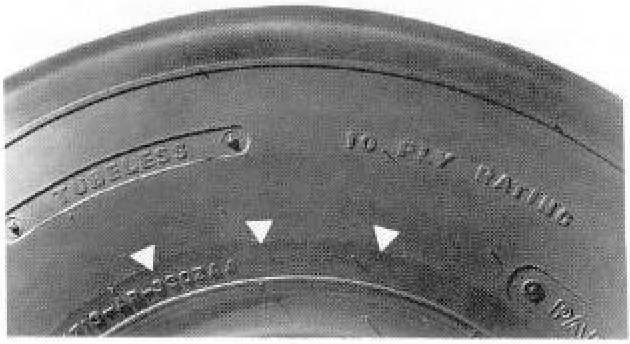


Chevron Cutting
Tread damage caused by running and/or braking on cross-grooved runways. Remove if chunking to fabric occurs, or tread cut removal criteria are exceeded.

Cut or Snag
Penetration by a foreign object on runways and ramps; in shops, or storage areas. Remove and replace if injury extends into fabric.

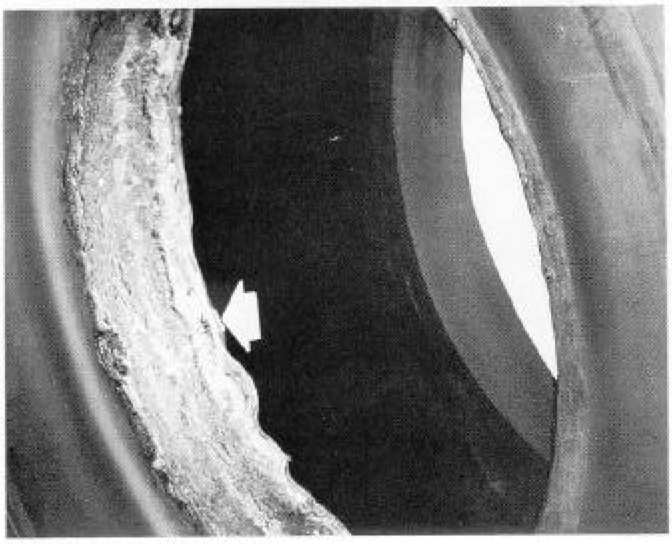


Ozone or Weather Checking/Cracking
Random pattern of shallow sidewall cracks. Usually caused by age deterioration, prolonged exposure to weather or improper storage. Remove if fabric is visible.

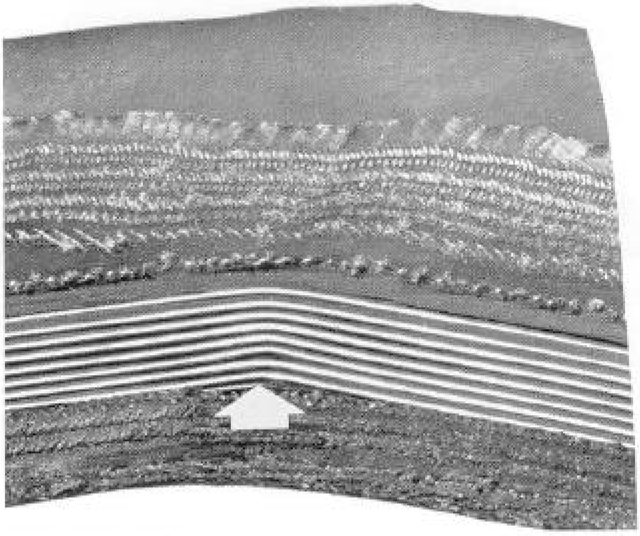


Radial or Circumferential Cracks
Cracking condition found in the sidewall/shoulder area; remove and replace if down to fabric. Can result from underinflated or overloaded operation.

Sidewall Separation
Sidewall rubber separated from the carcass fabric. Remove immediately.



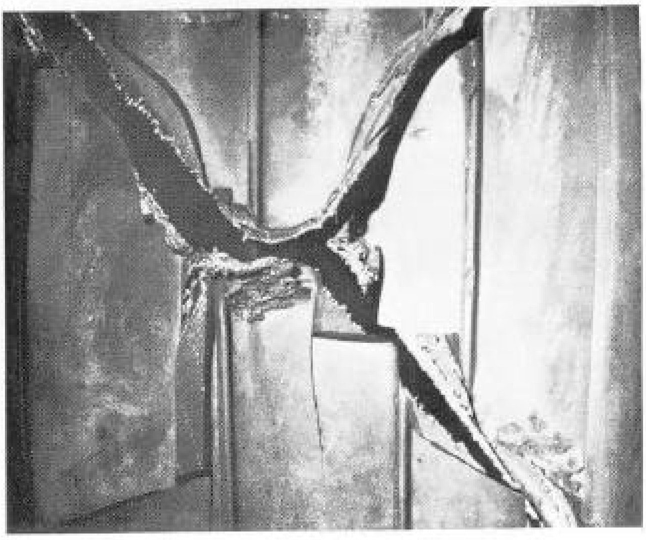
Brake Heat Damage
A deterioration of the bead face from toe to wheel flange area; minor to severe blistering of rubber in this area; melted or solidified nylon fabric if temperatures were excessive; very hard, brittle surface rubber. Tire is to be scrapped.



Kinked Bead
An obvious deformation of the bead wire in the bead toe, face or heel area. Can result from improper mounting or demounting and/or excessive spreading for inspection purposes. Tire is to be scrapped.

CARCASS CONDITIONS

Inner Tire Breakdown
Deterioration (distorted/wrinkled rubber of tubeless tire innerliner or fabric fraying/broken cords in tube-type tires) in the shoulder area... usually caused by underinflated or overloaded operation. Tire is to be scrapped.



Impact Break
Rupture of tire carcass in tread or sidewall area, usually from extreme hard landing or penetration by foreign object. Tire is to be scrapped.