METRO TIRE SERVICE MANUAL
&
TIRE REMOVAL GUIDE

April 2018

⚠WARNING

Tire and wheel servicing can be dangerous and must be done only by trained personnel using proper tools and procedures. Failure to read and comply with all procedures may result in serious injury or death to you or others.

⚠WARNING

Re-inflation of any type of tire and wheel assembly that has been operated in a run-flat or underinflated condition (80% or less of recommended operating pressure) can result in serious injury or death. The tire may be damaged on the inside and can explode during inflation. The wheel may be worn, damaged, or dislodged and can explosively separate.

Caution

Always follow tire manufacturer's recommendation for removal of tire from the system and Distance Limit» or «Limit of Course» (LOC) management as stated in the « Fiche usage letter ».

DEFINITION

1 – Definitions :

Distance Limit or Limit of course:
It is the maximum distance over which a tire can run before demounting and inspection.
When Distance Limit is reached, the tire must be dismounted and inspected regardless of its apparent condition. The respect of the Distance Limit is a key factor in ensuring the safety of the passengers. The Distance Limit of a given tire can be different between line applications (usage conditions effect).

Inspection or reform :
This is a process involving the examination tires removed from service a network. Tire examination results including the reason for removal from service (PMR), distance covered by the tire etc., must be furnished in the specified format. For each network, Michelin targets 100% examination removed from service of the tires. This means if a network removes from service 100 Michelin tires in a year the network must give Michelin the opportunity to examine all 100 of these Michelin tires.

2 – PMR guide:

This PMR guide is applicable where the distance between two tire inspections is 20.000 km /12.000 miles.

METRO PMR GUIDE

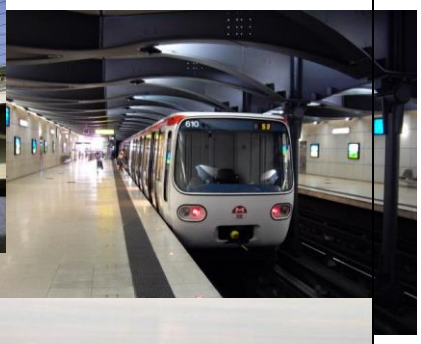
METRO TIRE REMOVAL REASONS (PMR)

April 2018- Edition-Visits frequency of 20.000 km / 12.000 miles

Metro Tire Removal Reasons (PMR)









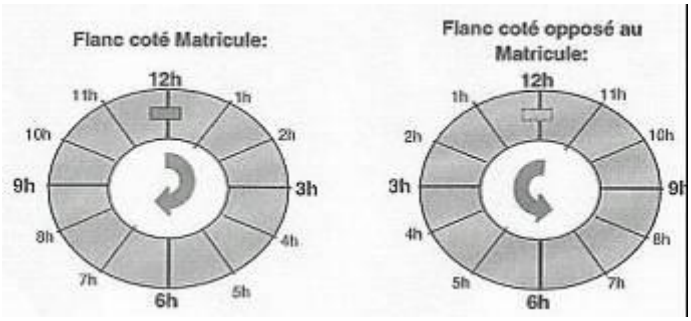





Size and location of damages

Understanding the magnitude to define the cause of the damage.

- The magnitude of the damage is expressed in millimeters, centimeters, inches, detail or in sector.
- A sector represents 1/12th of the tire as seen from entire sidewall.
- To locate the damage:
- Serial number side, the serial number is positioned at 12h, moving clockwise each sector represents 1 hour.
- Opposite to the serial number side, **maintain the direction of rotation,** and specify that the damage is **"Opposite serial number side"**

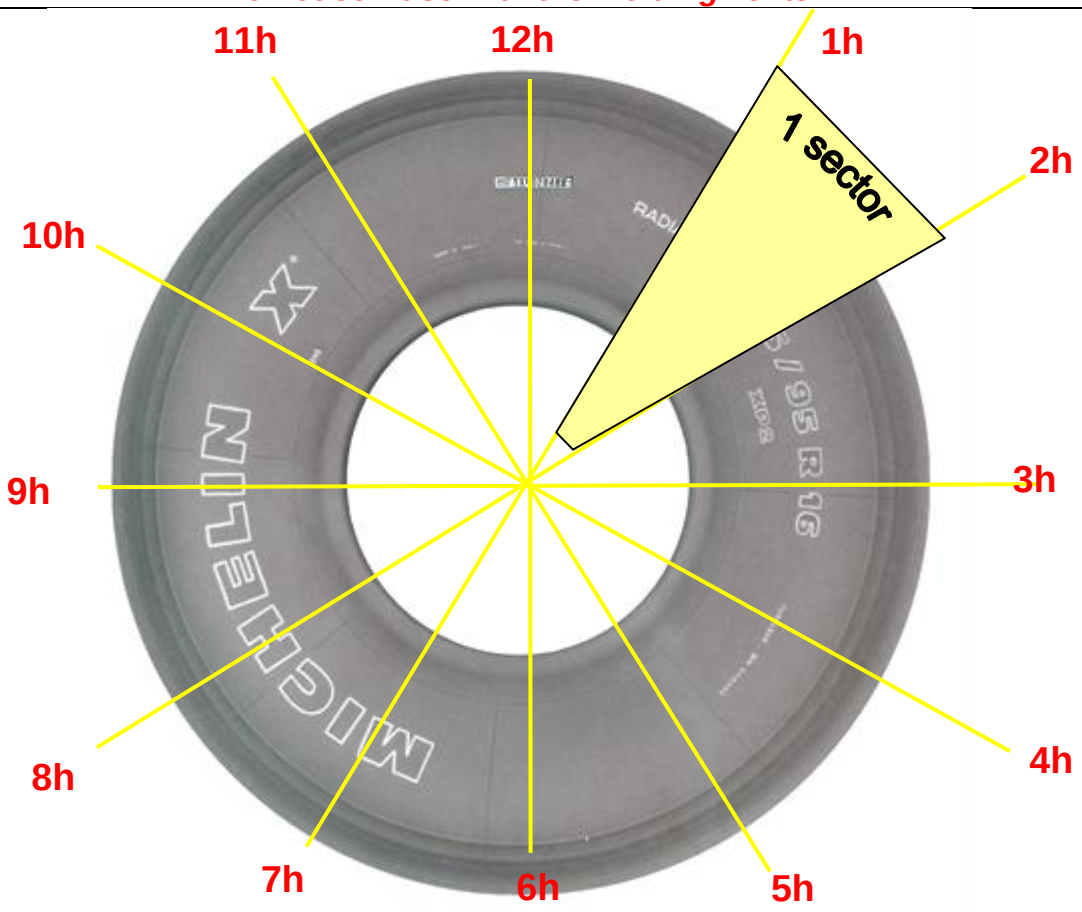


Serial number side / Opposite serial number side

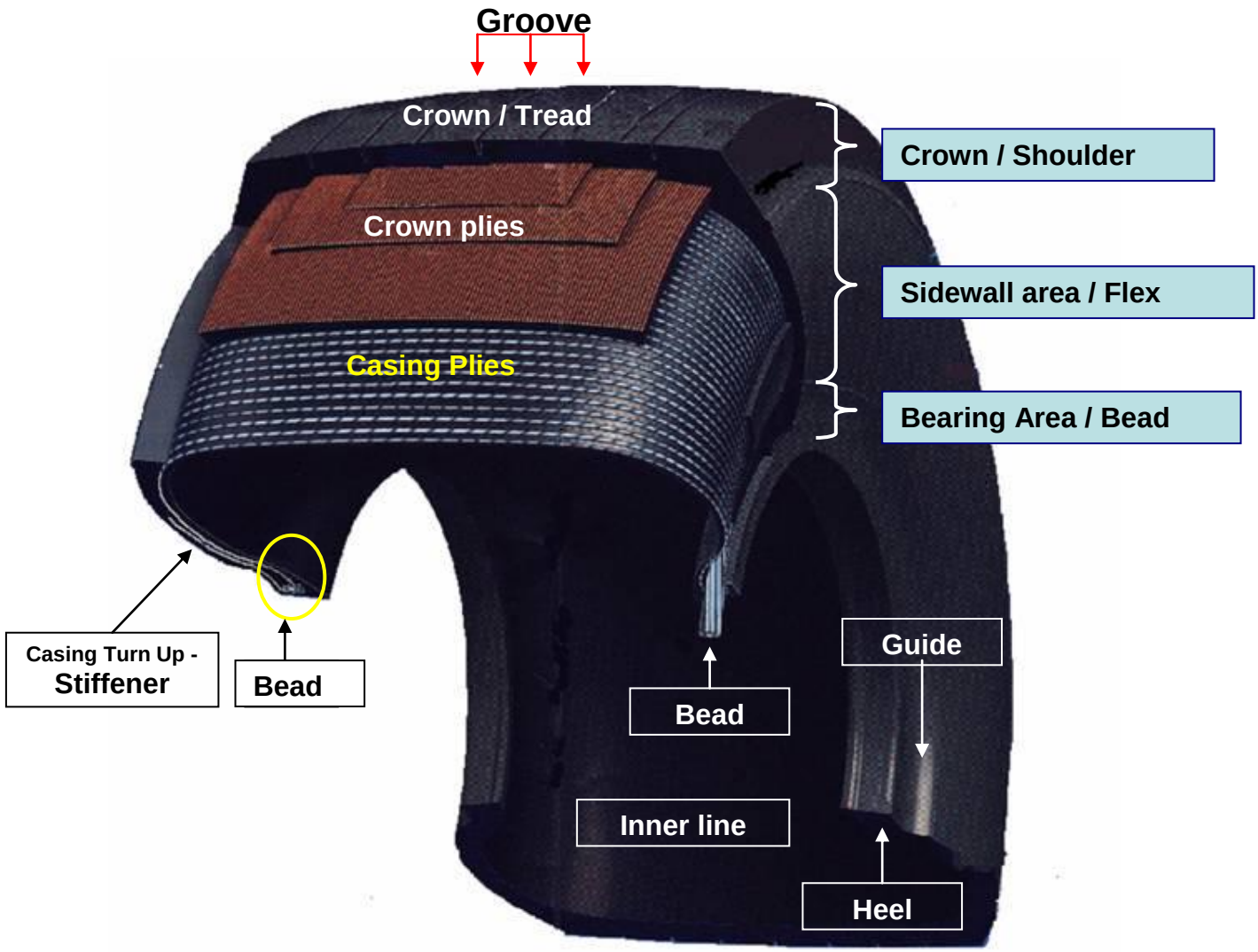
Example: Damage located starting at 1 h and ending at 2 h, will cover 1 sector.

Note : These sectors are not actually identified on the tire,

Do not confuse with the molding vents.



CROSS SECTION OF A METRO TIRE



TIRE REMOVAL REASONS

Tire removal definition and inspection codes.

The edition April 2018 cancels and supersedes the issue of March 2016 as well as previous issues.

The use of this manual is planned for inspection visits ***frequency of 20.000 km +/- 2.000 km (12.000 miles +/- 1.250miles) max.****.*

❑ TREAD:

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12	Cable break under the tread	11
13	Premature localized wear	12
14	Premature wear, entire tread	13
15	Abnormal or irregular wear	14-15
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❑ SIDEWALL AND SHOULDER:

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❑ BEAD AREA:

❑ MISCELLANEOUS:

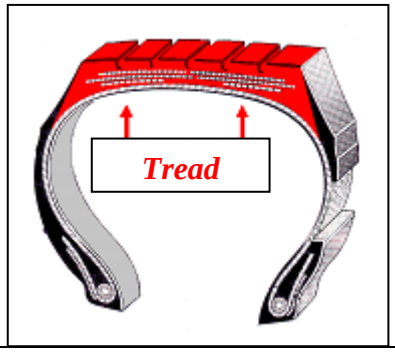
…/…

PMR no.10

DEFINITION:
Crown Separation

MANIFESTATION:
Deformation or abnormal wear localized on the tread

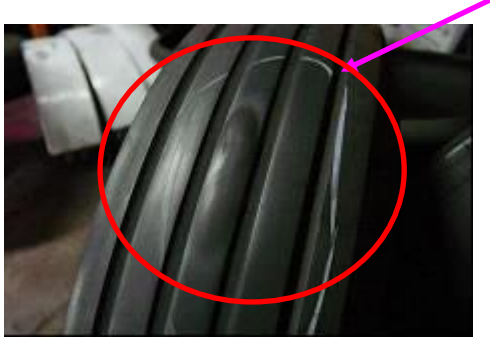
Area of the tire concerned:

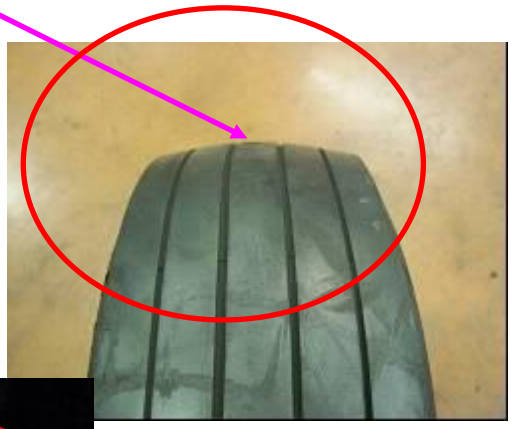


DECISION TO MAKE:
The tire has to be dismounted and scrapped when the damage appears

DAMAGE ILLUSTRATION

Tread bulge





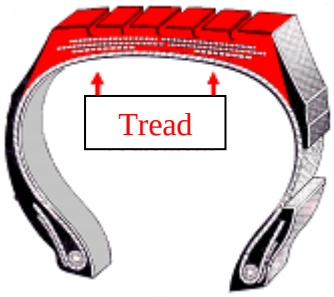
…/…

PMR no.12

DEFINITION:
Cable break under the tread

MANIFESTATION:
Appearance of cable on the tread.
This damage is usually related to a crown shock or a progression of crown separation (PMR 10).

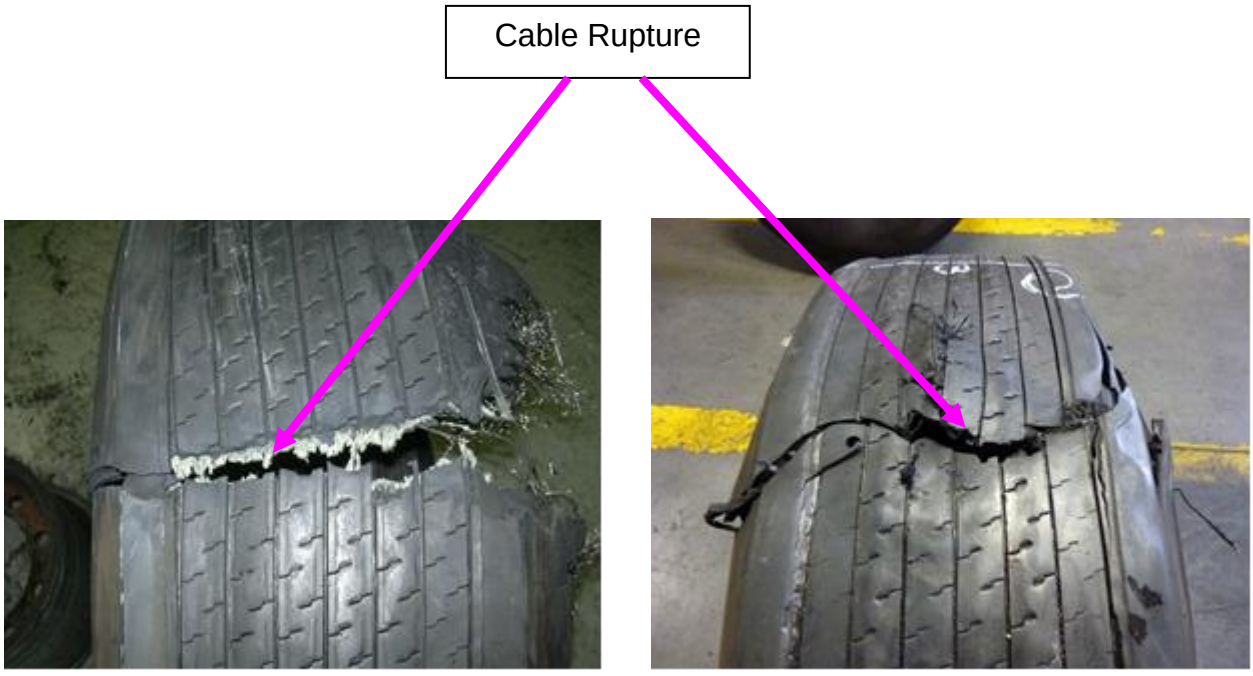
Area of the tire concerned:



DECISION TO BE TAKEN:

The tire has to be removed and scrapped when the damage appears

DAMAGE ILLUSTRATION



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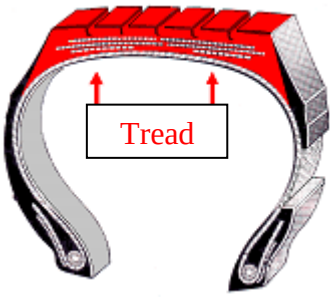
PMR no.13

DEFINITION:
Premature localized wear

MANIFESTATION:
Rapid wear at abnormal low mileage. This wear is generally causes by an incident.

Area of the tire concerned:



DECISION TO BE TAKEN:

Tire has to be removed from service for the following cases:

- Reaching wear indicator on the shoulder at a sector.
- Longitudinal disappearances of a tread groove on a sector (see PMR 15, page 14 and 15).
- Minimum tread depth " limits as per the network on a case by case basis"

Removal from service in all cases will be done prior to the appearance of the crown belts.

DAMAGE ILLUSTRATION

Localized wear





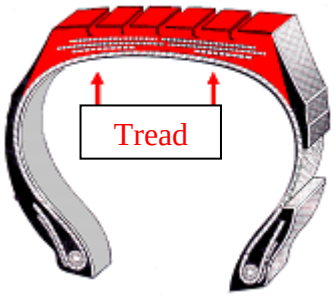
…/…

PMR no.14

DEFINITION:
Premature wear, entire tread.

MANIFESTATION:
Disappearance of the tread groove.

Area of the tire concerned:



DECISION TO MAKE:
Tire must be removed for the following cases:

- Reaching wear indicator on the shoulder at a sector.
- Disappearance of a groove on a sector (see illustration page 15).
- Minimum tread depth " limits as per the network on a case by case basis"

Removal from service in all cases will be done prior to the appearance of the crown belts.

DAMAGE ILLUSTRATION

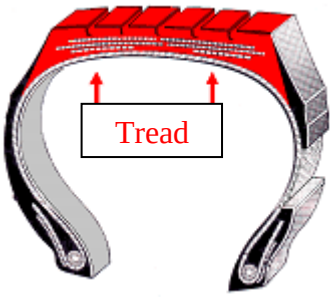
Complete disappearance of 2 grooves

PMR no.15

DEFINITION:
Abnormal or irregular wear

MANIFESTATION:
Uneven wear (Scallop and Cupping wear).

Area of the tire concerned:



DECISION TO MAKE:

Tire must be removed for the following cases:

- Reaching wear indicator on the shoulder
- Disappearance of a groove (see illustration page 15).
- Minimum tread depth " limits as per the network on a case by case basis"

Removal from service in all cases will be done prior to the appearance of the crown belts.

ILLUSTRATION OF THE DAMAGE

Irregular wear

Rail wear and diagonal wear

PMR no.15(next).

DAMAGE ILLUSTRATION

Wear indicator at the shoulder is defined according to the tread design:

- by a shoulder rib
- by a sacraficial rib

DISMOUNTING INSTRUCTIONS

Reaching the shoulder rib on more than 1 sector.

Reaching the bottom of the sacrificial rib

Disappearance of the sacrificial rib

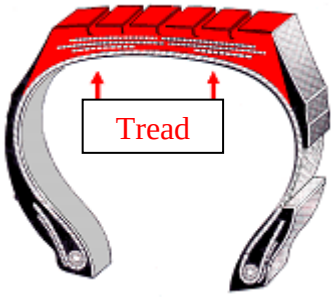
…/…

PMR no.18

DEFINITION :
Splits at the base of the tread pattern

MANIFESTATION:
Split in the rubber compound

Area of the tire concerned:



DECISION TO BE TAKEN :
The tire must be removed and scrapped when the splits reach the crown plies or at a depth equal or greater than 3 mm (1/8 inch).

DAMAGE ILLUSTRATION

…/…

PMR no.20

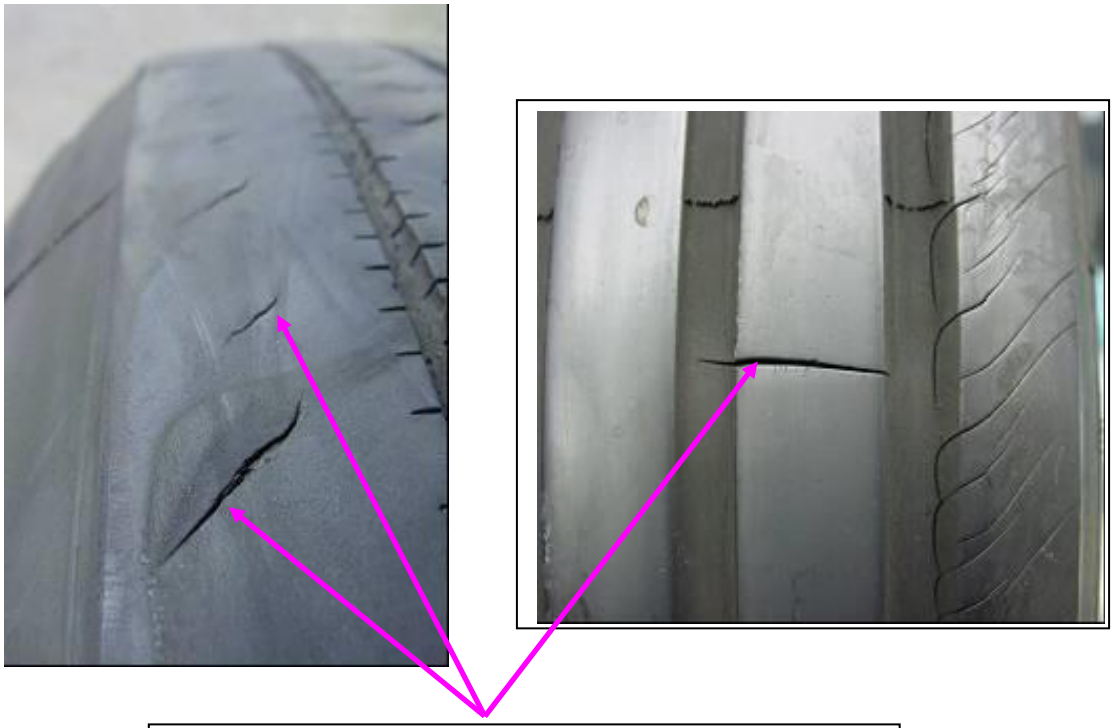
DEFINITION :
Splits other than at the base of the tread pattern.

MANIFESTATION:
Splits propagating in the transversal or longitudinal direction.

Area of the tire concerned:

DECISION TO BE TAKEN :
The tire must be removed and scrapped when the splits reach the crown plies or at a depth equal or greater than 10 mm (0.5 inch)

DAMAGE ILLUSTRATION



Transversal splits on the tread

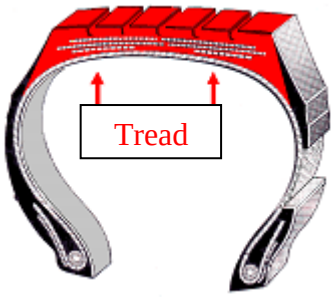
…/…

PMR no.21

DEFINITION :
Localized detachment of tread pattern.

MANIFESTATION:
Detachment of the tread pattern.

Area of the tire concerned:



DECISION TO BE TAKEN :
Tire must be removed and scrapped as soon as the damage appears.

DAMAGE ILLUSTRATION

Total detachment

Partial detachment

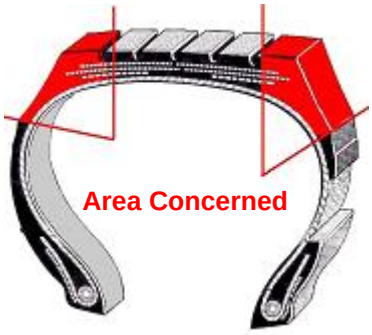
…/…

PMR no.30

DEFINITION :
Separation at the shoulder.

MANIFESTATION:
Deformation or opening of the rubber in the upper shoulder area.

Area of the tire concerned:



DECISION TO BE TAKEN :

Tire must be removed and scrapped:

- **As soon as the damage appears in the steel crown plies.**

10 R 22,5 X Metro, 2.00R15 X Metro,305/70R 22,5 X Metro HD, 305/75R 20 XPMA XPMC, 315/95R16 XP2 et XP3 / 345/85R16 XP2, 390/75R 16 X Metro, 495/45R 22,5 X One Metro.

- **As soon as the damage reaches a deformation of 80 mm (3 inches) or an opening for textile crown plies:** A maximum of 3 occurrences of damage below these tolerances is acceptable on either side of the tire.

DAMAGE ILLUSTRATION

Shoulder deformation

Shoulder opening

PMR no.31

DEFINITION :
Circumferential separation between tread and sidewall rubber in the shoulder area.

MANIFESTATION:
Circumferential opening in the upper sidewall area.
This damage may manifest itself by more or less important separations.

Area of the tire concerned:

DECISION TO BE TAKEN :
Tire should be removed and scrapped when the depth of the separation reaches 10 mm (0.5 inch).

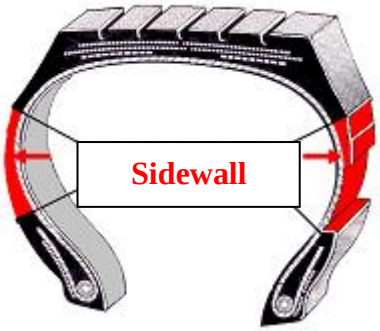
DAMAGE ILLUSTRATION

PMR no.32

DEFINITION :
Radial break on the sidewall

MANIFESTATION:
Irregular opening of the sidewall rubber.
Not to be confused with PMR41

Area of the tire concerned:



DECISION TO BE TAKEN :

Tire should be removed and scrapped as soon as the damage appears.

DAMAGE ILLUSTRATION

…/…

PMR no.34

DEFINITION :
Deformation of the sidewall

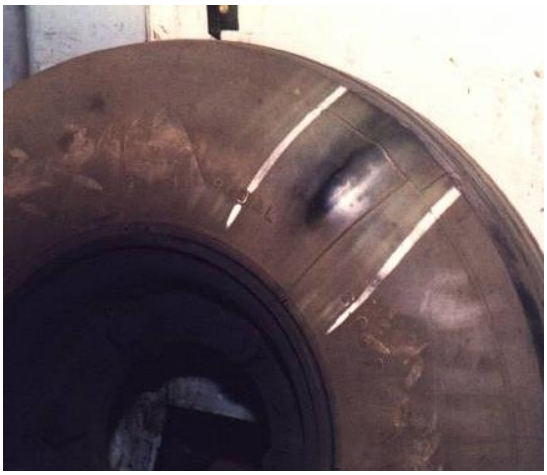
MANIFESTATION:
Radial deformation of the rubber.

Area of the tire concerned:

DECISION TO BE TAKEN :

- For the load tires, it should be removed and scrapped as soon as the damage appears.
- For the guide tires, it should be removed and scrapped when the deformation reaches **4 mm** (1/8 inch) in magnitude.

DAMAGE ILLUSTRATION



…/…

PMR no.35

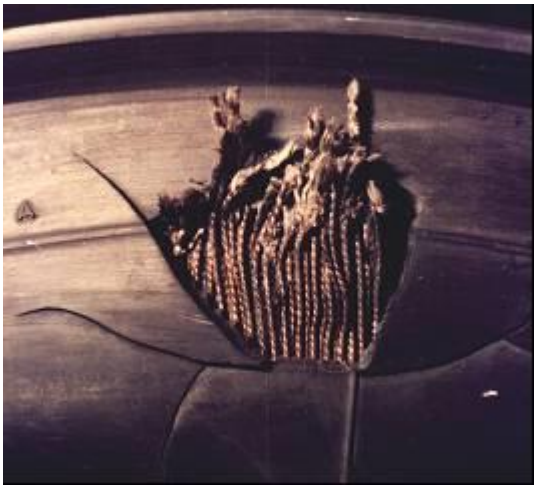
DEFINITION :
Sidewall rupture

MANIFESTATION:
Casing rupture in a star or circumferential shape.
Tire rupture due to a driving under pressure.

Area of the tire concerned:

DECISION TO BE TAKEN :
Tire should be removed and scrapped as soon as the damage appears.

DAMAGE ILLUSTRATION



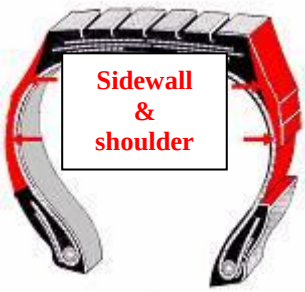
…/…

PMR no.36

DEFINITION :
Blistering of the sidewall

MANIFESTATION:
The damage may be caused by air infiltration due to breaks of the interior rubber.

Area of the tire concerned:



DECISION TO BE TAKEN :
The tire should be removed and scrapped as soon as the damage reaches 3 cm or 1.2 inches (length and/or width).

DAMAGE ILLUSTRATION

Sidewall air pocket

…/…

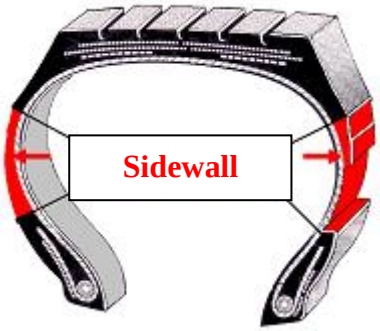
PMR no.41

DEFINITION :
Opening of the sidewall rubber at the joint

MANIFESTATION:
Oblique beveled opening of the sidewall rubber with a smooth aspect.
Not to be confused with:

- a cut : PMR 75
- a break: PMR 32

Area of the tire concerned:



DECISION TO BE TAKEN :

The envelope has to be dismounted and reformed as soon as this damage presents a depth greater than 1 mm (1/16 inches) and a length greater than 100 mm (4 inches).
As soon as the PMR is visible, an inspection of all the tires has to be done by a tire expert.

DAMAGE ILLUSTRATION

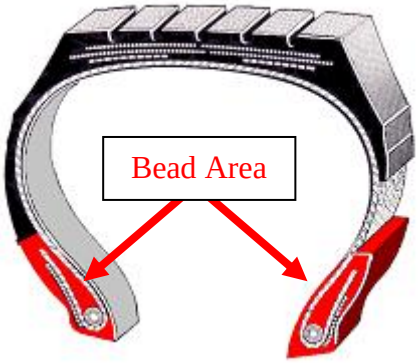
…/…

PMR no.50

DEFINITION :
Sidewall rubber separation in the guide rib area

MANIFESTATION:
Separation between the rubber compounds. No wires are visible.
Not to be confused with PMR 54.

Area of the tire concerned:



DECISION TO BE TAKEN :
Tire should be removed and scrapped when the damage extends more than 1 sector.

DAMAGE ILLUSTRATION

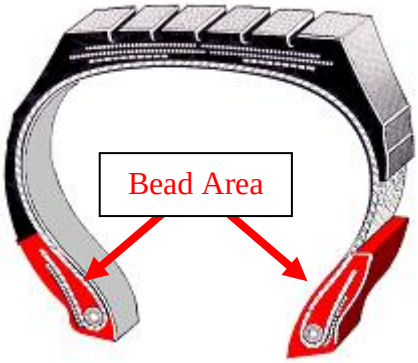
…/…

PMR no.51

DEFINITION :
Oblique opening of the protective rubber at the joint

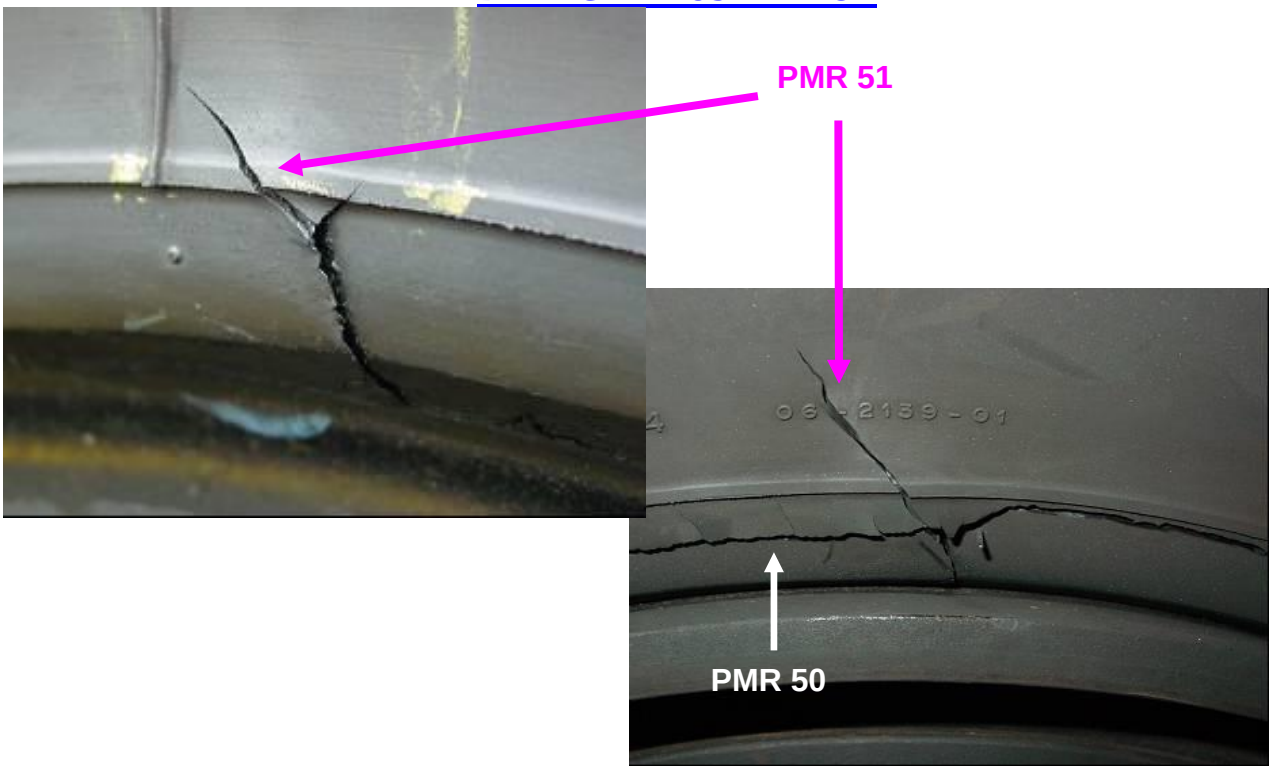
MANIFESTATION
Oblique opening of the rubber under and above the guide rib.

Area of the tire concerned:



DECISION TO BE TAKEN :
Tire should be removed and scrapped when the opening extends beyond the guide rib or when PMR 50 is greater than 50mm (2 inches) is associated with PMR 51.

DAMAGE ILLUSTRATION



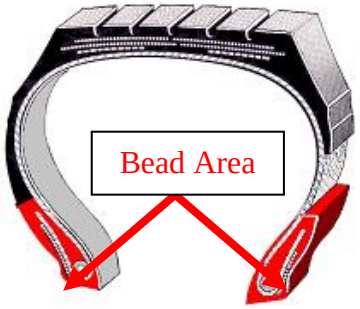
…/…

PMR no.54

DEFINITION :
Separation of the casing ply at the turn-up

MANIFESTATION:
Presence of bumps or circumferential openings in the guide rib area. Metallic wires may be apparent in the opening.

Area of the tire concerned:

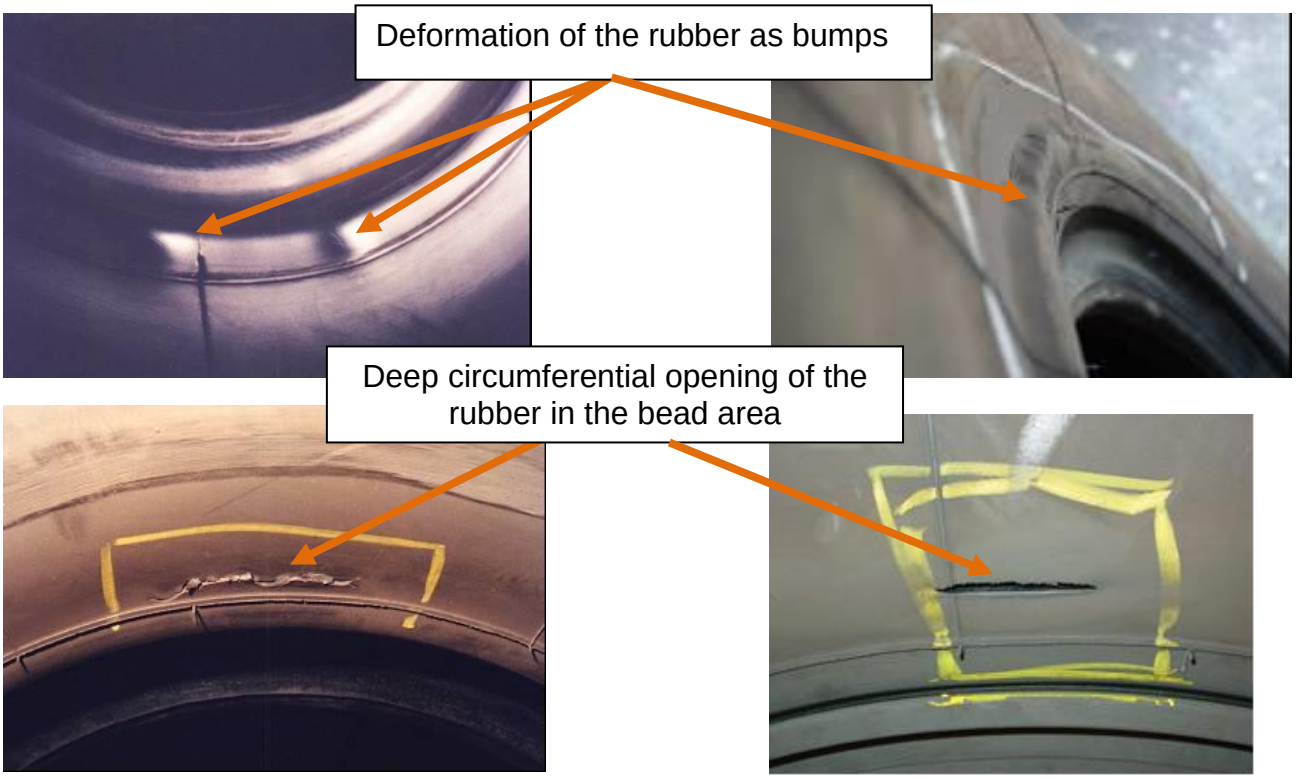


DECISION TO BE TAKEN :

Tire should be removed and scrapped :

- As soon as the damage appears (deformation) for the 10R22.5
- Where the deformation of the rubber bumps is greater than 1 sector for the following tires 16, 20 22 and 22,5 inches.
- **As soon as a circumferential break of the rubber appears.**

DAMAGE ILLUSTRATION

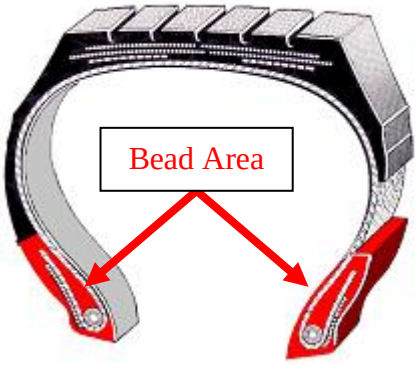


PMR no.55

DEFINITION :
Split of the protective rubber in the bearing area

MANIFESTATION:
Circumferential split of the rubber in the bearing area.
Metallic wires may be apparent in the opening.

Area of the tire concerned:



DECISION TO BE TAKEN :
The tire must be removed and scrapped as soon as the split is apparent.

DAMAGE ILLUSTRATION

Circumferential split in the bearing area

…/…

PMR no.60

DEFINITION:
Tire removal from service due to the age limit. (Identified by the DOT)

MANIFESTATION:
Tires Guides: The maximum age of a tire Guide tire is 13 years from date of manufacture (DOT date), to include a maximum of 10 years of total in service usage.
Example: 4 years of storage allows 9 years of maximum in service use.
Tires Load: The maximum age of a load tire is 10 years, from the DOT date, and no more 6 years maximum in service usage

DECISION TO BE TAKEN :
The tire concerned must be removed from service before the defined age limit.

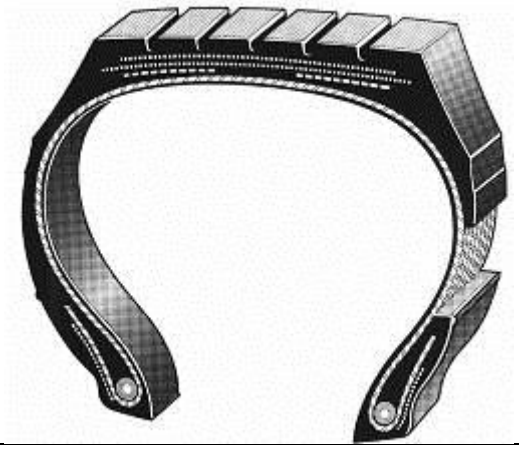
DAMAGE ILLUSTRATION

This tire was made in 10st week of 2012

PMR no.70

DEFINITION :
Removal of the tire by user decision

MANIFESTATION:



DECISION TO BE TAKEN :
The tire is removed and/or scrapped upon user's request.

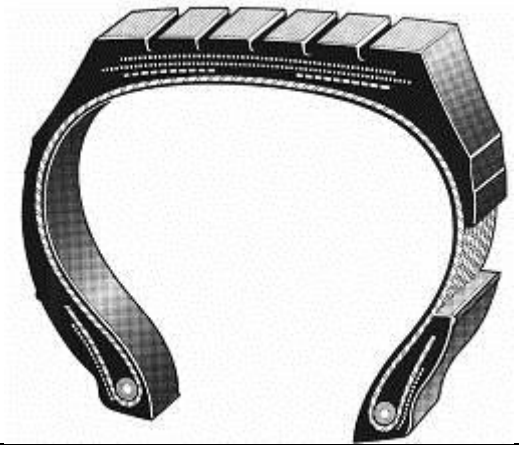
ILLUSTRATION OF THE DAMAGE

Example:
The tire is removed from service by the user for multiple reasons. (Vehicle maintenance, etc.)

PMR no.71

DEFINITION :
Tire removal at the Manufacturer's request

MANIFESTATION:



DECISION TO BE TAKEN :
The tires will be removed from service before end of defined service life.

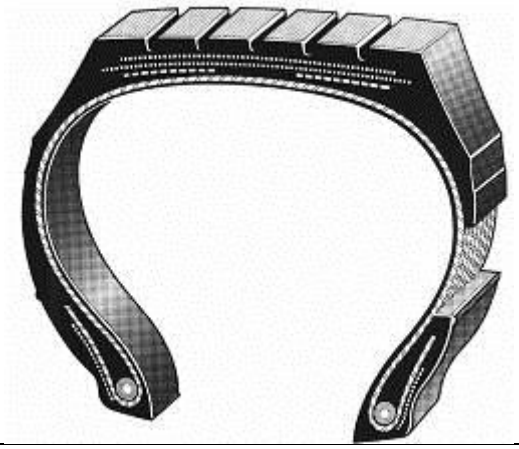
DAMAGE ILLUSTRATION

…/…

PMR no.72

DEFINITION :
End of defined service life

MANIFESTATION:
The tire has reached the defined maximum mileage.



DECISION TO BE TAKEN :
The tires that have reached the maximum defined mileage by Michelin will be removed from service and scrapped..

Defined Mileage

- A metro tire generally wears slowly however it is exposed to severe fatigue.
- Inflation pressures are very high.
- Deformation related to the flexing of the tire under load is severe and creates internal wear that is not visible by external inspection.
- The evaluation of the fatigue level of the tires is obtained from internal Michelin expertise based on the characteristics of new tires.
- The result of the expertise makes it possible to determine a possible maximum mileage which corresponds to the end of service life.

Important :

➔ **The level of fatigue related to the defined mileage cannot be detected by a visual inspection.**

➔ **The defined mileage is unique to each network.**

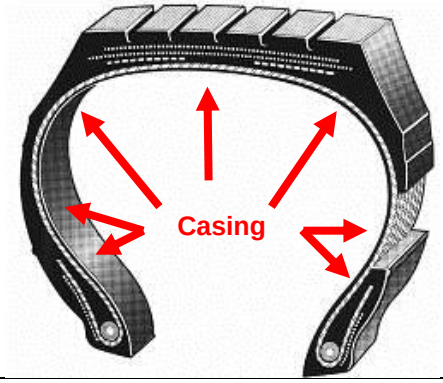
➔ **Based on analysis and historical performance, metro tires can experience endurance issues as a result of prolonged tire use, heavier loads, and fatigue.**
As a result, all tires removed from service (reformed tires) are to be classified as scrap.

PMR no.73

DEFINITION :
Rolling with insufficient pressure

MANIFESTATION:
Air pressure lost detected.

Area of the tire concerned:



DECISION TO BE TAKEN :
The tire must be removed and scrapped when the detected air loss is greater than **2 bars (30psi) or 20%** from the recommended air pressure**.**

DAMAGE ILLUSTRATION

…/…

PMR no.75

DEFINITION:
Puncture or cut by a foreign body.

MANIFESTATION:
Puncture or cut.

Area of the tire concerned:

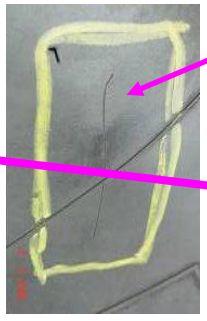
DECISION TO MAKE:
The tIre must be removed and reformed

- **At the top, on the tread**:
  - ✓ when the cut reaches the plies or a depth of **10 mm max**.
- **At the top, at the bottom of the design**:
  - ✓ when the cut reaches a depth of **3 mm (0.1 inch) max**.
- **On the shoulder** when depth reaches **1 centimeter (0.4 inch)**.
- **On the sidewall, upon appearance** of the damage.
- ***They cannot be repaired (it would weaken its structure),***

ILLUSTRATION OF THE DAMAGE


When the cut reaches the belt


At the shoulder when depth reaches 1 centimeter (0.5 inch)



On the sidewall, when damage appears, **DO NOT TO CONFUSE with CUT and SCRATCH**, those being surface, or at the time of repeated mechanical aggressions.
Here with the safety wheel.

…/…

PMR no.76

DEFINITION :
Deterioration due to electrical arc

MANIFESTATION:
Change of aspect, and/or degradation of the rubber or belts from burning.

Area of the tire concerned

DECISION TO BE TAKEN :
Tire must be removed and scrapped as soon as the damage appears.

DAMAGE ILLUSTRATION


Sidewall and Crown Area load bearing tire


Sidewall with a bluish aspect


Damage on the sidewall of the tire l

…/…

PMR no.81

DEFINITION :
Dislocation due to run flat

MANIFESTATION:

- Sidewall casing deformation
- Lifting of the inner liner rubber
- Radial splits on the inner liner and sidewall in numerous points.
- Separation between the casing and the crown.

Area of the tire concerned:

DECISION TO BE TAKEN :

Tire must be removed and scrapped as soon as the damage appears.

DAMAGE ILLUSTRATION

Radial splits on the inner liner

Separation between the casing and the crown

…/…

PMR no.82

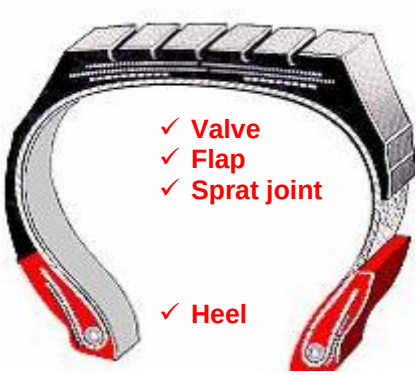
DEFINITION :
Mismount

MANIFESTATION:
Air loss less than 2 bars (30 psi)

POSSIBLE CAUSES :

- Load Bearing Tire:leak caused by the wrong positioning of the SPRAT seal.
- Guide Tire :
  - ✓ Flap in poor condition or creased at mounting.
  - ✓ Creased tube.
  - ✓ Wrong positioning of the valve at mounting.

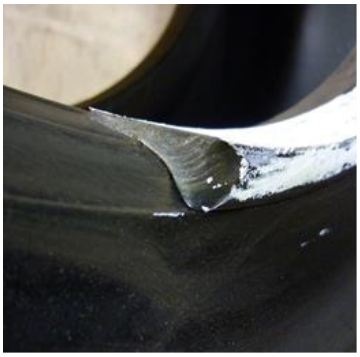
Area of the tire concerned:



DECISION TO BE TAKEN :

- Tire is removed and scrapped if deterioration is apparent or a lost of air greater than 2 bar (30psi).
- Replace deteriorated elements.

DAMAGE ILLUSTRATION



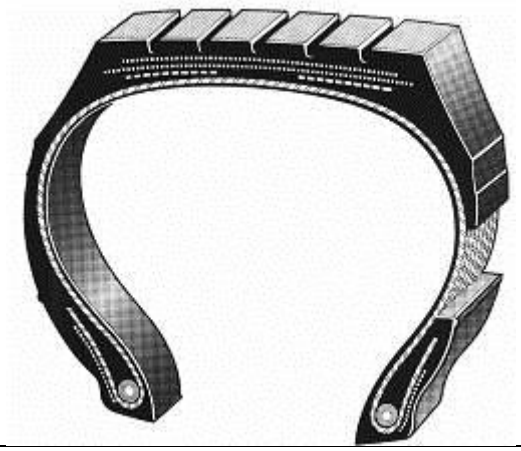
Assembly conforms of the joint SPRAT and SPRAT seal deformed on Load Bearing tire to be scrapped

Tire deteriorated during the assembly

PMR no.83

DEFINITION :
Removal of a tire for inspection

MANIFESTATION:



DECISION TO BE TAKEN :
Tire removed from service for technical inspection in agreement with the User.

DAMAGE ILLUSTRATION

…/…

PMR no.86

DEFINITION :
Deterioration due to chemical damage

MANIFESTATION:
Softening and possible deformation of the rubber in the concerned area.

Area of the tire concerned:

DECISION TO BE TAKEN :
Tire must be removed and scrapped as soon as the damage appears.

DAMAGE ILLUSTRATION

Deformed area and appearance of grease

…/…

PMR no.96

DEFINITION :
Separation of a repair after curing

MANIFESTATION:
Elliptical aspect separation of the repair rubber, generally situated in the lower portion of the sidewall.

Area of the tire concerned:

DECISION TO BE TAKEN :
The tire must be removed and scrapped as soon as the damage appears

DAMAGE ILLUSTRATION

…/…

PMR no.97

DEFINITION:
Removal of non-classifiable damage

MANIFESTATION:

Area of the tire concerned:

DECISION TO BE TAKEN:

DAMAGE ILLUSTRATION

…/…

PMR no.99

DEFINITION :
Pending code, covers tires and/or tire assemblies that have been stored for a detailed inspection or for a specific case.

MANIFESTATION:

Area of the tire concerned:

DECISION TO BE TAKEN :
The tire will be scrapped upon Michelin's decision with the agreement of the User.

DAMAGE ILLUSTRATION

…/…

Evolution of the PMR manual

Issue reference:

The edition of April 2018 cancels and supersedes the issue of March 2016 as well as previous issues.

Generalities on evolutions included:

In a general way the modifications in this Edition is aimed at :

- To update the Edition with necessary information, to multiply the photographic illustrations.
- To adapt the recommendations based on usage experience and feedback from the networks.

Evolutions brought in the edition.

- PMR 13-15-41-54-82-86 new photographic illustrations
- Reprise “Definitions” or “Decision to be taken” PMR 14-60-75-97.

IMPORTANT: BE SURE TO READ THIS SAFETY INFORMATION.

Make sure that everyone who services tires or vehicles in your operation has read and understands these warnings.

SERIOUS INJURY OR DEATH CAN RESULT FROM FAILURE TO FOLLOW SAFETY WARNINGS.

No matter how well any tire is constructed, punctures, impact damage, improper inflation, improper maintenance, or service factors may cause tire failure creating a risk of property damage and serious or fatal injury.
Michelin recommends strongly that the employer provide a program to train all employees who service wheels in the hazards involved in servicing those wheels and the safety procedures to be followed. The employer should ensure that no employee services any wheel unless the employee has been trained and instructed in correct procedures of servicing the type of wheel being serviced, and should establish safe operating procedures for such service.

Based on analysis and historical performance, metro tires can experience endurance issues as a result of prolonged tire use, heavier loads, and fatigue. As a result, all tires removed from service are to be scrapped.

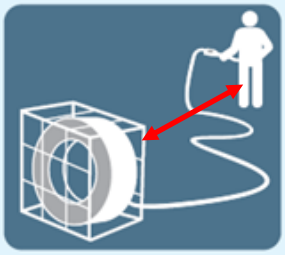
Metro tires cannot be retreaded.
They are not "REGROOVABLE"
They cannot be repaired (which would weaken the structure).
It is forbidden to re-use a Metro tire once dismounted from its rim, and it is forbidden to be remounted regardless the condition of the tire.

Always use a safety device such as an inflation cage or other restraining device that will constrain all wheel components during an explosive separation of a multi piece wheel, or during the sudden release of the contained air of a single piece wheel that is in compliance with OSHA (Occupational Safety and Health Administration) standards. Do not bolt restraining device to the floor. Never stand over a tire or in front of a tire when inflating. Always use a clip-on valve chuck with an in-line valve with a pressure gauge or a pre settable regulator. Additionally, ensure there is a sufficient length of hose between the clip-on chuck and the in line valve (if one is used) to allow the service technician to stand outside the trajectory path when Inflating. Trajectory zone means any potential path or route that a wheel component may travel during an explosive separation, or the sudden release of the pressurized air, or an area at which a blast from a single piece wheel may be released. The trajectory may deviate from paths that are perpendicular to the assembled position of the wheel at the time of separation or explosion.

REGROOVING
Prohibited

RETREADING
Prohibited

REUSE
Prohibited



3 m (10 ft)

With inflation cage

Follow the maker's instructions. The cage must be placed in a clear area.

Always use a tire inflation cage

Tire Repair
Prohibited

Note: Please contact a Government-Approved waste tire management company for Metro tire disposal.

IMPORTANT INFORMATION ON MOUNTED TIRES WHILE NOT IN USE

- If the cars are being stored (not in use) for more than 6 months, it is recommended that one of two requirements is applied:
  - The cars are supported with tires not in contact with the ground (unloaded): inflated with a maximum pressure of 15 psi (1bar) with nitrogen.
  - The cars are supported by the tires (loaded) : tires should be inflated to 123 psi and each car should travel for at least 10 hrs during each month of storage.

- Important: If the car storage duration without running exceeds 6 months, a technical expertise by a Michelin Field Engineer on at least 2 of the tires from the car is imperative before running the tires in commercial use.

IMPORTANT INFORMATION ON THE LIMIT OF COURSE (LoC)

- The Limit of Course (LOC) set in km for the maximum usage of the tire has been defined from a technical analysis by Michelin. Tires must be removed when the LoC has been achieved. LoC can be different based on the different applications and is validated always by Michelin in the Fiche Usage letter.

- With any proposed evolution of the usage conditions that are defined in the Fiche usage letter, the LoC must be reevaluated by Michelin and, if needed, will be updated. The updated LoC (higher or lower) must be respected as noted above.
  - A Network operator can request for a revision of LoC through the Michelin Field Engineer.
  - An analysis of the request will be made by Michelin (studies may be required).

TIRE INFLATION GUIDE:

WARNING: Tyre and rim servicing can be dangerous and must be done only by trained personnel using proper tools and procedures. Failure to read and comply with all procedures may result in serious injury or death to you or others. Re-inflation of any tyre and rim assembly that has been operated in a run-flat or underinflated condition (80% or less of recommended operating pressure) can result in serious injury or death. The tyre may be damaged on the inside and can explode while you are adding air. The rim parts may be worn, damaged or dislodged and can explosively sepa

WARNING: Any inflated tyre mounted on a rim contains explosive energy. The use of damaged, mismatched or improperly assembled tyre/rim parts can cause the assembly to burst apart with explosive force. If you are struck by an exploding tyre, rim part or the air blast, you can be seriously injured or killed.

WARNING: Re-assembly and inflation of mismatched parts can result in serious injury or death. Just because parts fit together does not mean that they belong together. Check for proper matching of all rim parts before assembly. Mismatching tyre and rim components is dangerous. A mismatched tyre and rim assembly may explode and can result in serious injury or death. This warning applies to any combination of mismatched components and rim combinations. Never assemble a tyre and rim unless you have positively identified and correctly matched the parts.

Welding

Wheels or rims should not be repaired by welding. If a welding operation has to be undertaken, the tyre must be removed from the rim. If this is not done, there is a serious risk of explosion. The tyre should only be refitted when all items have returned to ambient temperature. Before any welding on the vehicle chassis or at proximity of the tyres, the tyre and wheel assemblies should be removed from the vehicle.

Tyre Inspection

A visual inspection of a previously used tyre should always include a thorough inspection of both sidewalls and innerliner, as this may reveal any potential damage condition that would cause the tyre to become scrap. Examine the innerliner for creases, wrinkling, discoloration or insufficient repairs, and examine the exterior for signs of bumps or undulations, as well as broken cords.

WARNING: Never inflate or re-inflate any tyres that have been run underinflated or flat without careful inspection for damage, inside and out.

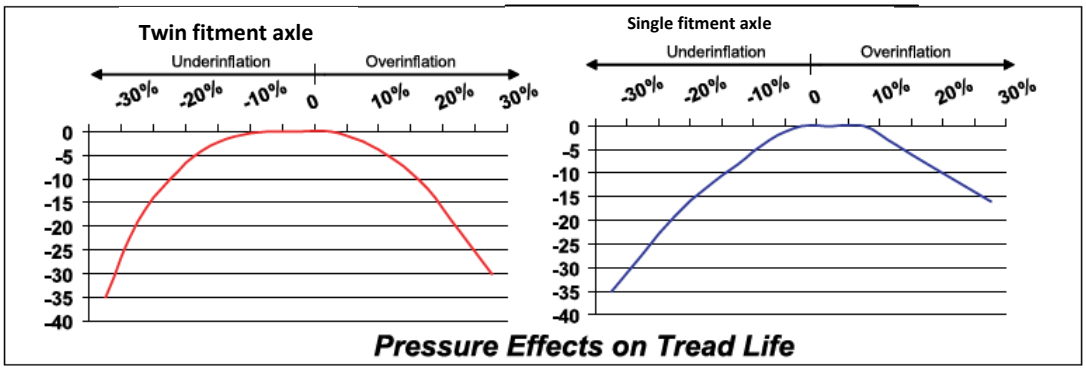
Never bleed air from hot tyres.

Additionally, altitude can have a slight effect on air pressure. For every 300 meters increase in altitude above sea level, air pressure will increase approximately 1.2 psi.

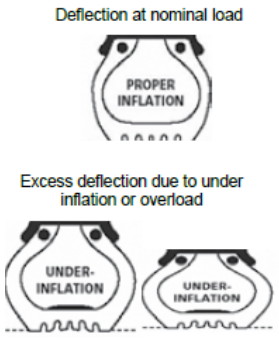
Follow the tire manufacturer's recommendation for air pressure. Adjust if needed for high altitude

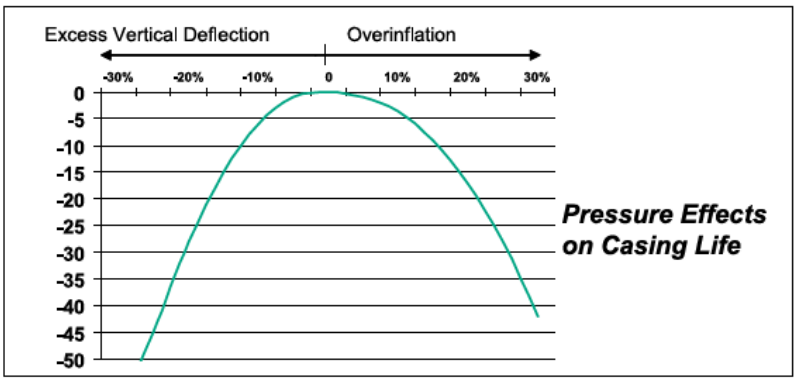
Inflation Pressure

The most critical factor in tyre maintenance is proper inflation. No tyre or tube is completely impervious to loss of air pressure. To avoid the hazards of under inflation, lost-air must be replaced. Inflation pressure has a direct impact in tyre performance - both tread life and endurance - as shown in the following charts :

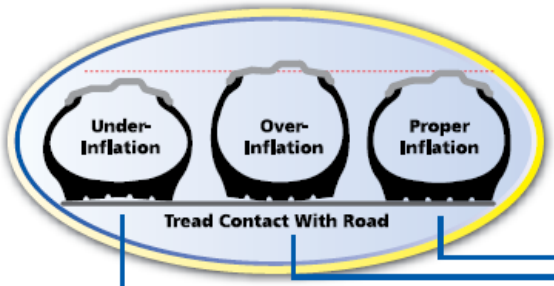


Pressure Effects on Tread Life





Pressure Effects on Casing Life



UNDERINFLATION
Causes abnormal tyre deflection, which builds up heat and causes irregular wear. Similar to the rim being too wide.

OVERINFLATION
Causes tyre to run hard and be more vulnerable to impacts. It also causes irregular wear. Similar to the rim being too narrow.

PROPER INFLATION
The correct profile for full contact with the road promotes traction, l **track** capability and safety.

Underinflation has an impact:

- on safety
- on reducing the casing's endurance thus **reducing casing life**
- increases the tyre's rolling resistance leading to **energy consumption increase**
- the behavior of the vehicle

Overinflation has a negative effect on:

- tyre life especially for drive wheels
- crown aggression sensitivity - stone cutting, shock rupture
- comfort
- grip
- casing endurance

Check inflation pressures on all tyres at least once a week, including spares, before driving when tyres are cold, especially when vehicle is used by more than one driver. The ideal time to check tyre pressures is early morning. Driving, even for a short distance, causes tyre to heat up and air pressures to increase. As a tyre rotates during operation, heat is generated inside which raises the internal pressure. During the first hour of operation, the tyre will gradually reach a point of equilibrium where the internal heat generation slows and is countered by the natural cooling of the tyre by the airflow around it.

Always inspect valve stems for proper installation, torque and verify there is a good airtight seal by use of a leak detector type spray such as a water/soap solution-applied from a spray bottle. It is also a good practice to periodically check existing fitments for slow leaks with this method.

Leaking Valve

Remember, a drop in ambient temperature results in a drop in tyre pressure. More frequent checks may be required during cold weather conditions. Avoid outdoor air pressure checks when the temperature is below freezing. Ice can form in the valve stem thus promoting leaks. Check inside a heated facility if possible.

Recommended STORAGE CONDITIONS for TIRES

General Conditions

- Warehouses have closed and covered areas which permit the protection of tires against atmospheric factors.
- When selecting a storage site, it should not be an area that is exposed to smoke, electrical radiation, chemical exposure or noxious gases.
- The tires should be clean during storage (no water, dirt, ice, etc.)

Floors

- Floors must be clean, smooth, and without a rough texture (minimizing the possibility to damage the products). They should also be free from any powdery material or pollutant (oil, grease, hydrocarbons, etc.).
- Storage in direct contact with untreated concrete (unsealed) or asphalt floor is not recommended
- Clay ground surface is not authorized for the storage of metro products.
- Storage on grass is also prohibited.

Walls / Roof

- The walls should be smooth to avoid product damage.
- The joints on the roof and walls must be properly sealed and watertight.
- Tire storage should not be in zone where there are water leaks.

Lighting

Artificial light:

- The recommended lighting systems are those which do not generate ozone or smallest possible quantity of
  Ozone.

Natural light:

- Tires should be protected from UV radiation by protective materials such as:
- **Standard glass** with protection by :
  - Acrylic paint (internal or external)
  - White water-based coatings (internal)
  - Adhesive solar protection films (Scotch tint type).
- **Translucent panels :**
  - Poly methacrylate
  - Poly carbonate
  - PVC
- **Or anti-UV glass**

Heating and ventilation

- No constraint **except free flame systems cannot be used**
- Openings and airstreams, during the hot seasons, should be minimized in order not to increase ozone exposure.

Temperature

- It is recommended that tires are not stored for greater than 3 months in sites located in geographical zones which have cold periods below -18°C/-1°F) or hot periods (above 30°C/ 86°F). Extreme temperatures affect the physical and chemical features of the rubber.

Foreign matter

- Tires should be kept clean and dry.

MISCELLANEOUS:

Arc/Electric welding

- In the case of welding, the tires must be physically protected and moved at least 10 meters away from the working area. This is to protect the tires from radiation, sparks, or ozone emissions.

Battery chargers

- Battery handling, storage and charging should be isolated from the tire storage area.

Tire Stacking:

Tires are to be stored vertically in a single layer. Tires should be rotated a quarter turn every other month. This is to reduce the time each part of the tire is taking the total weight of the tire.





Storage aging limit:

Please refer to PMR 60 in this Guide.

Tire Service limit:

Tires should be removed from the vehicle/system as indicated below, whichever is earliest:

- ❖ Once it reaches its Distance Limit as defined by Michelin and irrespective of the remaining tread depth available.
- ❖ When the tire reaches the wear indicator positioned at the shoulder of the tire. Please refer to PMR 15 in this guide.
- ❖ When a damage referred in the Guide of the PMR is logged in

Pressure Unit Conversion Table

bar	psi*
1	15
1.5	22
2	29
2.5	36
3	44
3.5	51
4	58
4.5	65
5	73
5.5	80
6	87
6.5	94
7	102
7.5	109
8	116
8.5	123
9	131
9.5	138
10	145
10.5	152
11	160
11.5	167
12	174

**Values in psi rounded to be nearest pratical units*

Addresses of Michelin companies:

Notes: