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service news

A SERVICE PUBLICATION OF LOCKHEED-GEORGIA COMPANY, A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

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LOCKHEED-GEORGIA COMPANY
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LOCKHEED AIRCRAFT CORPORATION

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Foreword

This is a general article intended to ***stress the*** importance of proper ***care*** and maintenance of aircraft tires. ***Due to*** differences between aircraft and between civil and military requirements, we have tried to avoid specific information where there ***could be a*** conflict. Procedures and practices approved and used by your ***organization take precedence over*** any information contained herein.

We wish to express ***our*** appreciation to the B. F. Goodrich Company ***for*** permitting us ***to use*** information in their booklet, Care and Maintenance of Aircraft Tires, ***from which this article was adapted, and for providing photographs as noted.***

TIRES

proper care and maintenance can prevent property loss and serious injury

Most of us have had some experience with tires. In fact, we have become so used to them that we tend to take them for granted, and do not readily acknowledge the significance and importance of the tire and its functions. Unfortunately, a "relaxed" attitude toward tires often carries with it some severe penalties. Careless maintenance and operation of tires leads to accelerated wear, premature failure, and excessive aircraft downtime; this costs money. Still worse, serious property loss and injury to personnel can result if aircraft tires are handled improperly. Aircraft damage in tire-related accidents has included everything from a few skin scratches to the destruction of the entire airplane. Injury to personnel can run the gamut from minor bruises to loss of sight, limb, or even life. A basic review of the aircraft tire, including its construction, handling, and maintenance, can go a long way in helping us toward safer, and more efficient, tire operation.

Aircraft tires provide a cushion of air that helps absorb the shocks and roughness of landings and takeoffs. They support the weight of the aircraft while on the ground and provide the necessary traction for braking and stopping aircraft on landing. Thus, aircraft tires must be carefully maintained to accept a variety of static and dynamic stresses over a wide range of operating conditions.

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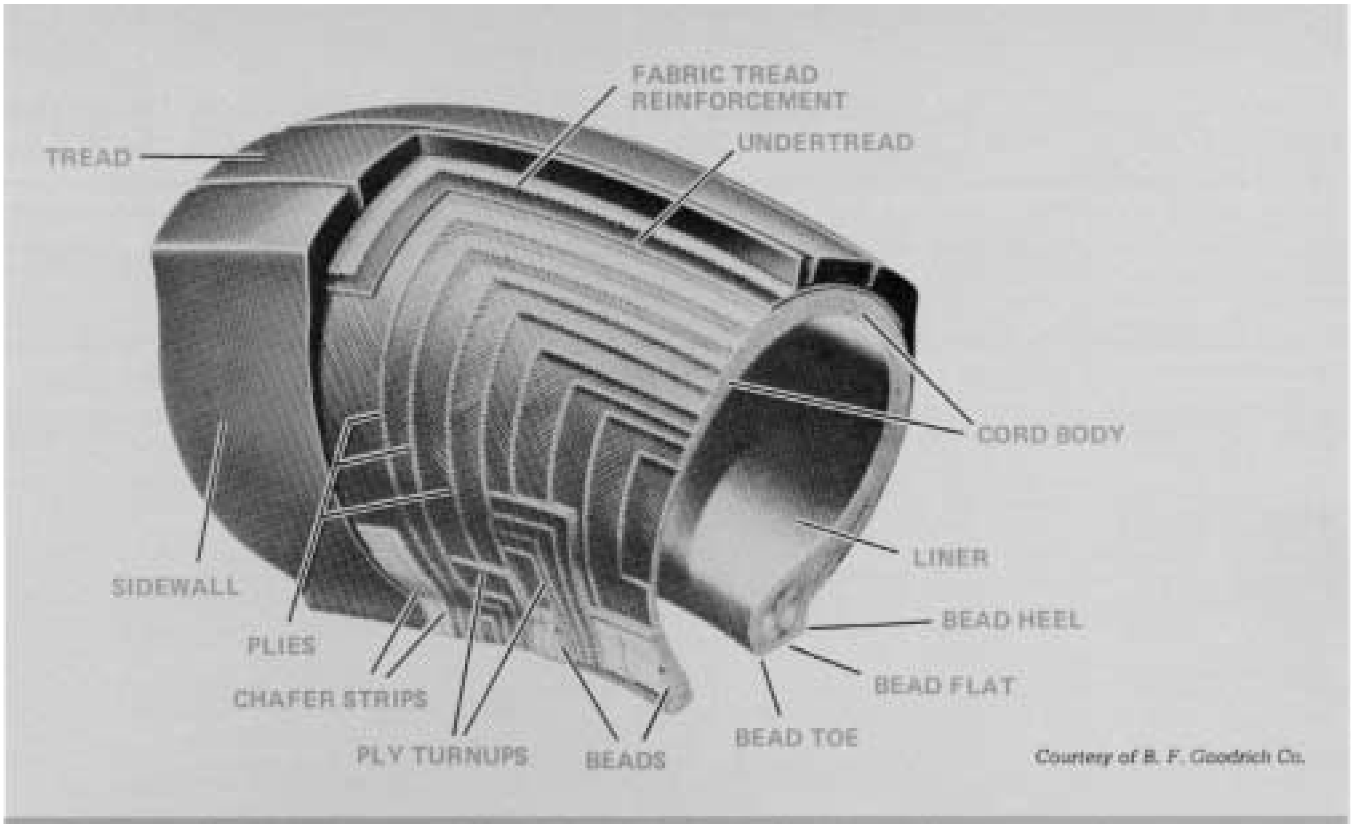


The modern aircraft tire is a carefully engineered product that is manufactured to close tolerances and subject to frequent inspections during fabrication. It is also a good deal more complex than it might appear to be from the outside. Here are the main parts of an aircraft tire and some of their functions.

Tread* – *The tread is a layer of rubber on the outer circumference of the tire which serves as the wearing surface. With the sidewall, it helps protect the cord body from cuts, snags, bruises, and moisture.

***Cord Body* –** The cord body consists of layers (plies) of rubbercoated nylon cord. Since a layer of these cords (a ply) has all of its strength in only one direction, the cords of every succeeding ply run diagonally to give balanced strength. The plies are folded around the wire beads, creating the ply turnups.

Beads* – *The beads are layers of steel wire imbedded in rubber and then wrapped with fabric. They give a base around which the plies are anchored and provide a firm fit on the wheel.

Sidewall* ~ *The sidewall is a cover over the side of the cord body to protect the cords from injury and exposure.

***Chafer Strips* –** Chafer strips protect the plies from damage when mounting or demounting the tire, and minimize the effects of chafing contact with the wheel.

Liner* ~ *The liner in tubeless tires is a layer of rubber specially compounded to resist diffusion of air. It is vulcanized to the inside of the tire, extending from bead to bead. In tube-type tires, a thin liner is provided to prevent tube chafing.

***Fabric Tread Reinforcement* –** This consists of plies added to reduce tire squirm and increase stability for high-speed operation.

***Undertread* -~** The undertread is a layer of special rubber which provides adhesion of the tread to the cord body, and enables the tire to be retreaded.

OPERATING AND HANDLING TIPS

Aircraft tires are amazingly strong. They are built to hold up under heavy loads and tolerate the great variety of stresses imposed upon them. They will give excellent service as long as they are handled and maintained properly. Let us take a look at some basic operating tips which will help maximize the aircraft tire's useful life.

Most of the weight of any aircraft is on the main landing gear wheels. Aircraft tires are designed to absorb the shock of landing and will deflect (bulge at the sidewall) about two and one-half times more than a passenger car or truck tire. The greater capacity for deflection also leads to some disadvantages; it causes more working of the tread, produces a scuffing action along the outer edge of the tread, and results in more rapid wear.

Needless tire damage or excessive wear can be prevented by proper handling of the aircraft during taxiing. If an aircraft tire strikes a chuckhole or some foreign object lying on the runway, there is a good possibility of its being cut, snagged, or bruised because of the high percentage of deflection. Similarly, severe sidewall or shoulder damage may occur if one of the main landing wheels drops off the edge of the paved surface while the aircraft is making a turn. The same type of damage may also occur when the wheel rolls back over the edge onto the paved surface.

To reduce the possibility of damage in taxiing, all personnel should see that ramps, parking areas, taxi strips, runways, and other paved areas are regularly cleaned and cleared of all objects that might cause tire damage.

Flat Spots

Nylon aircraft tires will develop flat spots under static load. The degree of this flat-spotting will vary according to the drop in the internal pressure in the tire and the amount of weight being sustained by the tire. Flat-spotting tends to be more severe and more difficult to work out during cold weather because the nylon cord is less flexible at low temperatures. When a cold tire begins to warm up from use, the cord becomes more flexible. Usually, a flat spot will disappear by the end of the taxi run. In any case, be sure to allow sufficient time to work flat spots out before attempting high-speed taxi runs or takeoffs. A flat spot serious enough to be felt by the flight crew during low-speed taxiing can cause real damage to the landing gear or aircraft structure at higher speeds.

Some flat spots are of the permanent variety. Severe use of brakes can wear flat spots on tires and cause them to go out of balance, making premature retreading or replacement necessary. Sudden or prolonged application of brakes can be avoided by careful control of ground speed and attention to proper taxiing procedures.

Careful pivoting of aircraft also helps prolong tire tread life and control flat-spotting. If an aircraft turned as an automobile or truck does – in a rather wide radius – the wear on the tire tread would be materially reduced. However, when an aircraft is turned by locking the wheel (or wheels) on one side, the tire on the locked wheel is twisted with great force against the pavement. This scuffing or grinding action takes off tread rubber and places a very severe strain on the sidewalls and beads of the tire at the same time. Furthermore, a small piece of rock or stone that would ordinarily cause no damage can, in such a case, be screwed right into the tire.

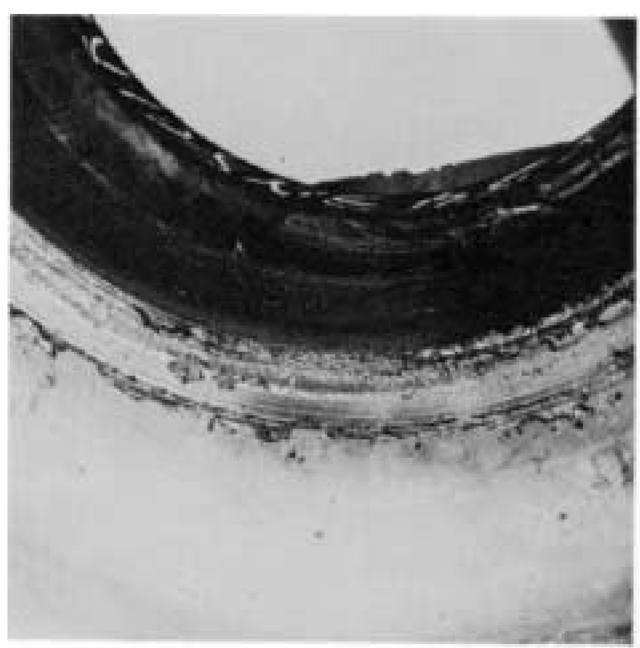
There is in any case little justification for turning a large, multi-engined aircraft by clamping down the brakes on one side. It is far easier on the tires if the aircraft is first put into motion forward and then turned, using nose wheel steering and power from the engines on one side or the other. Only very light brake applications should ever be used to augment steering, and then only when the wheels are in motion. Note too that special care needs to be exercised in regard to tires when it comes to handling aircraft with tandem main landing wheels like the Hercules. A wider radius is required to turn an aircraft equipped with tandem wheels and appropriate allowances should be made.

Instances of landing with brakes locked have become less common with the advent of modern antiskid systems, but it still can happen in cases where these devices malfunction. When it does occur, the usual result is a tire so deeply flat-spotted that it must be removed and retreaded or replaced. Brakes-on landings also cause very severe heat at the point of contact on the tire tread and may even melt the tread (skid burn). Heat has a tendency to weaken the cord body and places severe strain on the beads. In addition, heat buildup during braking may literally devulcanize the tire in the bead area. Under these circumstances, blowouts are common because air must expand when heated. If tires are skidded on the runway at high speed, the action is similar to tires being ground against a fast-turning emery wheel.

More tires fail on takeoffs than on landings because of heavy fuel loads and higher speeds. Such failures on takeoff can be extremely dangerous. For that reason, emphasis must be placed on proper preflight inspection of tires and wheels and correct tire pressure.

Hydroplaning

In recent years, much emphasis has been put on the phenomenon of hydroplaning. On wet runways, a wave



Deterioration of rubber from high wheel heat

Photo courtesy of B F Goodrich Co

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of water can build up in front of spinning tires and when the tires ride up on this wave, they may no longer make physical contact with the runway surface. This results in a complete loss of steering capability and braking action.

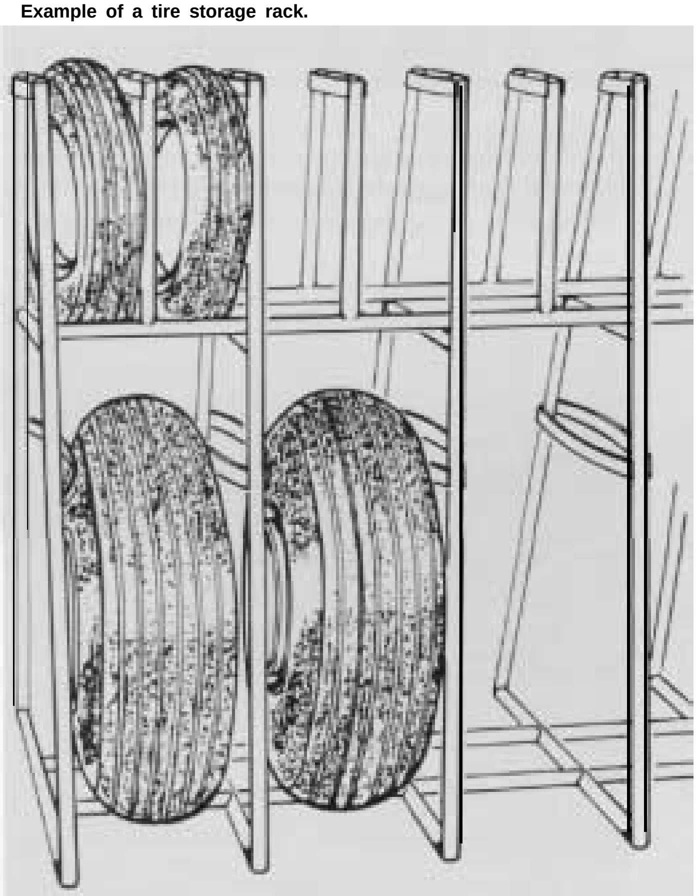
Cross-cutting of runways has been completed at some of the major airports and reportedly has greatly reduced the danger of hydroplaning. However, the ridges of concrete created by this cross-cutting can cause a “chevron” type of cutting of tread ribs, particularly with the higher pressure tires used on jet aircraft. These cuts are at right angles to the ribs and rarely penetrate to the fabric tread reinforcing strip. Such damage would not be considered cause for removal unless fabric was exposed due to a piece of tread rib being torn out.

Storing Tires and Tubes

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 32’F) are not objectionable, room temperatures above 80°F are detrimental and should be avoided.

Wet or moist conditions have a rotting effect, and may be even more damaging when the moisture contains corrosive agents that are injurious to rubber and cord fabric.

Example of a tire storage rack.



Avoid storing tires where they are exposed to strong air currents. Air currents 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 away from fluorescent lights, electric motors, battery chargers, electric welding equipment, electric generators, and similar equipment which create ozone.

See that tires do not come in contact with oil, gasoline, jet fuel, hydraulic fluids, or any type of rubber solvent, 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.

The storage room should be cool and dark, preferably without windows. If a windowless storeroom cannot be found, paint the windows of the room selected with dark paint, or cover them with opaque plastic. The less sunlight that reaches the stored tires, the better. The electric lighting provided in the storeroom should be incandescent; remember that fluorescent lighting is a source of ozone, which is harmful to rubber.

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

Avoid stacking tires horizontally, in piles. The weight of the upper tires will tend to flatten tires near the bottom of the pile and this may lead to mounting problems.

This is particularly true of tubeless tires; those on the bottom of the stack may have the beads pressed so closely together that a bead seating tool will have to be used to force the tire beads onto the wheel far enough to retain air pressure for inflation. If tires must be stacked, they should not be stacked more than four high unless they are in boxes. Stacks of boxed tires must be checked periodically to determine that the bottom boxes are not crushed.

Tubes should always be stored in their original cartons so that they are protected from light and air currents. They should never be stored in bins or on shelves without being wrapped, preferably in several layers of heavy paper.

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

INSPECTIONS

Tire inspections are generally performed while the tire is installed on the aircraft and inflated.

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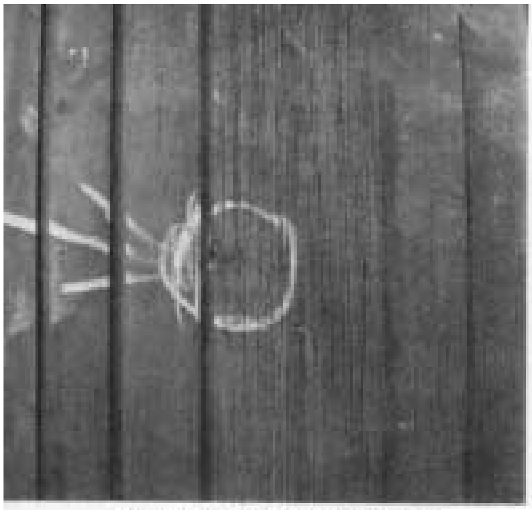
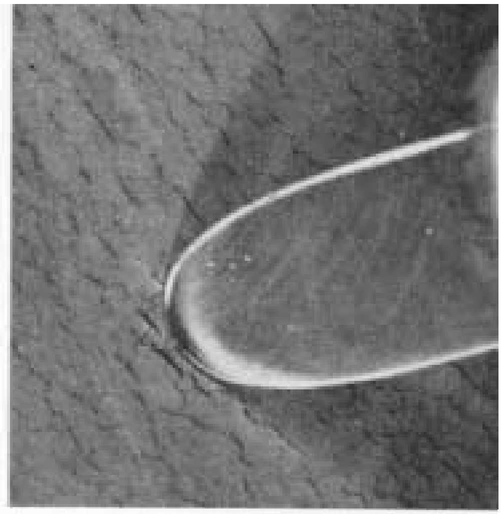


Mark and remove foreign objects.
Photo courtesy of B. F. Goodrich Co.

Probe foreign object damage with blunt awl: shield work. Photo courtesy of B. F. Goodrich Co.



Are sidewall cords exposed? Photo courtesy of B. F. Goodrich Co.

Tread

Carefully examine the tread area for cuts or other injuries, and' remove any glass, stones, metal, or other foreign objects that might be embedded in the tread or that have penetrated the cord body.

Use a blunt awl for this purpose (a medium-size screwdriver can be used if a blunt awl is not available.) When probing an injury for foreign material, be careful not to enlarge the injury or drive the point of the awl into the cord body beyond the depth of the injury.

Tires with cuts or other injuries which expose or penetrate the cord body should be removed, deflated, and held for possible repair or scrapping. Where a cut does not expose the cord body, taking the tire out of service is not required.

Remove any tires that show signs of a bulge in the tread or sidewall. This may be the result of an injury to the cord body, or may indicate tread or ply separation.

Sidewalls

Inspect both sidewalls for evidence of weather or ozone cracking, radial cracks, cuts, snags, gouges, etc. (Weather-checking is a normal condition affecting all tires and, unless the cords are exposed and/or damaged, it will in no way affect a tire's serviceability or safety). Scrap any tire where checking or cracking have extended down to the cords, or where cuts or snags have damaged the outer ply.

A light-colored crayon or paint stick should be used to mark all cuts, leaks, or damaged areas while the tire is inflated, and as soon as they are located. It may be difficult or impossible to locate these areas after a tire is deflated.

Beads

A tubeless tire fits tighter on the wheel than a tube-type tire in order to retain air pressure properly. Therefore, the flat of the bead (the flat surface between the toe and heel of the bead) must not be damaged as this may cause the tire to leak. This area is the primary sealing surface of the tubeless tire, so examine it carefully for evidence of damage that would permit air to escape from inside the tire. Bare cords on the face of the bead normally will cause no trouble, and such a tire is suitable for continued service if it is otherwise sound.

Check the bead and the area just above the heel of the bead on the outside of the tire for chafing from the wheel flange or damage from tire tools. Any blistering or separation of the chafer strips from the first ply requires repairing or replacement of the chafer strip. If cords in the first ply under the chafer strip are damaged, the tire should be scrapped.

If protruding bead wire, bead wire separation, or a badly kinked bead is found, the tire is unsafe and cannot be continued in service.

Bead area damage; repairable chafer strip. Photo courtesy of B. F. Goodrich Co.

Inner Casing

Check any tire which was marked for bulges when the tire was mounted and inflated. If no break is found on the inside of the tire, determine whether an area of separation exists. If separation is found, the tire should be discarded unless there is only a small localized separation between the tread or sidewall rubber and the cord body. In this case, spot repair or retreading may be satisfactory.

Any tire found with loose, frayed, or broken cords inside should be scrapped.

Important: Do not use an awl or any pointed tool on the inside of a tubeless tire for probing or inspection purposes, and do not pierce or cut into the liner. This will destroy the air-retaining ability of the tire.

Repairability

Tires are repairable which have minor injuries through the chafer strip or slight injuries caused by tire tools in the general bead area, provided the injury does not extend into the plies of the tire, and if there is no sign of separation in the bead area. If the chafer strips are loose or blistered, they can be repaired or replaced. Shallow cuts in the sidewall or shoulder rubber are repairable only if the cords are not damaged.

Liner blisters smaller than 4 inches by 8 inches may be repaired if there are not more than two in any one quarter section of the tire, and no more than five in the complete tire. Normally, it would be more economical to postpone this repair work until the time the tire is retreaded.

Due to differences between military and commercial practices, refer to the applicable documents used by your organization for detailed repair procedures.

Tube Inspection

In tube-type tires, failure of an inner tube can easily cause irrepairable damage to the tire in which it is mounted, as well as to the wheel and the aircraft itself. It is very important that tubes be of the proper size and equipped with the correct valves.

When inspecting tubes, do not inflate with more air than is required to simply round out the inner circumference of the tube. Too much air places a strain on splices and areas around valve stems. In addition, excessive air pressure will damage fabric-base tubes by causing the fabric base to pull away from the outside of the tube.

Inspect the tube carefully for leaks while under pressure, preferably by submerging it in water. If the tube is too large to be submerged in an available water tank, spread water over the surface as you inspect the tube, and look for bubbles.

Examine the tube carefully around the valve stem for leaks, signs of valve pad separation, and bent or damaged valve stems.

Tubes with severe wrinkles should be removed from service and scrapped. These wrinkles are evidence of improper fitting of the tube within the tire, and wherever a wrinkle occurs, chafing takes place. A blowout could result.

Inspect tubes for evidence of chafing at the toes of the tire beads. If considerable evidence of this chafing is present, remove the tube from service and scrap it.

Where the heat is greatest, the tube has a tendency to be stretched over the rounded edge of the bead seat of the wheel. This is one of the reasons why, when mounting tube-type tires, tubes should always be inflated until the tire beads are in position, and then completely deflated and reinflated to the final pressure. The stretch on the tube is then equalized throughout its inner and outer periphery.

Also check tubes for possible thinning out due to brake heat in the area where they contact the wheel and bead toes. The "set" or shape of the tube can assist in determining when it should be removed from service because of thinning in the bead area. In addition, feeling the tube with the fingers in the area of suspected failure will, after a little practice, enable you to tell when the life has gone out of the tube and it should be scrapped. On wheels with only one brake, this heat-set condition will normally show up on only one side of the tube. In those cases where the brake is a considerable distance from the rim, it is unlikely that this condition will ever be encountered.

In cases where brake heat is a recognized factor, careful checking of the tube and tire beads should be made to prevent a failure which might be disastrous. In such instances, fabric-base tubes should always be used. These have a layer of nylon cord directly imbedded in the inner circumference of the tube to protect them from thinning out under brake heat. Additional protection is also provided against the chafing action of the tire bead toes, and from damage during mounting and demounting.

A definite schedule should be set up to provide for regular inspections of tires and tubes. However, if an aircraft has made an emergency or particularly rough landing, the tire and tube should be demounted and inspected as soon as possible to determine whether any hidden damage exists. The wheel should also be examined at the same time.

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TUBELESS ASSEMBLY: AIR LOSS REFERENCE CHART	A	B	C	D
Initial Stretch Period (12 Hour Tire Growth)	X			
Changes in Air Temperature	X			
Venting of Tubeless Tires	X	X		
Cut or Puncture		X	X	X
Damaged Beads		X	X	
Improperly Sealed Beads		X		
Leaking Valve Core		X		
Other Valve Problems		X	X	X
Improper Installation of O-Rings		X	X	
Faulty Thermal Fuze or Installation	X	X	X	X
Porous Wheels	X	X		X
Improperly Torqued Wheel Tie Bolts		X		
Wheel Gouges and Scratches		X	X	
Corrosion or Wear on Bead Ledge Area		X	X	
Knurls		X	X	
Damaged Sealing Surfaces		X	X	
Wheel Assembly Holes		X		X
Wheel Cracks		X	X	X

- **Items listed in Column A are often overlooked when checking a newly installed tire**
- **The point of leakage for items listed in Column B can be checked by the application of a soapy water solution (leak detector) to the 'tire and wheel assembly or by immersing the assembly in water. It is unusual for a tire to suddenly become a leaker after it is partially worn and has not leaked previously. Pressure loss in used tires is usually caused by factors other than the tire.**
- **Items in Column C can be further checked with the tire removed.**
- **Items in Column D should be checked before a tire is removed from the wheel when a new tire is to be installed.**

NOTE: Inflation must be at operating pressure or Tire and Rim maximum pressure when testing for points of air pressure loss.

***Caution: Care should be taken that the bearings and cup area are not contaminated while testing for leaks.**

Courtesy of B. F. Goodrich Co.

The chart shown above will help in setting up a uniform check list and inspection methods.

Air Pressure Loss

There can be numerous causes for loss of air pressure within an aircraft wheel and tire assembly; thus, it is economical and wise to follow a systematic check list. Factors which may seem to be only distantly related to the problem are often the underlying cause of a reported pressure loss.

Initial Stretch Period (Tire Growth) – Most aircraft tires are of nylon cord construction, and a certain amount of stretch occurs after the tire has been inflated to operating pressure. This in itself will reduce air pressure within the tire. It is absolutely necessary that the tire be inflated to its operating air pressure and let stand at least 12 hours in order to permit this "growth" of the cord body. It may result in as much as 10% drop in air pressure. Compensate by reinflating the tire to the correct pressure.

After reinflating to operating pressure, the pressure drop in any 24-hour period will determine actual pressure loss due to normal diffusion or any leaks that may be present. This pressure loss check should be made as soon as possible after a tire is mounted and before a tire is placed in service.

Changes ***in Air Temperature*** Was the tire inflated in a heated room and then stored outside? Air pressure will drop approximately 1 PSI for every 4'F drop in temperature. Tires should be checked and pressure-adjusted for specific requirements, otherwise the actual operating pressure may not be correct.

Venting of Tubeless Tires Tubeless aircraft tires are vented in the sidewall area to permit any air that is trapped in the cords, or that is diffused through the liner into the cords, to escape. This venting prevents pressure build-up within the cord body which could cause tread, sidewall, or ply separation.

Vent holes are sometimes inadvertently closed by spilled solvent or by tire paint. They may also be covered during the retreading process. Check for evidence that tubeless tires have been revented after being retreaded.

The vents themselves will not cause undue air loss. The rate of diffusion will vary by manufacturer and individual tire. Discounting tire growth (initial stretch period) during the first 12 hours after inflation to operating pressure, the maximum permissible pressure drop due to diffusion is 5% in any 24 hour period.

Vent holes penetrate the sidewall rubber to, or into, the cord body and may vary in size, depth, and angle. The amount of air diffused through these holes also varies. Thus, when water or a soapy solution is brushed over the outside of an inflated tubeless tires, air bubbles form. Some vent holes may emit a continuous stream of bubbles. This is normal and does not mean that there is anything wrong with the tire. In fact, as long as a tubeless

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Tightening wheel bolts with torque wrench

tire is in an inflated condition, air will be coming out of these vent holes. When the rate of loss exceeds 5% in 24 hours, recheck for possible injuries.

Wheel Inspection

Inspect the entire wheel for damage. Wheels which are cracked or injured should be taken out of service and laid aside for further checking, repair, or replacement.

Thermal Fuse Plugs – Some aircraft main wheels, such as those used by the Hercules and JetStar, have fusible plugs that are designed to melt at specific elevated temperatures and relieve air pressure to prevent the tire blowing out or the wheel breaking. Should air be lost due to the melting of one of these plugs, it is recommended that the tire involved be scrapped. However, an effort should be made to determine whether air could have been lost around the plug because of its being improperly installed.

A faulty thermal fuse may cause leakage and require replacement. Usually this is the result of a poor bond between the thermal melting material and the bolt body.

The sealing surface for the thermal fuse gasket must be clean and free from scratches and dirt. In some cases, the surface can bc repaired in accordance with the wheel manufacturer's instructions. Be sure that the scaling gasket is the one specified by the wheel manufacturer. The gasket should be free of distortion, cuts, etc.

NOTE: If a tire with inner tube is used with a wheel having fuse plugs, the fuse plugs are of course ineffective. However, it is necessary to cover the fuse plug with a high-temperature filler material, such as TYGO-FIL 505, to prevent the sharp edges of the fuse plug and its opening from chafing the tube. Procedures for doing this are detailed in the wheel overhaul handbooks.

Improperly Torqued Wheel Tic Bolts – The torque values and torquing procedures specified by the wheel manufacturer should be followed to assure adequate compression of the sealing O-ring under all temperature conditions. Low torques, low temperature, and shrinkage of the wheel halves may cause a significant lessening of compression on the O-ring seal, leading to air loss.

Wheel Gouges and Scratches – Wheel gouges and scratches are the result of handling damage or the improper use of tire irons. Leakage may show in the O-ring seal or bead-to-wheel contact area.

Corrosion or Wear in Bead Ledge Area – This usually occurs at the toe area of the tire bead. The leakage will show at the bead-to-wheel contact area.

Damaged Sealing Surfaces – Look for damage or improper machining of sealing surfaces. Care should be taken to see that there is no handling damage. Any irregularities should be corrected before remounting the wheel and tire.

Foreign material or paint can impair the sealing surface. Thus, all foreign material should be cleaned from the sealing surface before assembly of the wheel. A light. even coat of primer is permissible. However, the surface must be free of dirt.

Wheel Assembly Holes – Where through bolts are used to attach such items as drive lugs for brake assembly, etc., the mounting screws or bolts must be properly sealed. The recommendations of the wheel manufacturer should be followed.

Wheel Cracks – A number of methods of crack detection are available such as penetrant inspection, eddy current inspection, and ultrasonic inspection. Wheel cracks can usually be traced to fatigue failure. Leakage may occur in the well area.

Improper Installation of O-rings – O-rings are used between wheel halves to seal the wheel when inner tubes are not used.

Twisting of the O-ring, or failure to provide lubricant when specified may cause loss of air. The wrong size or type of O-ring, or an O-ring of the wrong composition may also cause leakage.

Inspect used O-rings carefully. Be sure they are not thinned out, deformed, chipped, damaged, or otherwise deteriorated. After cleaning, used O-rings should be allowed to shrink at least 3 hours before being reinstalled.

MAINTENANCE

Matching Dual Tire Diameters

Matching tires on dual wheels is necessary so that each tire will have the same contact area with the ground and thereby carry an equal share of the load. Only those tires having inflated diameters within the following listed tolerances should be paired together on dual wheels.

Tires should not be measured until they have been mounted and kept fully inflated for at least 12 hours at normal room temperatures to allow for normal tire growth.

O.D. Range of Tires	Maximum Tolerance Permissible
up to 24”	1/4”
25” to 32”	5/l 6”
33” to 40”	318”
41” to 48”	7/16”
49” to 55”	1/2”
56” to 65”	9/l 6”
66” and up	5/8”

Courtesy of B. *F.* Goodrich Co.

Tie Pressures

Undoubtedly, proper inflation is the most important maintenance factor in ensuring safe, long service from aircraft tires. To ensure correct inflation for aircraft gross weight and runway load limits, refer to the proper technical publications.

Tire pressure should only be checked when tires are cool. A wait of at least two hours after a flight is recommended before checking pressures, three hours in hot weather.

Difference of air pressure in tires mounted as duals, whether main or nose, should be cause for concern, because it ordinarily means that one tire is carrying more of the load than the other. If there is a difference of more than 5 Ibs., it should be noted in the aircraft records. The records should then be referred to on each subsequent inflation check. Impending tire or tube failure can often be detected by this method.

Load Recommendations

There is a limit to the load that any aircraft tire can safely and efficiently carry. Loading aircraft tires above the limits can result in these undesirable effects:

- Undue strain is put on the cord body and beads of the tire, reducing the factor of safety and service life.
- There is greater chance of bruising when striking an obstruction or upon landing (bruise breaks, impact breaks and flex breaks in the sidewall or shoulder).
- The possibility of damaging wheels. Under the severe strain of an extra load, a wheel may fail before the tire does.

NOTE: While additional air pressure (inflation) to offset increased loads can reduce excessive tire deflection, it puts an added strain on the cord body and increases its susceptibility to cutting, bruises, and impact breaks.

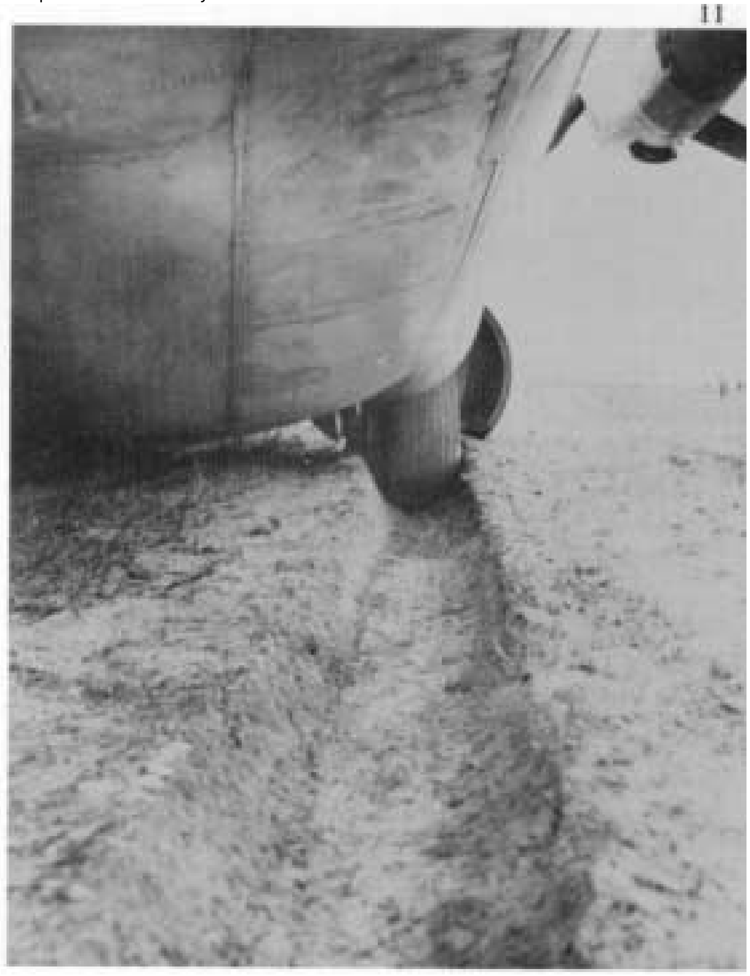
When tires are inflated under load, the recommended pressure should be increased by 4%. The reason is that the deflected portion of the tire causes the volume of the air chamber to be reduced, and increases the inflation pressure reading.

Effects of Underinflation

Underinflation results in harmful and potentially dangerous effects. Aircraft tires which are underinflated are much more likely to creep or slip on the wheels on landing or when brakes are applied. Tube valves can shear off, and the complete tire, tube, and wheel assembly may be destroyed under such conditions. Too-low pressure can also cause rapid or uneven wear at or near the edge of the tread.

Underinflation provides more opportunity for the sidewalls or the shoulders of the tire to be crushed by the wheel’s rim flanges on landing, or upon striking the edge

Unprepared landing sites are hard on tires and make more frequent inspections necessary.



of the runway while maneuvering the aircraft. Tires may flex over the wheel flange, with greater possibility of damage to the bead and lower sidewall areas. A bruise, break, or rupture of the tire's cord body can result. Severe underinflation may result in cords being loosened and the tire destroyed because of extreme heat and strain produced by the excessive flexing action. This same condition could cause inner tube chafing and a resultant blowout.

Tie Gauges

Quite often it is found that differences in reported air pressures are due entirely to the variation in accuracy of different gauges, rather than in any change in air pressure.

It is not unusual to find an inaccurate tire gauge in constant use with a tag that states that the gauge reads a certain number of pounds too high, or too low. Unfortunately, this error may not be consistent as different pressures are checked. A tire gauge reading 10 lbs. high at 80 lbs. pressure may very well read 25 lbs. too high at 150 lbs. pressure. Therefore, inaccurate tire gauges should either be repaired or replaced. They should not be continued in service.

Cold temperatures may also affect tire gauges and cause pressure readings lower than they actually are. Occasionally, too, a gauge has been mistakenly treated with oil or some other lubricant in the expectation of making it work better. This, of course, can actually cause incorrect readings, and will probably render the gauge unfit for further service.

It is good practice to have gauges recalibrated periodically, and to use the same gauge for performing an inflation cycle – the original 12- or 24-hour stretch period. Good quality, dial-type gauges are highly recommended for all tire maintenance installation – regardless of size!

Extreme underinflation, shoulder ribs worn off.
Photo courtesy of B. F. Goodrich Co.

Putting wheel halves into tire.

Vibration and Balance

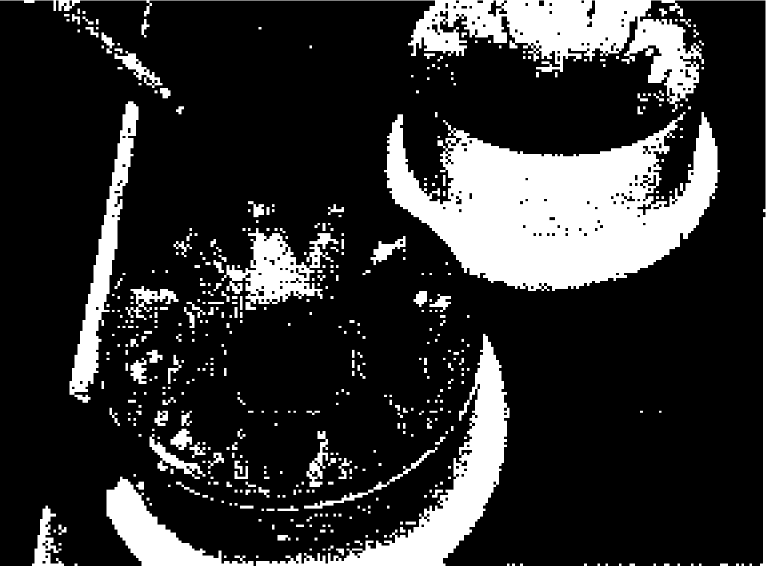
A major complaint in aircraft operation is that of vibration or shimmy. Although tire balance is usually suspect, there are other items of the tire, wheel, and gear assembly which can be the cause of the vibration:

- Wheel assembly installed before full tire growth achieved.
- Axle nut improperly torqued, resulting in a loose wheel bearing.
- A wrinkled or mis-shaped tube, or air trapped between tire and tube due to improper inflation procedure.
- The use of an inaccurate pressure gauge, resulting in improper inflation pressures.
- An improperly mounted tubeless or tube-type tire.
- Poor alignment of the landing gear.
- A wheel may be bent or twisted.
- Worn or loose landing gear components may be present.
- The tire diameters not matched, or the tire inflation not equalized on dual tire installations.
- A tire may be flat-spotted.
- Improperly seated beads and, of course, wheel and/or tire imbalance.

Mounting and Demounting Aircraft Tires

General – Remember that strict attention to detail is required when mounting and demounting tires on aircraft. It is not a good practice to try to mount or demount tires on guesswork. Before beginning, get the specific data you will need regarding wheel bolt torque, proper inflation pressures, and so forth for the job at hand.

Of course, almost every experienced aircraft tire service man has developed methods which are more or less his own, and undoubtedly some of these methods are as practical as the suggestions that will be given here. In one area, however, there can be no compromises or shortcuts;



Installing O-ring between wheel halves.

Layout of parts required for wheel and tire buildup.

that is in the area of safety. The mounting and demounting of aircraft tires should be accomplished with as much attention to safe working practices as possible. Use only the proper tools and suitable protection devices, and make every effort to avoid damage to tires, tubes, and wheels. When working on engines or landing gear, tires should be covered so that oil does not drip on them.

The following general items should be helpful: Before mounting any tire, examine the wheel carefully to make sure there are no cracks or damaged parts. Check thermal fuse plugs and tubeless tire inflation valves for proper installation and absence of damage.

Nearly all aircraft wheels being made for modern aircraft are of the split-wheel type, including those for the Hercules and the JetStar. Tires are much easier to mount and demount on this type of wheel. When inner tubes are not used, the split wheels are sealed against the loss of air by an O-ring mounted in a groove in the mating surface of one of the wheel halves. Be sure to inspect the O-ring for damage and replace it if necessary. When reinstalling-the O-ring, lubricate it as specified by the wheel manufacturer and insert it in the wheel groove. Make sure that the O-ring is free of kinks or twists and is seated properly.

Assemble wheel halves of split-type wheels with the light sides (an "L" is impressed on the flanges on some wheels) 180' apart from each other to ensure minimum out-of-balance conditions. If the wheel has balance weights, position the wheel halves with balance weights 180' apart.

Be sure that nuts, washers, and bolts used to assemble split-type wheels are in proper order and that the bearing surfaces of these parts are properly lubricated. Tighten to recommended torque values.

When demounting a tire, always remove the valve core and deflate the tire completely before beginning work. There have been many serious accidents caused by failure to follow this important step. It is also recommended that tires be deflated before wheels are removed from the aircraft. They should then be reinflated if they are to be checked for leaks.

NOTE: Use caution when unscrewing valve cores; the air pressure within the tube or tire can cause a loosened valve core to be ejected like a bullet.

With any type of wheel, the tire beads must be loosened from the wheel flange and bead seat before any further steps are taken in demounting. Be very careful not to injure the beads of the tire or the relatively soft metal of the wheel. Even with approved tools, extreme care must be taken.

Always use a bead breaker to loosen tire beads. Apply pressure around the entire circumference of each sidewall to separate the tire from the wheel-half flanges. Do not use a pry bar, tire irons, or any other sharp tool to loosen tire beads because the beads, or the wheel, may be damaged. Break the beads away from the wheel flanges before loosening the tie bolts and pull both parts of the wheel away from the tire.

Tubeless Tires – Tubeless tires fit tighter on the wheel than do the tube type. It is therefore desirable to lubricate the toes of the beads with an approved 10% vegetable oil, soap, or plain water before installation. This will facilitate mounting, and accomplish proper seating of the tire beads against the wheel flanges. The air pressure contained in a tubeless tire seals the tire bead ledge to prevent loss of air. When using the lubricant, be careful not to get the solution onto this area. The wheel bead ledge must be clean and dry to assure proper sealing of the tubeless tire bead.

Be sure to inspect the valve seal when installing a tubeless tire. The valve seal is a packing ring, or O-ring, installed in the valve hole of each wheel. Its purpose is to prevent the loss of air when an inflation valve is mounted through the hole. If the valve seal is cracked, or aged in appearance, or in any other way suspect, replace it with a new one.

Care must be taken when demounting tubeless tires to avoid damaging the wheel's O-ring groove and mating register surfaces. The ledge area that seals the tire bead, and the inflation valve sealing area are two other critical points. If these places have sustained damage, the wheel and tire unit will fail to maintain the required air pressure.

Tube-Type Tires – Dust the inside of the tire and inner tube with talc or soapstone before the tube is installed in the tire. This will prevent the tube from sticking to the inside of the tire during inflation, and lessen the chances of the tube wrinkling or thinning out. Also remember that it is a good practice to always mount the tube in the tire with the valve projecting on the serial-number side of the tire.

Install the tube entirely deflated, after the talc has been applied. Insert it in the tire (folding may make this easier) and inflate until the tube is just rounded out. The valve core should be in the valve during this operation.

Line up the tube and the tire balance marks. Insert the section of the wheel containing the valve hole into the tire and push the valve through the valve hole in the wheel.

Insert the other side of the wheel while holding the valve in position. Be careful during this operation not to pinch the tube between the wheel sections.

To seat the tube properly on the wheel, first place the tire in a safety cage and inflate the tire to the recommended pressure. The tire should then be completely deflated, and once more reinflated to the correct pressure. This procedure helps remove any wrinkles in the tube and prevents pinching the tube under the toe of the bead. It also avoids the possibility that the tube will be forced to stretch unevenly, and thin out more in some areas than in others. Finally, it assists in the removal of air that might have become trapped between the inner tube and the tire.

Do not fasten the valve to the rim until this procedure has been carried out; then install the locking nut (or nuts) and tighten securely. Put on the valve cap and tighten with the fingers.

NOTE: When tubes are used, cover fuse plugs as described previously.

Inflation

After the tire and tube are mounted on the wheel, the assembly should be placed in a safety cage for inflation. The cage is best located against an outside wall that is constructed so as to be able to withstand the effects of an explosion of tire or wheel, if necessary. The air line from the compressor or other air source should be run to a point at least 20 or 30 feet away from the safety cage, and a valve and pressure gauge installed at that point. The line should then be continued and fastened to the safety cage with a rubber hose extending from that connection. This arrangement makes it unnecessary to reach into the cage to check air pressures, or to be anywhere near the safety cage while the tire is being inflated.

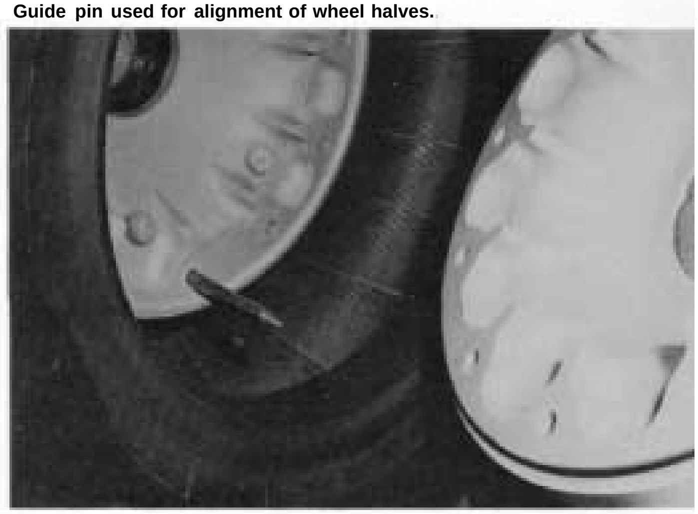
Balance

Balance in an aircraft wheel assembly is very important. From a wear standpoint, when the wheels are in the landing position, a heavy spot in a wheel assembly will have a tendency to remain at the bottom and thus will always strike the ground or runway first. This results in severe wear at one area of the tire tread, and can necessitate early replacement. In addition, an unbalanced tire may cause severe vibration during taxi, which may affect the operation of the aircraft.

Balance marks appear on certain aircraft tubes to indicate the heavy portion of the tube. These marks are approximately l/f-inch wide by 2 inches long. When the tube is inserted in the tire, the balance mark on the tube should be located at the balance mark on the tire. If the tube has no balance mark, place the valve at the balance mark on the tire.

inserting valve stem into wheel.

Guide pin used for alignment of wheel halves.



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When mounting tubeless aircraft tires, the "red dot" balance mark on the tire must always be placed at the valve that is mounted in the wheel unless otherwise specified by the wheel manufacturer.

Tire Valves

Replacements are available for all tubeless tire valves. Valve repair in the case of a tubeless tire is, of course, simply a matter of installing a new valve in place of the defective one. Repair-type valves are also available for many tube-type tires, but it is often a better practice to replace the tube if the indicated valve repairs will go beyond straightening the threads or replacing valve cores. Be sure to consult the appropriate manuals or regulations applicable to your organization before attempting valve repairs.

Tube Repair

Most tube repairs involve valve damage of one kind or another. However, occasionally a tube might be cut, pinched, or punctured by tire tools during mounting or demounting. Injuries larger than one inch can be repaired by using a reinforcement patch inside the tube. This reinforcement should be of the same material that is used for repairing the outside of the tube. An injury smaller than one inch usually will not need a reinforcement patch. If a tube has an injury that extends for more than two inches, it is best to scrap the tube.

Tie Repair and Rebuilding

Many aircraft tires which become injured in service can be successfully repaired. When considered economical, spot repairs can be made to take care of tread injuries such as cuts, snags, etc. which are through no more than 25% of the actual body plies of the tire, and not over 2 inches in length at the surface. Vulcanized spot repairs are also made at times to fill in tread gouges that do not go deeper than the tread rubber and do not penetrate the cord body.

Aircraft tires which have become worn out, or flat-spotted and removed prematurely, can often be retreaded and restored to service. The retreading and repairing of aircraft tires has been practiced for many years and has saved aircraft operators considerable sums of money. Tires which might otherwise have been discarded have been repaired and retreaded for continued use.

Retreading is a general term meaning reconditioning of a tire by renewing the tread, or renewing the tread plus one or both sidewalls. There are actually four different types of retreading for aircraft tires, depending on the need or process used:

Top Capping – Top capping is used for tires worn to the bottom of the tread design, with no more than slight flat spotting and/or shoulder wear. The remaining tread is removed and a new tread is applied.

Full Cupping – This procedure is useful for tires worn all around, those flat-spotted to the cords, or those with numerous cuts in the tread area. The new tread material is wider than that used on a top cap, and comes down over the shoulder of the tire for several inches.

Three-Quarter Retread – A three-quarter retread is applied to tires needing a new tread, plus renewing of the sidewall rubber on one side, due to damage or weather checking. A full cap is applied, and in addition, approximately l/l 6 inch of the thickness of the old sidewall rubber is buffed off one side. New sidewall rubber is then applied from the bead to the edge of the new tread, on the buffed side only.

Bead-to-Bead Retread – A new tread and both new sidewalls are applied by this method.

Tube balance mark (heavy point) aligned with tire balance mark (light point). Photo courtesy of B. F. Goodrich Co.

Worn through tread reinforcement strips only. O K for retread. Photo courtesy of B. F. Goodrich **Co.**

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Sidewall cords damaged beyond repair.
Photo courtesy of B. F. Goodrich Co.

Non-Repairable Aircraft Tires

The following conditions render an aircraft tire unfit for repair:

- Any injury to the beads, or in the bead area (except injuries limited to the bead cover or finishing strip).
- Tires with weather checking or ozone cracking of tread or sidewall that expose body cords.
- Any tire with protruding bead wire or a kinked bead.
- Any tire which shows evidence of ply separation
- Any tire with loose, damaged, or broken cords on the inside.
- Tires with broken or cut cords in the outside of the sidewall or shoulder area.
- Tires that have been run flat, or partially flat, due to the melting or failure of fuse plugs in the wheels should normally be scrapped even though there may be no visible evidence of damage to the inside or outside of the tire. The only exceptions would be where it was known that the fuse plug leaked air because of its being defective,and the tire was not run in an underinflated condition.

SUMMARY

Safety First - and Last

Every day, aircraft maintenance personnel have to confront many potential safety hazards. Some of these hazards are fairly obvious and have earned a full measure of respect. Other, perhaps less obvious, hazards yield dramatic results if ignored, and thus make an indelible impression on the memory. Carelessness with fuel or hydraulic fluid has produced disasters that were immediate and spectacular. Accidents involving moving propellers are also not soon forgotten by those who witness them.

But how is it with tires?Perhaps because tires are so familiar, particularly in the relatively harmless low-pressure forms that equip every car and light truck, it is easy to forget that they can be a real source of danger. Even automobile tires are far from being immune to sudden failure. Tines on parked vehicles have been known to explode without warning, injuring everyone within range.

Aircraft tires, which must operate in an environment of higher pressures, temperatures, and stresses, clearly pose a much greater danger. Don't be fooled by appearances. Although aircraft tires are tough, and will stand a lot of hard use, they are also vulnerable, highly-pressurized vessels which can kill or maim if something goes wrong. Here are a few points to help reduce that possibility to a minimum:

- Don't attach anything to a tire with staples, tacks, or pins. Anything that makes a hole in a tire can produce a weakened spot with potential for later leaks, or worse. Use pressure-sensitive tape or cement to stick tags to tires, but avoid attaching anything to the bead area where it may damage the sealing surface.

- Avoid prying between the flange and the bead with sharp tools. The use of improper tools is credited with causing **more** wheel and tire damage than any other single factor. Damaged areas on wheels and tires are not just nuisances that lead to leaks or premature tire replacement; they are dangerous. Damaged spots are weak spots, and any weak spot can become the starting point for the chain of events that can end in sudden, explosive tire failure.

- Be sure to use a safety cage and proper inflation equipment when inflating a tire after replacement or repair. Do not use air bottles or booster pumps not designed for tire inflation. Watch pressure carefully! Don't use high-pressure air sources (over 500 PSI) unless a suitable pressure regulator has been installed in the system. Rapid overinflation of tires is a leading cause of explosive tire failures.

- Always approach inflated tires from the front or rear. This is particularly important if the tire is hot from landing or a high-speed taxi run, or failure is suspected. If a tire fails suddenly, it is usually the sidewall, not the tread area, that ruptures. Staying out of the potential line of fire makes good sense.

These hints do not, of course, begin to complete the list of do's and don'ts in the area of tire safety. The subject of tire safety, like that of tires itself, is a very big one. But the essence of tire safety, and good tire management as well, can be summed up as follows: Use good information, approved procedures, and proper tools. These are the key steps which will help you take good care of your aircraft tires, and of yourself.

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Using the Tach Generator Tester for an Auto-Tat

by W. S. Milford,Service *Representative*

Have you ever needed an Auto-Tat (precision RPM test set) for checking RPM and other troubleshooting on the Hercules, but didn't have one readily available? The sketch in Figure 1 shows how to fabricate a wire harness to adapt the Tachometer Generator Tester, Model TTU/27E, (FSN 6625-799-7813) for use as an accurate Auto-Tat.

After making the wire harness, follow these simple instructions:

1. **Connect the test set power cable to a source of 115VAC, single phase power.**
2. **Connect the fabricated wire harness to the TEST GEN input connector on the test set; then plug the other end into the test jack on the synchrophaser test panel.**
3. **Turn the test set ON and allow for warmup.**
4. **The engine select (ENG SEL) knob on the synchrophaser test panel is used to select the engine for which you wish to check the RPM. The digital readout on the test set shows the RPM for the selected engine.**

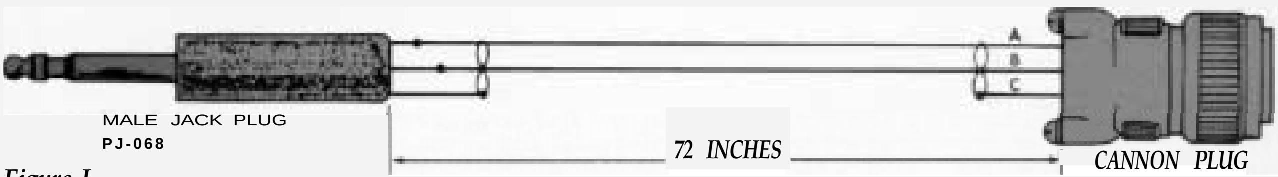

Figure I

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CREW ENTRANCE DOOR CABLE

by W. C. Barre, *Service Representative*

The crew entrance door of the Hercules is a sturdy and durable unit. Given normal care and proper attention to latches, hinges, and gaskets, it will stand up to a lot of hard use and still last the life of the airplane.

Nevertheless, there's always a way to make a good thing better. Some Hercules operators have found that they can add to the strength and convenience of the door for ground operations by connecting a covered cable between the hand lanyard attachment point and the door close hook.

The installation shown in the picture is one developed by the men of the Royal Danish Air Force, who report that they got the idea from a similar arrangement they saw installed on Hercules' belonging to the Norwegian Air Force.

The cable gives additional load support on the side of the door opposite the standard telescoping tube support, and offers both a convenient hand hold and a lift rope when closing the door from the inside.

In the door-closed position, the cable should be stowed to prevent personnel from tripping and inadvertently opening the door in flight by grabbing the door handle.

HOT BRAKES

by T. A. Faber, *Aerospace Safety Engineer, Senior*

There is an old adage in aviation circles that airplanes are made to fly, and the sooner they are airborne, the safer they are. The air and ground environments are not always compatible, and compromises must consistently be made in favor of the air environment where the aircraft is primarily designed to operate. While on the ground, aircraft are exposed to all kinds of man-made hazards. Sometimes they are treated with the same kind of abuse and indifference normally associated with the operation of cars and trucks, and all too often the results are catastrophic. Airplanes have been taxied into buildings, ditches, and each other on their way to and from the runway. Others have been involved in one of the most costly problems associated with ground operations: wheel-well fires which can be traced back to overheated brakes. In this respect, the Hercules is no exception.

The Hercules is a remarkable airfreighter with an outstanding reputation for safety. But on the ground, as well as in the air, careful attention to correct operating procedures is the key to avoiding hazards that can lead to costly damage or personal injury. Nowhere is this more true than in regard to the proper handling of main landing wheel brakes.

An article entitled "Hercules High Energy Brakes," published in the Vol. 2, No. 1, January – March 1975 issue of the Service News, emphasized the need for pilots to use the Hercules brakes sparingly. The article pointed out that although the trimetallic brakes have more stopping power and better high-temperature performance than the older type, care must still be exercised to prevent the brakes from becoming overheated.

Other than an unusual brake system malfunction, the majority of brake fires are caused by repeated brake applications in a short period of time, thus allowing heat to build up. As brake stack temperatures increase, the heat is transmitted from the stack to the brake housing; thereby subjecting hydraulic hoses, seals, and brake cylinders to excessive temperatures. As a result, seals may leak, hydraulic hoses are subject to failure, or cylinders can rupture. Should any of these conditions develop, the hydraulic fluid is expelled and atomized under pressure. If the volatile mist comes in contact with the hot brakes, it can ignite and can cause extensive fire damage unless immediately controlled. Brake fires have occurred after rejected takeoffs (RTOs), during prolonged taxi operations, while executing "windmill taxi starts," and after takeoffs. However, such problems may be prevented by the exercise of due care, and by following the recommendations in this article, as well as those in applicable operating or procedural manuals.

Let's look at some specific points which will help avoid brake overheating problems.

During taxi, Hercules pilots should make maximum use of the reverse pitch propeller for decelerating the aircraft. The brakes should be used primarily for stopping the aircraft when parking, or whenever needed during RTOs or other emergencies. Pilots should be aware that during taxi the heat buildup from successive low-energy stops is cumulative, and eventually can exceed even the amount of heat that is generated in the brakes during an RTO. To assure that an RTO stop can be made, Goodyear, the brake manufacturer, advises that brake temperatures must be no higher than 400'F before takeoff.

After some brake fires, it was found that some pilots inadvertently overheated the brakes by taxiing the aircraft with their feet on the rudder pedals. In this position, the tips of the pilot's shoes rested against the tops of the rudder pedals. As they taxied, the slightest foot pressure against the top of the pedal resulted in hydraulic pressure being applied to the brakes. This caused "dragging brakes" which, on a long taxi run, could set the stage for a brake fire. As a result of this discovery, pilots have been cautioned to place their heels on the cockpit floor when taxiing the aircraft.

Flight manuals and maintenance manuals contain information, cautions, and warnings concerning overheated brakes. Significant points to remember are:

- When taxiing, use low-speed ground idle to reduce taxi speed, and use reverse pitch propeller to decelerate the aircraft.
- Do not allow brakes to "drag."
- The maximum capability of the brakes may easily be reached during an RTO, and the service life shortened to the point where they are no longer serviceable. Have your maintenance crew inspect the brakes after a heavy aircraft-weight RTO, or any time hot brakes are suspected.
- If maximum braking has been used in landing and/or taxiing, it is recommended that the gear be left extended after takeoff for a minimum of 15 minutes before retraction.

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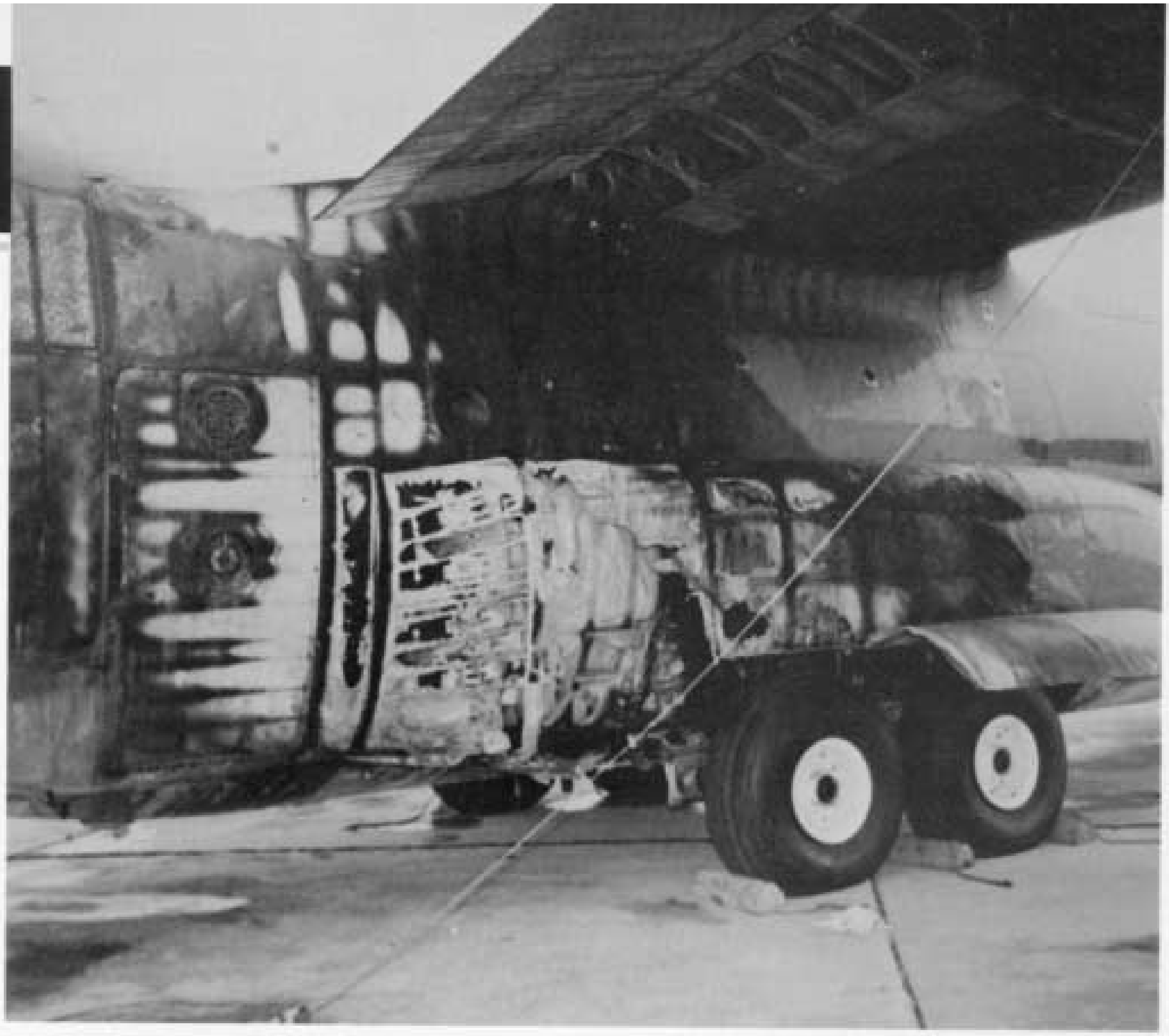

- Remember that peak temperatures occur in the brake assembly in approximately 1 to 5 minutes, and occur in the wheel and tire assembly in approximately 20 to 30 minutes after maximum braking. Two to three hours are required for brakes to cool enough for safe removal when artificial cooling is not used.
- If overheated brakes are indicated, notify the fire department and have the brakes inspected. All persons other than fire department personnel should stay well clear of wheels and tires. Wheels and tires should be approached from only the front or rear, never from the side.

Some Dont's for Overheated Brakes

- Do not set parking brakes while an overheated condition exists.
- Do not taxi the aircraft into a crowded parking area. After clearing the runway, stop, and chock the nose wheel.
- Do not apply coolant directly on a wheel until after the tire has been deflated.

It has often been stated that a well-trained, knowledgeable crew operating a serviceable aircraft can successfully and safely complete any assigned mission. It is hoped that this discussion has provided that extra bit of information concerning the Hercules brakes which will help all aircrews to complete missions successfully and safely.

Remember, take care of your brakes and they will take care of you when you need them. Abuse them, and they may not be there when the end of the runway is approaching.

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Precipitation Static Dissipation

A recurring topic for discussion with Hercules operators and field representatives has been precipitation static, or "p-static", noise in the radio receivers.

P-static, as heard in a radio receiver, is caused by an electrical discharge known as corona discharge from the aircraft. This discharge occurs when the electrical potential of the aircraft is high with respect to the space surrounding the aircraft.

When flying through precipitation or clouds, a large number of particles will strike the aircraft and bounce away. An electrical charge is transferred at each particle impact. Under typical "charging" conditions, this potential can reach values of 100,000 to 200,000 volts in a fraction of a second. These charges can also be induced when flying near or between electrically charged clouds during electrical storms, even if no particles are striking the aircraft. When the potential reaches a high enough value, it can cause ionization of the air at sharp edges where the charge is concentrated, and short bursts of charge will be transferred to the surrounding air or to a low-potential part of the aircraft. It is the energy released by these pulses, coupled into the radio antennas, that causes noise in the aircraft radio receivers.

P-static will normally be severe on ADF, cause "grass" on LORAN A and C, and be objectionable on HF communications. In general, it will be less severe on VHF or VOR.

P-static interference also can be generated by movable control surfaces, detachable panels, and plastic or fiberglass surfaces not properly bonded to the airframe which accumulate static charges and discharge them to a low-potential part of the airframe. This discharging of surfaces can couple into the receiving antenna systems like a spark transmitter, producing crackling noises in the headphones.

To avoid this problem, it is necessary to keep the resistance between the airframe and all moving surfaces, detachable panels, etc., below approximately one ohm. Plastic and fiberglass surfaces should be coated with an antistatic paint or other controlled-resistance coating sufficiently dense to allow electrical charges to leak away to the surrounding metal structure. Also, an electrical path between the plastic surface and the airframe must be provided. Of course, the static dischargers must also be in good condition and properly bonded to the airframe in order to eliminate spark discharge from the concentrated-charge and low-pressure points on the airframe to the surrounding air.

Limited research has been done to determine the cause of p-static on the Hercules, but it appears that aircraft with decorative paint on the radomes are the worst offenders. This would indicate that the radome is the most probable source of p-static troubles, so attention has been focused in this area.

Lockheed engineering advises that the design philosophy regarding static on the radome is this: The charge builds on the surface paint and bleeds through the antistatic paint beneath. It is conducted through the antistatic paint to the silver conductive paint (DuPont No. 4929) on the edge of the radome, from which it passes through a conductive rubber seal and adhesive, or through the radome hinges or braces to the airframe.

The antistatic paint is checked in production to measure 2 to 200 megohms between probes spaced six inches apart, before decorative painting. The resistance should be in this range when measured between needlepoint probes about six inches apart which have been pushed through to the antistatic layer. The antistatic paint-to-fuselage resistance should be less than 100 megohms as measured with the needlepoints three or four inches from the edge of the radome. In each case, several places should be checked and the needlepoint holes should be touched up after testing is completed.

If the radome checks do not reveal any suspected breakdown in the mechanism for dissipating static charge, then other possible sources of static noise should be sought. The possibility of an electrically isolated surface should be investigated. The grounding of antenna bases is not suspect because this would cause trouble all the time, not just in the precipitation conditions. The static dischargers should also be checked, especially the wire braid type.

One final note regarding coatings: Several types have been used to avoid p-static problems, with varying results. Olin Astrocoat antistatic paint has yielded good results during Lockheed usage.

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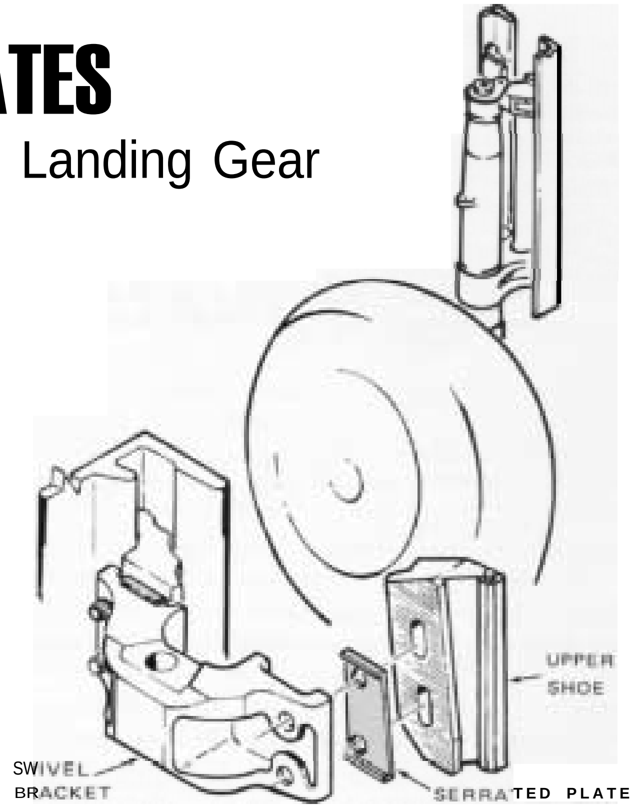
THINNER SERRATED PLATES

for Hercules Main Landing Gear

by C. R. Bush, *Design Engineer Specialist*



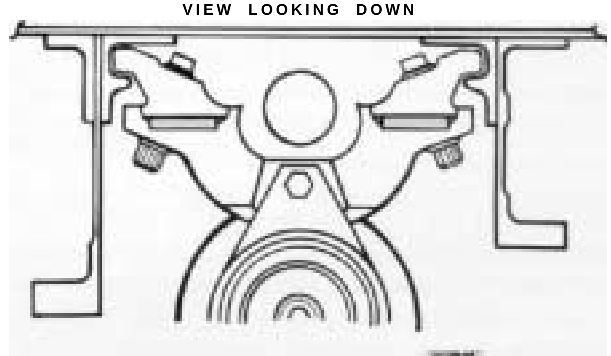
Occasional contact between the main gear torque strut and the vertical beams, or between the main gear piston and shelf bracket, has been experienced by some Hercules operators. This can be caused by the buildup of manufacturing tolerances, shoe misadjustment, wear, and tire unbalance.

A production change has been made on Hercules aircraft serial number LAC 4710 and up to replace the 0.130-inch thick serrated plates (P/N372602-IL and -1 R) that fit between the main gear swivel bracket and the upper shoes with thinner 0.065/0.070-inch thick (P/N 372602-3 and 4) plates.

The use of the thinner serrated plate shifts the position of the top of the main gear strut slightly inboard, and the piston and torque strut area slightly outboard, thereby increasing the clearance in the contact area. The thinner plates are interchangeable with the existing plates, and may be substituted on earlier airplanes if increased clearance is desired.

Both plates should be replaced together. If the P/N372602-3 and -4 thin plates are not readily available, the -IL and -1R plates can be modified to the -3 and -4 configuration by machining the inside of the web of the channel section to 0.065/0.070 inch thickness, and replating the reworked area with cadmium.

VIEW LOOKING DOWN



service news

Static Ground Assemblies deleted from Landing Gear

The trend toward deletion of main landing gear (MLG) static grounding devices got its impetus in 1968 when the U. S. Air Force issued T. 0.4A-I-501 which required removal of those devices from all USAF aircraft. Subsequently, various airlines and aircraft manufactures followed suit and the FAA granted its approval.

Lockheed continued installing the MLG static grounding straps/wires as a precautionary measure. However, it is now felt that sufficient data has been accumulated to show that no adverse effects will occur if these devices are not installed, as the static charge is sufficiently dissipated through the electrically-conducting MLG tires.

MLG static grounding assemblies have been deleted from the JetStar, C-5A, C-141, and L-lOll aircraft with no reported problems to date. They have also been deleted from production Hercules aircraft serial No. LAC 4691 and up.

NOTE: Only approved tires and retreads should be used as use of nonconducting tires would not allow adequate dissipation of built-up static charges.

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Hercules

Towbar Shear Bolts

Recent reports from the field indicate that an explanation of the function of the towbar safety shear bolts would be helpful. The AN6 (3/8-inch diameter) bolts that attach the towhead to the towtube are designed to protect the nose landing gear assembly during towing operations. Under a condition of extreme load, such as an excessively sharp turn radius, or a sudden start or stop, the AN6 bolts will shear and thereby prevent damage to the nose landing gear strut. These alloy steel bolts are therefore very important, and should be checked periodically to ensure that they will function properly.

It should be remembered that the AN6 safety shear bolt installed in the aircraft nose landing gear crossbar and tow fitting (see Figure 1) is designed to shear only with a pulling force. If the Hercules is being pushed backward, the nose landing gear tow fitting will bottom out against the crossbar and the crossbar bolt will not shear, leaving only the towbar's AN6 bolts to provide the safety shear function.

It appears that the two AN6 bolts in the towbar shear more frequently than does the AN6 bolt in the nose gear tow fitting. One reason for this is that the bolt in the nose gear tow fitting must shear in two places while the bolts in the tow bar have only one shear point. Also, leverage may be exerted on only one of the two bolts in the towbar, causing it to overload and shear.

The original Hercules towbar was made by Lockheed (P/N403980), and since the towhead and towtube end connections were made of high strength steel, the two AN6 safety shear bolts were installed without bushings.

The newer towbar made by Ventura (P/N 126-000-101) has a towhead and towtube end connector made from general purpose structural steel. Although the steel used is of good quality, it does not provide for proper shearing of the AN6 bolts, Therefore, high strength steel bushings are used in the towtube-to-towhead attachment holes. These bushings must be sharp and flush at the towtube and towhead mating surfaces. Also, larger washers should be used to prevent the bolt head and nut from pulling into the bushing holes. (See Figure 2.)

Under no circumstances should the bushings be removed and 5/8-inch bolts installed, since a considerably higher shear load would be required for separation of the larger-than-standard bolts. Also, the specified bolts must not be replaced with higher strength bolts of the same size.

Figure 1 A SHEAR BOLT SECURES TOW FITTING TO CROSS BAR ON NOSE LANDING GEAR.

If there is a problem with the AN6 bolts shearing in the towhead attachment, it is likely that the towing instructions and limitations detailed in the Hercules maintenance manuals are not being followed. The ground handling-towing and taxiing section should be reviewed.

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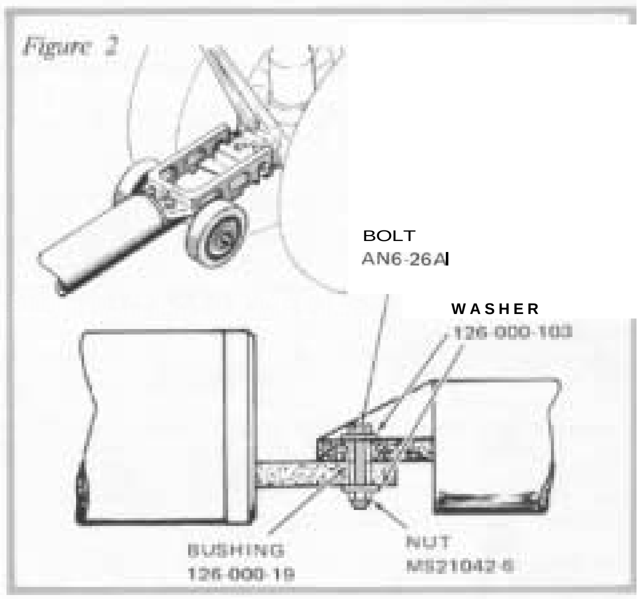
Figure 2



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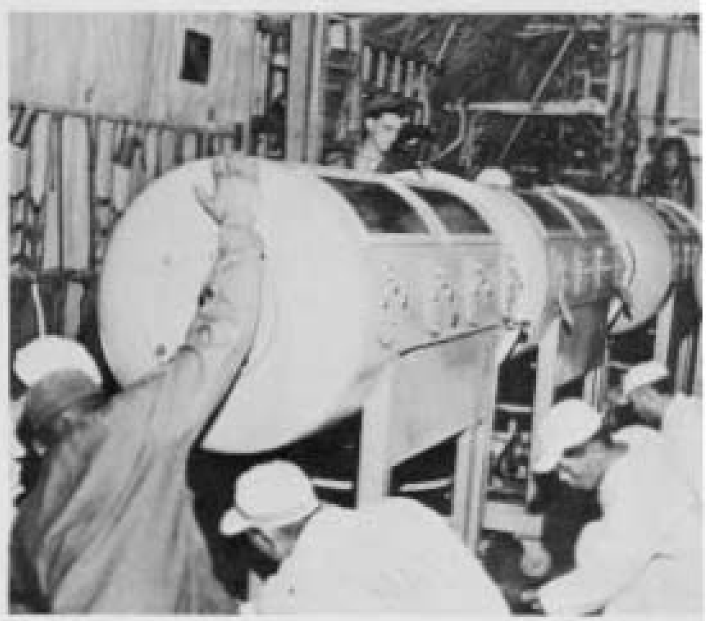
HERCULES — the airlifter that helps people.

The Hercules is the workhorse of the air, transporting tons of equipment and supplies with ease over natural barriers that defy surface transportation. Arctic tundras, oceans, mountains, deserts, or jungles — the Hercules knows no boundaries. Whether it be earth movers to carve out farms and roads, drilling machinery for oil wells, or lifesaving supplies to a disaster-wracked area, the dependable Hercules is first on the scene — and often the *only* way the scene can even be reached.



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