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TIRE **MILITARY**

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TIRE GUIDE

TIRE GUIDE

A. AIRCRAFT TIRES OVERVIEW

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. Nevertheless, 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.

Petlas manufactures a wide variety of sizes and types of tires to the exact standards of the aircraft industry. The information included in this Data Book has been put together as an engineering and technical reference to support the users of Petlas tires. The data is, to the best of our knowledge, accurate and complete at the time of publication.

To be as useful a reference tool as possible, we have chosen to include data on as many industry tire sizes as possible. Particular sizes may not be currently available from Petlas. It is advised that all critical data be verified with your Petlas representative prior to making final tire selections. The data contained herein should be used in conjunction with the various standards; T&RA, ETRTO, MIL-PRF-5041 with the airframer specifications or military design drawings. For those instances where a contradiction exists between T&RA and ETRTO, the T&RA standard has been referenced. In some cases, a tire is used for both civil and military applications. In most cases they follow the same standard. Where they do not, data for both tires are listed and identified.

The aircraft application information provided in the tables is based on the most current information supplied by airframe manufacturers and/or contained in published documents. It is intended for use as general reference only. The requirements may vary depending on the actual configuration of particular aircrafts. Accordingly, inquiries regarding specific models of aircraft should be directed to the applicable airframe manufacturer.

1. T&RA: Tire and Rim Association
2. ETRTO: European Tyre and Rim Technical Organization
3. MIL-PRF-5041: Military Specification for Aircraft Tires

B. AIRCRAFT TIRE CONSTRUCTION

As a function of its purpose, an aircraft tire must withstand a wide range of operational conditions. When on the ground, it must support the weight of the aircraft. During taxi, it must provide a stable cushioned ride while resisting heat generation, abrasion and wear. At take-off, the tire structure must be able to endure not only the aircraft load but also the forces generated at high angular velocities. Landing requires the tire to absorb impact shocks while simultaneously transmitting high dynamic braking loads to the ground.

All of this must be accomplished without comproimising a long, dependable and reliable service life. These extreme demands require a tire which is precisely engineered and manufactured for specific conditions. For this reason, a special combination of various rubbers, fabric and steel are used in tire design. Each component serves a specific function to improve the performance of the tire.

To meet the aircraft demands of today and tomorrow, different and distinct tire constructions are utilized: The conventional cross-ply or bias tire and the radial tire. Both nomenclatures (BIAS and RADIAL) refer to the angular direction of the carcass plies.

The carcass plies of BIAS constructed tires are laid at angles between 30° and 60° to the centerline or direction of rotation of the tire. Succeeding plies are laid opposite to each other, with cords running diagonally to provide balanced strength.
The carcass plies of RADIAL constructed tires on the other hand, are laid at an angle approximately 90° to the centerline or direction of rotation of the tire. Each successive layer is laid at this same angle. Radial tires of the same size have a fewer number of plies compared to tires of a bias construction because the radial design


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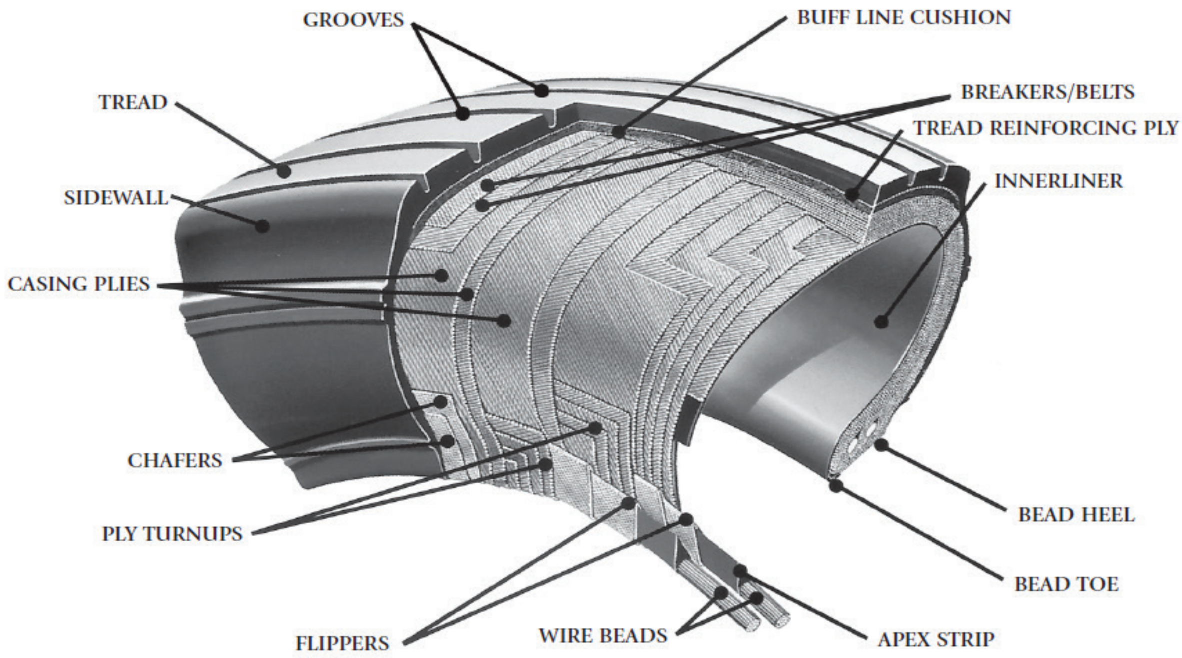
enables each component of the tire to be optimized independently.



Bias Tire Construction

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:
The buff line cushion is made of rubber compound to enhance the adhesion between.

Cushion:
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:
Casing plies are anchored by wrapping them around the wire beads, thus forming the ply

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.

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C. AIRCRAFT TIRE IDENTIFICATION

1. DIMENSIONAL MEASUREMENT PARAMETERS

At the design stage, tires are designed to meet the specific needs of each vehicle type. According to the needs of the wide variety of tools available in the environment, problems in need of standardization of the tires were classified into a certain extent and pattern of compliance has been made compulsory.

This issue for the European market, E.T.R.T.O. (European Tire And Rim Technical Organisation) and Americian market for T.R.A. (Tire And Rim Assosication) organizations are formed. MIL-T-5041 series as well as MIL-PRF-5041 series and also describes the standard.

Belong to the standard size tire rubber wheels mounted in dimensional measurements can be inflated under pressure after a certain period after conditions are determined. Tires' overall measure can be mounted on rims are inflated; Maximum Section Width, Rim Mountable, the Nominal (Rated) Diameter, Aspect Ratio (cross-section of height to width ratio of the maximum cross section), Speed Index, Load Capacity Index and PR (Ply Rating) is defined as parameters.

2. 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.

Outer 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:

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

Aspect Ratio: Measure of the tire's cross section shape. This can be calculated by the following formula:

$$\text{Aspect Ratio} = \frac{\text{Section Height}}{\text{Section Widthg}}$$

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:

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

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:

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

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:

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

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.

3. AIRCRAFT TIRE TYPES

Aircraft tires have typically been classified into different categories or "types". This type designation was used in addition to the size, ply rating and speed rating to describe the tire. It has been useful in categorizing tires of similar design/performance characteristics. Through the years there have been nine different types of aircraft tire designations. Today only four are still manufactured: TYPES I, III, VII and the Three Part Nomenclature.

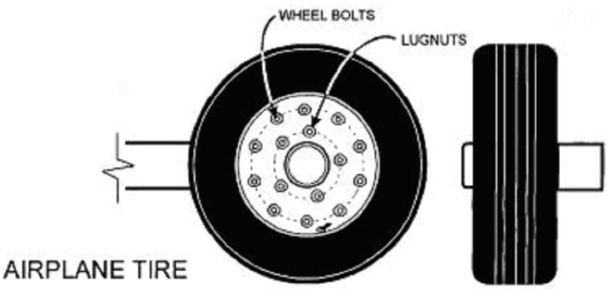
I. TYPE I

TYPE I category tires are primarily for aircraft with non-retractable landing gear. The TYPE I tire design is no longer active. Information provided in this data book is for reference only.

Size designation is as follows:

M Where	M=Nominal Overall Diameter

Examples: 8.00"
33"
56"



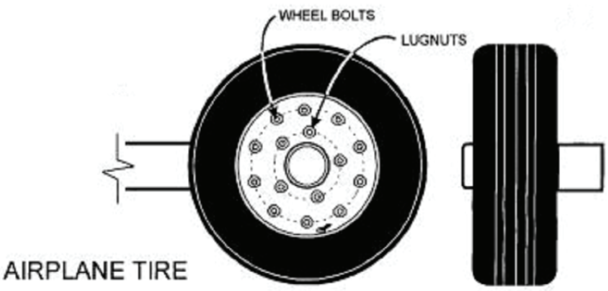
II. TYPE III

TYPE III tires are generally used for low pressure service providing a larger footprint or "flotation" effect. Tires have smaller rim diameters relative to the overall diameter as compared to other TYPE designs. While some military exceptions exist, speeds are generally limited to 160 mph or less

Size designation is as follows:

N-D Where	N=Nominal Section Width in Inches
	D=Rim Diameter in Inches

Examples: 5.00 - 5
8.50 - 10
20.00 - 20



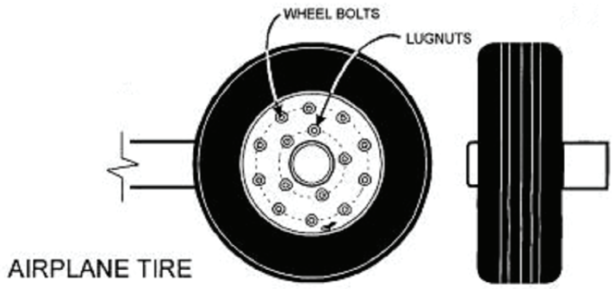
III. TYPE VII

TYPE VII are high pressure tires widely used on jet aircraft. Section widths are generally narrower than other TYPES.

MxN	M=Nominal Overall Diameter in Inches
	N=Nominal Section Width in Inches

Size designation is as follows:

Examples: 16 x 4.4
26 x 6.6
49 x 17



IV. THREE PART NOMENCLATURE

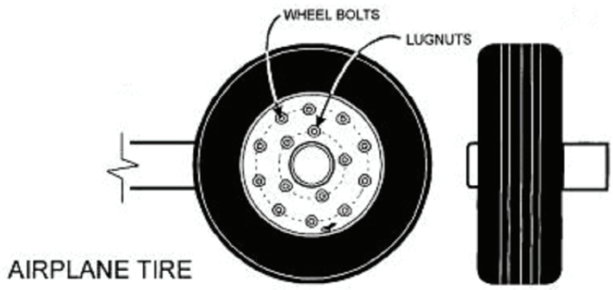
The Three Part Nomenclature is designated as follows:

MXN-D or MxNRD	M=Nominal Overall Diameter
	N=Nominal Section Width
	D=Rim Diameter

The tire nominal section width is separated from the tire rim diameter by a "-" for bias tires; by an "R" for radial tires. The "-" and "R" are sometimes referred to as a construction code. These tires are designed for the high speed/high load aircraft of today. The different possible THREE PART NOMENCLATURES are presented here.

Examples (Inch Code):
17.5 x 5.75 - 8
49 x 19.0 - 20
30 x 8.8 R 15

Examples (Metric Code):
380 x 150 - 4
670 x 19.0 - 20
360 x 135 R 6



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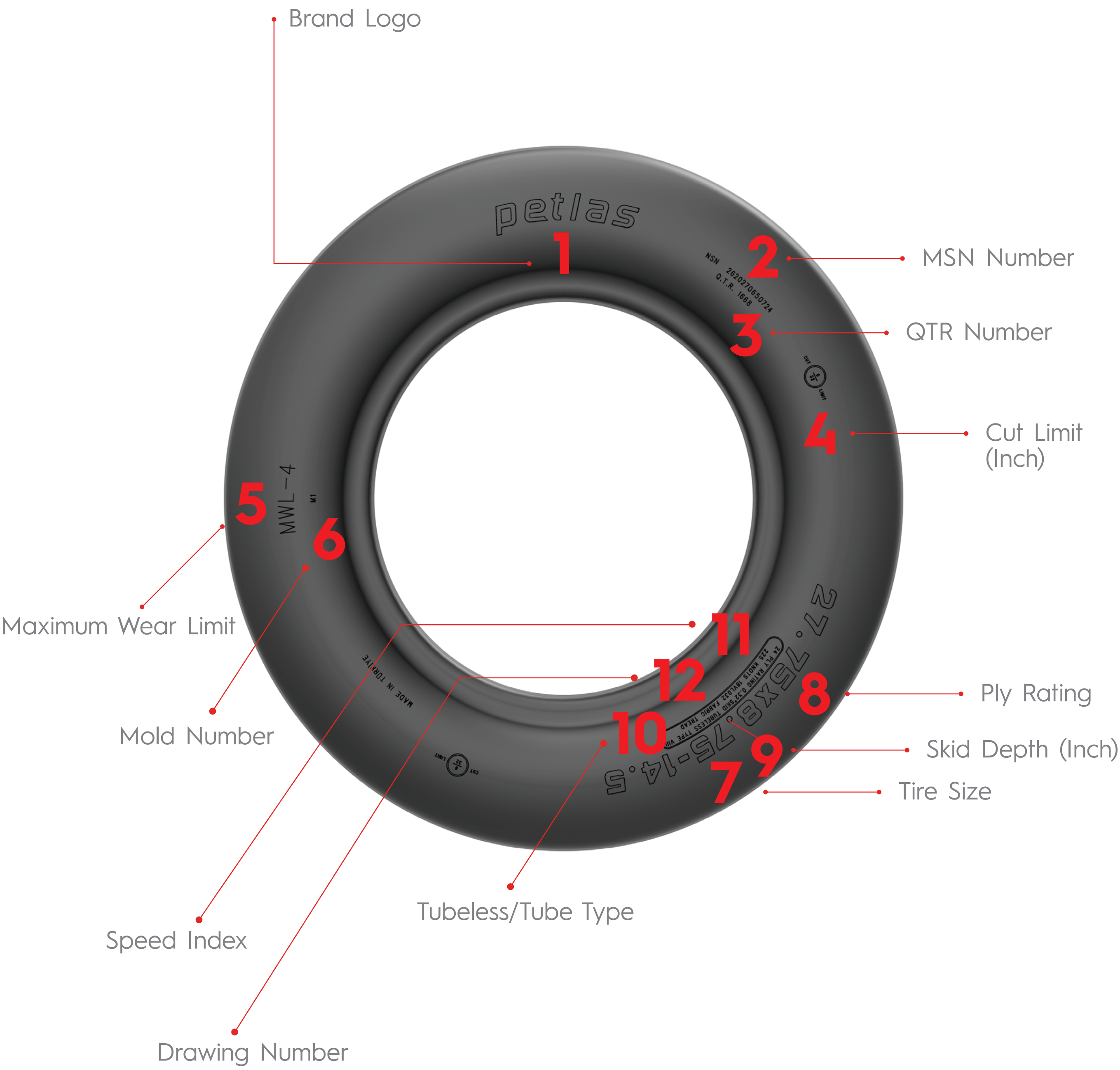
D. THREE PART NOMENCLATURE

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CARE VE SAFETY

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A.SAFETY OVERVIEW

Aircraft tire and wheel assemblies must operate under high pressures in order to carry the loads imposed on them. They should be treated with the same respect that any other high pressure vessel would be given. Following the recommended procedures given throughout this manual, as well as those provided by authorities such as wheel manufacturers, air-framers and industry regulatory agencies, will minimize the risks and probabilities of injury.

In the event of a conflict between recommended procedures, be sure to contact your Petlas representative before undertaking the procedure in question.

1.Mounting

Follow the instructions given in the section on "General Mounting Instructions For Aircraft Tires".

Be particularly attentive when:

- Rolling tires on the floor and using mechanical lifting equipment to avoid possible back injuries.
- Inspecting tires and wheels in advance for possible shipping damage.

2. Inflating

- When inflating tires, be sure to use a suitable inflation cage.
- Keep pressure hose and fittings used for inflation in good condition.
- Allow the tire to remain in the inflation cage for several minutes after reaching full inflation pressure.
- Respect inflation pressures and all other safety instructions.

3. Tires in service

- Careful attention should be shown to tire/wheel assemblies being handled or in storage.
- Never approach a tire/wheel assembly mounted on an aircraft that has an obvious damage until that tire has cooled to ambient temperatures (allow at least 3 hours).

- Always approach a tire/wheel assembly from an oblique angle, in the direction of the tire's shoulder.
- Deflate tires before removing them from the aircraft unless the tire/wheel assembly is to be immediately remounted on the aircraft, such as with brake inspections. Deflate tires before attempting to dismount the tire from the wheel or before disassembling any wheel component. Show caution when removing valve cores as they can be propelled at a high speed from the valve stem.
- While serviceable tires may be shipped fully pressurized in the cargo area of an aircraft, Petlas's preference is to reduce pressure to 25% of operating pressure or 3 bars / 40 psi, whichever is the lesser.
- Remove from service tire/wheel assemblies found with one or more tie bolt nuts missing.

B. SAFETY OVERVIEW

1. What is Ozone?

Ozone is a gas, a form of oxygen. In the earth's atmosphere, where it occurs naturally in small amounts, ozone plays a crucial geophysical role because of its intense absorption of solar ultraviolet radiation.

Additional ozone, created when industrial exhaust mixes with ultraviolet rays, can be harmful. Ozone degrades organic matter, such as rubber.

2. Ozone and Tire

Most of the natural and synthetic elastomers used in aircraft tires are susceptible to ozone attack. Ozone in the air readily reacts with the double bonds (unsaturation) in the rubber molecules. The result of this reaction is the breaking of molecular bonds and a degradation of the rubber, which lead to crack initiation. Continued stress, and especially cyclic stress, cause the crack to grow until it is visible as the characteristic surface crack, perpendicular to the direction of the applied stress.

3. Tire Resistance Against the Ozone

To aid in the control of ozone attack on rubber, the tire materials specialist adds waxes and protective chemicals.

Some of these ingredients address ozone attack when the tire is in a static state at room temperature; other ingredients are activated by heat and protect the tire once it is in service. Further, the tire designer is mindful of the impact of shapes and contours on stress concentrations. Still, steps need to be taken in storage to delay the effects of ozone attack.

Wet or moist conditions have a deteriorating effect on tires and tubes, and can be even more damaging when the moisture contains foreign elements that are further harmful to rubber and cord fabric.

4. Storage Locatation

Inside a warehouse away from direct sunlight or precipitation. Wet or moist conditions can carry other chemicals which can have a further damaging effect on tires.

5. Storage Area Environment

Temperatures should remain between 0°C/32°F and 32°C /90°F. Use reasonably low intensity lighting (sodium vapor lamps are preferred). Environment should be free of strong air currents and excessive dirt.

i. Storage and Ozone Effects

Store away from fluorescent lighting, mercury vapor lamps, electric motors, battery chargers, electric welding equipment, and electric generators.

Stand the tire such that it rests on its tread, whether on the floor or in a rack. This orientation should be used for any tire which will be held in storage for more than 1 months time. (Storage racks should provide an adequate amount of surface area to support the tire to prevent a distortion or "set" from occurring in the tread area). If high ozone concentrations can not be reduced or eliminated, each tire should be protected by appropriate wrapping such as dark polyethylene or paper.

ii. Mounted Tires

Mounted tires not immediately placed in service should be covered or wrapped until they are to be installed on an aircraft.

To minimize the effects of ozone attack and where re-inflation capability exists, tire pressure may be reduced to a value below operational pressure, but not less than 25% of the operational pressure.

C. MOUNTING AND DISMOUNTING INSTRUCTION

1. Visually Inspect Tire/Wheel Assembly for damage from handling, storage, or contaminants. Look for deformations, bulges, swelling, blisters, or other anomalies that would make the assembly unserviceable.
- Superficial cuts or cracks not reaching the cord body are acceptable for service.
- Groove cracking that does not reach the protector or reinforcing ply is acceptable for service.

2. Readjust Tire Pressure after mounting the tire/wheel assembly on the aircraft. Operating pressures are set by the airframe manufacturers based on a variety of factors including maximum ramp or taxi weight, center of gravity and dynamic loading. Reference the Operator's Manual for the particular aircraft.
Important

- Check pressure with aircraft load on tire.
- Use loaded operating inflation pressure.
- Operational pressure values are for loaded tires.
- Loaded inflation pressure = 104% unloaded inflation pressure.

D. TIRE INFLATION PRESSURE

The most important service you can perform on your aircraft's tires is to make sure they are properly inflated at all times. The more often you use the aircraft, the more often the tires need checking. It is the Key to Optimum Service.

If you make one or more flights a day, tire pressure should be checked daily, with an accurate, calibrated gauge (preferably with a dial or digital indicator appropriate for the pressure range of your tires). When installed, the TPIS (Tire Pressure Indicator System) can be used to make the daily inflation pressure check, provided the TPIS indicators are verified against a calibrated pressure gauge at each aircraft "A" check.

If you fly less than one time per day, you should check tire pressure before each flight.

Be particularly alert to severe temperature drops, which will also reduce tire pressure. Repeated pressure losses beyond the daily 5%, under constant temperature conditions, may signal a slow leak in the tire/wheel assembly.

To avoid false readings, tire pressure should be checked on "cool" tires (air in a hot tire will expand, causing a temporary higher pressure reading). Wait at least 3 hours after landing or until the tire has reached ambient temperature as noted by carefully feeling with the palm of the hand, before making pressure checks. If it is absolutely necessary to check pressures when tires are hot, compare the relative pressures between tires on the same landing gear positions (main or nose). Never bleed pressure from a hot tire [See "Checking Hot Tires" later in this section for details].

1. Effects of Underinflation

Too little pressure can be harmful to your tires and dangerous to your aircraft and those in it. Underinflated tires can creep or slip on the wheel under stress or when brakes are applied. Valve stems can be damaged or sheared off and the tire, tube, or complete Wheel assembly can be damaged or destroyed. Excessive shoulder wear may also be seen.

Underinflation can allow the sidewalls of the tire to be crushed by the wheel's rim flanges under landing impact, or upon striking the edge of the runway while maneuvering. Tires may flex over the wheel lange, with the possibility of damage to the bead and lower sidewall areas. The result can be a bruise, break or rupture of the cord body. In any case where the bead or cord body of the tire is damaged, the tire is no longer safe to use and must be replaced.

Severe underinflation may cause ply separation and carcass degradation because of the extreme heat, the strain caused by the excessive flexing action, or the occurrence of premature standing waves.

This same condition can cause inner tube chafing and a resultant blowout. In dual tire applications, underinflation of one tire causes the other tire to carry a disproportionate amount of load. As a result, both tires can be deflected considerably beyond their normal operating range, potentially causing ply separations and/or carcass degradation.

2. Effects of Overinflation

Tires operating under too much inflation pressure are more susceptible to bruising, cuts and shock damage. Ride quality as well as traction will be reduced. Continuous high pressure operation will result in poor tire wear characteristics (center wear) and reduced landings performance

Important! Aircraft tires can be operated up to or at rated inflation pressure. Extremely high inflation pressures may cause the aircraft wheel or tire to explode or burst, which may result in serious or fatal bodily injury. Aircraft tires must always be inflated with a properly regulated inflation canister. The high pressure side should never be used. The safety practices for mounting and dismounting aircraft tires detailed in this Manual must be followed.

3. Checking Duals for Equal Operating Pressure

Tires mounted as duals or on the same bogey, whether main or nose, whether bias or radial, should be maintained at equal operating pressure. If pressures are not equal, the tire with the highest pressure will be carrying an unequal proportion of the load even though there may be no perceptible difference between tire deflections.

If it is determined that dualmounted tires are operating at unequal pressures (more than 5% is cause for special attention), inflate both tires to their proper pressure. Make a logbook entry indicating the original pressure differential, the date and time corrected and the ambient temperature. At each subsequent pressure check, the logbook should be consulted.

If the same tire continues to evidence a pressure loss, it should be checked for leakage (FOD, valve core, etc.). If no obvious cause is found, the tire should be removed and given a thorough inspection until the reason for the pressure loss can be determined. For mixability of bias and radial tires, see the section on "Matching Dual Tires" in this manual.

4. Proper Inflation - Setting The Pressure Level

Inflating and Reinflating the Tire/Wheel Assembly;

Whether for tubeless or tubetype, tire operating pressures should be set following the instructions given by the airframe manufacturer. For newly mounted tires, follow the instructions given in the section on "General Mounting Instructions for Aircraft Tires." When required, reinflate tires to their specified operating pressure with a dry, commercial grade nitrogen of at least 97% purity.

In some cases, nitrogen may not be available for adjusting tire inflation. When this occurs, clean dry air may be used as long as the oxygen content does not exceed 5% of the total tire volume. If the 5% oxygen limit is exceeded, the tire must be deflated and then reinflated with nitrogen to the specified operating pressure.

In the event of excessive heat build-up in the tire/Wheel assembly (example, locked brakes), hydrocarbons released by the tire may spontaneously ignite in the presence of oxygen. A tire filled with air can explode, causing injury to persons and damage to equipment.

Be sure that it is clear whether operating inflation pressures are given for loaded or unloaded tire conditions. A tire's inflation pressure when loaded will be 4% higher than when unloaded (Loaded pressure = 1.04 x unloaded pressure

Air is usually trapped between the tire and the tube at the time of mounting. Although initial readings indicate proper pressure, the trapped air will seep out around the valve stem hole in the wheel, and under the beads. Within a few days, as the tube expands to fill the void left by the trapped air, the tire may become severely underinflated. To compensate for this effect, check tire pressure before each flight for several days after installation, adjusting as necessary, until the tire maintains proper pressure.

5. Effect of Ambient Temperature on Gauge Pressure

Watch for severe changes in ambient temperature. Changes in temperature affect gauge pressure readings as follows:

The above charts are a helpful example of the change in inflation pressure readings as a result of a change in ambient temperature. For convenience, it is given in metric units and in customary units.

	Temperature Variation (°C)	Pressure Variation (psi)			
Temperature Rise (C°)	+ Δ 50	175,9	205,6	234,3	264,0
	+ Δ 40	170,5	199,8	227,1	256,5
	+ Δ 30	165,0	192,5	221,4	249,0
	+ Δ 20	160,9	186,7	214,3	240,0
	+ Δ 10	155,5	180,8	207,1	232,5
Operating Pressure	**Δ 0**	**150,0**	**175,0**	**200,0**	**225,0**
	- Δ 10	144,5	169,2	192,9	217,5
Temperature	- Δ 20	139,1	163,3	185,7	210,0
Drop (C°)	- Δ 30	135,0	157,5	178,6	201,0
	- Δ 40	129,5	150,2	172,9	193,5
	- Δ 50	124,1	144,4	165,7	186,0

A “cold” tire is defined as a tire which has come to equilibrium with its operating environment (ambient temperature). While the actual (ambient) temperature of the “cold” tire will vary from location to location and from season to season, the operational inflation pressure (PN), as specified by the airframe manufacturer for each aircraft configuration, is necessary to carry the load of the aircraft. This pressure value is therefore needed regardless of the ambient temperature. For example, if PN = 12 bars / 175 psi, this is the pressure needed at any ambient temperature.

6. Schedule and Action

Measured Pressure as % of Operating Pressure	Tire Condition	Course of Action
More than 105	Overinflated	•Because of variations in ambient temperature, gauge accuracy, etc., caution should always be shown before adjusting an overinflated pressure. •It is recommended that the first overinflated reading be recorded in the aircraft log along with the ambient temperature. After the 2nd confirmed reading >5%, readjust tire pressure to maximum of normal operating range
105-100	Normal Operating Pressure Range	•Do not adjust tire pressure
100-95	Acceptable Daily	•Readjust tire pressure to maximum of normaloperating pressure range.
94-90	Accidental Pressure Loss	•Readjust tire pressure to maximum of normal operating pressure range •Record in log book. •Recheck pressure after 24 hours. •If after 24 hours, pressure loss is again greater than the daily acceptable pressure loss (>5%), remove tire/wheel assembly.
89-80	Pressure Loss	•Remove tire/wheel assembly from aircraft •Reinflate to specified operating pressure. •If pressure loss is within daily acceptable pressure loss allowance (<=5%), accept assembly. •If pressure loss is outside the daily acceptable pressure loss allowance (>5%), inspect tire/wheel assembly for cause of pressure loss. •If the cause cannot be found, dismount tire for inspection by an authorized repair station.
79-0	Major Pressure Loss	•Remove the tire/wheel assembly. •Remove the adjacent tire/wheel assembly. •Replace tires (*)

If it is known that a major pressure loss occurred while the aircraft was at rest or parked and the wheels did not turn with weight on them, the tire and the adjacent tire can be saved. If doubt exists, tag the tire(s) and have an authorized retread repair station inspect them.

7. Check To Frequency

Tires in service should have their "cold" inflation pressure checked daily to properly maintain operating ressures. For aircraft operating on a less frequent basis, inflation pressure should be checked before each flight. When installed, the TPIS (Tire Pressure Indicator System) can be used to make the daily inflation pressure check, provided the TPIS indicators are verified against a calibrated pressure gauge at each aircraft "A" check.

Understand that tires are capable of retaining pressure to tolerances which will keep them well within 5% of the specified pressure each day. Since pressure losses due to other causes can seriously affect performance and safety, it still remains a recommended practice to verify the pressure value at least daily.

Compare tire pressures on the same given landing gear

Pressures measured from tires on the same landing gear should be of the same magnitude. They should always be at least equal to the specified operating pressure. If any tire is less than 90% of minimum loaded service pressure, remove the tire from service. In such cases, note reason for removal and return the tire to an authorized repair facility for examination. Aircraft flying between airports with a significant temperature drop, should be aware of the effects of temperature on inflation pressure. See section "Effects of Temperature."

Do not reduce the pressure of a hot tire.

The basic rules to follow for correcting inflation pressure of hot tires on the same landing gear.

- **Single and Multiple tire gear:** Should always be at least equal to, and may exceed, the specified operating pressure.
- **Two tire gear:** If one tire is approximately equal in temperature but low in pressure it should be brought up to the pressure level of the other tire. In all cases, both tires should be at least equal to or greater than the specified operating pressure.
- **Three or more tire gear:** Check all tires on the gear. Any tire that is approximately equal in temperature but low in pressure should have its inflation increased such that all tires are within a 5% pressure range. In all cases, all tires should be at least equal to or greater than the specified operating pressure.

Note: If one tire has an abnormally high pressure (>5%) as compared to the other tires on that gear, look for possible causes such as faulty brakes or incorrect pressure adjustment at previous check.

8. Monitoring Inflation Pressure

Checking and monitoring inflation pressure is usually performed on loaded tires. Be sure to know whether the operating inflation pressure is for loaded or unloaded tire conditions.

- Loaded inflation pressure is 1.04 x Unloaded inflation pressure.
- Use an accurate, calibrated gauge, preferably with a dial type indicator.
- Watch for changes in ambient temperature. A 3°C/5°F temperature change will result in a 1% tire pressure change.

When making tire pressure entries in the aircraft log book, it is best to record the ambient temperature along with the pressure readings.

A recommended tracking system for daily pressure checks is to write tire pressure, ambient temperature and date on the sidewall of each tire during pressure monitoring. This method allows easy, quick followup on tire pressure conditions from line station to line station.

Make sure tires have sufficient time to cool.

- A cool tire is one at ambient temperature.
- Allow 3 hours after landing, if not exposed to direct sunlight, for tires to properly cool. By carefully using the palm of the hand, it is possible to determine if a tire is cool or not.

Note that operating pressures, whether loaded or unloaded, are specified for “cool” tires.

- The maximum allowablepressure loss for a tire is 5% for any 24-hour period.

9. Pressure Loss

The maximum daily pressure loss for a tire/wheel assembly is 5%. The graph above shows how the normal pressure of a tire/eheel assembly can change with time even when no disruption in the sealing system exists. It demonstrates the importance of checking pressure when mounting a new assembly on the aircraft.

10. Testing For Pressure Loss

The source of a pressure loss can best be determined by applying a soap solution to suspected areas of leakage or by total immersion of the tire and wheel assembly in a water bath. Begin with the most simple checks first:

- Check that the valve core is not leaking. Apply a small amount of soap solution on the end of the valve stem.

  If bubbles appear, replace the valve core and recheck. Be sure that the valve stem threads are not damaged. Otherwise, the valve core and the valve cap will not fit properly.

  Each valve should have a valve cap on it to prevent dirt, oil, moisture and other contaminants from getting inside and damaging the core.

- Be sure that the valve is not bent or rubbing against the wheel. If damaged, dismount the tire and replace the tube or valve.

  Check the fuse plugs or pressure relief plugs with a soap and water solution. If bubbles appear, replace the valve core and recheck.

- Inspect the tread and sidewall areas for FOD's, cuts, snags, etc. Check suspected areas with a soap solution. If bubbles appear, the tire must be dismounted and repaired by a qualified repair station or scrapped.
- Totally immerse the tire/Wheel assembly in a water bath. If a water bath is not available, apply a soap or other leak detector solution to the entire tire/Wheel assembly.

  The appearance of bubbles at any point other than at the vents in the lower sidewall of the tire just above the wheel flange will indicate a leak.

  Note that nitrogen will diffuse through the sidewall vents for the entire life of an aircraft tire.

  Look closely for bubbles in the tubewell area of the wheel to be sure nitrogen is not leaking from any fatigue cracks or at the O-Ring seal of the wheel halves.

- If no leak source other than the sidewall vents can be found, it will be necessary to dismount the tire and make a further inspection.

11. Causes Of Pressure Losses

A tire that consistently loses inflation pressure beyond the 5% daily allowance should be inspected to determine the cause of the pressure loss. Some inspections can be made while the assembly remains mounted on the aircraft. Others will require the tire/wheel assembly to be dismounted from the aircraft and sent to the tire shop. Follow the guidelines given under the section "Monitoring Inflation Pressure - What To Do."

There are number of possible causes of pressure loss in a tire:

- Tire growth during the first 12 hours after mounting and inflation to the specified operating pressure. This is entirely normal.

- To avoid a possible underinflation condition, it is important that a tire not be placed in service until it has undergone the complete growth cycle and has been reinflated to the specified operating pressure.

An apparent pressure loss can be caused by a drop in ambient temperature. Was the tire inflated in a heated room and stored in an unheated one? Was the tire relocated from a warm climate to a cold climate? For more details on the effects of ambient temperature.

- Use only an approved calibrated gauge, preferably of a dial or digital type. It is best to use the same gauge when monitoring a slow pressure loss in a tire/Wheel assembly.
- Foreign object damage that penetrates the cord body and liner. Inspect the tire carefully for any FOD's.

This condition can be caused by:

• Insufficient inflation pressure.
• Bead toes (bias tires only) not properly lubricated.
• Kinked or distorted beads.
• Accumulation of rubber on the bead flats.
• Dirt trapped between the tire and wheel.

- Check for improperly seated beads. This condition can be identified by comparing the position of the tire's lower sidewall annular rings, mold lines, or branding. Look to see if they are uniform from side to side or that they are above the wheel flange.
- Leaks at the valve stem or valve core.
- Put a small amount of water on the end of the valve stem and watch for bubbles. If bubbles appear, replace the core and repeat the check.
- Valve caps, finger tightened, should be used to prevent dirt from entering and holding open the valve stem.
- Leaks at the valve seal (tubeless tires).
- Valve holes in the wheel must be free from scratches, gouges and foreign material.
- The proper O-Ring or grommet, as specified by the Wheel manufacturer, must be used.
- Wheel half parting line O-ring seal (tubeless tires) leaks in service.

• Twisting or failure to lubricate the O-ring before installation may cause leakage at the wheel mating surfaces.
• Use of the wrong O-Ring compound, as specified by the wheel manufacturer, suitable for the intended aircraft service (in particular low temperature service) may also cause leakage at the wheel mating surfaces.
• This type of leakage is very difficult to diagnose since the inservice conditions causing the leakage are not reproducible in a shop.

- Leakage through the fuse plug (tubeless tires).

• Use sealing gaskets specified by the wheel manufacturer, suitable for the intended aircraft service (in particular for low temperature service).

- A faulty fuse plug can allow a seepage of nitrogen and thus a loss of pressure.

- Pressure release plug (tubeless tires). Some wheel designs have a pressure release plug. The potential causes of leakage are the same as for a fuse plug.

Cheking Time Check List	In all cases, be sure to account for	For a Mounted Tire/Wheel Assembly, check for	For a Dismounted Assembly, check tire and tube for	For a Dismounted Assembly, check wheel for
Initial Stretch Period (24 Hour Tire Growth)	X			
Changes In Air Temperature	X			
Venting of Tubeless Tires	X	X		
Release of Trapped Air in Tube-Type Tires	X	X		
Cut or Puncture		X	X	
Damaged Beads			X	
Improperly Seated Beads		X		
Leaking Valve core		X		
Other Valve Problems		X		X
Improper Installation of O-Rings				X
Faulty Thermal Fuse or Installation		X		X
Porous Wheelst		X		X
Improperly Torqued Wheel Tie Bolts		X		
Wheel Gouges and Scratches		X		X
Corrosion or Wear on Bead Ledge Area				X
Knurls				X
Damaged Sealing Surfaces		X		X
Wheel Assembly Holes				X
Wheel Cracks		X		X

E. TIRE INFLATION PRESSURE

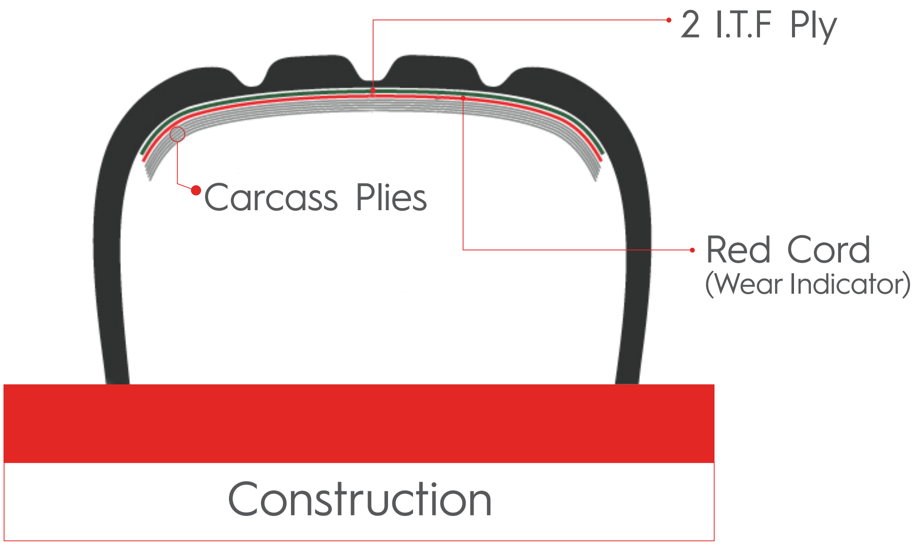
A simple, easy-to-perform series of inspection procedures can prevent minor incidents from developing into major problems and help to optimize tire performance. Regular inspection is a small price to pay to protect your valuable tires, and the safety of your aircraft and the people it carries.

Maximum Wear Limit Indicator- (MWL) : Safe service life of rubber tires for the purpose of the watch back from the region may wear expresses the maximum number of times. Reaches the specified value when the tire MWL received from the service must.

I.T.F. (Inter Tread Fabric) : An aircraft tire can include inter-tread fabric (ITF) (also known as tread reinforcement layers). This is one or more layers of nylon fabric between the casing plies and the base of the tread. The ITF keeps the tread stable and free from distortion during high speeds when there is increased centrifugal force. The ITF also gives protection to the casing plies if debris cuts the tread. For tires which can be retreaded, the ITF can be used as a wear indicator.

For special high speed applications, the ITF can be moulded into the rubber of the tread. As the tire wears, the ITF is seen in the tread pattern.

Figure - 2 : Aircraft Tire General Profile



Tread: The tread is made of rubber, compounded for toughness, durability and wear resistance. The tread pattern is designed in accordance with aircraft operationaln requirements. The circumferential ribbed tread is widely used today to provide good traction under varying runway conditions.

Removal Criteria – Wear

The tread area of the tire should be visually inspected for any damage and the state of tread wear. Removal at the right time will optimize tire wear, while still protecting the life and investment of the carcass. In the absence of specific instructions from the Airframer (Operations Manual, Service Bulletins, etc.), a tire should be removed from service for wear using the following criteria.

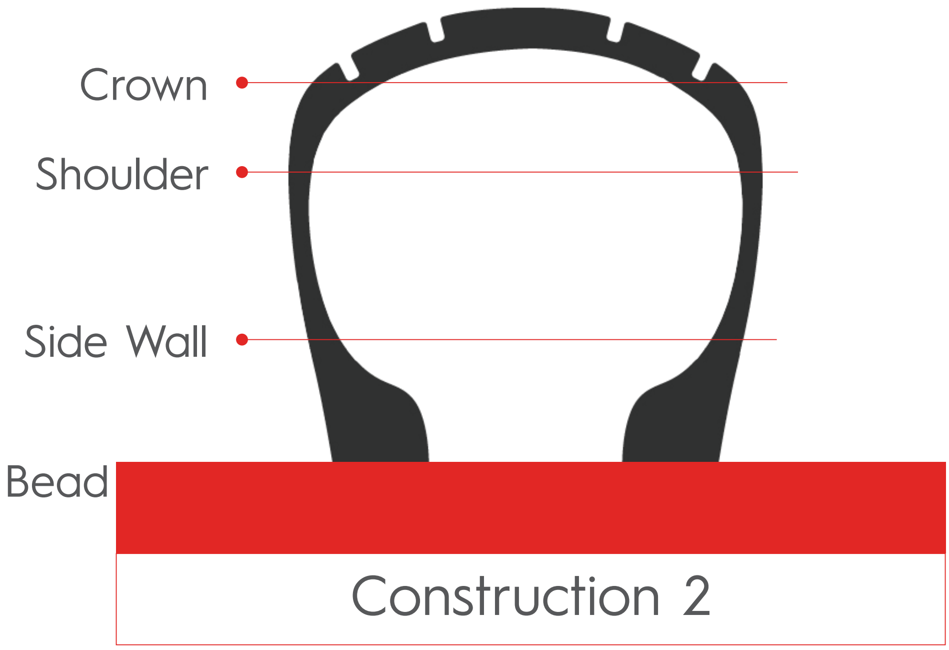
Based on the fastest wearing location, remove tires:

- When the wear level reaches the bottom of any groove along more than 1/8 of the circumference on any part of the tread,
  or
- If either the protector ply (radial or the reinforcing ply (bias) is exposed for more than 1/8 of the circumference at a given location.

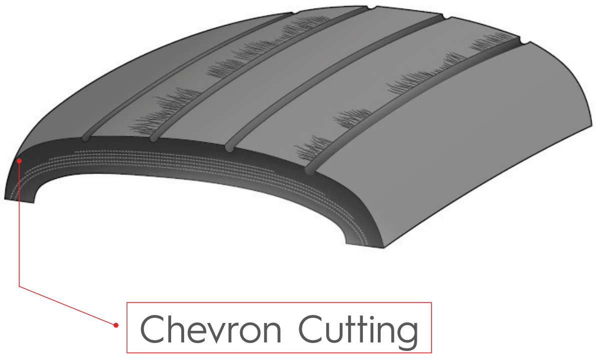
Note: Tires reaching this wear point on an aircraft at a remote station can make a return-tobase flight(s) under Standard operating conditions without sacrificing retreadability of the casing.

- Water can affect traction, the accumulation of water on runway surfaces can affect wet traction. Its affect is dependent on a number of factors including water depth, aircraft speed and runway surface conditions. The most effective method to minimize the affects of water on traction is to reduce water depth or allow the water to escape from under the footprint more rapidly. Many airport authorities today have adopted “cross-grooving” for their runway surfaces which allows for rapid drainage of water.

Figure - 3 : Aircraft Tyre General Profile



Chevron Cutting



Chevron Cutting: It causes because of damaged runway surface. Chevron cutting is just a visual condition and don't have a negative effect the tire performance.

Remove from service if the chevron cutting results in chunking which extends to and exposes the reinforcing or protector ply. The area of the chevron cutting is more than the tread footprint or the chevron cutting extends below a tread rib.

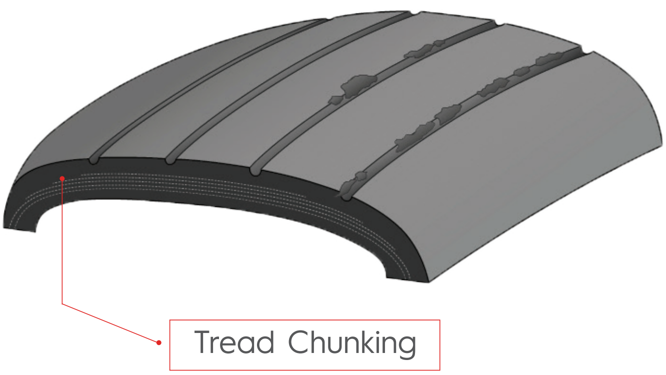
Dry Braking Flats (wood effect)

Locked (or almost locked) wheels during a landing on a dry runway can cause a dry braking flat spot on a tire. This is a flat scuffed surface on a part of the tread circumference.

- Replace the tire that has a dry braking flat spot if the wear is more than the specified wear limits
- Replace the tire if the dry braking flat spot causes out-of-balance or shimmy movements of its wheel.

Figure : Dry Braking Flats

Tread Chunking

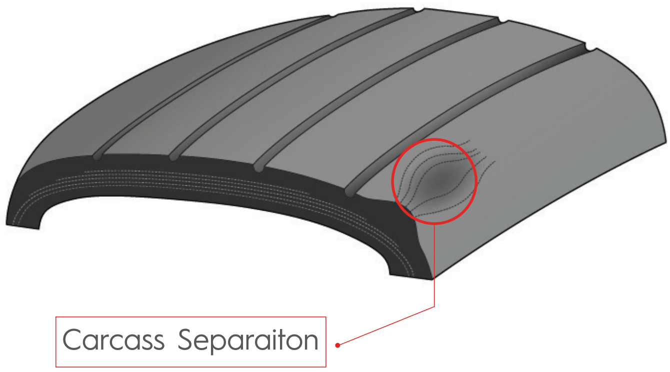


Tread Chipping / Chunking remove from service if the reinforcing ply (bias) or protector ply (radial) is exposed for more than 6 cm2/ 1.0 sq. in.

Caused by tight turning. Depent on severity tire may be left on aircraft for remainder of its service life.

Tread-Carcass Separation

Structure of the tire rubber in the back or ITF in multiples of 0.5 cm from the small bubbles in the back is the emergence of the corrosion with authentication.In warm seasons of heavy loaded aircraft movements occur with long-term use of a taxi or a manufacturing defect in this region during the pressing process can stay in the blister is called the emergence of small bubbles. Bubbles remain in the back structure has no effect on the performance of rubber and rubber use is continued. Bubbles are removed from service this rubber is in ITF structures. This breakdown is similar to the larger separation of "Tread-Carcass Separation" will be discussed under the heading.

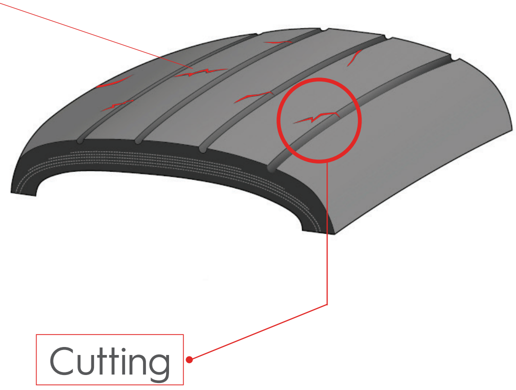


Cutting

Some very high speed tires have nylon fabric reinforcement in the ribs of the tread. You will see this fabric as the tread wears. Cuts in this fabric are not necessarily a cause for tire replacement (unless the cuts are more than the limits specified figure - 8)

Debris on the runway can cause cuts to the tread and the sidewall of a tire. Replace a tire with cuts if:

- The cuts are into the casing plies,
- You can see the casing cords, for example when you open the cut
- The criterion for that issue is Cut Limit Criteria

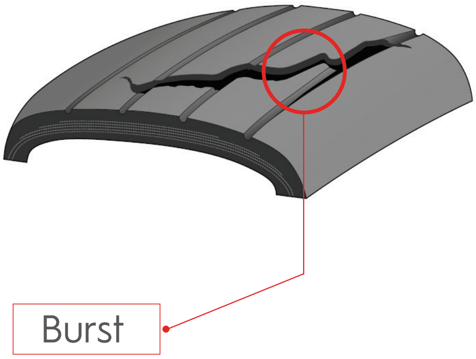


Burst

Operation with low tire pressures, or the aircraft is taxied quickly for a long time. These operations can cause impact concussion or increase the rate of fatique in the carcass.

A tire burst increases the load on the other

tire(s) on the same strut. The carcass (es) of the tire(s) which receive the added load could be damaged The burst tire and its related tire on the same axle must be removed and discarded if the aircraft has removed on the ground with a burst tire.

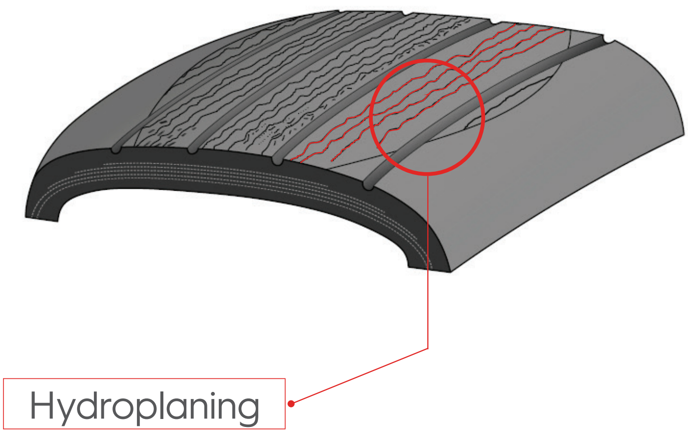


Hydroplaning

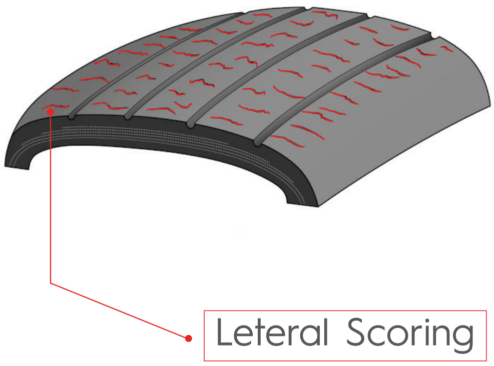
This condition results when, on a wet runway, the tire's tread is progressively lifted off the runway surface. A wave of water builds up in front of a Rolling tire, allowing the tire to ride on the water and lose contact with the runway surface. Loss of traction, steering ability and braking action occurs.

This action is usually referred to as "dynamic hydroplaning." Its occurrence is a function of water depth and aircraft speeds. The same phenomenon can result when a thin film of water on the runway mixes with the contaminants present or if the surface texture of the runway is smooth. This is called "viscous hydroplaning." Generally the irregular condition of the runway surface is sufficient to break up this film.

- Replace a tire that has a wet braking flat spot if the wear is more than the specified wear limits
- Replace the tire if the wet braking flat spot causes out-of-balance or shimmy movements of its wheel.



Lateral Scoring

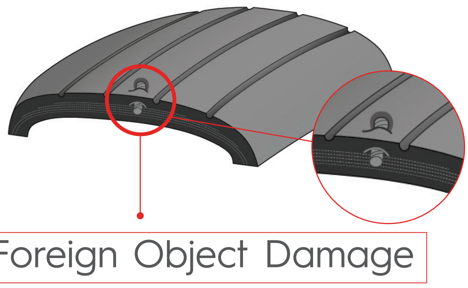


- A landing in a high cross wind can cause lateral scoring across the tread of a tire. Tight aircraft turns can cause lateral scoring on the shoulders of the tread.
- With large lateral scoring damage, adjacent tears can also occur in the interface between the tread and the casing. Subsequently, during the life of the tire, thetears can be related to separation of tire components.
- Replace a tire if the scoring has related tread chunking more than specified limits or cuts below a rib.

Foreign Object Damage

This may vary from a crack in the tire though to a tread strip.

Usually occurring on the tread area, this condition is caused by unclean runways, but may also be associated with towing bars. The tİre must be removed.



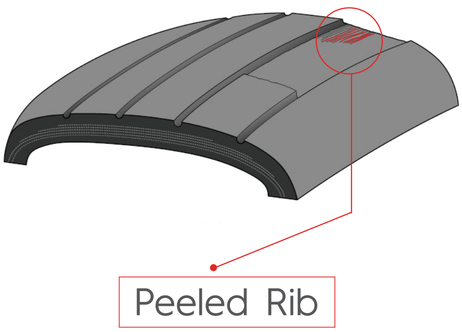
Irregular Wear

Even tread wear indicates that tire pressure has been maintained at the correct inflation level during service (see figure- 13). The tire must be removed.

When a tire has been operated with a higher pressure than required for the aircraft loads, an accentuated enterline wear will be apparent. Overinflation has reduced the number of cycles to wearout and made the tire more susceptible to bruises, cutting and shock damage (see figure14).

When a tire has consistently been operated underinflated, shoulder wear will result. Severe underinflation may cause ply separations and carcass heat build-up which can lead to thrown treads, sidewall fatigue and shorten tire life. Follow wear removal criteria (see figure 15).

Peeled Rib

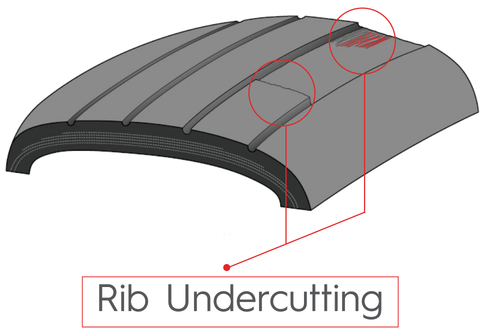


This condition occurs when a tread rib partially or totally peels off in a circumferential direction. Usually beginning with a cut in the tread, it results in a circumferential delamination of a tread rib away from the tire carcass.

Remove such tires from the aircraft. In the case of transverse cuts on the tread, remove the tire if the cut is deeper than the tread groove or extendsacross a rib from groove to groove.

Rib Undercutting

An extension of groove cracking progressing under a tread rib which can lead to tread chunking, peeled rib or thrown tread. Under side wind on a single pillar in the decline, the only place to stay hard erection occurs in the sharp turns.



Ozone Craking

Aircraft tire under the title of the ozone in the “STORAGE” section in the light of the description of the tires sidewall surfaces of the cracks are occurring capillary. Depending on the size of cracks are removed from service.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F. STORAGE

Tires are designed to be tough, durable and to withstand large loads and high speeds. They can provide years of reliable service if a few precautions are followed.

1. Handling Aircraft Tires

Care should be shown when handling aircraft tires. While tough and durable, tires can be damaged or cut by sharp objects or if excessive force is used. Avoid lifting tires with conventional two prong forks of material handling trucks. Damage to bead mounting areas or the inner liner can occur. A wide, flat, pincher type fork assembly of the type that lifts the horizontal tire by squeezing against the tread surface is recommended. An alternate recommended method would be to use a rounded bar to lift the tire.

2. Storege in Ozone and Moisture

The ideal location for tire and tube storage is a cool, dry and reasonably dark location, free from air currents and dirt. While low temperatures (not below 0°C/32°F) are not objectionable, room temperatures above 32°C / 90° F are detrimental and should be avoided.

To aid in the control of ozone attack on rubber, the tire materials specialist adds waxes and protective chemicals. Some of these ingredients address ozone attack when the tire is in a static state at room temperature; other ingredients are activated by heat and protect the tire once it is in service. Further, the tire designer is mindful of the impact of shapes and contours on stress concentrations. Still, steps need to be taken in storage to delay the effects of ozone attack. Wet or moist conditions have a deteriorating effect on tires and tubes, and can be even more damaging when the moisture contains foreign elements that are further harmful to rubber and cord fabric.

Strong air currents should be avoided, since they increase the supply of oxygen and quite often carry ozone, both of which cause rapid aging of rubber. Particular care should be taken to store tires and tubes away from fluorescent lights, electric motors, battery chargers, electric welding equipment, electric generators and similar electrical devices, since they all create ozone.

3. Store Away From Fueland Solvents

Make sure that tires do not come into contact with oil, gasoline, jet fuel, hydraulic fluids or other hydrocarbon solvents, since all of these are natural enemies of rubber and cause it to disintegrate rapidly. Be especially careful not to stand or lay tires on floors that are covered with oil or grease. When working on engines or landing gears, tires should be covered so that oil does not drip on them.

If tires accidentally become contaminated, wash them off with denatured alcohol and then with a soap and water solution. After cleaning, be sure to remove any water that may have accumulated in the interior of an unmounted tire. If after cleaning, the surface of the tire appears soft, or spongy, or bulges are present, the tire is not suitable for service. Should you have any doubt about the serviceability of such a tire, please contact your Petlas epresentative or authorized repair station.

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4. Storege in Lighting

The storage room should be dark, or at least free from direct sunlight. Windows should be darkened with a coat of blue paint or covered with black plastic. Either of these will provide some diffused lighting during the daytime. Black plastic is preferred since it will lower the temperature in the room during the warm months and permit tires to be stored closer to the window.

Fluorescent or mercury vapor lights should not be used because they generate ozone. Low intensity sodium vapor lights are recommended. See the section on "Aircraft Tires and Ozone" for more information.

5. Tires Rack and Storage Form

Whenever possible, tires should be stored in regular tire racks which hold them up vertically. The surface of the tire rack on which the weight of the tire rests should be flat and, if possible, 3 to 4 inches wide to prevent permanent distortion of the tire. 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.

If tires are stacked horizontally, they may become distorted, resulting in mounting problems. This is particularly true of tubeless tires. Those on the bottom of a stack may have the beads pressed so closely together that bead spreader tools will have to be used to properly space the beads for contact with the wheel during initial inflation.

Tires which are stacked on top of each other, sidewall-to-sidewall, have increased stresses in the tread grooves. If tires are stored for an extended period of time, or in an environment with high ozone concentration, ozone cracking is most likely to form in the tread grooves. If tires must be stacked, they should not be stacked for more than 6 months maximum.

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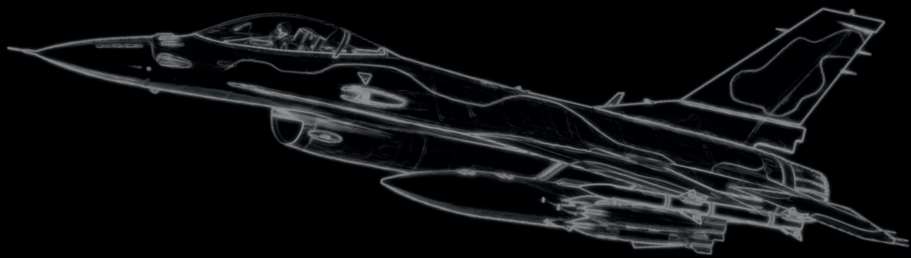
The maximum stacking height:
- 3 tires high if tire diameter is greater than 40 inches / 1 meter.
- 4 tires high if tire diameter is less than 40 inches inches / 1 meter.

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.

Once a tire has been properly mounted and the assembly verified for pressure retention, only minimal precautions need be taken
- Do not expose the tire toexcessively high temperatures (greater than 40° / 104° F)
- Do not expose the tire to direct sunlight or to high ozone concentration
- Avoid contact with contaminants (oil, grease, etc.)
- A Mounted tire / wheel assembly properly prepared and delivered to a line maintenance station as an airworthy replacement unit should meet the following storage conditions:
- To minimize the effects of ozone attack and where reinflation capability exists, tire pressure may be reduced to a value below operational pressure, but not less than 25% of the operational pressure or 40 psi / 3 bars, whichever is less.
- Transportation of a serviceable aircraft tire/wheel assembly should be in accordance with the applicable regulatory body for the airline. While serviceable tires may be shipped fully pressurized in the cargo area of an aircraft, Petlas'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.



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