


# Aircraft tire ratings

## PLY RATING

Ply rating identifies the maximum static load carrying capacity of a given tire and corresponding inflation pressure in a specific type of service. It is important to realize that ply rating is an indicator of tire strength and not necessarily the actual number of carcass plies in the tire. For example, a 26 x 6.6 with a 14 Ply Rating has only 8 carcass plies. The maximum static load and corresponding pressure for a particular ply rating and tire size are determined by calculations as outlined in the Engineering Design information guides of T&RA and ETRTO.

## LOAD RATING

It is the maximum permissible load of the tire when at rest.

### *MAIN WHEEL TIRE:*

FAR/JAR 25.733 specifies that for aircraft with a main landing gear axle fitted with more than one wheel, the maximum load capability of a tire be at least 7% greater than the maximum load requirement of the aircraft for that wheel position. Thus an H40 x 14.5-19/22PR tire with a rating of 30,100 lbs. could only be fitted on an aircraft with a tire load requirement up to 28,131 lbs. (30,100/1.07).

### *NOSE WHEEL TIRE:*

All Michelin tires operating in a nose landing gear position are designed to withstand the following maximum loads during braking:
TYPE III: 1.45 x Maximum Static Tire Load
All Other TYPES: 1.50 x Maximum Static Tire Load

## INFLATION PRESSURE

All inflation pressures shown in the rating tables are for **unloaded tires at ambient temperature (cold)**. A 3-hour cooling time should be allowed after landing before checking inflation pressure.

### *UNLOADED CONDITION:*

Most tires are put into service at loads less than rated load. In order to maintain the design operating conditions (Static Load Radius) of the tire, the operating inflation pressure is adjusted accordingly. This adjustment is in direct proportion to the rated load and pressure.

*For example:*

| | |
|---|---|
| *Rated Load* | *= 30,100 lbs* |
| *Rated Pressure* | *= 180 psi* |
| *For a Maximum Operating Load* | *= 28,430 lbs* |
| *Operating Pressure Unloaded* | $= \frac{28{,}430 \times 180}{30{,}100} = 170$ *psi* |

### *LOADED CONDITION:*

Many inflation checks are made while the tire is mounted on the aircraft. Under loaded conditions, the measured pressure of the tire will be a value 4% greater than the unloaded pressure.

*Taking the example from above:*

| | |
|---|---|
| *Rated Load* | *= 30,100 lbs* |
| *Rated Pressure* | *= 180 psi* |
| *Rated Pressure Loaded= 180 x 1.04* | *= 187 psi* |
| *For a Maximum Operating Load* | *= 28,430 lbs* |
| *Operating Pressure Loaded* | $= \frac{28{,}430 \times 180 \times 1.04}{30{,}100} = 177$ *psi* |

### *PRESSURE/TEMPERATURE RELATIONSHIP*

The relationship between tire temperature and tire pressure is proportional. As the temperature of the tire increases, so will the pressure. The inverse is also true. When the tire temperature is reduced, the pressure will also reduce.

Assuming a constant volume, the relationship for degrees centigrade can be defined as follows:

New Pressure: $P = P_o \times \frac{(273 + t)}{(273 + t_o)}$

where: $P_o$= initial pressure of the tire in BARS or PSI
P= new pressure of the tire in BARS or PSI
$t_o$= initial tire temperature in °C
t= new tire temperature in °C




# Aircraft tire ratings

Thus, if a tire has an initial pressure of 10.5 bars at 15°C, the tire pressure at 30°C would be:

$$P = 10.5 \times \frac{(273 + 30)}{(273 + 15)} = 11.0 \text{ bars}$$

Assuming a **constant volume**, the relationship for degrees Fahrenheit can be defined as follows:

$$\text{New Pressure: } P = P_o \times \frac{(460 + T)}{(460 + T_o)}$$

where: $P_o$ = initial pressure of the tire in BARS or PSI
$P$ = new pressure of the tire in BARS or PSI
$T_o$ = initial tire temperature in °F
$T$ = new tire temperature in °F

The above calculations make the assumption that the volume of the tire remains constant over the range of temperature change. In reality, because a tire is an elastic body, the volume change can be sufficient to influence the pressure change. Michelin has found that as a general rule, a temperature change of 5°F (3°C) will result in a tire pressure change of approximately 1%.

## STATIC LOADED RADIUS

A civil aircraft tire is designed to operate at a specific deflection within its load rating capability.
For BIAS tires, the design rules, historically, have been to set overall new tire dimensions and to use the standard deflection (based on tire TYPE) with the result being the Static Loaded Radius (SLR) of the new tire.
For the RADIAL tire, the design parameter has been to specify the $SLR_G$ and the overall grown dimensions of the tire (after rolling). The actual, percentage deflection of a RADIAL tire may be different than its BIAS equivalent in order to achieve a specified SLR.
However, it is very possible that a new BIAS tire and a new RADIAL tire designed for the same application and stood, unloaded, side by side, would not be of the same overall diameter.



## HELICOPTER USE

When aircraft tires are used on helicopters, standard aircraft tire ratings are adjusted by a factor of 1.5 (both rated load and inflation).

The maximum allowable inflation pressure is 1.8 times the rated inflation pressure or 45% of the specified burst pressure, whichever is lower.

The maximum dimensions for new helicopter tires are 4% greater than the maximum aircraft tire dimensions when inflated to the 1.8 factor or 45% of burst inflation pressure. To calculate the maximum dimensions, apply the 4% factor to section height and section width of the tire only (deduct rim diameter).

## GROUND USE OF AIRCRAFT TIRES

Because of their apparent high-load capabilities, aircraft tire load ratings may appear attractive for ground vehicle applications. However, aircraft tires are designed specifically for aircraft tire service where high loads and deflections are acceptable because of the relatively short periods of ground roll and intermittent usage. When aircraft tires are inoperative, they have relatively long periods in which to dissipate the heat built up from landing, taxi and take-off operations.

AIRCRAFT TIRES SHOULD NOT BE USED FOR GROUND USE EXCEPT IN SPECIAL CASES WHERE THE INFLATION PRESSURES, SPEEDS, AND LOADS HAVE BEEN RELATED TO SERVICE CONDITIONS BY ENGINEERING ANALYSIS. For ground vehicle applications of aircraft tires, contact your Michelin representative.