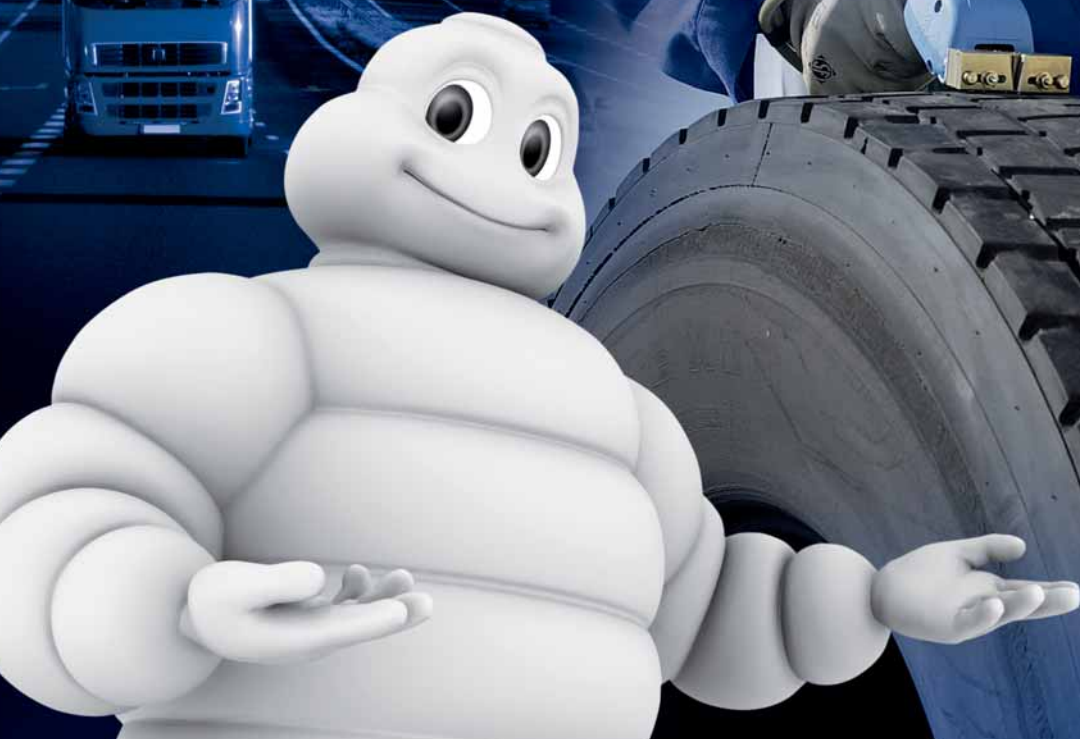


Edition 2007

Regroove brochure for Michelin truck tyres



Increased mileage increased safety

Regrooving is a key stage in optimizing the mileage of your tyres and using their full potential.

Regrooving can in fact significantly extend a tyre's grip.

For this, when we at MICHELIN design our products we prescribe an undertread of compound that is thick enough to allow high-quality regrooving, without affecting the strength or toughness of the product.

This gives you increased safety, higher returns and lower fuel consumption.

Regrooving gives new sharp edges and a tread depth of about 6 to 8 mm, or about half that of a new tyre. A regrooved tyre does not weaken the crown block. Carried out in accordance with our recommendations, regrooving does not adversely affect the strength of the crown block and casing.

Your Michelin advisor and your specialist dealer are the experts who can advise you. Do not hesitate to contact them.



We would like to draw your attention to the Michelin group's policy; this consists of Michelin vigorously defending its rights of intellectual property and will take legal action against any company or individual manufacturers and/or marketing counterfeits of our products.

Contents

**The regrooving of truck tyres
is authorized and recommended
to improve SAFETY and ECONOMY**

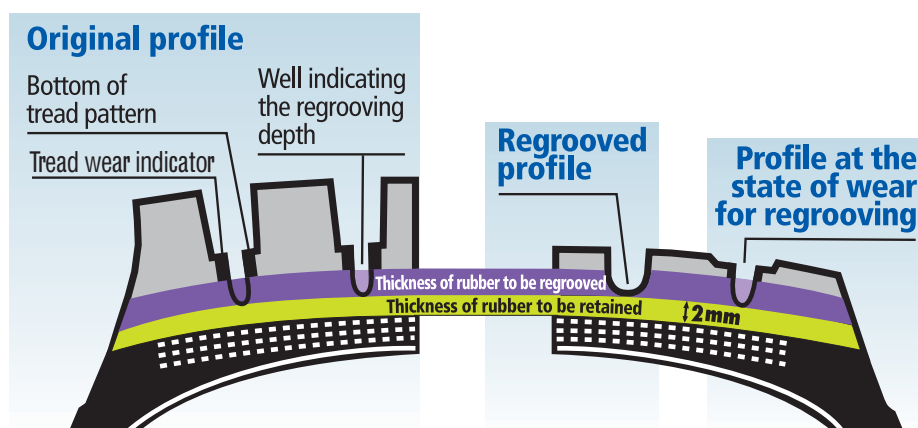
■ The principle of regrooving	4
■ Safety and regrooving	4
■ Retreading and regrooving	5
■ Economic savings	
- Mileage	5
- Fuel consumption	6
■ Regrooving	6
■ Tyre work	8
■ Legislation	11
■ Environment	12
■ Recommendations	12
■ Regrooving plans	15

Regrooving

Principe

Regrooving consists of removing some compound from the existing undertread of compound.

For this, when a tyre is designed, MICHELIN prescribes an undertread of compound that is **thick enough** to allow high-quality regrooving, without affecting the strength or toughness of the product.



Safety

Regrooving significantly extends the potential grip of a tyre.



It is carried out when there is still 2 to 4 mm of tread depth.

Regrooving gives new sharp edges and a tread depth of about 6 to 8 mm, or a tread depth of about the same as that of a half-worn tyre.

Carried out in accordance with our recommendations it has no adverse effect on the product regarding the strength of the crown block or casing.

Retreading

Michelin retreading = **MICHELIN**  **Remix**

A Michelin REMIX retread has the same advantages as a new tyre, with a constant depth below the grooves that is adequate for high-quality regrooving.

Regrooving has no adverse effect on acceptance for REMIX retreading.

A study shows us that out of a very large quantity of casings presented for REMIX retreading (1,400,000 casings), regrooved casings have a higher rate of acceptance (by about 3%).

This 3% increase proves that regrooving does not adversely affect acceptance for retreading. It is professional tyre management that is the essential factor in acceptance for retreading.

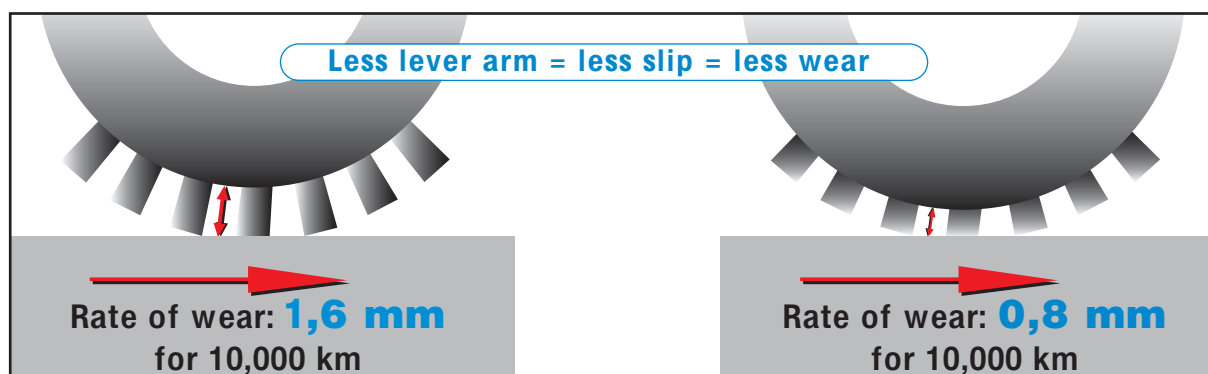
Economy: increased mileage

Regrooving is carried out at a time in a tyre's life when it is possible to optimize the increased mileage and the improved fuel consumption.

In fact, when a tyre is worn, the lever arm represented by each block of compound in relation to the ground is more rigid than when the tyre is new. This minimizes the deformations of the compound and minimizes micro-slip.

The speed of wear is slower and the rolling resistance is lower than for a new tyre.

Regrooving makes it possible to increase the mileage by around **20 to 25%**



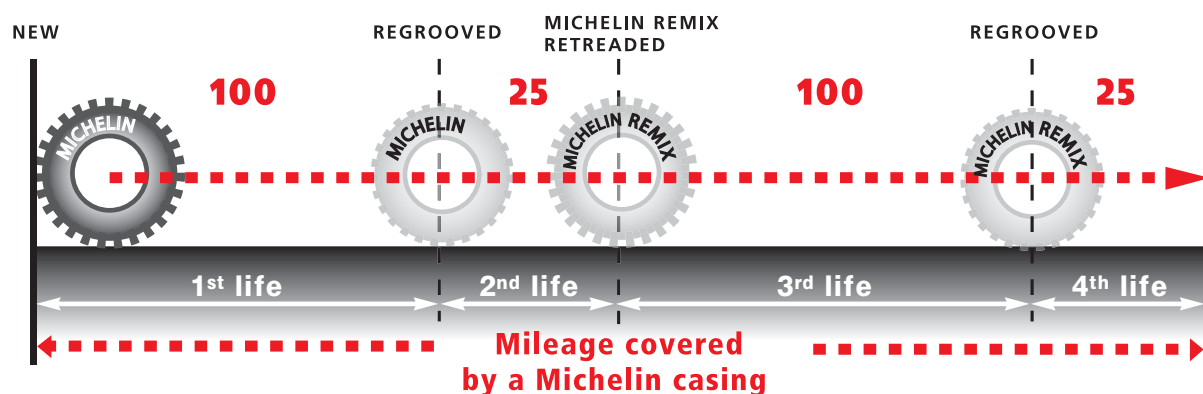
The deeper the tread = more slip, more deformation, more wear.

- 5 -

Regrooving

If we look at the diagram new + regrooved + retreaded + regrooved, we can see that regrooving gives the user a considerable saving.

By regrooving the new tyre and then the retread, the increased mileage is 50% of the mileage of the new tyre before retreading.



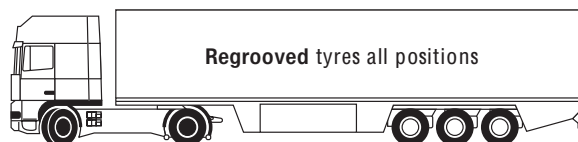
Economy: fuel consumption

Regrooving is carried out in the phase in which the tyre has the lowest rolling resistance.

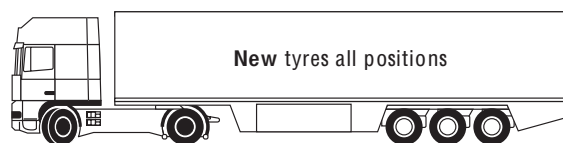
As a worn tyre has less compound deformation in the tread pattern, it gets less hot and so offers less rolling resistance and uses less fuel.

For given driving conditions and on a straight road, if the rolling resistance is 100 for a new tyre, it becomes 75 for a tyre worn to the tread wear indicators.

Between these two extremes, the rolling resistance is proportional to the wear. For a tractor unit + semi-trailer vehicle combination used for long-distance haulage, the fuel saved by regrooving the tyres instead of fitting new tyres can reach 2 liters per 100 kms (according to the number of axles equipped).

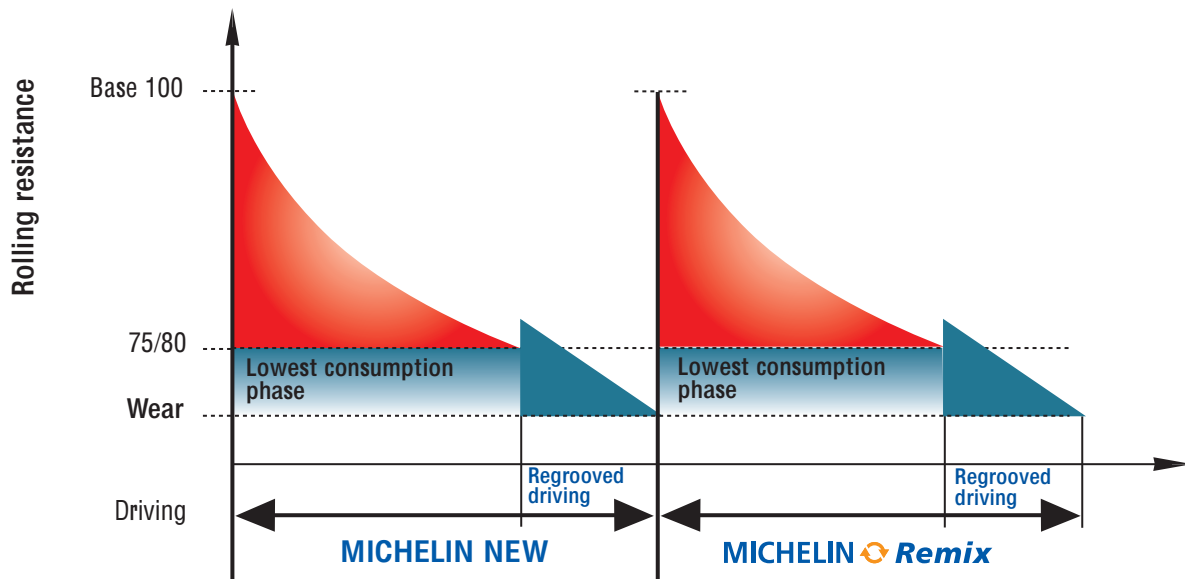


**Improvement of 6 to 10%
in diesel fuel consumption**



If we take the example of 2 long-distance haulage users

User 1 with regrooving

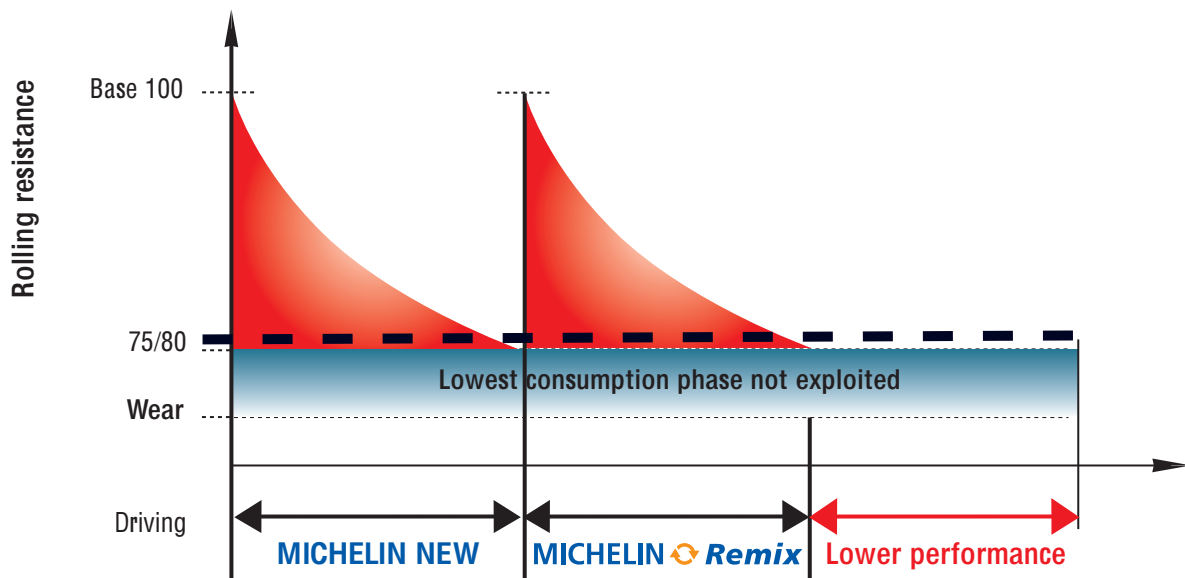


User 1:

Has the benefit of the phase giving lower fuel consumption.

In addition, they have the benefit of increased mileage of about 50% of the mileage of the new tyre before regrooving.

User 2 without regrooving

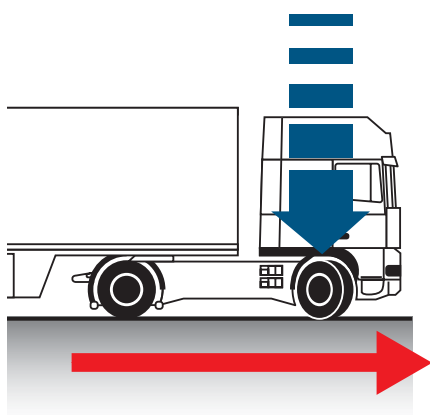


- 7 -

Regrooving

Tyre work

FITTING



Work done on tyres is an important factor in the overall performance of tyres.

Turning them round on the rim, changing their positions and regrooving them in accordance with our recommended rules increase tyre life.

Steering axle position tractor unit or rigid truck

For right-hand drive the left-hand front tyre wears faster than the right-hand front tyre, and the right-hand front tyre often has more pronounced wear on the outer shoulder (camber of the road).

To optimize the mileage and to balance the wear between the two tyres on the front axle, we recommend that you:

Change position

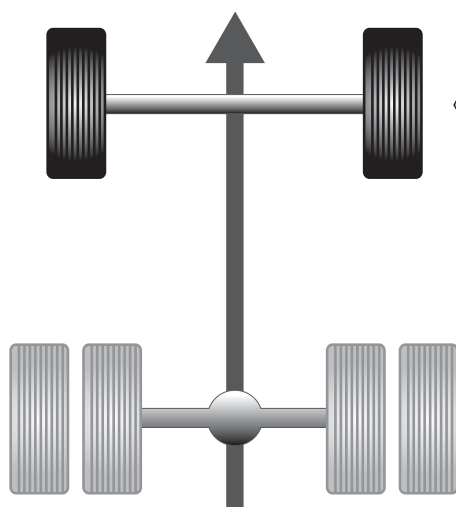
At 50% wear
Position LH ---- RH
and Turn the right-hand front around on the rim

Regroove

Between 2 / 3 mm of
tread remaining
About 80%
rate of wear

Remove

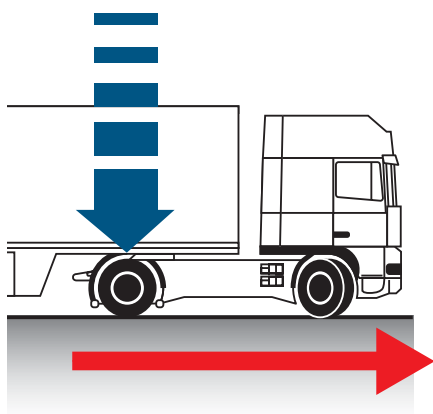
both tyres
at the country's
legal wear limit



Regrooved fitment:
POSSIBLE



FITTING



Driven axle position tractor unit or rigid truck

As a general rule, the 2 inside twin tyres wear more on the shoulders of the tread nearest the inside of the chassis.

The cause:

the camber angle, the type of suspension, the use of the retarder, the route and the load are the main factors.

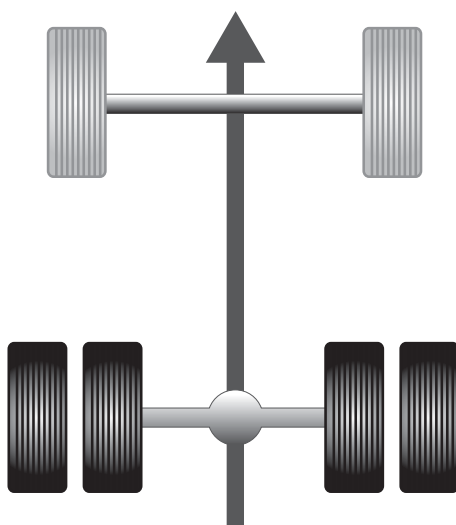
In order to even out the wear so that you can regroove and optimize performance, we recommend that you:

Regroove/Change position

At about 80% worn.
Turn the two inside tyres round on the rims and change position: Interior- exterior (twin wheels)

Remove

the 4 tyres at the country's legal wear limit



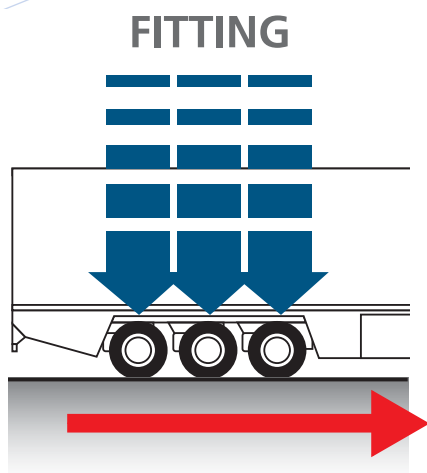
Regrooved fitment: **RECOMMENDED**



MICHELIN

A better way forward

Regrooving



Semi-trailer 3-axle vehicle (TRIPLE fixed axle)

Because of the scuffing phenomenon, the tyres fitted to the 3 axles do not wear identically.

The 3rd axle is the worst affected because of the scuffing accentuated by the rear overhang of the vehicle.

The 1st axle, which is also affected by scuffing, wears more quickly than the 2nd axle.

The 2nd axle, which is not affected by scuffing, has a very low rate of wear.

If we take a base of 100 for the 3rd axle, the 1st axle is at about 150 and the 2nd axle at about 250.

To optimize the mileage and allow regrooving:

Regroove/Change position

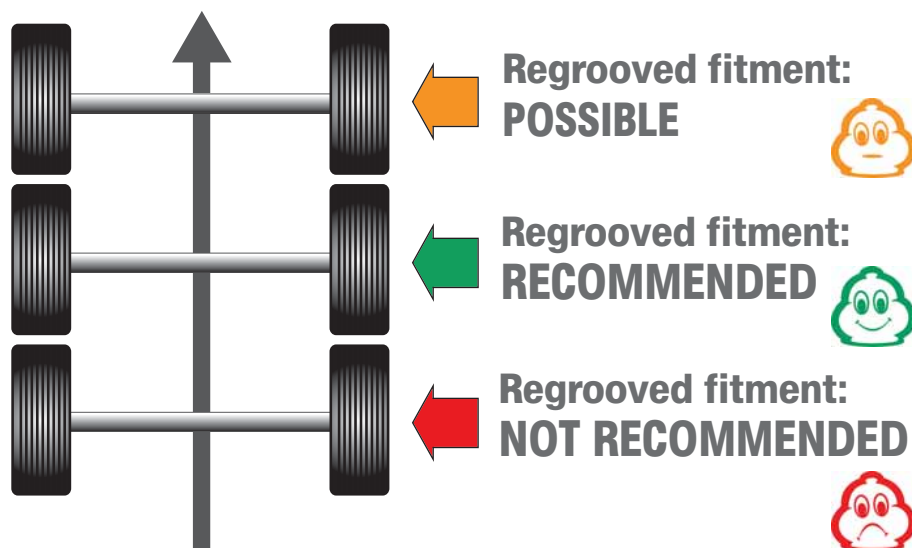
At 80% wear on the 3rd axle
Regroove + Turn round on rim and change position
3rd ---- 2nd

Regroove

At 80% wear on the 1st axle
Regroove + Turn round on rim

Withdraw

At the country's legal wear limit



Legislation

Complying with the European legislation

Regrooving conforms to the legislation in force in European countries.

For practically all countries, the legislation specifies that tyres can be regrooved on condition that the "regroovable" indicator

or the U symbol appears on the sidewalls and that the regrooving is carried out by professionals in accordance with good practice. Concerning wear at removal, all countries mention that no fabric or metal layer must be visible on the surface and/or at the bottom of the tread and that the tread pattern must be visible over the whole of the tread.

COUNTRY	Restrictions on fitting regrooved tyres	Removal of tyres dues to wear	
		Minimum depth	Observations
GERMANY	Except front axle of cars, speed 100 km/h*.	1,6 mm	
AUSTRIA	Except front axle of coaches, speed 100 km/h, and transport of dangerous materials*.	2 mm	
BELGIUM	No legislation at regrooving. No restrictions.	1,6 mm	
SPAIN	None	Nil	Tread pattern visible over the whole tread.
FRANCE	None	1 mm	Maximum permissible difference of 5 mm on the same axle.
ITALY	None	1,6 mm	
LUXEMBURG	No legislation at regrooving. No restrictions.	1,6 mm	
NETHERLANDS	None	Nil	
SWITZERLAND	None	1,6 mm	For foreign vehicles legislation of the country.
U.K.	None	1 mm	
SWEDEN	None	1,6 mm	Outside twin tyres no min depth.
NORWAY	None	1 mm	3 mm for the period: October to April.
DENMARK	None	1 mm	
FINLAND	None	1,6 mm	
POLAND	Except single axles of coaches, speed 100 km/h.	2 mm	4 mm mm for M+S radial Tyres.
CZECH REP.	None	1,6 mm	
HUNGARY	Except single axles of coaches and buses.	1,6 mm Tyre diameter < 750 mm 3 mm Tyre diameter > 750 mm 3 mm Coaches and Buses Tyre diameter < 750 mm 5 mm Coaches and Buses Tyre diameter > 750 mm	
CROATIA ESTONIA REP. SLOVAKIA SERBIA LATVIA LITHUANIA SLOVENIA	None	1,6 mm	Maximum permissible difference of 5 mm on the same axle.
BULGARIA ROMANIA	None	1 mm	Maximum permissible difference of 5 mm on the same axle.
UKRAINE RUSSIA	None	1 mm: Tyres 2 mm: Coaches/Buses	Maximum permissible difference of 5 mm on the same axle.

* Prohibited on the front axles of coaches with a maximum speed of 100 km/h.

Regrooving

Preservation of the environment

The regrooving of tyres extends the driving period in the lowest consumption phase. By extending the life of the tyre, regrooving reduces the number of worn tyres that cannot be reused.

Recommendations

Carry out the regrooving when there is still 2 to 4 mm of tread

This precaution makes it possible to:

- Reproduce the tread pattern easily.
- Adjust the regrooving depth so as to always keep at least 2 millimeters of compound between the bottom of the tread pattern and the crown layers.

Regrooving is not recommended:

If the tread shows major damage:

- Multiple holes and cuts, places where the tread has been torn off.
- If the metal layers of the crown can be seen through damage or cuts.

Regrooving that is too deep can:

- Result in damage that causes the premature destruction of the casing.
- Compromise the possibility of retreading.
- Allow metal layers of the crown to appear, which is not permitted by the legislation.

It is essential that the regrooving be carried out by professionals in accordance with our recommended rules.

Fitting regrooved tyres:

It is recommended that regrooved tyres are fitted outside snowy or icy periods. In order to avoid vehicles being immobilized for excessively long periods during the regrooving operation, we recommend that you keep fitted assemblies in stock to optimize the operation. The regrooving operation is also a means of improving the time management of work in the workshop.



Supplier of regrooving accessories: P.S.O.
(Pneu Service Outillage)
11, rue Gustave EIFFEL
F 77140 NEMOURS
Tel: 33 1 64 45 00 61
Fax: 33 1 64 45 02 14
Email: infopso@pso-fr.com

Equipment

Use round blades (R) only.

Comply with the part number shown for each tread pattern.

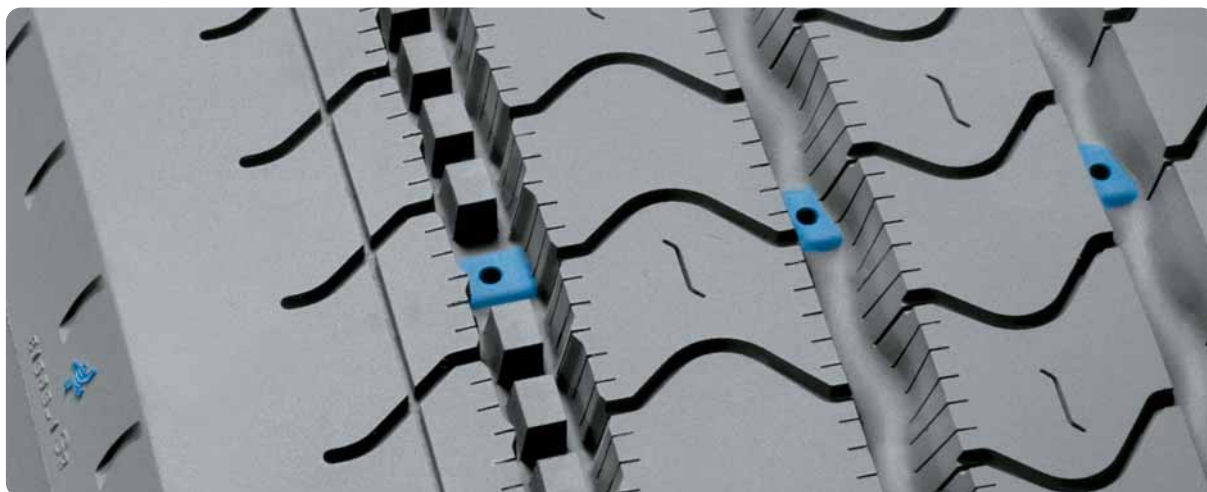


Supplier of regrooving accessories:
P.S.O. (Pneu Service Outillage)
11, rue Gustave EIFFEL - F 77140 NEMOURS
Tel: 33 1 64 45 00 61 - Fax: 33 1 64 45 02 14
Email: infopso@pso-fi.com

Regrooving assistance

All Michelin tyres have a regrooving well in the center of the tread wear indicators, to allow high-quality regrooving.

The blade can also be adjusted for depth using a special jig.



**LONG
DISTANCE**
A



A 2 RANGE

Long distance. Long stages on freeways and trunk roads.
Sustained speed.
Little stress from engine or braking torques.

**MEDIUM
DISTANCE**
E



E 2 RANGE

For multi-purpose road use, main roads and freeways
with frequent stress from engine and braking torque.
Short distances on main roads with frequent stops.
Use on poor roads.

GRIP
N



GRIP RANGE

For road use under changeable climatic conditions,
requiring a high level of grip and winter capability
performance.

URBAN
U



INCITY RANGE

For driving in urban areas with very frequent stops
(urban buses, household waste collection trucks,
highway vehicles, etc.).

ON/OFF ROAD
Y



Y RANGE

For general driving over short distances
and all types of road.
Access to loading and unloading points can be difficult.

SITWORK
H



H RANGE

For rough ground of site and quarry type.
Need for off-road grip.
Frequent risk of damage to tyres.

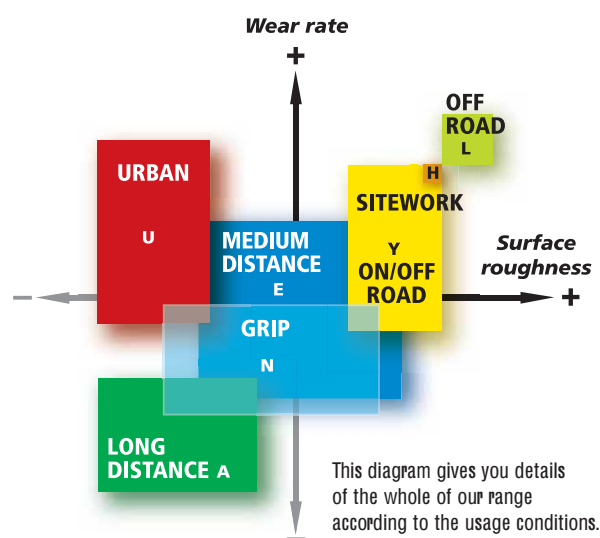
OFF-ROAD
L



L RANGE

For special civil or military vehicles driving
mainly on unimproved surfaces and requiring
maximum mobility.

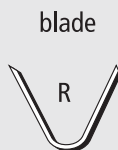
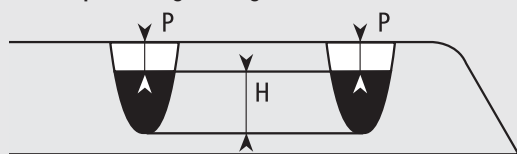
Regrooving plans



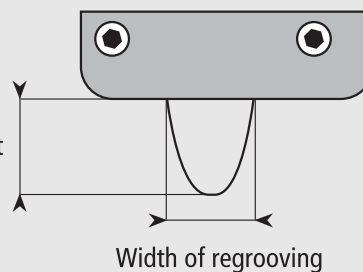
■ A 2 range	16
■ E 2 range	19
■ Grip range	21
■ InCity range	23
■ Y - H range	24
■ L range	26

Regrooving

P = Depth remaining after regrooving
H = Depth of regrooving



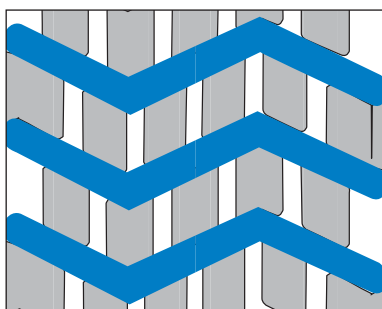
Adjustment of blade height
 $P+H$



Only regroove the areas shown in blue on the following sketch

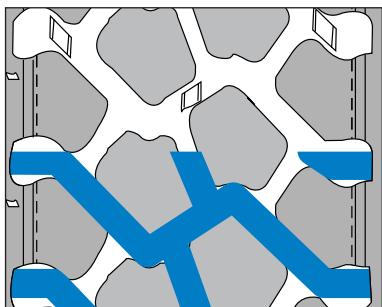
Regrooving plans

L range



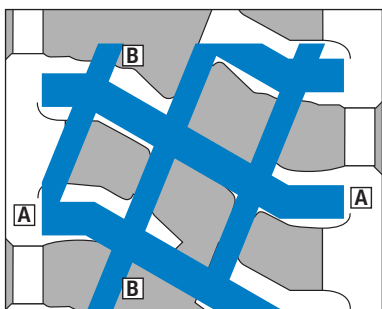
XS

Theoretical depth of regrooving	Width of regrooving	Blade
H = 4 mm.	8 to 10 mm.	R3



XZL

Theoretical depth of regrooving	Width of regrooving	Blade
H = 4 mm.	10 to 12 mm.	R4



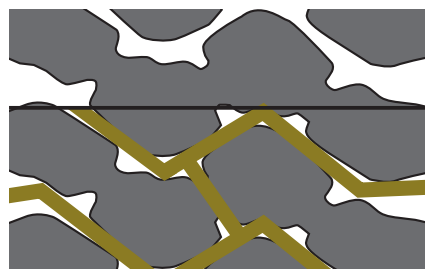
XML

Theoretical depth of regrooving	Width of regrooving	Blade
H = 4 mm.	A = 20 mm. B = 10 to 12 mm.	R4



Véhicules spéciaux, civils ou militaires roulant majoritairement sur des surfaces non aménagées.

X[®] FORCE[™] Z / XZL



Dimension	Profondeur théorique de recrusage*	Largeur de recrusage	Lame
255/100 R 16 (9.00 R 16)	3 mm	10 à 12 mm	R4
325/85 R 16	3 mm	10 mm	R4
10.00 R 20	4 mm	10 à 12 mm	R4
11.00 R 20	4 mm	11 à 13 mm	R3
12.00 R 20	4 mm	10 à 12 mm	R4
14.00 R 20	3 mm	10 à 12 mm	R4
16.00 R 20	4 mm	10 à 12 mm	R4
275/80 R 20 (10.5 R 20)	4 mm	10 à 12 mm	R3
335/80 R 20 (12.5 R 20)	4 mm	10 à 12 mm	R4
365/80 R 20 (14.5 R 20)			
365/85 R 20			
395/85 R 20			
13 R 22.5			

*La profondeur de recrusage est à vérifier systématiquement avant l'opération de recrusage, voir indications pages 82-83.

Together, we'll go far

Michelin Truck Tyres Our commitments



+ innovations

At MICHELIN Truck Tyres, we innovate to enable you to go further. Innovation has been at the center of our concerns for over a century. Each of our tyres and services are developed to provide a solution to meet your needs. This permanent commitment is currently put into practice by the launch of MICHELIN Durable Technologies.



+ mileage

MICHELIN tyres are renowned for their exceptional life-span. Thanks to the casing endurance, our Truck tyres can be regrooved and retreaded with MICHELIN Remix technology.



+ safety

MICHELIN Truck Tyres ensures that you have the most reliable tyres. Each mile with Michelin brings you great peace of mind, whether your tyres are new, regrooved or retreaded with MICHELIN Remix.



+ personalized advice

Our expertise at your service. With over 100 sales reps and almost 250 technicians in France, we are there to pass on our expertise and propose solutions enabling you to reduce costs and improve competitiveness.



+ services

We support carriers through innovative services. Is one of your vehicles immobilized in Europe? Thanks to the new MICHELIN Euro Assist 'not more than 2 hours' line of services, you will set off again as soon as possible in cases of tyre breakdown wherever you are in Europe.



+ fuel savings

Because 1 full tank of fuel in 3 is due to tyre rolling resistance, we have designed the MICHELIN A 2 ENERGY range to help carriers cut their diesel fuel consumption. In September 2006, Michelin organized "The CHALLENGE", a test carried out in real conditions over 1 250 km which confirmed that fuel savings are made using MICHELIN A 2 ENERGY low rolling resistance tyres.

This test showed that Michelin A2 Energy low rolling resistance tyres lead to fuel savings of up to 2.3 liters over 100 km



+ environmental protection

As part of its sustainable development objective, Michelin is committed to minimizing the environmental impact of its products.

