AIRCRAFT TIRE CARE AND MAINTENANCE

On The Wings Of

GOODYEAR

AVIATION

REVISED - 10/04

Contents

Notice: This Aircraft Tire Care and Maintenance Manual effective 10/04 combines information from previous Goodyear Aircraft Tire Care and Maintenance manuals and supercedes all previous manuals.

Introduction

The information in this manual is designed to help aircraft owners and maintenance personnel obtain maximum service life from their bias and radial aircraft tires. The discussions contained in this part are designed not only to teach how to properly operate and maintain aircraft tires, but also to demonstrate why these techniques and procedures are necessary.

Aircraft operating conditions require a wide variety of tire sizes and constructions. The modern aircraft tire is a highly-engineered composite structure designed to carry heavy loads at high speeds in the smallest and lightest configuration practical. Despite this, tires are one of the most underrated and least understood components on the aircraft. The general consensus is that they are "round, black, and dirty," but in reality, they are a multi-component item consisting of three major materials: steel, rubber and fabric. By weight, an aircraft tire is approximately 50% rubber, 45% fabric, and 5% steel. Taking this one step further, there are different types of nylon and rubber compounds in a tire construction, each with its own special properties designed to successfully complete the task assigned.

Goodyear aircraft tire technology includes Computer Aided Design along with Finite Element Analysis, as well as the science of compounds and materials applications. Materials and finished tires are subjected to a variety of laboratory, dynamometer, and field evaluations to confirm performance objectives and obtain certification.

The manufacturing process requires the precision assembly of tight-tolerance components and a curing process under carefully controlled time, temperature and pressure conditions. Quality assurance procedures ensure that individual components and finished tires meet specifications.

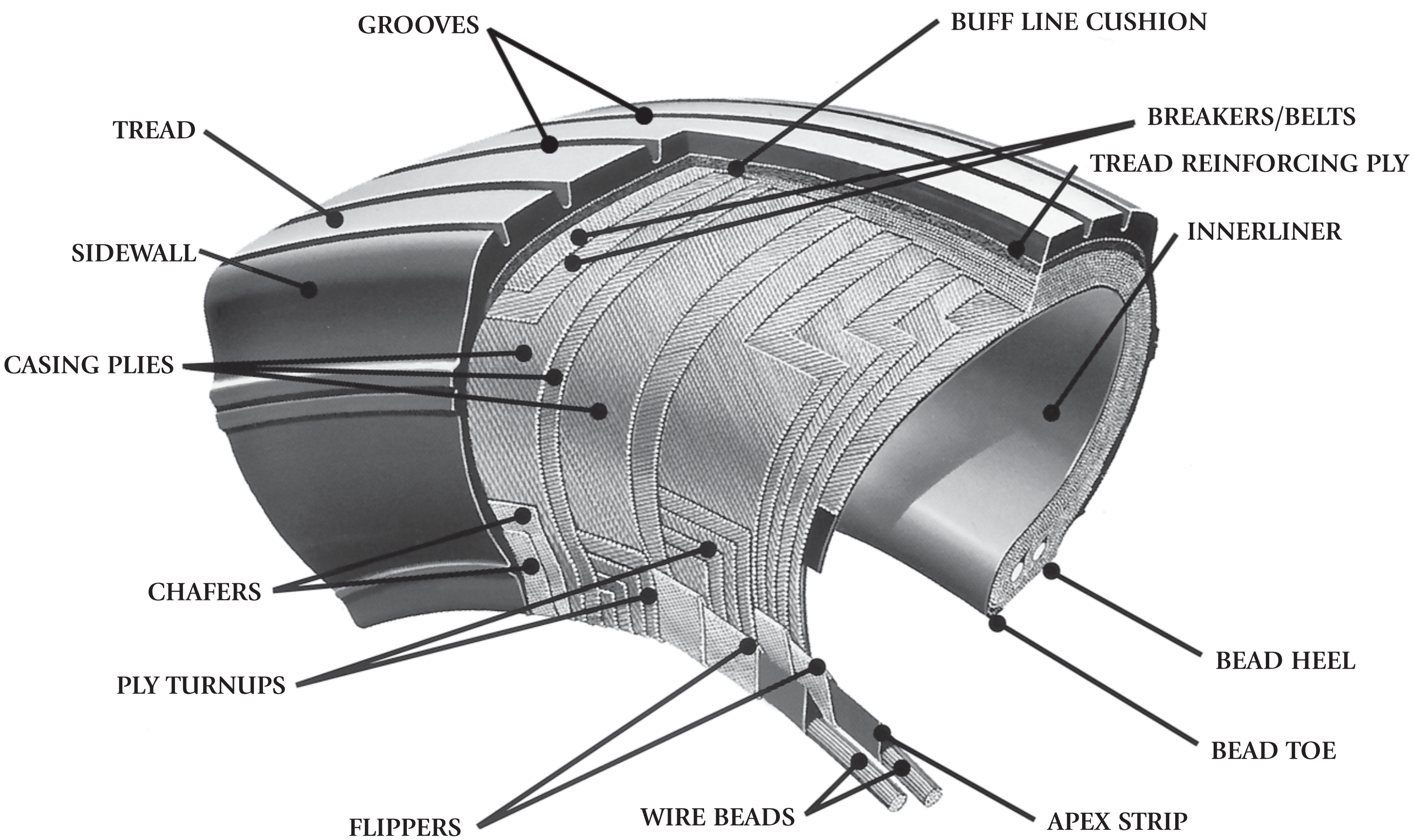
The Goodyear Technical Center and all Goodyear Aviation Tire new and retread tire plants are ISO 9001:2000 certified.

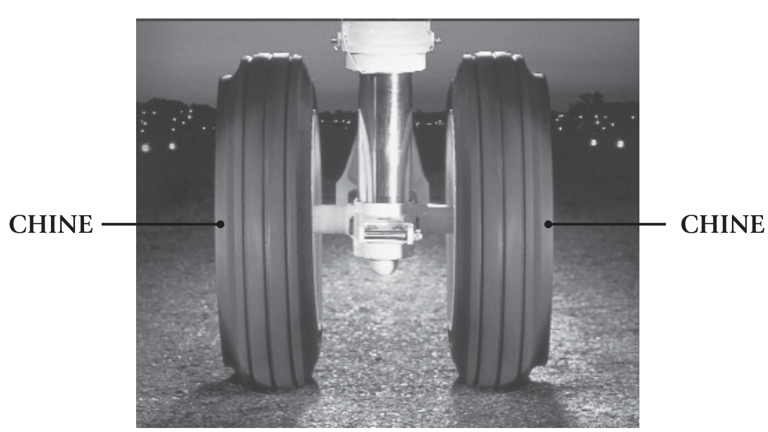
NOTE: The procedures and standards included in this manual are intended to supplement the specific instructions issued by aircraft and wheel/rim manufacturers.

1 General Data

BIAS PLY AIRCRAFT TIRE CONSTRUCTION

Bias aircraft tires feature a casing which is constructed of alternate layers of rubber coated ply cords which extend around the beads and are at alternate angles substantially less than 90° to the center line of the tread.





BIAS PLY AIRCRAFT TIRE CONSTRUCTION (CONT'D)

Glossary

Apex Strip The apex strip is a wedge of rubber affixed to the top of the bead bundle.

Bead Heel The bead heel is the outer bead edge that fits against the wheel flange.

Bead Toe The bead toe is the inner bead edge closest to the tire centerline.

Breakers Breakers are reinforcing plies of rubber coated fabric placed under the buffline cushion to protect casing plies and strengthen and stabilize tread area. They are considered an integral part of the casing construction.

Buff Line Cushion The buff line cushion is made of rubber compound to enhance the adhesion between the tread reinforcing ply and the breakers or casing plies. This rubber layer is of sufficient thickness to allow for the removal of the old tread when the tire is retreaded.

Casing Plies Plies are alternate layers of rubber-coated fabric (running at opposite angles to one another) which provide the strength of the tire.

Chafer A chafer is a protective layer of rubber and/or fabric located between the casing plies and wheel to minimize chafing.

Chines Also called deflectors, chines are circumferential protrusions that are molded into the sidewall of some nose tires that deflect water sideways to help reduce excess water ingestion into the engines.

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

Grooves Circumferential recesses between the tread ribs.

Liner In tubeless tires, this inner layer of low permeability rubber acts as a built-in tube and restricts gas from diffusing into the casing plies. For tube-type tires a thinner rubber liner is used to prevent tube chafing against the inside ply.

Ply Turnups Casing plies are anchored by wrapping them around the wire beads, thus forming the ply turnups.

Sidewall The sidewall is a protective layer of flexible, weather-resistant rubber covering the outer casing ply, extending from tread edge to bead area.

Tread The tread is made of rubber, compounded for toughness, durability and wear resistance. 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.

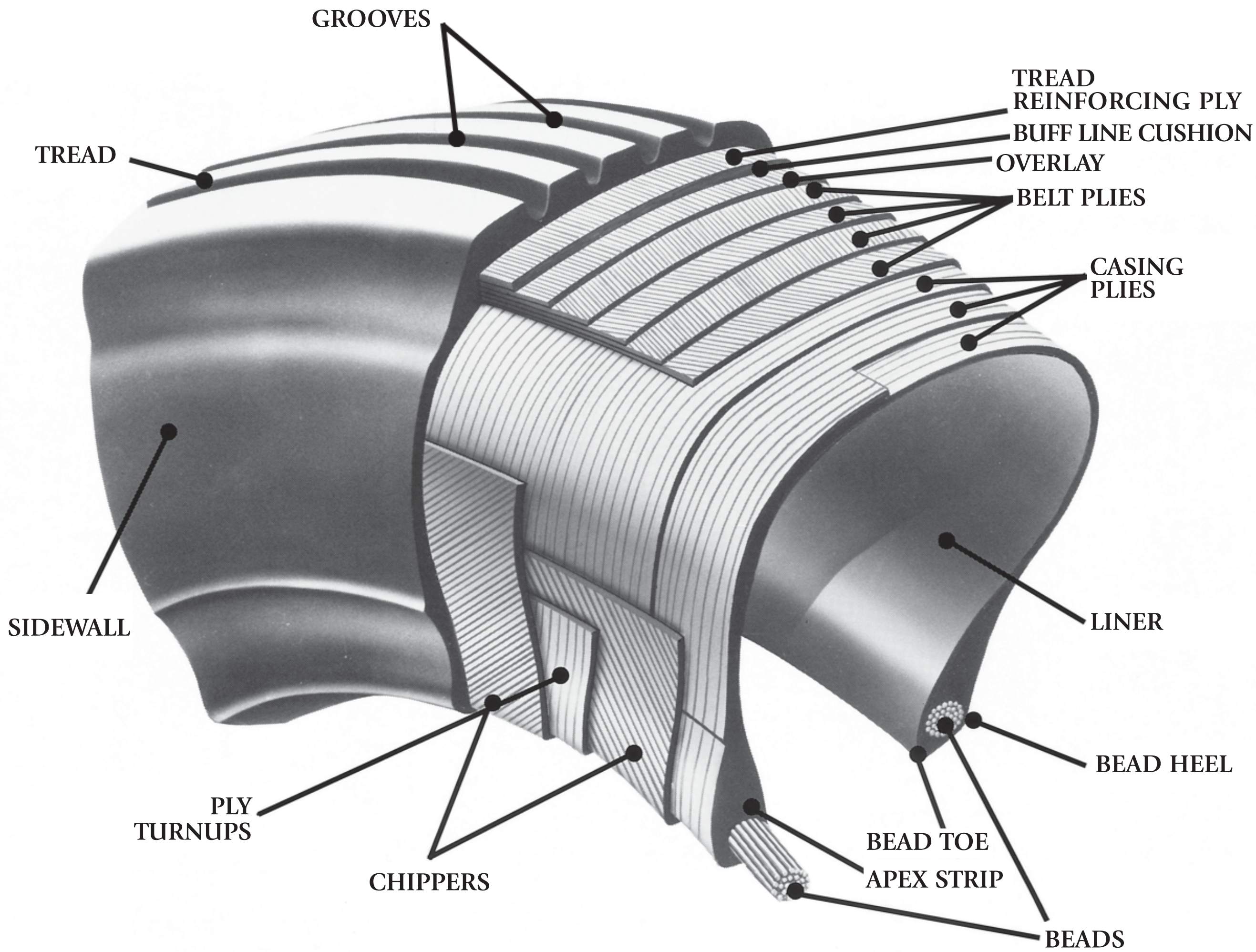
Tread Reinforcing Ply Tread reinforcement is one or more layers of fabric that strengthen and stabilize the tread area for high-speed operation. It also serves as a reference for the buffing process in retreadable tires.

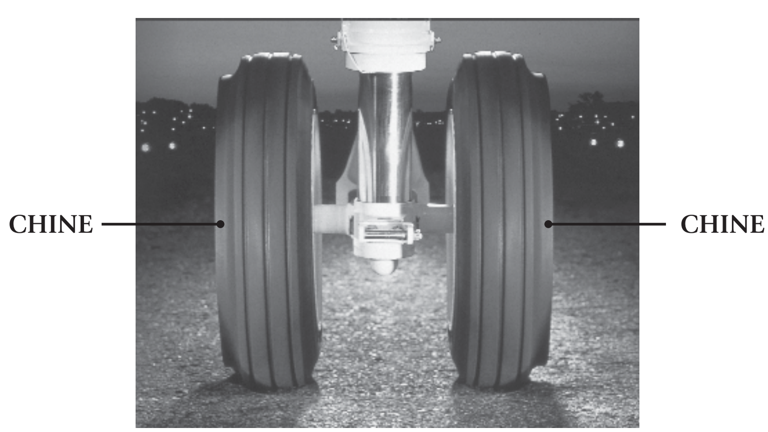
Wire Beads The beads are hoops of high tensile strength steel wire which anchor the casing plies and provide a firm mounting surface on the wheel.

1 General Data

RADIAL PLY AIRCRAFT TIRE CONSTRUCTION

Radial aircraft tires feature a flexible casing which is constructed of rubber coated ply cords which extend around the beads and are substantially at 90° to the centerline of the tread. The casing is stabilized by an essentially inextensible circumferential belt.





RADIAL PLY AIRCRAFT TIRE CONSTRUCTION (CONT'D)

Glossary

Apex Strip The apex strip is a wedge of rubber affixed to the top of the bead bundle.

Bead Heel The bead heel is the outer bead edge that fits against the wheel flange.

Bead Toe The bead toe is the inner bead edge closest to the tire center line.

Belt Plies This is a composite structure which stiffens the tread area for increased landings. The belt plies increase the tire strength in the tread area.

Buff Line Cushion The buff line cushion is made of rubber compounded to enhance the adhesion between the tread reinforcing ply and the overlay. This rubber layer is of sufficient thickness to allow for the removal of the old tread when the tire is retreaded.

Casing Plies Casing plies are layers of rubber-coated fabric which run radially from bead to bead. The casing plies provide the strength of the tire.

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.

Chines Also called deflectors, chines are circumferential protrusions that are molded into the sidewall of some nose tires that deflect water sideways to help reduce excess water ingestion into the engines.

Grooves Circumferential recesses between the tread ribs.

Liner In tubeless tires, this inner layer of low permeability rubber acts as a built-in tube and restricts gas from diffusing into the casing plies. For tube-type tires, a thinner rubber liner is used to prevent tube chafing against the inside ply.

Overlay The overlay is a layer of reinforcing rubber coated fabric placed on top of the belts to aid in high speed operation.

Ply Turnups Casing plies are anchored by wrapping them around the wire beads, thus forming the ply turnups.

Sidewall The sidewall is a protective layer of flexible, weather-resistant rubber covering the outer casing ply, extending from tread edge to bead area.

Tread The tread is made of rubber, compounded for toughness, durability, and tread wear. 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.

Tread Reinforcing Ply Tread reinforcement is one or more layers of rubber coated fabric that strengthen and stabilize the tread area for high-speed operation. This also serves as a reference for the buffing process in retreadable tires.

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

1 General Data

TIRE TERMINOLOGY

PLY RATING - The term "ply rating" is used to indicate an index to the load rating of the tire. Years ago when tires were made from cotton cords, "ply rating" did indicate the actual number of plies in the carcass. With the development of higher-strength fibers such as nylon, fewer plies are needed to give an equivalent strength. Therefore the definition of the term "ply rating" (actual number of cotton plies) has been replaced to mean an index of carcass strength or a load carrying capacity.

RATED LOAD - This is the maximum allowable load that the tire can carry at a rated inflation pressure.

RATED PRESSURE - Rated pressure is the maximum inflation pressure to match the load rating. Aircraft tire pressures are given for an unloaded tire; i.e, a tire not on an airplane. When the rated load is applied to the tire, the pressure increases by 4% as a result of a reduction in air volume.

OUTSIDE DIAMETER - This measurement is taken at the circumferential center line of an inflated tire.

SECTION WIDTH - This measurement is taken at the maximum cross sectional width of an inflated tire.

RIM DIAMETER - This is the nominal diameter of wheel/rim on which the tire is mounted.

SECTION HEIGHT - This measurement can be calculated by using the following formula:

$$\text{Section Height} = \frac{\text{Outside Diameter - Rim Diameter}}{2}$$

ASPECT RATIO - Measure of the tire's cross section shape. This can be calculated by the following formula:

$$\text{Aspect ratio} = \frac{\text{Section Height}}{\text{Section Width}}$$

FLANGE HEIGHT - This is the height of the wheel rim flange.

FLANGE DIAMETER - The diameter of the wheel including the flange.

FREE HEIGHT - This measurement can be calculated by using the following formula:

$$\text{Free Height} = \frac{\text{Outside Diameter - Flange Diameter}}{2}$$

STATIC LOADED RADIUS - This is the measurement from the center of the axle to the runway for a loaded tire.

LOADED FREE HEIGHT - This measurement can be calculated by using the following formula:

$$\text{Loaded Free Height} = \frac{\text{Static Loaded Radius - Flange Diameter}}{2}$$

TIRE DEFLECTION - A common term used when talking about aircraft tires is the amount of deflection it sees when rolling under load. The term % Deflection is a calculation made using the following formula:

$$\text{\% Deflection} = \frac{\text{Free Height - Loaded Free Height}}{\text{Free Height}}$$

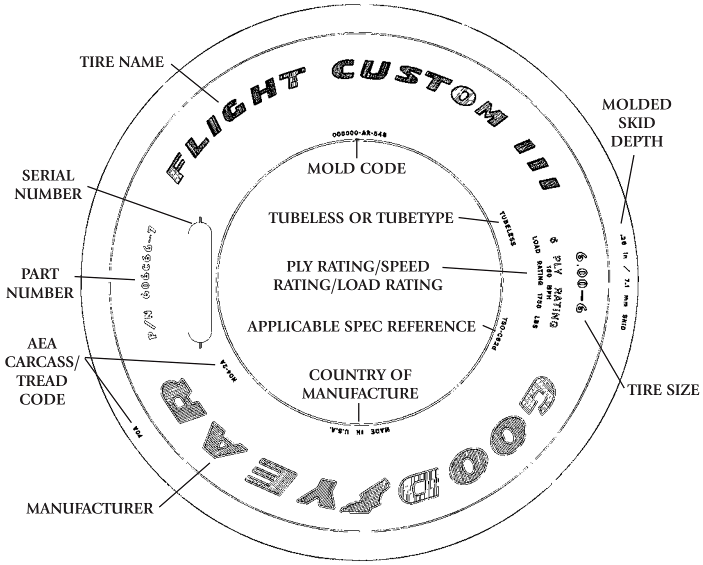
Aircraft tires are designed to operate at 32% deflection, with some at 35%. As a comparison, cars and trucks operate in the 17% range.

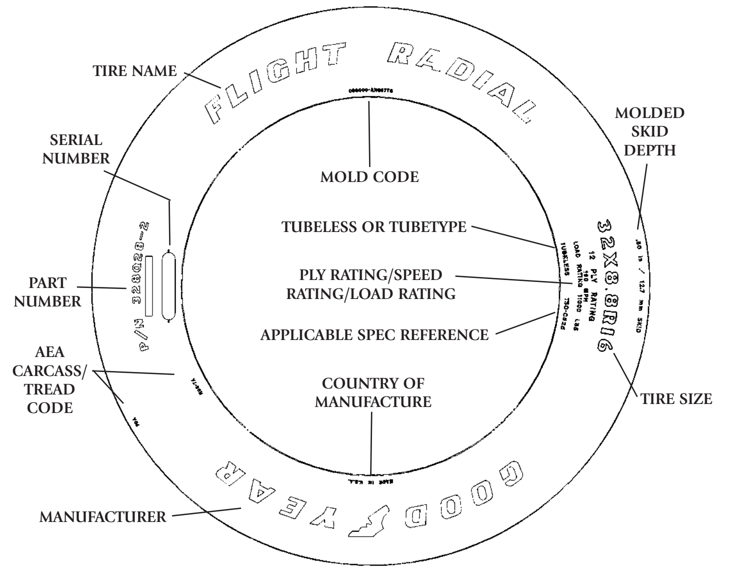
SERVICE LOAD (OPERATIONAL LOAD) – Load on the tire at max aircraft takeoff weight.

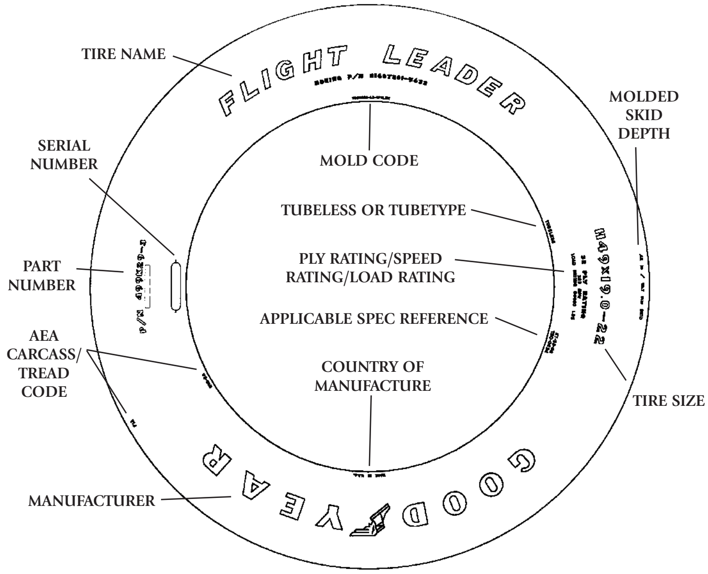
SERVICE PRESSURE (OPERATIONAL PRESSURE) – Corresponding pressure to provide proper deflection at service load.

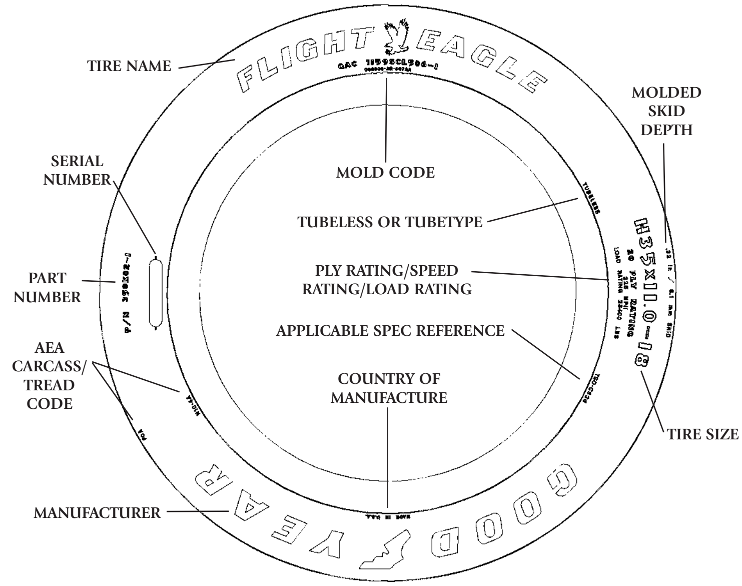
RATED SPEED – Maximum speed to which the tire is qualified.

TIRE MARKING









All Goodyear commercial aircraft tires are clearly marked with the following information: Goodyear, size, load rating, speed rating, molded skid depth, Goodyear part number, serial number, Goodyear plant identification and TSO marking. In addition, Goodyear tires are marked with the ply rating and other markings as required by airframe manufacturers or other organizations, such as an AEA code (which defines new tire casing and tread construction).

All TSO-C62b qualified tires with a speed rating of 160 mph or less and all TSO-C62c qualified tires do not require requalification to TSO-C62d unless the tire is changed.

Tires retreaded by all of Goodyear's facilities have the following information marked in the shoulder: the size, ply rating, speed category, retread plant and/or country of retreading, as well as retread level (R-Level), date of retreading and retread AEA code if appropriate.

1 General Data

AIRCRAFT TIRE SERIAL NUMBER CODES

All serials consist of eight (8) characters.

Example: YJJJNNNN

Position 1 (Y) represents the year of production

Positions 2, 3 and 4 (JJJ) signify day of year (Julian Date)

Note: Positions 1 through 4 fulfill requirements of MIL-PRF-5041J for military tires.

Positions 5, 6, 7 and 8 (NNNN) signify the Individual Tire ID Number

Danville's tire IDs range from 0001 to 4999

Thailand's production ranges from 5000 to 5999

Brazil's production ranges from 7000 to 7999

For production prior to January 1, 2001, tires produced in Thailand showed a 'T' in the 5th position, and tires produced in Brazil had a 'B' in the 5th position. Tire IDs for both plants (positions 6, 7 and 8) were 001 through 999. Danville tire IDs have always been 0001 through 4999.

EXAMPLES

Danville

2001

1019 1234

JULIAN DAY　　TIRE ID

Thailand

2002

2019 5123

JULIAN DAY　　TIRE ID

Brazil

2003

3019 7123

JULIAN DAY　　TIRE ID

Tires cannot be taken for granted on any aircraft. Tire maintenance costs will be at their lowest and tire life will be at its longest if proper maintenance practices are observed. Safe tire operation also depends on proper maintenance. Thus, preventive tire maintenance leads to safer, more economic operations.

PROPER INFLATION PROCEDURES

NOTE: Keeping aircraft tires at their correct inflation pressure is the most important factor in any preventive maintenance program.

The problems caused by incorrect inflation can be severe. Overinflation can cause uneven treadwear, reduce traction, make the tread more susceptible to cutting and increase stress on aircraft wheels. Underinflation produces uneven tire wear and greatly increases stress and flex heating in the tire, which shortens tire life and can lead to tire blowouts. More information about the effects of improper inflation is available in the section "Effects of Operating Conditions."

1. **CHECK DAILY WHEN TIRES ARE COOL**

   Tire pressures should always be checked with the tire at ambient temperatures. Tire temperatures can rise in excess of 200˚F (93˚C) above ambient during operation. A temperature change of 5˚F (3˚C) produces approximately one percent (1%) pressure change. It can take up to 3 hours after a flight for tire temperatures to return to ambient.

   A tire/wheel assembly can lose as much as five percent (5%) of the inflation pressure in a 24-hour period and still be considered normal. This means that tire pressures change on a daily basis. Even a tire which does not normally lose pressure can become damaged by FOD or other outside factors that can suddenly increase pressure loss. These are all reasons why it is important to check pressure daily or before each flight.

2. **INFLATE TO WORST CONDITIONS**

   When tires are going to be subjected to ground temperature changes in excess of 50˚F (27˚C) because of flight to a different climate, inflation pressures should be adjusted to worst case prior to takeoff. The minimum required inflation must be maintained for the cooler climate; pressure can be readjusted in the warmer climate. Before returning to the cooler climate, adjust inflation pressure for the lower temperature. An ambient temperature change of 5˚F (3˚C) produces approximately one percent (1%) pressure change.

3. **USE DRY NITROGEN GAS (WHEN REQUIRED)**

   Nitrogen will not sustain combustion and will reduce degradation of the liner material, casing plies and wheel due to oxidation.

4. **INCREASE PRESSURE 4% FOR TIRES UNDER LOAD**

   It must be determined if "loaded" or "unloaded" pressure has been specified by the aircraft manufacturer. When a tire is under load, the gas 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. The opposite is true as well: if loaded pressure has been specified, that number should be reduced by four percent (4%) if the tire is being inflated while unloaded.

5. **ALLOW 12-HOUR STRETCH AFTER MOUNTING**

   All tires, particularly bias tires, will stretch (or grow) after initial mounting. This increased volume of the tire results in a pressure drop. Consequently, tires should not be placed in service until they have been inflated a minimum of 12 hours, pressure rechecked, and tires re-inflated if necessary.

6. **NEVER REDUCE PRESSURE ON A HOT TIRE**

   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. Procedures for hot tire inflation pressure checks are described later in this session.

7. **EQUAL PRESSURE FOR DUALS**

   To prevent one tire on a gear from carrying extra load, all tires on a single gear should be inflated equally. The mate tire(s) will share the load, allowing individual tires to run underinflated or overloaded if pressures are unequal, because all tires on the gear will deflect identically.

8. **CALIBRATE INFLATION GAUGE REGULARLY**

   Use an accurate, calibrated gauge. Inaccurate gauges are a major source of improper inflation pressures. Gauges should be checked periodically and recalibrated as necessary. Goodyear recommends the use of a digital or dial gauge with 5 PSI increments and a memory needle.

PROPER INFLATION PROCEDURES (CONT'D)

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 will seep out under the beads, through sidewall vents or around the valve stem, resulting in an underinflated assembly.

Mounted Tubeless Tires

A slight amount of gas diffusion through the liner material and casing of tubeless tires is normal. The sidewalls are purposely vented in the lower sidewall area to bleed off trapped gases, preventing separation or blisters. *A tire/wheel assembly can lose as much as five percent (5%) of the inflation pressure in a 24-hour period* and still be considered normal. If a soap solution is used to check leaks, it is normal for small amounts of bubbles to be observed coming from the vent holes.

COLD PRESSURE SETTING

The following recommendations apply to cold inflation pressure setting:

1. Minimum service pressure for safe aircraft operation is the cold unloaded inflation pressure specified by the airframe manufacturer.
2. The loaded service inflation must be specified four percent (4%) higher than the unloaded inflation.
3. A tolerance of minus zero (-0) to plus five percent (+5%) of the minimum pressure is the recommended operating range.
4. If "in-service" pressure is checked and found to be less than the minimum pressure, the following table should be consulted. An "in-service" tire is defined as a tire installed on an operating aircraft.

Cold Tire Service Pressure	Recommended Action
100 to 105 percent of loaded service pressure	None - normal cold tire operating range.
95 to less than 100 percent of loaded service pressure	Reinflate to specified service pressure.
90 to less than 95 percent of loaded service pressure	Inspect tire/wheel assembly for cause of pressure loss. Reinflate & record in log book. Remove tire/wheel assembly if pressure loss is greater than 5% and reoccurs within 24 hours.
80 to less than 90 percent of loaded service pressure	Remove tire/wheel assembly from aircraft (See **NOTE** below).
Less than 80 percent of loaded service pressure	Remove tire/wheel assembly and adjacent tire/wheel assembly from aircraft (See **NOTE** below).
0 percent	Scrap tire and mate if air loss occurred while rolling (See **NOTE** below).

NOTE: Any tire removed due to a pressure loss condition should be returned to an authorized repair facility or retreader, along with a description of the removal reason, to verify that the casing has not sustained internal degradation and is acceptable for continued service.

PROCEDURES FOR HOT TIRE INFLATION PRESSURE CHECKS

Do not approach a tire/wheel assembly that shows signs of physical damage which might compromise its structural integrity. If such conditions exist refer to operator safety procedures for damaged tire/wheel assemblies.

THIS PROCEDURE DOES NOT REDUCE OR REPLACE THE NEED AND IMPORTANCE OF 24-HOURLY "COLD" TIRE PRESSURE CHECKS.

When it is deemed necessary to make "hot" tire inflation pressure checks between normal 24 hourly "cold" tire pressure checks, follow these procedures to identify any tire that has lost pressure faster than its axle mate(s).

PROPER INFLATION PROCEDURES (CONT'D)

- This procedure identifies, for a given multi-tire landing gear, the tire/wheel assembly that has lost inflation pressure at the fastest rate on a given landing gear. This procedure does not apply to the normal inflation pressure drop which all tires experience, and proposes no action for this case.
- Tires at elevated temperatures will develop inflation pressures higher than the specified cold inflation pressures. *Excess inflation pressure should never be released from "hot" tires.*
- Inflation pressure should be checked on all tires of a given landing gear before taking action.
  - If any tire is less than 90% of minimum loaded service pressure, remove the tire from service.
  - Determine the average pressure of all tires on the gear. Any tire(s) that is/are less than 95% of the average, should be inflated up to the average.

SPECIAL PROCEDURES – EMERGENCY TIRE STRETCH

In an emergency situation, tires which must be placed in service without being inflated a minimum of 12 hours should be inflated to 105% of the unloaded service pressure. The tire/wheel/valve assembly should be sprayed with a soap solution and checked for abnormal leakage (abnormal leakage is if the soap solution bubbles anywhere on the wheel or if a constant stream of bubbles is produced at the tire vents). If there is abnormal leakage, the tire/wheel assembly should be rebuilt according to normal procedures. If there is no abnormal leakage, the tire can be placed in service, as long as cold tire pressure is checked before every flight within the next 48 hours and the tire is re-inflated if necessary. Note: If the pressure drops below 90% of service pressure during these checks, follow the guidelines per the Cold Tire Service Pressure chart in this section.

OTHER PREVENTIVE MAINTENANCE

CASING FLAT SPOTTING

Loaded tires that are left stationary for any length of time can 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's recommendations on mounting as described on the new tire label.
2. Use only new wheel manufacturer-approved O-ring seals with the proper cold weather properties, properly lubricated and installed.
3. Use only an accurate calibrated 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.
6. High speed taxis and sharp turns should be avoided to prevent excessive sideloading.
7. An important fact to remember is that for every 5°F (3° C) change (increase) in temperature will result in a corresponding one percent (1%) change (increase) in tire pressure.
8. Do not reduce the inflation pressure of a cold tire that is subjected to frequent changes of ambient temperature.

OTHER PREVENTIVE MAINTENANCE (CONT'D)

SPECIAL PROCEDURES – ABOVE NORMAL BRAKING ENERGY

Tires that have been subjected to unusually high service braking or operating conditions such as HIGH ENERGY REJECTED TAKEOFFS or HIGH ENERGY OVERSPEED LANDINGS* should be removed and scrapped. Even though visual inspection may show no apparent damage, tires may have sustained internal structural damage. Consequently, affected tires inflated should be clearly marked and/or documented by serial number with a description of the reason for removal and returned to a full service tire supplier.

*Overspeed landings are those that exceed the tire speed rating.

Tires that have deflated due to a FUSE PLUG RELEASE should be removed and scrapped. If this has occurred in dynamic (rolling) conditions, the mate tires have been subjected to high stress conditions and should also be removed. If this has occurred in a static (not rolling) condition, the mate tire does not have to be removed unless it fails to pass other AMM or applicable Goodyear CMM service or inspection criteria.

For "HARD LANDINGS", the AMM should be followed.

Also, all wheels should be checked in accordance with the applicable Wheel Overhaul or Maintenance Manual.

PROTECTING TIRES FROM CHEMICALS AND EXPOSURE

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

Tire coatings or dressings: Goodyear adds antioxidants and antiozonants to the sidewall and tread to help prevent premature aging from ozone and weather exposure. There are many products on the market that are advertised to clean tires and to improve appearance and shine. Since many of these may remove the antioxidants and antiozonants, we do not endorse any of them unless the tires are to be used for display purposes only.

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.

Store tires away from fluorescent lights, electric motors, battery chargers, electric welding equipment and electric generators, since they create ozone which has a deteriorating effect on rubber.

CONDITION OF AIRPORT AND HANGER FLOOR 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. Foreign object damage (FOD) is the most common cause for early removals.

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 airport, 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. 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. See picture of a typical example of chevron cutting in the tread photo section at the right.

BEFORE MOUNTING

Correct mounting and demounting of aircraft tires and tubes are essential for maximum safety and economy. It is a specialized job that should be done with the proper tools and careful attention to specific instructions and established procedures.

BIAS AND RADIAL AIRCRAFT TIRE GUIDELINES

Radial aircraft tires may exhibit different characteristics than bias aircraft tires when operated under similar conditions. The following guidelines are recommended:

1. The airframe must be certified for use of radial tires in place of bias or vice versa. Questions concerning the certification of a given aircraft must be referred to the airframe manufacturer.

2. Radial aircraft tires should not be mounted on wheels designed for bias ply tires or bias tires on wheels designed for radial tires without first checking with the wheel manufacturer.

3. It is acceptable to mount bias tires on nose positions and radial tires on main positions, or vice versa, on the same aircraft.

4. For Return to Base Operation Only: In case a tire replacement is needed in a remote location, the position may be filled with an appropriate tire of the other construction for return to base operation only.

WARNING

Aircraft tires are designed to be operated up to or at rated inflation pressure. Greatly exceeding these pressures may cause the aircraft wheel or tire to explode, which can result in serious or fatal injury. Pressure Regulators should always be used to help prevent injury or death caused by over-pressurization of the tire assembly. Maintenance and use of pressure regulators should be performed in accordance with the manufacturer's instructions. The safety practices for mounting and demounting aircraft tires referenced in the aircraft and wheel manufacturers maintenance manuals should be followed.

Newly assembled tires and wheels should be inflated in safety cages.

AIRCRAFT WHEELS

Aircraft wheels made today, for tube-type and tubeless tires, are the split wheel or demountable flange variety. While this makes the job of mounting and demounting physically easy, strict attention to detail is required.

Wheel Manufacturer's Instructions

Specific instructions on modern wheels are contained in maintenance manuals available from the aircraft manufacturer or directly from the wheel manufacturer. It is inadvisable to mount or demount aircraft tires without the specific information contained in these manuals. In addition, refer to airframe manufacturer's manual on use of incline ramps and/or jacks for maintenance purposes.

Safety Precautions With Wheels

An inflated tire/wheel assembly is a potentially explosive device. Mounting and demounting of aircraft tires is a specialized job that is best done with the correct equipment and properly trained personnel. The following precautions are advisable in handling both tube-type and tubeless tires.

BEFORE MOUNTING *(CONT'D)*

AIRCRAFT TIRE CONDUCTIVITY

Under certain circumstances (for example during refueling), operators have concerns relative to the dissipation of static electricity for aircraft.

In those situations where buildup of static electricity is of concern, *it is important that mechanical means always be used to ground the aircraft.*

CAUTION
Do not rely on tires to dissipate static electricity.

MATCHING DUAL TIRES

When new and/or retreaded tires are installed on the same landing gear axle, the diameters do not have to be matched, as long as the dimensions are within the Tire and Rim Association inflated dimensional tolerances for new and grown tires. This will insure that both tires will carry an equal share of the axle load.

Data for new tire diameters after a 12 hour stretch period, at rated inflation pressure, are available in Goodyear's Aircraft Tire Data book. The maximum grown diameter is calculated using Tire and Rim or ETRTO formulas, and these formulas are also found in Goodyear's Aircraft Tire Data book. If help is needed with these calculations, please contact your local Goodyear representative.

MOUNTING PROCEDURES

WARNING
Failure to comply with the following instructions may cause tire/tube/wheel failure and serious injury.

IMPORTANT - INFLATION PRACTICES

(See Section 2, Proper Inflation Procedures)

1. **CHECK DAILY WHEN TIRES ARE COOL**
2. **INFLATE TO WORST CONDITIONS**
3. **USE DRY NITROGEN GAS (SAFELY)**
4. **INCREASE PRESSURE 4% FOR TIRES UNDER LOAD**
5. **ALLOW 12 HOUR STRETCH AFTER MOUNTING**
6. **NEVER REDUCE THE PRESSURE OF A HOT TIRE**
   REMEMBER - 1% PRESSURE CHANGE FOR 5°F (3° C)
7. **EQUAL PRESSURE FOR DUALS**
8. **CALIBRATE INFLATION GAUGE REGULARLY**

MOUNTING PROCEDURES (CONT'D)

Bead lubrication in mounting both tubeless and tube-type tires is often desirable to facilitate mounting and seating of the beads against the wheel flanges. A light coat of talc can be used. Use the following guidelines for mounting:

- Use a clip-on chuck, an extension hose, and a safety cage for inflation.
- Use a direct reading or dial type pressure gauge with 5 psi increments that is calibrated on a regular basis.
- When inflating a tire/wheel assembly, regulate the supply line to a pressure no more than 50% higher than the tire service pressure.
- Do not inflate a tire above rated pressure to seat beads.

TUBE-TYPE

- Use the correct tire and tube for the wheel assembly.
- Clean inside of tire, then lubricate lightly with talc.
- Inflate tube to slightly round, and insert in tire.
- Align yellow stripe on tube with red balance dot on tire. Align red dot with valve if no stripe on tube.
- When mounting tire and tube on wheel, be sure that wheel bolts are torqued to wheel manufacturer's instructions before inflating.
- Inflate tire in a safety cage to rated pressure.
- Deflate assembly to equalize stretch.
- Reinflate to rated pressure.
- After 12 hour stretch period, reinflate to rated inflation pressure.

Within the next 24 hours, if the pressure decreases more than 5%, it could be caused by trapped air between the tire and tube, valve core leakage, or a damaged tube.

NOTE: Check inflation pressure prior to each flight.

Tube Inspection

Since there are three reasons for air loss in a tube-type tire (a hole in the tube, a defective valve stem or valve core), finding an air leak is usually simple. The first step is to check the valve and tighten or replace the core if it is defective. If the valve is airtight, demount the tire, remove the tube, locate the leak (by immersion in water if necessary). Replace the tube.

CAUTION

For inspection use only enough pressure to round out tube. Excessive inflation strains splices and may cause fabric separation of reinforced tubes.

Reuse Of Tubes

A new tube should be used when installing a new tire. Tubes grow in service, taking a permanent set of about 25% larger than the original size. This makes a used tube too large to use in a new tire, which could cause a wrinkle and lead to tube failure.

TUBELESS TIRES

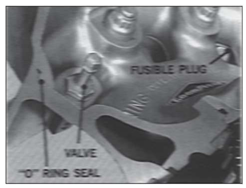
A new O-ring seal with the correct part number should be used at each tire change following the wheel manufacturer's specifications.

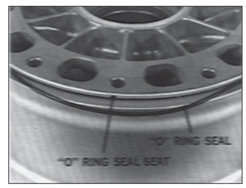
- Check for word "Tubeless" on sidewall.
- Make sure tire is clean inside.
- Clean the bead base with a cloth dampened with denatured alcohol. Allow bead seat area to dry.
- Align red balance dot on the tire with wheel valve or wheel heavy point (if indicated on wheel). If no red dot appears on the tire, look in the liner for a balance pad. Align this area to the valve or heavy spot on the wheel. If no balance pad is in the tire, then align the tire serial number to the valve or heavy spot on the wheel.
- Be sure that wheel bolts are properly torqued per the wheel manufacturer's instructions.
- Inflate tire in a safety cage using dry nitrogen to rated pressure.
- After 12-hour stretch period, reinflate to rated inflation pressure with dry nitrogen.

MOUNTING PROCEDURES *(CONT'D)*

If pressure drops more than five percent (5%) in the next 24 hours:

- Check with water or soap solution for loose or defective valve, valve core, valve seal, fuse plug, pressure release plug, O-ring seal, wheel base and flanges.
- If no leaks are found, rerun 24 hour diffusion check. If pressure still drops more than 5%, disassemble tire/wheel assembly.
- Check wheel O-ring seal for condition, proper size and type, and lubricant.
- Check wheel for cracks, porosity, fuse plug or pressure release plug malfunction.





TUBES IN TUBELESS TIRES

A Goodyear tubeless aircraft tire can be used (with a tube) in place of the same size tube-type tire if the tube - type tire has the same or lower speed and ply ratings. Ensure that any manufacturing stickers on the tire innerliner are removed to prevent damage to the tube. When the tube and tubeless tire are initially mounted some air may be trapped between the tire and tube. Since tubeless tires have much thicker innerliners than tube-type tires, any air trapped will take longer to escape and will slowly reduce the inflation pressure as it does so. During the first two weeks after mounting, monitor the inflation pressure carefully and reinflate as required.

INFLATION PRESSURE LOSS IN TUBELESS ASSEMBLIES

Since there are many causes for inflation pressure loss with a tubeless assembly, a systematic troubleshooting approach is advisable for minimum maintenance costs. Moreover, when chronic but not excessive inflation pressure loss exists, other factors such as inaccurate gauges, air temperature fluctuations, changes in maintenance personnel, etc., may be the source. If a definite physical fault is indicated, a troubleshooting procedure similar to the one outlined below is recommended. (See wheel manufacturer's maintenance/ overhaul manual for details pertaining to specific wheels.)

Valve

Before deflating and removing tire, check the valve. Put a drop of water or soap solution on the end of the valve and watch for bubbles indicating escaping pressure. Tighten valve core if loose. Replace valve core if defective and repeat leak test to check. Check the valve stem and its mounting for leaks with a soap solution. If a leak is detected, deflate the tire/wheel assembly and replace the valve core and/or valve assembly. Make certain that every valve has a cap to retain inflation and prevent dirt, oil, and moisture from damaging the core.

Fusible Plug

The fusible plug may also be defective or improperly installed. Use a soap solution to check fusible plugs for leaks before removing tire. Leaks can usually be pinpointed to the plug itself (a poor bond between the fusible material and the plug body) or to the sealing gasket used. Be sure the gasket is one specified by the wheel manufacturer and that it is clean and free of cuts and distortion.

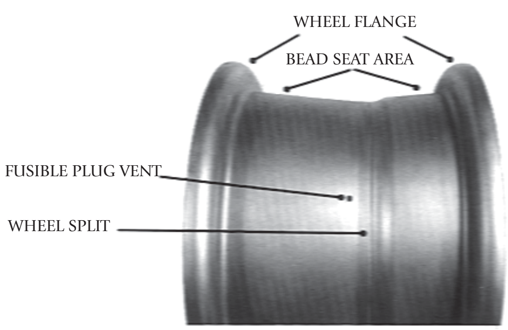
If excessive heat has caused a fusible plug to blow, the tire may be damaged and should be replaced. After a fuse plug in a wheel blows, the wheel should be checked for soundness and hardness in accordance with the applicable wheel maintenance/overhaul manual. If the tire has not rolled, it can be sent to a retreader for inspection and retreading.

INFLATION PRESSURE LOSS IN TUBELESS ASSEMBLIES
(CONT'D)

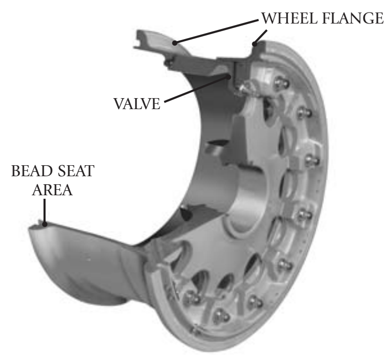
Release Plug

The inboard wheel half may contain a pressure release plug, a safety device that prevents accidental overinflation of the tire. If the tire is overinflated, the pressure release plug will rupture and release the tire pressure. A soap solution can be used to check a release plug to determine whether or not it is defective.

SPLIT RIM WHEEL



DEMOUNTABLE FLANGE RIM



Wheel Base

Gas escaping through a cracked or porous wheel base is usually visible in an immersion test. Consult the wheel manufacturer's manual for rim maintenance and repair.

O-Ring Seal

A defective o-ring seal can usually be detected in an immersion test. Check to see that wheel bolts are properly torqued.

Beads And Flanges

Check the bead and flange areas of a tire for leaks before demounting. This can be done either by immersion or by using a soap solution. Any of the following factors can cause gas loss:

- Cracks or scratches in wheel bead ledge or flange area.
- Exceptionally dirty or corroded wheel bead seating surfaces.
- Damaged or improperly seated tire bead.

Tire Carcass

Before demounting, use an immersion test or soap spray to determine if the tire itself has a puncture. If a puncture is found in the tread or sidewall, the tire must be scrapped.

Casing Vents (Weep Holes)

All tubeless tires have been vented in the lower sidewall area. These vents prevent separation by relieving pressure buildup in the casing plies and under the sidewall rubber. These vent holes (marked by green dots) will not cause undue pressure loss and do not close. Covering them with water or a soap solution may show an intermittent bubbling, which is normal.

Pressure Retention Test

When no leaks can be found on the prior checks, a pressure retention test must be performed. The tire should be inflated to operating pressure for at least 12 hours before starting the test. This allows sufficient time for the casing to stretch, but can result in apparent inflation pressure loss. The tire must be reinflated after the stretch period to operating pressure. Allow the tire to stand at constant temperature for a 24-hour period and recheck pressure.

TIRE BALANCING AND LANDING GEAR VIBRATION

It is important that aircraft wheels and tires be as well balanced as possible. Vibration, shimmy, or out of balance is a major complaint. However, in most cases, tire balance is not the cause.

Other factors affecting balance and vibration are:

- Flat-spotted tire due to wear and braking
- Out of balance wheel halves
- Installation of wheel assembly before full tire growth
- Improperly torqued axle nut
- Improperly installed tube
- The use of non aircraft tubes
- Improperly assembled tubeless tire
- Poor gear alignment
- Bent wheel
- Worn or loose gear components
- Incorrect balancing at wheel assembly

In addition, pressure differences in dual mounted tires and incorrectly matched diameters of tires mounted on the same axle may cause vibrations or shimmy.

With some split wheels, the light spot of the wheel halves is indicated with an “L” stamped on the flange. In assembling these wheels, position the “L's” 180 degrees apart. If additional static balancing is required after tire mounting, many wheels have provisions for attaching accessory balance weights around the circumference of the flange.

AIRCRAFT TIRE/WHEEL BALANCER FOR GENERAL AVIATION OPERATION

Balancing instructions for this tire/wheel balancer can be obtained from Desser Tire & Rubber Company: **800-AIR-TIRE (800-247-8473).**

NOTE: The T.J. Karg Company tire/wheel balancer is no longer available.

DEMOUNTING

CAUTION

A tire/wheel assembly that has been damaged in service should be allowed to cool for a minimum of three (3) hours before the tire is deflated.

The two types of demounting equipment used are "full-circle" and "semi-circle" bead breakers. With both types of bead breakers, the desired procedures are a combination of pressing against the tire sidewalls close to the edge of the wheel flanges and controlling the lateral movement of the bead breaker rings after contacting the tire sidewalls. This procedure assures the maximum lateral force against the tire to demount it without internal tire damage or kinking the tire beads.

1. Prior to demounting the tire from the wheel, it should be completely deflated with a deflation cap.

2. After all the pressure has been relieved, remove the valve core. Remember that valve cores still under pressure can be ejected like a bullet. If wheel or tire damage is suspected, approach the tire from the front or rear, not from the side (facing the wheel).

3. Leave the wheel tire bolts tight until after unseating the tire beads. If the bolts are loosened or removed before unseating the tire beads, the wheel mating surfaces may be damaged.

4. If "full-circle" type bead breaking equipment is used, the appropriate bead breaker flange ID should be approximately 1 inch larger than the aircraft flange OD. For example, an H40x14.5-19 tire is mounted on a 19 inch diameter wheel with a 1.4 inch flange. So, 19 inch wheel diameter plus twice the wheel flange height of 1.4 inches plus the 1 inch clearance adds up to 22.8 inches, which is rounded to give a bead breaker flange ID of 23 inches. Also, the bead breaker flanges should be equipped with rubber or plastic pads to prevent lateral movement after contacting and compressing each tire sidewall approximately 1.5 inches and to prevent damage to the aircraft wheel.

5. If "semi-circle" type bead breaking equipment is used, the same press tools are used for all size tires, but the press tools are raised or lowered to position them for each tire at the level of the center of the wheel and as close to the wheel OD as possible. This type of bead breaking equipment is equipped with sensors that prevent lateral movement after the press tools have compressed the tire approximately 3.5 inches (1.75 inches per side) and contacts the wheel. The tire can be turned on the bead breaker rollers and the breaking action repeated until the tire beads are unseated

4 Inspection, Storage and Shipping

INSPECTING MOUNTED TIRES

Systematic inspection of mounted tires is strongly recommended for safety and tire economy. The frequency of the inspection should be determined by the use and normal tire wear of the particular aircraft involved. With some aircraft, tire inspection after every landing or at every turnaround is required. With all aircraft, a thorough inspection is advisable after a hard landing.

Treadwear

Inspect treads visually and check remaining tread. Tires should be removed when tread has worn to the base of any groove at any spot, or to a minimum depth as specified in aircraft T.O.'s.

Return To Base Limits

Goodyear tires can remain in service with visible cord in the tread area only as long as the top fabric layer is not worn through or exposed for more than 1/8 of the circumference of the tire, and not more than one inch wide. Tires within these limits can continue in service no longer than necessary to return to a maintenance base and be replaced. (This applies to the proper tires for the aircraft as specified in its Aircraft Maintenance Manual.) For all other circumstances, normal removal criteria are still recommended as per the rest of this manual. This does not apply to military tires with Maximum Wear Limits marked on the sidewall.

NOTE: Further use of tires beyond this point may render a tire unsafe or unretreadable.

Uneven Wear

If tread wear is excessive on one side, the tire can be demounted and turned around, providing there is no exposed fabric. Gear misalignment causing this condition should be corrected.

Tread Cuts

Inspect tread for cuts and other foreign object damage and mark with crayon or chalk. Follow the removal criteria below:

1. Follow specific cut removal criteria from Aircraft Maintenance manuals, Operation manuals, or tire cut limits on the tire sidewall when available.
2. When specific cut removal criteria are not available use the following Goodyear removal criteria: any cut into the casing plies on bias tires, any cut into the belt package on radial tires, any cut which extends across one or more rubber tread ribs to the fabric, rib undercutting at the base of any cut.

WARNING
Do not probe cracks, cuts or embedded foreign objects while tire is inflated.

Sidewall Damage

Remove tire from service if weatherchecking, cracking, cuts and snags extend down to the casing ply in the sidewall and bead areas. Cuts and cracks deeper than one ply require the tire to be scrapped.

Bulges

Bulges in any part of tire tread, sidewall or bead area indicate a separation or damaged tire. Mark with crayon and remove from service immediately.

Fabric Fraying/Groove Cracking

Tires should be removed from service if groove cracking exposes fabric or if cracking undercuts tread ribs.

Flat Spots

Generally speaking, tires need not be removed because of flat spots due to touchdown and breaking or hydroplaning skids unless fabric is exposed. If objectionable unbalance results, however, rebalance the assembly or remove the tire from service.

Casing Flat Spotting

Loaded tires that are left stationary for any length of time can 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. Under normal conditions, a flat spot will disappear by the end of the taxi run.

Radial Tire Sidewall Indentation

Remove from service with 3mm or greater sidewall indentation.

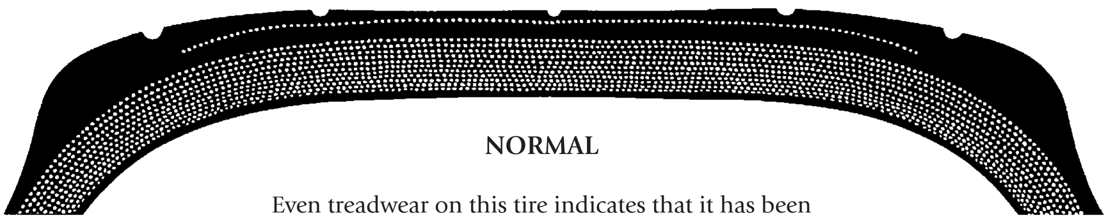
Beads
Inspect bead areas next to wheel flanges for damage due to excessive heat, especially if brake drag or severe braking has been reported during taxi, take-off or landing. If damaged, remove tire from service.

Tire Clearance
Look for marks on tires, gear, and in wheel wells that might indicate rubbing due to inadequate clearance.

Wheels
Check wheels for damage. Wheels that are cracked or damaged should be taken out of service for repair or replacement in accordance with manufacturer's instructions.

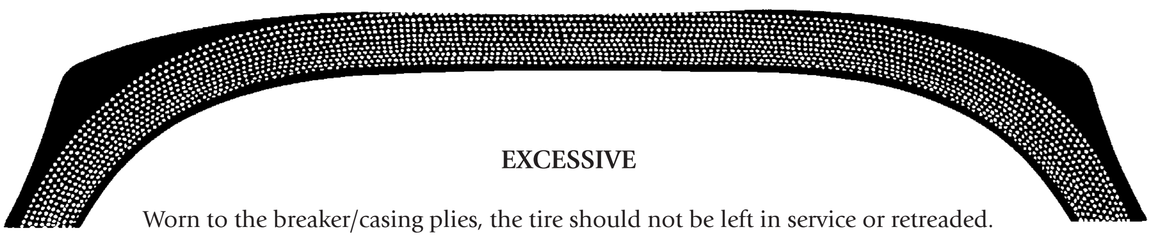
Inflation Pressure Loss In Tire/Wheel Assemblies
Refer to section on MOUNTING for a complete review of these procedures.

TYPICAL TREADWEAR PATTERNS



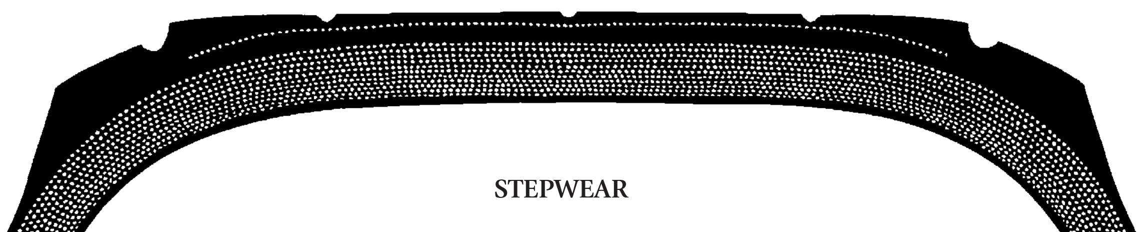
NORMAL

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



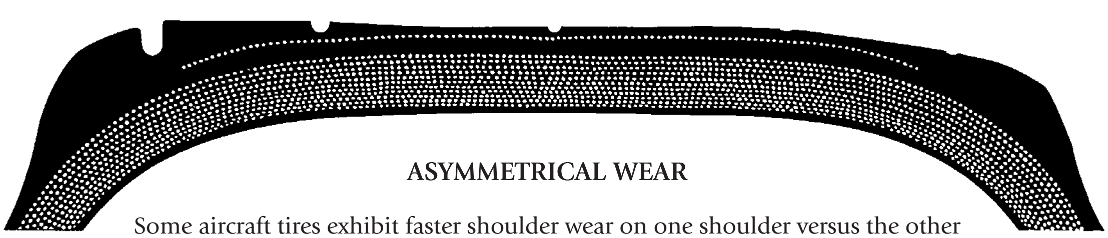
EXCESSIVE

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



STEPWEAR

This is a normal wear pattern on some tires, particularly H-type tires. Can be caused or worsened by underinflation.

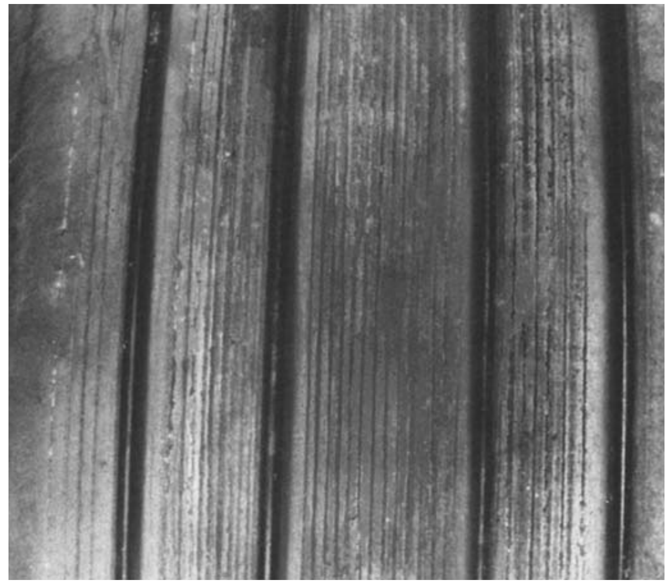


ASYMMETRICAL WEAR

Some aircraft tires exhibit faster shoulder wear on one shoulder versus the other due to non-tire influences (camber-type wear, etc.). If this condition exists, the tire's life can be extended by demounting and reversing ("flipping") the tire on the wheel as long as tire wear limit and the physical condition criteria are satisfied.
NOTE: "FLIPPING" MUST NOT BE DONE ON SINGLE CHINE TIRES.

TREAD CONDITIONS

Cuts
Penetration by a foreign object. See Section 4, Inspection, Storage and Shipping; Inspecting Mounted Tires; Tread Cuts.

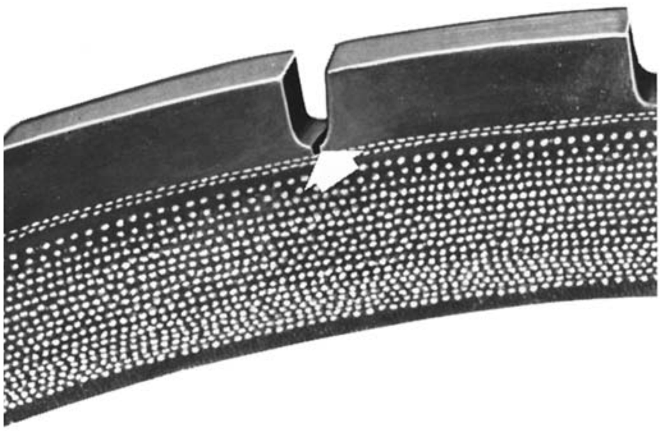


Spiral Wrap
Some retreads have reinforcing cords wound into the tread which become visible as the tire wears. This is an acceptable condition and not cause for removal. The wrap reduces chevron cutting and tread chunking.

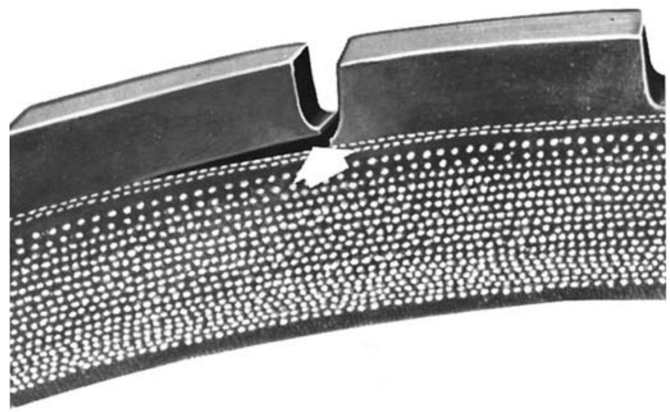
Tread Chunking
A condition in the wearing portion of tread usually due to rough or unimproved runways. Remove if fabric is visible.

Tread Separation
A 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.

TREAD CONDITIONS (Cont'd.)



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

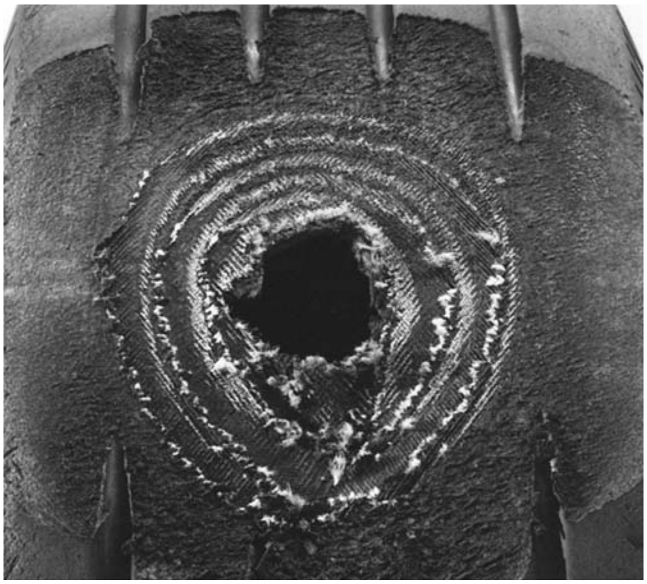


Rib Undercutting
An extension of groove cracking progressing under a tread rib; remove from aircraft. Can lead to tread chunking, peeled rib or thrown tread.

Peeled Rib
Usually begins with a cut in tread, resulting in a circumferential delamination of a tread rib, partially or totally, to tread reinforcing ply. Remove from aircraft.

Thrown Tread
Partial or complete loss of tread down to tread fabric ply or casing plies. Remove from aircraft.

TREAD CONDITIONS (Cont'd.)



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, fabric is exposed, or tire is ruptured.

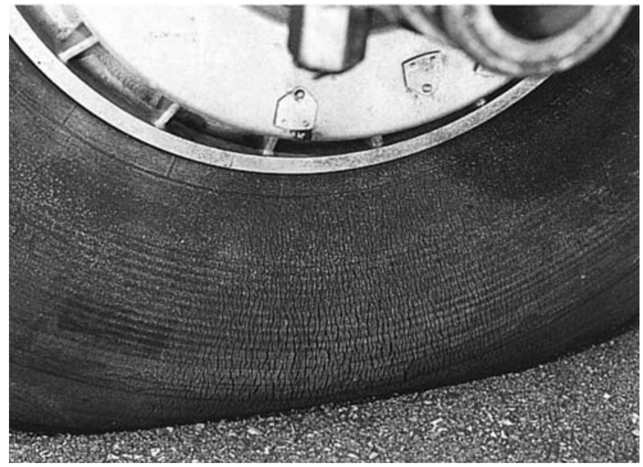
Tread Rubber Reversion
An oval-shaped area in the tread similar to a skid, but where rubber shows burning due to hydroplaning during landing usually caused by wet or ice-covered runways. Remove if balance is affected.

Open Tread Splice
A crack in the tread rubber where the joint (splice) separates in a radial (sideways) direction. Tires with this defect should be removed from service.

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.

SIDEWALL CONDITIONS

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



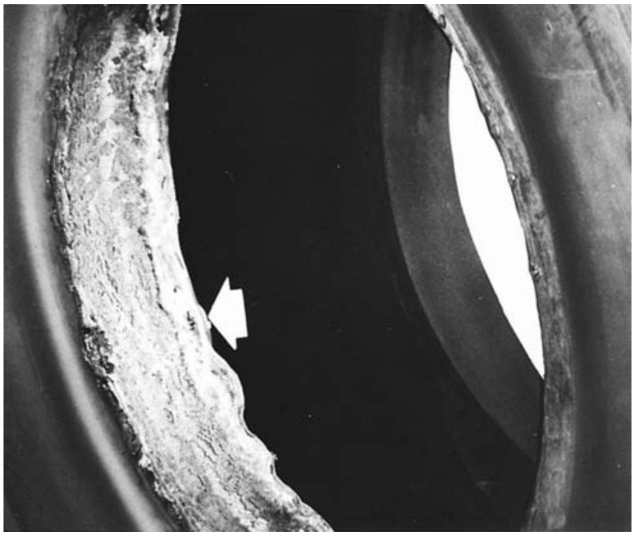
Ozone or Weather Checking/Cracking
Random pattern of shallow sidewall cracks usually caused by age deterioration, prolonged exposure to weather, or improper storage. Remove from aircraft if fabric is visible.

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

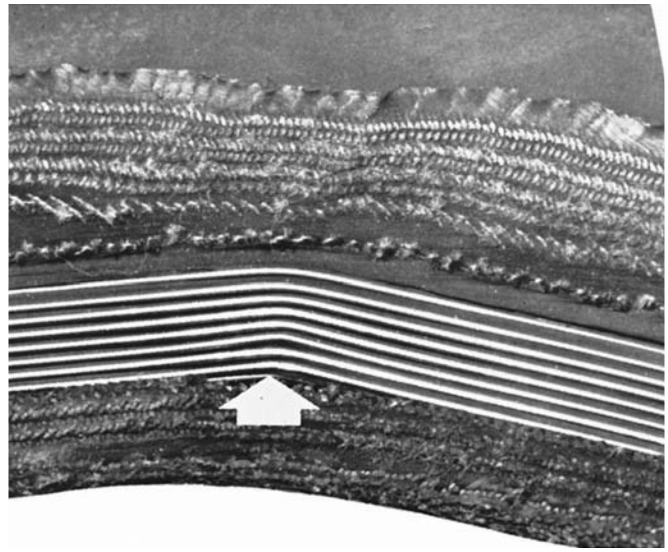
Sidewall Separation
Sidewall rubber separated from the casing fabric. Remove from aircraft.

4 Inspection, Storage and Shipping

BEAD CONDITIONS



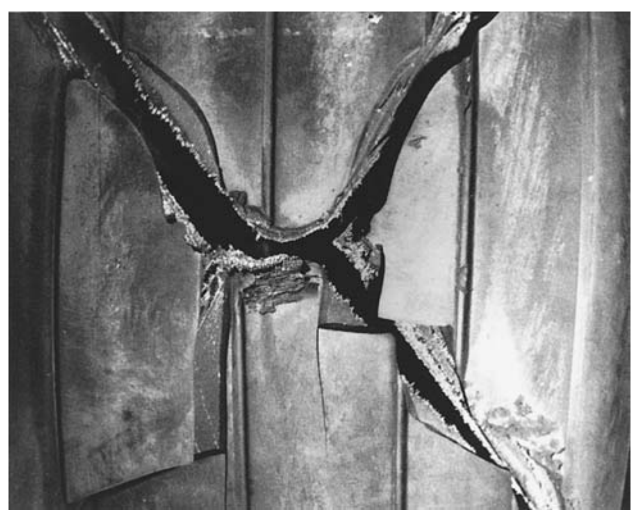
Brake Heat Damage
A deterioration of the bead face from toe to wheel flange area; minor to severe blistering of rubber in this area; melted or solidified nylon fabric if temperatures were excessive; very hard, brittle surface rubber. Tire is to be scrapped.



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

CASING CONDITIONS

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



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

TIRE AND TUBE STORAGE

Ideally, both new and retreaded tires should be stored in a cool, dry place out of direct sunlight. Temperatures should be between 32°F (0°C) and 85°F (30°C). Particular care should be taken to store tires away from fluorescent lights, electric motors, battery chargers, electric welding equipment, electric generators and similar equipment. These items create ozone, which has a deteriorating effect on rubber.

Care should be taken that tires do not come in contact with oil, gasoline, jet fuel, hydraulic fluids or similar hydrocarbons. Rubber is attacked by these in varying degrees. Be particularly careful not to stand or lay tires on floors that are covered with these contaminants.

All tires and tubes should be inspected immediately upon receipt for shipping and handling damage.

Whenever possible, tires should be stored vertically on tire racks. The surface of the tire rack against which the weight of the tire rests should be flat and wide to minimize distortion.

Axial (circumferential) rotation of unmounted, vertically stored tires should not be required. With respect to the effect of storage time on rotation, we strongly suggest the use of first-in first-out (FIFO) storage. This helps to avoid overage, distortion and related field issues.

Stacking of most tires is permissible; however, care must be used to prevent distortion of the tires on the bottom of the stack. To prevent chine distortion, stacking chine/water deflector tires is not recommended. Tires stored in racks, but leaning on the chine, can also cause distortion. The following is the maximum recommended stacking height:

Tire Diameter	Maximum Recommended Stacking Height
Up to 40 inches	5
Over 40 inches to 49 inches	4
Over 49 inches	3

Tubes should be stored in their original cartons whenever possible. If stored without their cartons, they should be lightly lubricated with talc powder and wrapped in heavy paper.

Tubes can also be stored in matching tires. Tires should be clean and lightly lubricated with talc with tubes inflated just enough to round them out.

Under no circumstances should tubes be hung over nails, pegs or any object that might form a crease in the tube. Such a crease will eventually produce a crack in the rubber.

TIRE AND TUBE AGE LIMIT

Age is not a proper indicator of tire serviceability. Goodyear aircraft tires or tubes have no age limit restriction regardless of calendar age as long as all service criteria (Section 2 of this manual), visual criteria (Section 4), or individual customer-imposed restrictions are met.

Tubes are not reusable; they can grow as much as 30% in service. Reusing them can result in folded, pinched tubes which can fail or create an imbalance.

STORAGE OF MOUNTED ASSEMBLIES

Set the pressure at operational pressure for the desired tire. The assemblies can be stored like this for up to 12 months. After that time, inflated assemblies that have not been used should be re-inspected by a qualified inspector. However, to maximize tire life, it is recommended to rotate inventory on a first-in-first-out (FIFO) basis.

The above inspections can be performed multiple times as long as the tire meets all inspection and inflation criteria. If these criteria cannot be met, the tire should either be scrapped or returned for retreading, depending on the defect found. For assemblies stored for extended periods of time, air retention checks should be performed to help re-verify the airworthiness of the assembly. Prior to putting the assembly in service, if nitrogen was not used for storage inflation, deflate the assembly and re-inflate with nitrogen (per industry standards).

These recommendations do not supersede local storage facility regulations, ground transportation restrictions, or prevailing aviation authority requirements. Depending on local regulations, it may be the operator's responsibility or that of the tire handler (shipping or storage) to ensure compliance with the requirements for the locations in which they operate, transport, and store mounted tire assemblies.

SHIPPING

SHIPPING INFLATION

Transportation of a serviceable aircraft tire/wheel assembly should be in accordance with the applicable regulatory body for the airline.

Transportation of a serviceable inflated aircraft tire is covered by the U.S. Department of Transportation Code of Federal Regulations, the International Air Transport Association (IATA), and other regulatory bodies.

While serviceable tires may be shipped fully pressurized in the cargo area of an aircraft, Goodyear's recommendation is to reduce pressure to 25% of operating pressure or 3 bars / ~40 psi, whichever is the lesser. Reinflate to operating pressure before mounting on the aircraft.

SHIPPING AND HANDLING DAMAGE

In Goodyear's manufacturing facilities, stringent finished tire inspection is performed to help ensure that Goodyear tires are shipped to the customer in first class condition. Because of the characteristics of rubber, special care is taken to inspect shipping containers, pallets and trucks for obvious conditions that could cause damage to these tires. However, aircraft tires may be damaged during shipping or handling after the tires leave the control of our facilities and prior to entering service. Damage of this nature is the responsibility of the freight carrier and needs to be handled between the receiving facility and the freight handler as soon as possible after receipt of the tire(s). The reader should keep in mind that some of this damage can be so slight that it escapes incoming inspection procedures and is noticed later or after the tire is mounted on the wheel assembly and inflated.

Cuts and snags can occur on tread areas, sidewalls and bead areas of tires. In many cases these cuts are caused by nails, wood, splinters, utility knives, forklift tines or sharp metal objects in transport trailers.

RETREADING TIRES

Goodyear has been retreading aircraft tires since 1927. Today, most military and commercial airline tires are designed to be retreaded. Retreading an existing casing can provide more landings per tire at a lower cost per tread, giving a significantly lower overall operating cost.

As with new tires, retreads must pass airworthiness authority testing requirements. Inspection techniques, such as air injection, holography and shearography, ensure that used casings and the final retread meet all specifications. Again, as with new tires, retread materials and components are certified by quality assurance standards.

The following is a scenario of the retread process:

- Tires are received and assigned a process card and number that follows the tire throughout the complete process. All pertinent information is entered into a computer database.
- Tires are visually inspected and air needle pressure tested to reveal any separations or possible liner leaks.
- Tires are put into hot storage to shrink the nylon casing back to its original shape.
- Tires are then placed on a buffing machine with the casing under pressure to ensure roundness.
- The old tread is buffed off the casing along with any removable fabric reinforcement plies.
- New fabric reinforcement plies are applied, as required, along with the new tread rubber.
- Tires are then placed in a mold and the new tread materials are vulcanized (cured).

Along with the standard visual and air needle inspections, a major part of the Goodyear retread inspection process includes Holography or Shearography inspections.

Shearography Inspection

Goodyear uses shearography equipment as part of its state-of-the-art nondestructive inspection methods. It is capable of detecting very small anomalies that could affect tire performance. Its advantages are real-time inspections through CRT screen viewing and video data storage. It has the capability of bead-to-bead inspection.

6 Aircraft Tire Properties

It is helpful to have some knowledge of aircraft tire properties to better understand some of the charts and graphs presented in this section. Some of the main properties are discussed on the following pages.

The major design philosophy of an aircraft tire, as compared to other tire types such as passenger and truck tires, is that they are designed for intermittent operation. Because of this design feature and to allow the lowest possible ground bearing pressure, the aircraft tire operates at much higher deflections than other tire types.

The Tire and Rim Association (T&RA) and European Tire and Rim Technical Organization (ETRTO) were established so that different manufacturers' tires and wheels (rims) would be interchangeable. Tire size nomenclature has changed throughout the years due to ever increasing technology. The T&RA and ETRTO also establish the load and pressure ratings of a given size tire.

TIRE NAME SIZE CLASSIFICATION

Three Part Type All new sizes being developed are in this classification. This group was developed to meet the higher speeds and loads of today's aircraft. Note: Some sizes have a letter such as "H" in front of the diameter. This is to identify a tire that is designed for a higher percent deflection.

Metric Type This size designation is the same as Three Part except the diameter and section width dimensions are in millimeters, and the wheel/rim diameter is in inches.

Type VII This type covers most of the older sizes and was designed for jet aircraft with its higher load capacity.

Type III This type was one of the earliest size designations used for piston-prop type aircraft. Its characteristic is low pressure for cushioning and flotation.

Radial Radial size nomenclature is the same as Three Part except an "R" replaces the "-" (dash) before the wheel/rim diameter.

Tire Name Type	Tire Size Example	Nominal Diameter	Nominal Section Width	Nominal Wheel/Rim Diameter
Three Part	H49x19.0-22	49	19.0	22
Metric	670x210-12	670 (mm)	210 (mm)	12 (in)
Type VII	49x17	49	17	
Type III	8.50-10		8.50	10
Radial	32x8.8R16	32	8.8	16

For a complete listing of tire sizes and aircraft applications along with some engineering design parameters, Goodyear publishes another book titled Aircraft Tire Data Book. Contact your local Goodyear representative to receive a copy.

AIRCRAFT TIRE -VS- OTHER TIRE APPLICATIONS

Many people believe that all tires are alike. This chart shows a comparison of an aircraft tire versus a passenger tire. The tires may be similar in size, but that is where similarities end.

Tire Comparison Aircraft - vs - Passenger		
PARAMETER	**AIRCRAFT**	**PASSENGER**
Size	27 x 7.75-15	P205/75R15
Diameter (in)	27.0"	27.1"
Section Width	7.75"	7.99"
Ply Rating	12	–
Load Rating	9650	1598
Pressure	200	35
Deflection	32%	11%
Max Speed	225	112
Load/Tire Weight	244	78

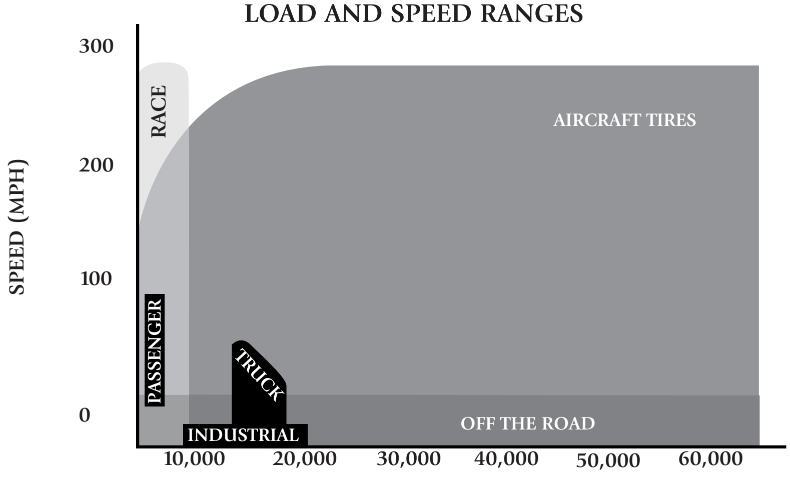
Comparing, in particular, the LOAD and SPEED ratings of these two tires, the aircraft tire carries 9650 lbs., which is approximately six times the passenger tire load of 1598 lbs. It is also traveling over twice as fast.

Also, notice that the operating pressure of the aircraft tire is almost 6 times that of the passenger tire; and that the aircraft tire is operating at a deflection of 32%, as compared to 11% for the passenger tire.

Aircraft Tires -vs- Other Tires Applications

The **HEAVY LOAD** coupled with the **HIGH SPEED** of aircraft tires makes for extremely **SEVERE OPERATING CONDITIONS.** Several of the following charts are centered around these two major factors. The purpose of these charts is to present items that minimize and maximize these adverse effects. The ultimate goal is to not only understand what needs to be done, but why.

TIRE OPERATING RANGES OF OTHER APPLICATIONS
LOAD AND SPEED RANGES



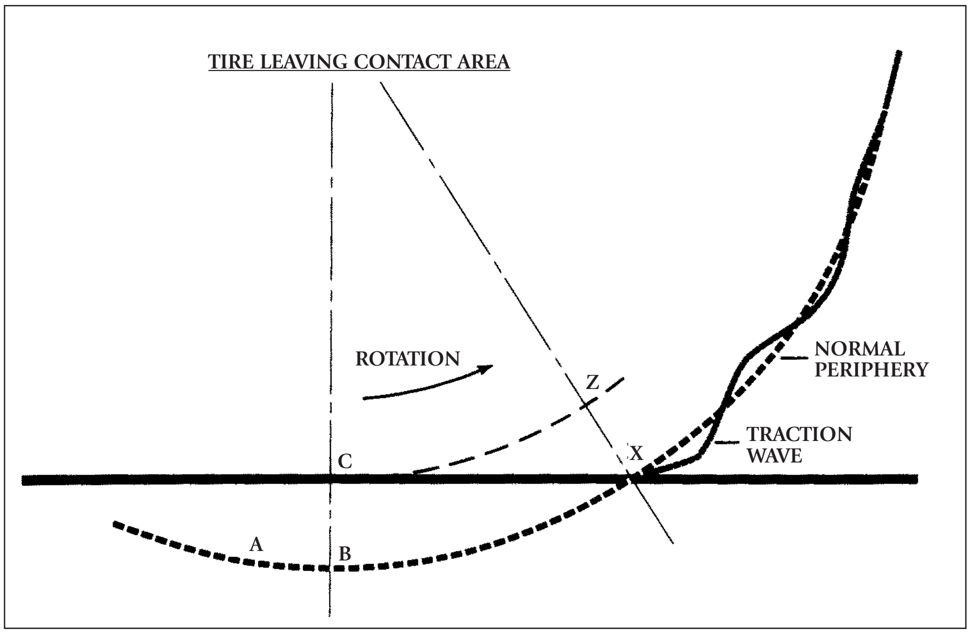
This chart shows the **SPEED** versus **LOAD** operating ranges of passenger, truck, race, farm, off-the-road, and aircraft tires. Only Aircraft tires have the worst of both loads and speeds. This means that maintenance practices and operating techniques that work fine for passenger tires are not acceptable for aircraft tires. Because of the severe conditions under which aircraft tires operate, any deviation from proper techniques and practices will have severe consequences.

CENTRIFUGAL FORCE

CENTRIFUGAL FORCE is combination of LOAD & SPEED

Both heavy loads and high speeds contribute to the strong centrifugal forces acting on an aircraft tire. The relationship of speed versus centrifugal force is obvious. The effect of coupling speed with a heavy load is shown in the drawing below.

This drawing depicts a tire rotating counterclockwise. The heavy solid horizontal line represents the ground or runway. The distance "CX" is half the footprint length. Because the tire is pneumatic, it deflects when coming into contact with the ground. This deflection is represented by the distance "BC" or "XZ". In the same length of time that a point on the surface of the tire travels the last half of the footprint "CX", it must also move radially outward the distance "ZX".

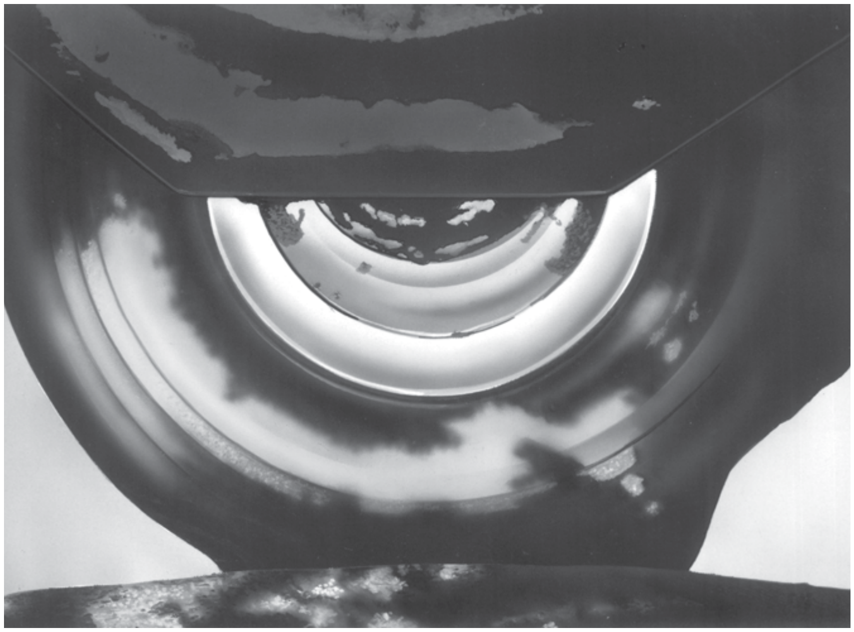


As the tire leaves the deflected area, it attempts to return to its normal shape. Due to centrifugal force and inertia, the tread surface doesn't stop at its normal periphery but overshoots, thus distorting the tire from its natural shape. This sets up a traction wave in the tread surface.

CENTRIFUGAL FORCE *(CONT'D)*

TRACTION WAVE

This photograph shows just how severe a traction wave can become under certain operating conditions.



The following parameters help explain the magnitude of forces acting on the tire carcass and tread as it runs on a test dynamometer.

Speed	**250 MPH**
Revolutions per Minute	**4,200**
Deflection	**1.9 inches**

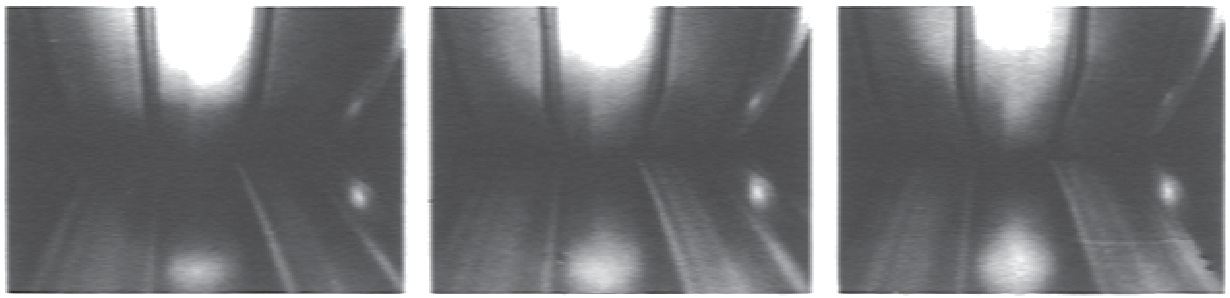
At this speed, it takes only 1/800 of a second to travel 1/2 the length of the footprint (CX). In that same time, the tread surface must move radially outward 1.9 inches. This means an average radial acceleration of 200,000 ft./sec./sec. That's over 6,000 G's!

This means the tread is going through 12,000 to 16,000 oscillations per minute.

Obviously, a tire cannot withstand this type of punishment. How can a traction wave be reduced or eliminated? In other words, what factors affect the traction wave? The following page shows effects of **SPEED** and **UNDERINFLATION**.

CENTRIFUGAL FORCE (CONT'D)

Traction Wave -vs- Speed

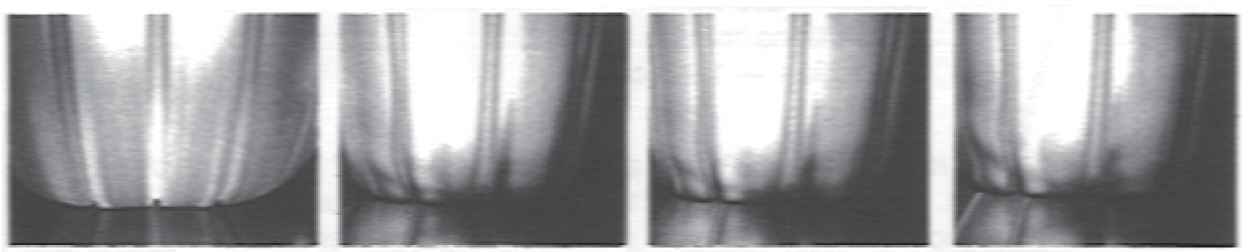


40X14 24 PR @ Rated Pressure

The above photographs show the tread of a tire as it leaves the footprint moving toward the reader. The only test variable is speed, showing from left to right 190, 210, 225 mph. The higher the speed, the more pronounced the traction wave.

One of the major tasks of the tire design engineer is to minimize this traction wave at the required speeds and loads.

Traction Wave -vs- Underinflation



40X14 24 PR 225 MPH

All tires in the above photographs are traveling at 225 mph. In the picture to the far left there is no appreciable traction wave because the tire is properly inflated. The only test variable is pressure, showing from left to right rated pressure, -10 psi, -15 psi, -20 psi. Obviously, the greater the underinflation, the more pronounced the traction wave.

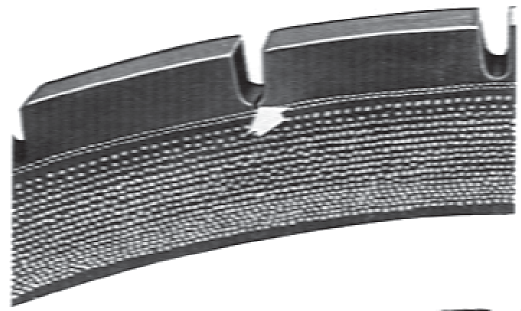
Note how the grooves open and close as the tread passes through the traction wave.

CENTRIFUGAL FORCE (CONT'D)

The centrifugal forces that generate a traction wave, combined with the thousands of revolution cycles, can cause tread problems such as Groove Cracking and Rib Undercutting, which could result in tread loss.

GROOVE CRACKING

is a circumferential crack that can develop in the base of the groove caused by the repeated flexing of the groove when a traction wave is present. Tires should be inspected frequently and removed if any fabric is visible.



RIB UNDERCUTTING

is normally a continuation of the groove cracking that continues under the tread rib between the rubber and the tread reinforcing fabric.

Rib undercutting can progress to a point where pieces of the rib or the whole rib can become separated from the carcass. In severe cases the complete tread can come off the carcass. Progression from deep groove cracks to undercutting and ultimate tread loss can occur rather quickly. Therefore, careful examination of the tires before each take-off is extremely important. The tire should be removed if the fabric is exposed.

Before leaving the subject of centrifugal force, it is interesting to look at the magnitude of these forces due to speed only, disregarding other radial accelerations caused by loads and deflections. This chart shows the centrifugal forces acting on one ounce of tread rubber on a 30-inch diameter tire.

**Centrifugal Forces
30-Inch Diameter Tire**

MPH	Gs	FORCE ON 1 OZ OF TREAD	FORCE ON TOTAL TREAD (8 LBS)
100	500	33 LBS	4,000 LBS
200	2000	130 LBS	16,600 LBS
300	4500	300 LBS	38,500 LBS
400	8000	528 LBS	67,500 LBS

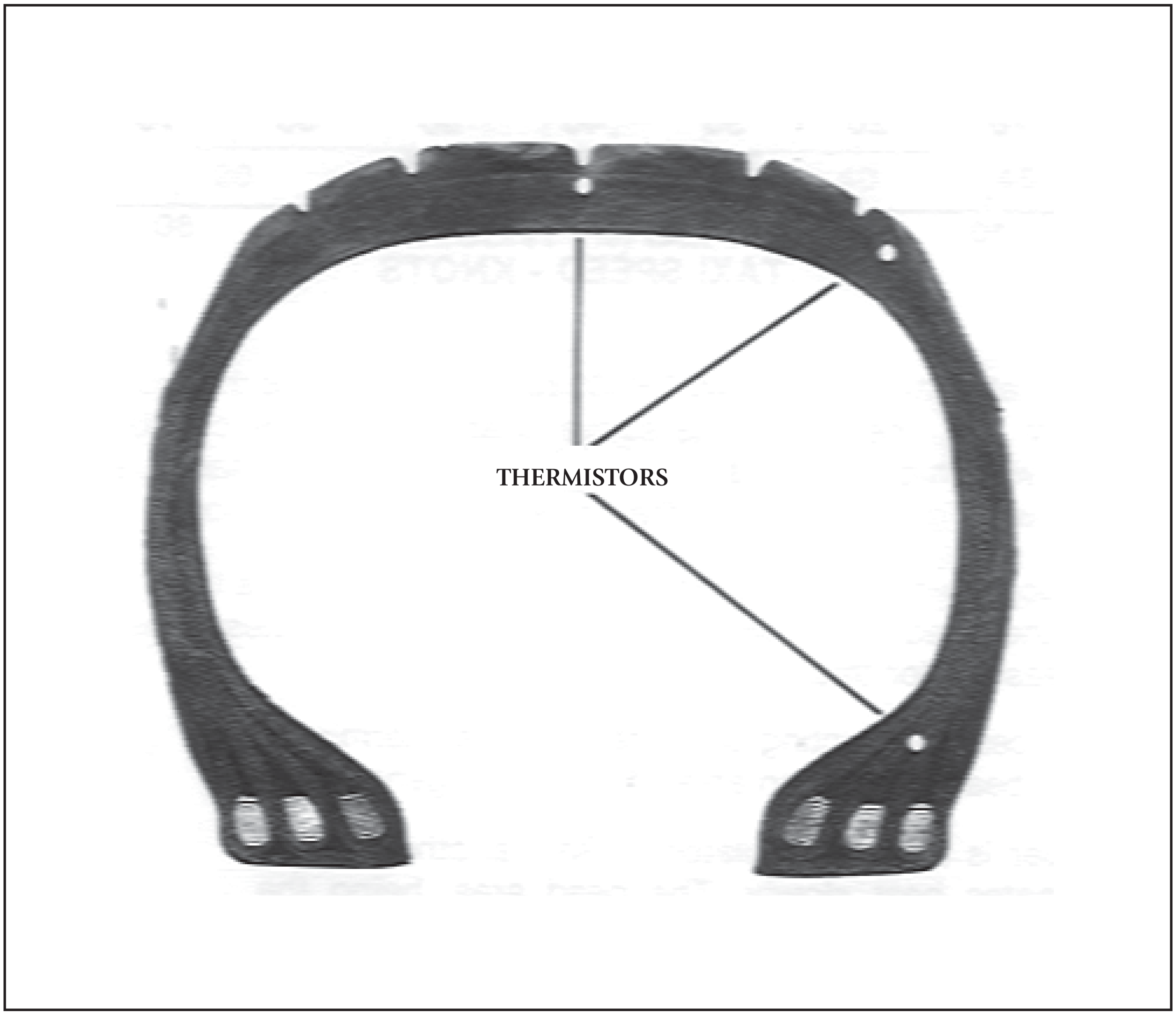
The force increases as the square of the speed from 500 Gs, or 33 lbs. per ounce, at 100 mph, to an extreme of 8000 Gs, or 528 lbs. per ounce, at 400 mph.

An average tread for this size tire would weigh approximately 8 lbs. This means that the effective weight of the total tread at 200 mph would be 16,600 lbs. and at 400 mph would be 67,500 lbs.

With forces like these, it is amazing that a tread can stay on a tire at all.

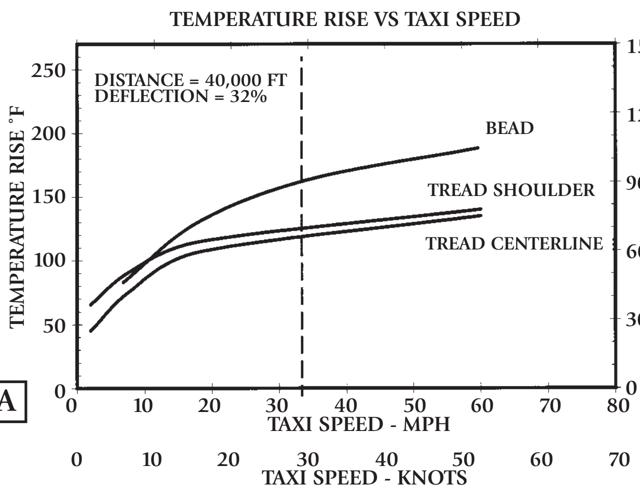
HEAT GENERATION

As severe as the effects of these high centrifugal forces are, **HEAT** has a more detrimental effect. **HEAVY LOADS** and **HIGH SPEEDS** cause **HEAT GENERATION** in aircraft tires to exceed that of all other tires.

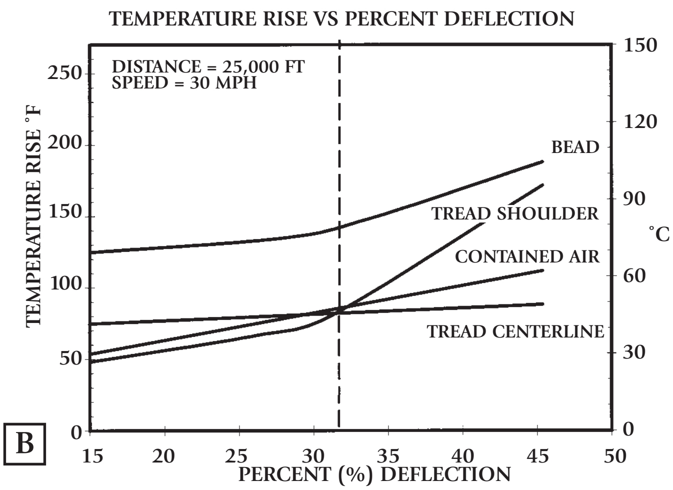


To understand the magnitude of heat generated in typical aircraft tires, several test tires were fitted with temperature sensors, or thermistors, mounted at the locations indicated. The actual temperature rise during a variety of free-rolling taxi tests was monitored and recorded. The following charts show the effect of taxi speed, inflation pressure, and taxi distance on internal heat generation for typical main landing gear tires.

HEAT GENERATION (CONT'D)



A



B

A The vertical dotted line at 35 mph (30 knots) indicates the recommended maximum taxi speed. On the above chart, the curves constantly slope upward with higher taxi speeds. In other words, the faster an aircraft travels over a given distance, the hotter the tires will become.

Many people would expect the shoulder area to generate the most heat. In reality, the bead and lower sidewall area are the hottest. There are two major reasons for this:

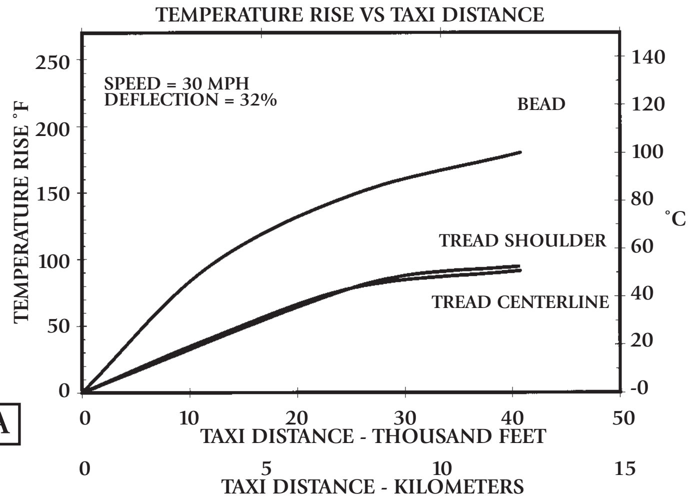
1. All forces, in or acting on a tire, ultimately terminate at the bead. This is an area of high heat generation.

2. Rubber is a good insulator; or said another way, it dissipates heat slowly. The bead area, being the thickest part of the tire, retains the heat longer than any other part of the tire.

B This tire was designed to be operated at 32% deflection, as the vertical dotted line indicates. Left of this line designates overinflation, and to the right underinflation. When the speed and the distance traveled are constant, the more a tire is underinflated the hotter it becomes.

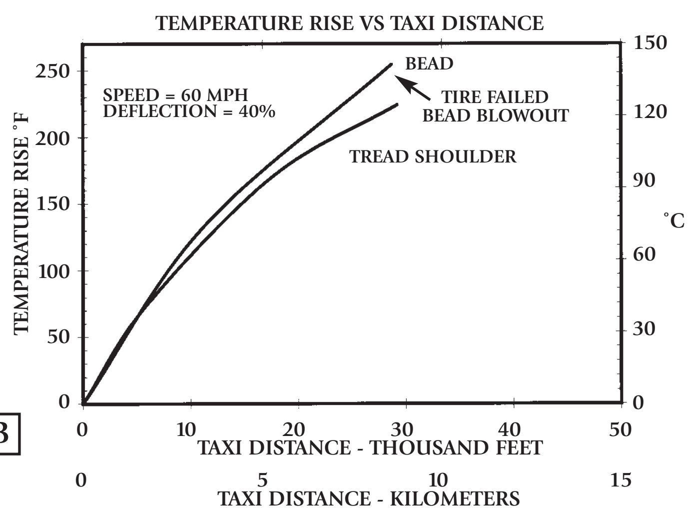
The rate of temperature rise versus underinflation is the highest in the shoulder area due to increased flexing. The bead area, however, still remains hottest.

HEAT GENERATION (CONT'D)



A

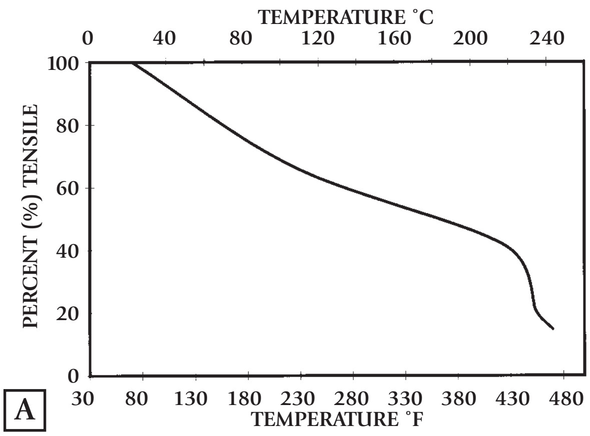
A Even when an aircraft tire is properly inflated and operated at moderate taxi speeds, the heat generation will always exceed the heat dissipated. (This is indicated by the ever increasing slope of the lines.) The farther the taxi distance, the hotter the tires will be at the start of the take-off.

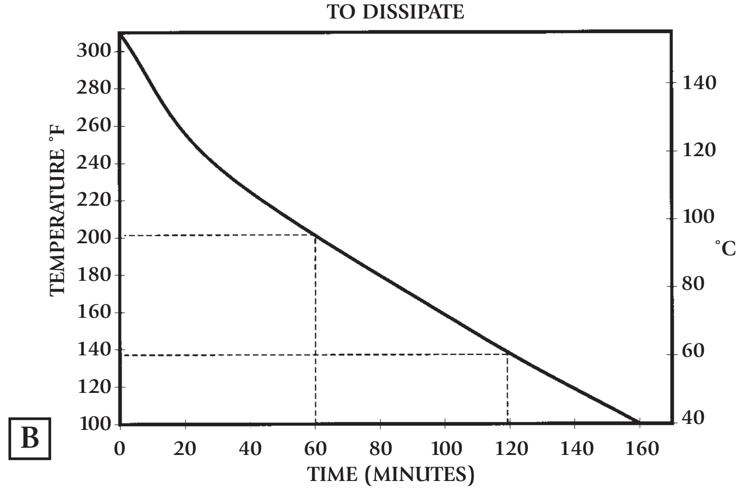


B

B This chart shows the effect of underinflation coupled with the high speed taxiing. A comparison is made between a tire run at 32% deflection and one run at 40% deflection. Not only is the slope of the 40% deflection curves much steeper (due to higher rate of heat generation) than the 32% curve, but the 40% deflection tire blew out in the lower sidewall after traveling about 30,000 feet.

HEAT GENERATION (CONT'D)





A The carcass or body of the tire is usually made up of rubber-coated layers of nylon fabric which extend from bead to bead. This fabric, which is anchored to the bead bundles, is a structural member of the tire to give it shape and strength.

As good as nylon is, it has limitations. There is a reduction in strength when exposed to high temperatures. Nylon melts at temperatures slightly above 400°F (200°C).

Effect of Temperature on Rubber Compounds

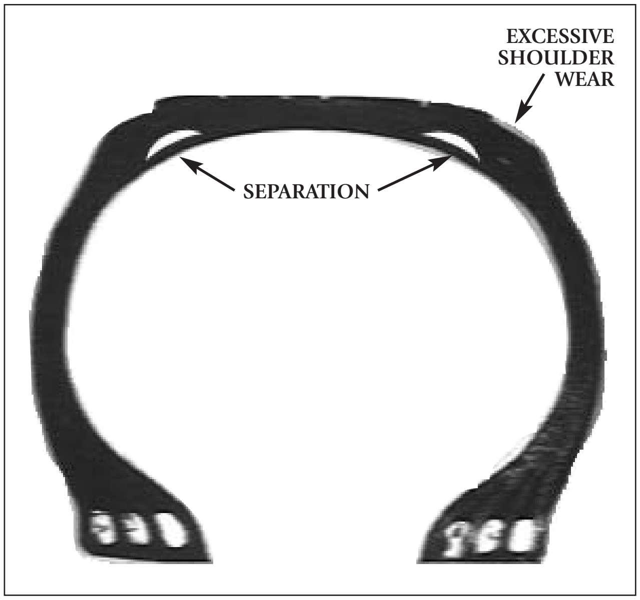
EFFECTS	°F	°C
APPEARANCE OF BLUE COLOR	210 - 230	100 - 110
RUBBER REVERTS	280 - 320	140 - 160
RUBBER BECOMES HARD & DRY	355 - 390	180 - 200

The physical properties of rubber compounds are also susceptible to degradation by high temperatures. Both strength and adhesion are lost when the rubber reverts to the uncured state. The temperatures shown in the above chart are related to time. Brief exposure to these temperatures are not as damaging to the tire as are prolonged exposures.

B On the previous charts it must be remembered that only temperature rise was indicated. Heat is cumulative. This chart shows the time required to cool the bead area of a test tire with two fans blowing on it. This would equal approximately a 30 mph breeze. The curve indicates that the temperature in a hot tire drops 100°F in the first hour and somewhat less in subsequent hours. The cooling time of a tire mounted on an aircraft would be slightly longer due to the effect of brake temperature.

HEAT GENERATION (CONT'D)

High internal temperatures deteriorate both compound and fabric, resulting in the following problems:

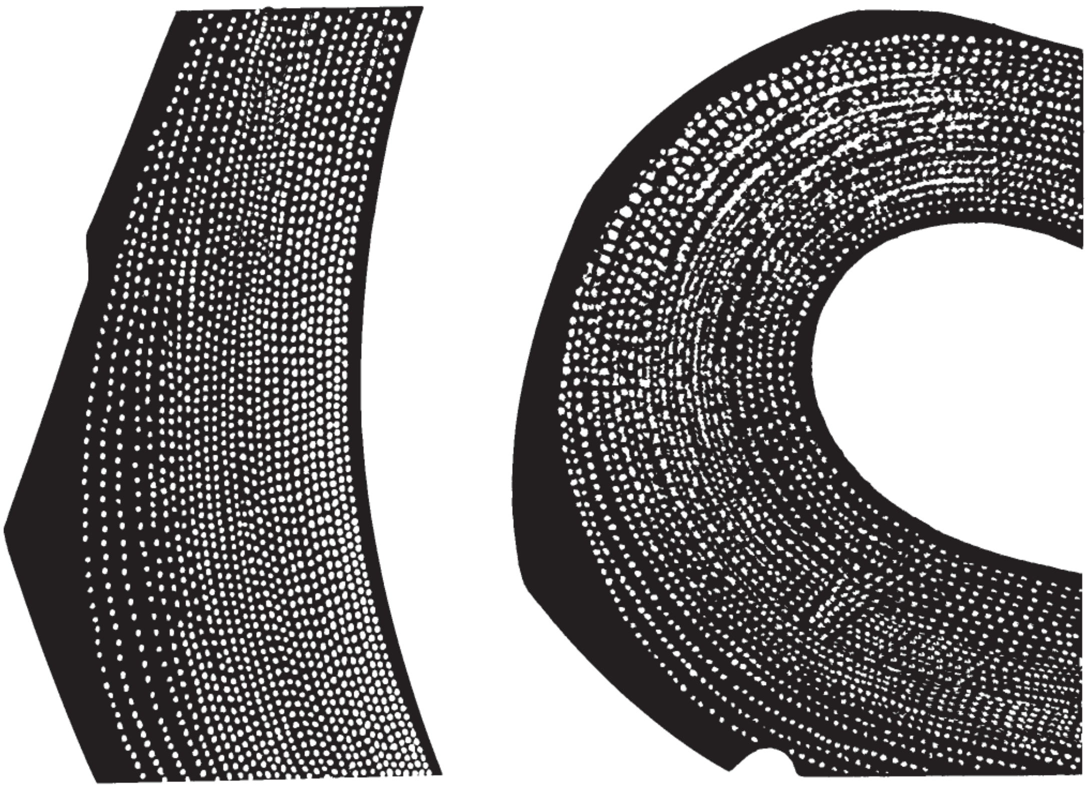


Tread & Casing Separations - Here we see separation in both shoulders. The wear pattern indicates this tire was run underinflated.

Bead Face Damage - Up to now, only heat generated internally has been discussed. This is an example of damage due to external heat from the brakes.

TENSILE, COMPRESSION AND SHEAR FORCES

A discussion of aircraft tires would not be complete without showing the effect of **LOAD** and **SPEED** on the **TENSILE, COMPRESSION** and **SHEAR FORCE**S within a tire.



UNLOADED CROSS SECTION **LOADED CROSS SECTION**

Tensile, compression and shear stresses can best be visualized by comparing an unloaded tire section to a loaded one as shown in the above photos. The following points can be made:

1. An aircraft tire is designed so that in the unloaded condition the internal tensile forces acting on each layer of fabric are uniform.

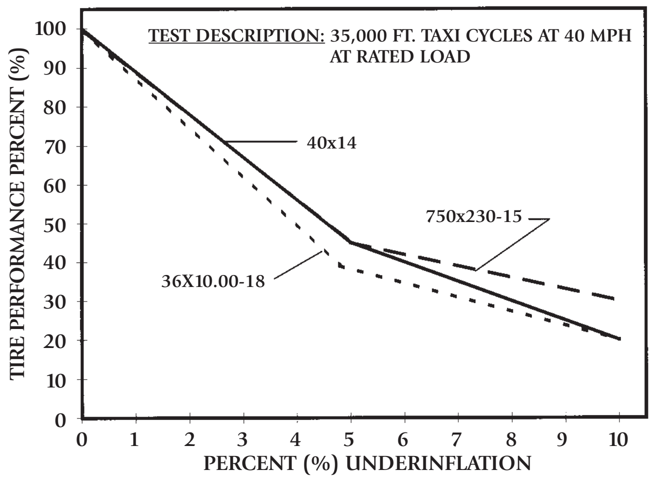
2. Due to the high deflection of the tire section under the load, the tensile forces on the outer plies will be higher than those on the inner plies.

3. Due to the force gradient from outer to inner plies, shear forces are developed between the various layers of fabric.

4. Underinflating or overloading a tire will increase these shear forces, thus rapidly decreasing the life of an aircraft tire.

TENSILE, COMPRESSION AND SHEAR FORCES (CONT'D)

CARCASS FATIGUE DUE TO UNDERINFLATION



To demonstrate how rapid carcass fatigue can occur due to underinflation, the chart above shows the average of three different tire sizes run at the following conditions:

1. One tire of each size was run on successive taxi cycles consisting of 35,000 ft. each at 40 mph. This was repeated until tire failure occurred. Since this tire was properly inflated, the test result was recorded as 100% durability performance.

2. A second tire of each group was run to the same test, but was 5% underinflated.

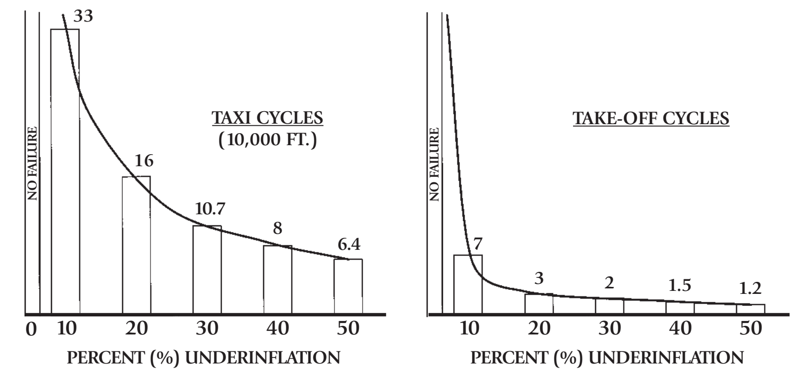
3. A third tire of each group was also run to the same test, but at 10% underinflation.

Obviously, one would expect the tire durability to decrease with underinflation. What's impressive, however, is the magnitude of reduction.

To further study the effect of underinflation on tire failure, additional tests were run on the dynamometer. Several tires, at various degrees of underinflation, were run to failure. Some tires were run to take-off cycles and others to 10,000 ft. taxi cycles. As would be expected, the cycles to failure decrease as the percent of underinflation increases.

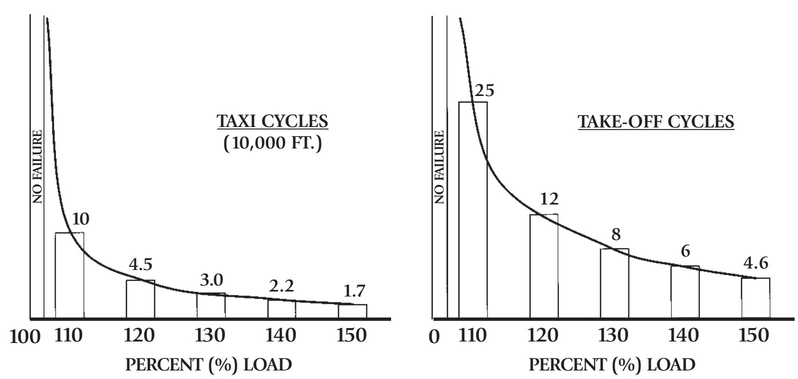
TENSILE, COMPRESSION AND SHEAR FORCES (CONT'D)

CYCLES TO FAILURE VERSUS UNDERINFLATION



A couple of interesting findings in this study were that all the taxi cycle failures were blowouts in the lower sidewall, while the take-off cycle failures were thrown treads. From the shape of the curves we see that take-off cycles were more sensitive to underinflation than were taxi cycles.

CYCLES TO FAILURE VERSUS OVERLOAD



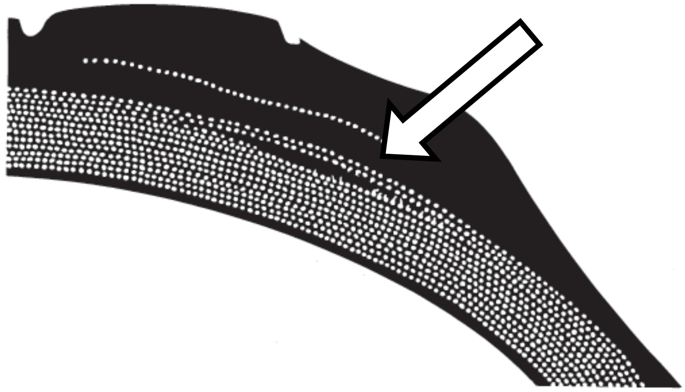
To determine if overloading has the same detrimental affect on tire life as underinflation, the same tests were run on several tires with increasing overloads. As expected, the more a tire is overloaded the quicker it fails.

A couple of interesting findings in this study were that all the taxi cycle failures were still lower sidewall blowouts, and only thrown treads occurred during the take-off cycles. This test shows that taxi cycles are more sensitive to tire overloading.

TENSILE, COMPRESSION AND SHEAR FORCES (CONT'D)

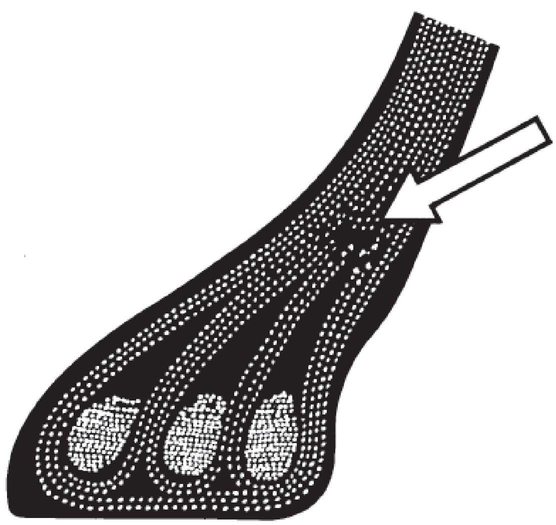
Tensile, compression, and shear forces in aircraft tires are extremely high. When the tires are not properly maintained, these forces go even higher until the compound and/or fabric start rapid deterioration. When this happens the following problems can occur:

SHOULDER SEPARATION



Shoulder separation is most likely to occur between outer plies where the shear forces are highest.

LOWER SIDEWALL COMPRESSION BREAK



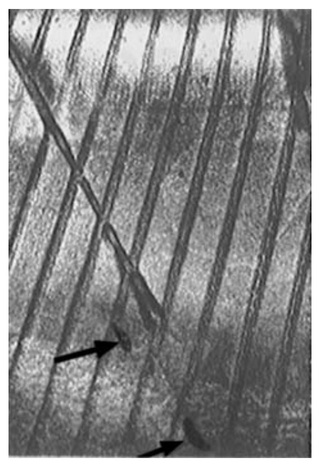
This is the start of the type of failure caused by underinflation or overloading. The above photo shows carcass cords above the bead area that are starting to fail due to flex fatigue.

TENSILE, COMPRESSION AND SHEAR FORCES (CONT'D)

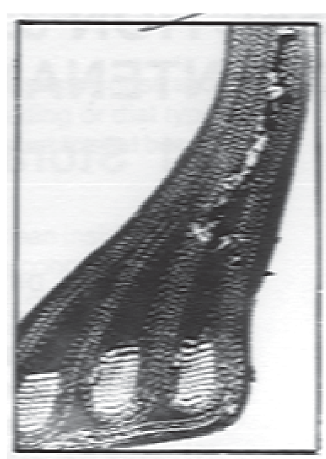
These photos show how underinflation or overloading can cause lower sidewall compression flex breaks.

Sidewall Crack - The first signs of compression flex break in the lower sidewall can appear on the outside sidewall or the inside liner. This photo shows a crack developing in lower sidewall.

Liner Crack - The first signs of a compression flex break can also appear on the inside liner. This condition will also be apparent by tire pressure loss. This pressure loss then magnifies the problem, resulting in sidewall blowout.



Massive Separation - During the creation of a sidewall or liner crack, the carcass plies on the inside become severely deteriorated, along with massive separations. This results in possible sidewall blowout.



These three photographs show the stages of progression. Never mistake these conditions for simply a sidewall or liner crack, as a blowout is imminent.

7 Effects of Operating Conditions

TIRE INFLATION

Heavy loads and high speeds are here to stay. In fact, they will probably get worse in the future. If they do, centrifugal force, heat generation, tensile, compression and shear forces will also increase.

This section has shown that aircraft tires will function properly only when they have the correct inflation pressure. It has also shown that there is a relatively small amount of tolerance in the amount of deflection in which the tire can operate effectively.

Many times we think we can look at the tire deflection and determine if it is under-inflated as we often do with our passenger car tires. This judgment is even more difficult with the aircraft sitting unloaded and low fuel, a condition typical when tire pressures are taken.

QUESTION: Can you tell which tire in this nose gear is underinflated?

ANSWER: No. You cannot tell by looking. The "mate" tire will share the load and the two tires will look equal. Therefore, you should always use a calibrated inflation gauge to check tire pressure.

On a four-wheel or six-wheel gear, visual inspection of a low pressure tire is even worse, as there are more tires picking up the load from the underinflated tire.

IMPORTANT - INFLATION PRACTICES

(See Section 2, Proper Inflation Procedures)

1. **CHECK DAILY WHEN TIRES ARE COOL**
2. **INFLATE TO WORST CONDITIONS**
3. **USE DRY NITROGEN GAS (SAFELY)**
4. **INCREASE PRESSURE 4% FOR TIRES UNDER LOAD**
5. **ALLOW 12-HOUR STRETCH AFTER MOUNTING**
6. **NEVER REDUCE THE PRESSURE OF A HOT TIRE**
   REMEMBER – 1% PRESSURE CHANGE FOR 5°F (3° C)
7. **EQUAL PRESSURE FOR DUALS**
8. **CALIBRATE INFLATION GAUGE REGULARLY**

NOTE: Following the suggested maintenance procedures and operating techniques in this manual can greatly extend tire life.

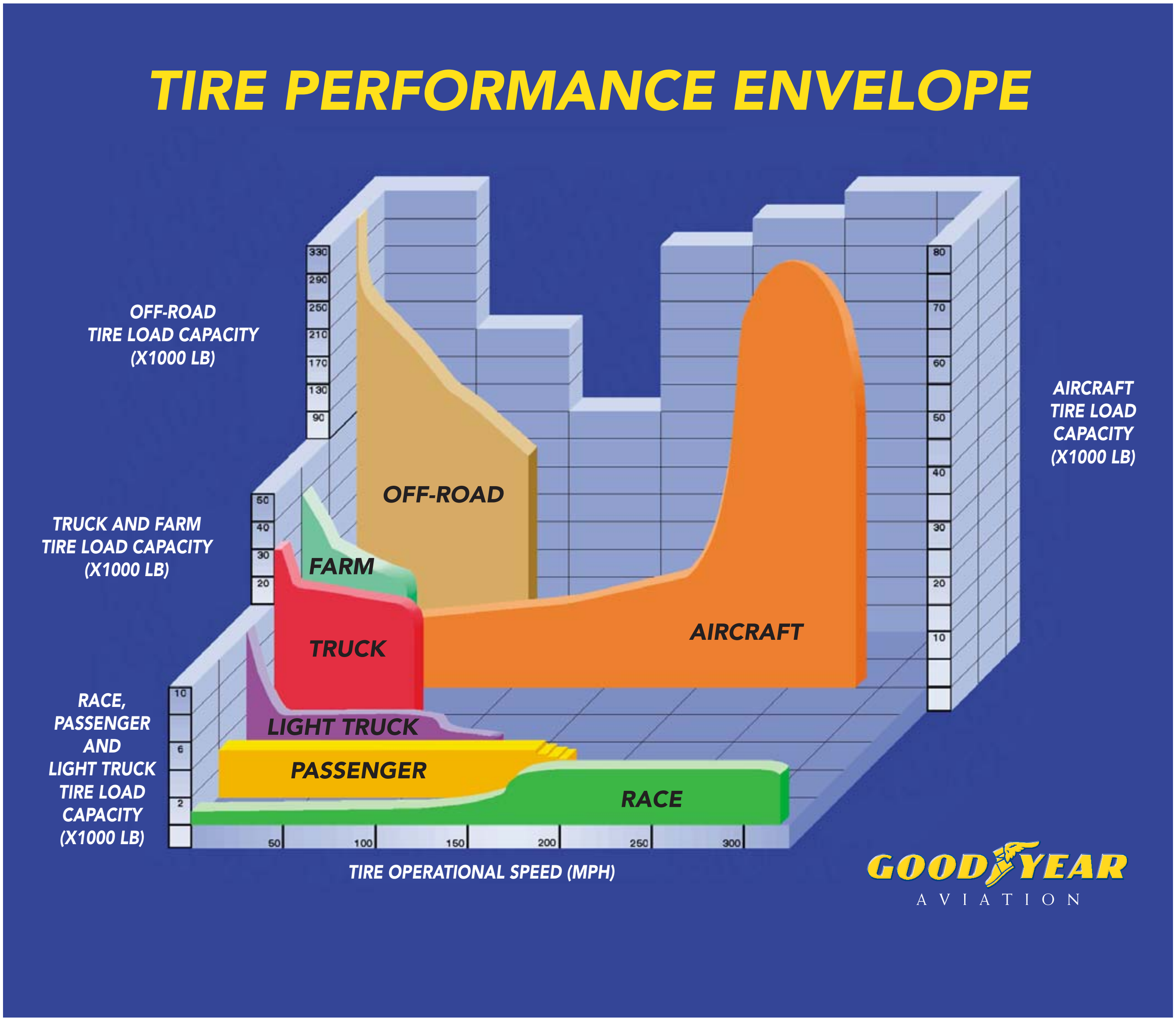
LIMITED WARRANTY FOR GOODYEAR NEW AIRCRAFT TIRES, TUBES AND RETREADS

Goodyear warrants that, when operated and maintained in accordance with approved instructions, every new tire or tube bearing Goodyear's name and complete serial number, or retread bearing Goodyear's or Air Treads' name and serial number, is warranted to be free from defects in workmanship and material. The sole and exclusive remedy for the customer for a tire, tube, or retread returned to us freight prepaid and determined by us to be defective, or which there is a pro-rata charge for service, is the repair or replacement of such tire, tube, or retread, or other suitable allowance.

EXCEPT AS STATED ABOVE, THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, AND SUCH TIRES, TUBES, AND RETREADS ARE NOT WARRANTED FOR MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, APPLICATION, PERFORMANCE OR USE AND THERE IS NO OBLIGATION OF THE SELLER AS TO THE CONFORMITY OF THE GOODS. SELLER'S LIABILITY WHETHER UNDER ANY WARRANTY OR IN CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE SHALL NOT EXCEED THE NET PURCHASE PRICE AFTER ALL DISCOUNTS INCLUDING CASH DISCOUNTS, AND IN NO EVENT SHALL SELLER BE LIABLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES. THE FOREGOING IS EXCLUSIVE AND IN SUBSTITUTION FOR, AND CUSTOMER HEREBY WAIVES, ALL OTHER WARRANTIES, GUARANTIES, RIGHTS, REMEDIES AND OBLIGATIONS. No representative has authority to modify or make any representation, promise or agreement, except as stated herein.

Do not return any item without prior approval. Contact your Goodyear Aviation Tire Representative for instructions.

NOTES


TIRE PERFORMANCE ENVELOPE
OFF-ROAD TIRE LOAD CAPACITY (X1000 LB)
330
290
250
210
170
130
90
TRUCK AND FARM TIRE LOAD CAPACITY (X1000 LB)
50
40
30
20
RACE, PASSENGER AND LIGHT TRUCK TIRE LOAD CAPACITY (X1000 LB)
10
6
2
OFF-ROAD
FARM
TRUCK
AIRCRAFT
LIGHT TRUCK
PASSENGER
RACE
50
100
150
200
250
300
TIRE OPERATIONAL SPEED (MPH)
AIRCRAFT TIRE LOAD CAPACITY (X1000 LB)
80
70
60
50
40
30
20
10
GOODYEAR
AVIATION

Aviation Tires
The Goodyear Tire & Rubber Company
1144 East Market Street
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