TECHNOLOGY OF MICHELIN RADIAL CASING TYRE

A tyre’s construction is the key to its performance, and outstanding tyre performance is a key competitive advantage for machines in the mechanical handling industry.

Using radial tyres can make an outstanding contribution to the performance of industrial equipments.

Composition

The radial design combines metal or fabric plies, extending from one bead to the other, with a belt made of several steel plies designed to reinforce the crown of the tyre.

A unique construction with numerous advantages

The sidewalls and crown work independently:
- Minimizing the deformation of the contact patch and the weight of the tyre
- Improving adhesion and traction while slowing down the wear rate
- Increasing the load capacity as the metal casing can take higher inflation pressures

The flexibility of the sidewalls of a radial tyre provides greater comfort:
- No compromise on stability
- Better resistance to damage and punctures

Tyre performance levels that transform machine performance

Michelin invented the radial design and is an expert in this field.
Radial tyres significantly improve the productivity of machines.
The radial technology offers the best compromise between the following factors: load, speed, operational efficiency of the machines, tyre service life, operator safety, etc.

The Michelin X Radial Technology

Advantages:
- longer tyre life.
- better traction on all types of surfaces.
- lower fuel consumption due to lower rolling resistance.
- improved comfort.
- increased resistance to punctures.
- increased resistance to heating.
**COMPETITOR SOLUTIONS**

**Bias or Cross Ply Construction**

The casing is made up of several criss-crossed plies.

The crown and sidewalls are formed by the same ply structure.

Disadvantages:
- accelerated wear
- less grip
- increased fuel consumption

The crown is not stabilized.

The tread is subjected to any flexing which occurs and this causes:
- deformation of the tyre contact area on the ground
- movement in the contact patch.

The casing plies tend to “scissor” in relation to each other.

The whole tyre is made of rubber. It is generally composed of at least three different rubber compounds.

According to the type of wheel, the construction of the tyre can:
- Look like a pneumatic tyre, but can be fitted to a multipiece rim (fig. 1)
- Enable so that once in place, it will auto-lock automatically (fig. 2). An extension to its base (called the ‘retainer Bead’) is positioned in the rim groove normally provided for receiving the locking ring. Removable parts of the wheel then not being provided make it more difficult retrofitting other pneumatic solutions.

**The Solid Tyre (PSS: Pneumatic Shaped Solid)**

The crown and sidewalls are formed by the same ply structure.

The tread is subjected to any flexing which occurs and this causes:
- deformation of the tyre contact area on the ground
- movement in the contact patch.

The casing plies tend to “scissor” in relation to each other.

Disadvantages:
- accelerated wear
- less grip
- increased fuel consumption

The casing is made up of several criss-crossed plies.

The crown is not stabilized.

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- movement in the contact patch.

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Tubeless radial tyre

MICHELIN is the first to **offer a complete and innovatively designed range of tubeless tyres for mechanical handling.**

Michelin’s tubeless radial tyre ensures:
- **Safety:** elimination of instant deflations following puncturing or failure of the inner tube.
- **Reliability:** elimination of constant internal friction between the inner tube, flap, and tyre, causing wear to the tube.
- **Ease of fitting and removal:** the tube and flap are replaced by a tubeless bead seal, an ‘O’-ring, or a rubber corner joint depending on the tyre size and/or type of rim.

Antistatic properties

**Working conditions with a high fire or explosive risk:**

Tyres for mechanical handling equipment working in high fire risk or explosive atmospheres: chemical production, petrochemicals, etc. (in both production and storage areas) must, for reasons of safety conform to antistatic legislative requirements.

These conditions are required for the tyre to be recognized “**Static Class 1**”. All Michelin industrial tyres comply with these standards and are marked with the following symbol moulded into the sidewall.

Conditions of use

The range of Michelin industrial tyres has been specifically designed to equip industrial machines. The sizes are specific to these machines and their work; the loads and speeds correspond to standardised figures.

Each time tyres need to be fitted to mechanical handling equipment, the following rules should be followed:

1°) When the tyre size exists in the industrial tyre range, the industrial tyre must be used.

2°) When size does not exist in the industrial tyre range, it may be necessary to consult other tyre ranges (Agriculture, Truck or Earthmover), whose characteristics are compatible.

In all cases contact your Michelin representative who will be able to guide you on the best solution.

Technical validation will be provided by Michelin for these uses.

Better for the environment

- **Longer tyre life**
  Fewer scrap types
- **Reduced rolling resistance**
  Lower fuel consumption
- **Tyre with no aromatic oils**
- **ISO 14001 certification**
  Tyres manufactured in our plants with ISO 14001 certification, the impact on the environnement of which has decreased by over 16% since 2005.
The different tyre families

There are different tyre families categorised by the aspect ratio H/S: (the ratio in % between the sidewall height and the tyre width).

- **H** = standard section height
- **S** = standard section width

### 100 series or standard tyre (narrow base)

The H/S aspect ratio is approximately equal to 1.00.

![Diagram showing 100 series tyre](image)

The section width, given in inches, is a whole number.
- e.g.: 12.00 R 20
- or the section width, given in inches, is a whole number followed by a fraction.
  - e.g.: 8.25 R 15
- The aspect ratio is not indicated in the size designation.

### Low profile tyres (65 to 95 series, 5 by 5)

The H/S aspect ratio is less than 1, i.e. (0.65 in the followed example).

![Diagram showing low profile tyre](image)

The nominal section width is expressed as an measurement in millimeters followed by the aspect ratio 65 to 95 (65 in the example).
- e.g.: 355/65 R 15

### The different tyre size designations

<table>
<thead>
<tr>
<th>Ø of rim (inches)</th>
<th>STANDARDISED TYRE SIZE DESIGNATION</th>
<th>RADIAL MARKING</th>
<th>METRIC TYRE SIZE DESIGNATION</th>
<th>RADIAL MARKING</th>
<th>Ø ext. (inch)</th>
<th>section width (inches)</th>
<th>section width (mm)</th>
<th>aspect ratio H/S</th>
<th>Ø of rim (inches)</th>
<th>load index</th>
<th>speed symbol</th>
<th>Ply Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>4.80 - 4</td>
<td>4.00 - 4</td>
<td></td>
<td></td>
<td>4.00</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>4.80 - 8</td>
<td>4.00 - 8</td>
<td>5.00 R 8</td>
<td>200 / 75 - 9</td>
<td>21 x 8</td>
<td>200 / 75</td>
<td>9</td>
<td>134</td>
<td>16</td>
<td>PR</td>
<td>A5</td>
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</tr>
<tr>
<td>6.90 - 9</td>
<td>6.00 - 9</td>
<td>6.00 R 9</td>
<td></td>
<td></td>
<td>6.00</td>
<td>6.00</td>
<td></td>
<td></td>
<td>12</td>
<td>PR</td>
<td>A5</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>6.50 - 10</td>
<td>6.50 R 10</td>
<td></td>
<td>225 / 75 - 10</td>
<td>23 x 9</td>
<td>225 / 75</td>
<td>10</td>
<td>142</td>
<td>20</td>
<td>PR</td>
<td>A5</td>
<td>12 PR</td>
</tr>
<tr>
<td>12</td>
<td>7.00 - 12</td>
<td>7.00 R 12</td>
<td></td>
<td>250 / 60 - 12</td>
<td>23 x 10</td>
<td>250 / 60</td>
<td>12</td>
<td>136</td>
<td>16</td>
<td>PR</td>
<td>A5</td>
<td></td>
</tr>
<tr>
<td>23 x 9 - 10</td>
<td></td>
<td>225 / 75 - 10</td>
<td></td>
<td></td>
<td>23 x 9</td>
<td>225 / 75</td>
<td>10</td>
<td>142</td>
<td>20</td>
<td>PR</td>
<td>A5</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>7.00 - 15</td>
<td>7.00 R 15</td>
<td></td>
<td>225 / 75 - 15</td>
<td>28 x 9</td>
<td>225 / 75</td>
<td>15</td>
<td>143</td>
<td>16</td>
<td>PR</td>
<td>A5</td>
<td></td>
</tr>
<tr>
<td>8.15 - 15</td>
<td>8.15 R 15</td>
<td></td>
<td></td>
<td>315 / 70 - 15</td>
<td>315 / 70 - 15</td>
<td>315 / 70</td>
<td>15</td>
<td>165</td>
<td>22</td>
<td>PR</td>
<td>A5</td>
<td></td>
</tr>
</tbody>
</table>
Position of wear indicator

Michelin 450
Nominal section width in mm (S = 450 mm)

95
Tyre aspect ratio (H/S = 0.95)

R
Radial construction

25
Nominal diameter of rim to which tyre should be fitted (25 inches)

X-Straddle 2
Range name

Tubeless
Tubeless tyre

202
Load Index (#): 15 000 kg

A7
Speed Symbol (#): 35 km/h

Cyclic
Cyclic use (#)

Radial X
Clear indication of tyre structure

“Antistatic Class 1” tyre

For special conditions use, please consult us

(#): see explanation page 8 of the Technical data Mechanical handling.
The TBS is a special device allowing the fitment of tubeless tyres as tubeless on tube-type rims. It consists of a ring of special rubber, which is placed inside the tyre, and fits between the tyre beads. It ensures the airtightness of the wheel and tyre assembly.

The choice of TBS depends on the width of the rim on which the tyre is to be fitted. The allowed rim width(s) are indicated on each tubeless bead seal. TBS fitted on wheels whose width is less than 6 inches have a chimney where the valve will be positioned. TBS for wheel with width greater than or equal to 6 inches have two chimneys; one central and the other offset to allow correct positioning relative to the valve sleeve. The chimney which is not used by the valve, is sealed with a plastic plug (supplied with the TBS).
# MICHELIN solutions for the principal conditions of use

<table>
<thead>
<tr>
<th></th>
<th>XZR</th>
<th>XZM</th>
<th>XZN2+</th>
<th>X STACKER</th>
<th>X-STRADDALE 2X</th>
<th>X TERMINAL-T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classic forklift truck</td>
<td>✗</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High capacity forklift truck</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;RoRo&quot; forklift (Roll on - Roll off)</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Low&quot; height permits access to ships holds</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High capacity forklift (container handler)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Side loader (used like a small truck with stabilisers when loading or unloading)</td>
<td>✓</td>
<td>✗</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fork logger (loading of logs)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Reach logger (can load logs from below ground level eg from a river, canal...)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reach stacker</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key: ✓ = standard fit
✗ = for possible specific conditions of use, to consult your usual MICHELIN representative
<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>XZR</th>
<th>X2H</th>
<th>X2NZ™</th>
<th>X STACKER</th>
<th>X STRADDLE</th>
<th>X STRADDLE 2</th>
<th>X TERMINAL-T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straddle carriers (transport machine used to handle containers)</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
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</tr>
<tr>
<td>Transtainer (similar to a straddle carrier, but heavier, and can only move in a straight line)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td>Consult us</td>
</tr>
<tr>
<td>Terminal tractors and trailers</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>&quot;Roro&quot; tractor (Roll on - Roll off)</td>
<td>✓</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aircraft tow tractor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Consult us</td>
</tr>
<tr>
<td>Towbarless tractor</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Consult us</td>
</tr>
<tr>
<td>tracteur tireur &quot;tout usage&quot;</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>trailer</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>sweeper</td>
<td>✓</td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

Key: ✓ = standard fit
✗ = for possible specific conditions of use, to consult your usual MICHELIN representative
Consult us
Mechanical handling

MICHELIN, a range of tubeless radial tyres for industrial handling for greater

SAFETY
RELIABILITY
PRODUCTIVITY
Tyres for small to medium capacity forklift trucks

Field of activity

- Glasswork, bottling, machine shops
- Foundries and steelworks
- Transport, logistic platforms

Tyres sizes

<table>
<thead>
<tr>
<th>Tyre Sizes</th>
<th>Load Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>150/75 R 8 113A5</td>
<td>180/70 R 8 125A5</td>
</tr>
<tr>
<td>5.00 R 8 111A5</td>
<td>200/75 R 9 134A5</td>
</tr>
<tr>
<td>6.00 R 9 121A5</td>
<td>225/75 R 10 142A5</td>
</tr>
<tr>
<td>6.50 R 10 128A5</td>
<td>250/75 R 12 152A5</td>
</tr>
<tr>
<td>7.00 R 12 136A5</td>
<td>225/75 R 15 149A5</td>
</tr>
<tr>
<td>7.50 R 15 146A5</td>
<td>8.25 R 15 153A5</td>
</tr>
<tr>
<td>315/70 R 15 165A5</td>
<td>355/65 R 15 170A5</td>
</tr>
</tbody>
</table>

Product benefits

- **XZM**
  - For small to medium capacity mechanical handling trucks (<7 tonnes) travelling short distances (up to 15 km in an hour) at speeds not exceeding 35 km/h, running over aggressive and abrasive surfaces.
  - Very robust with excellent wear resistance: massive tread pattern, very thick crown and sidewalls protected by internal reinforcements.
  - Driving comfort and protection, merchandise and mechanics: radial casing cushions vibrations.

- **XZR**
  - For forklift truck with low commitment rates at exceptionally low cost of use.
  - Speed: intense use at speed up to 50 km/h.
  - Durability and robustness: rubber and tread pattern limiting abrasion wear.
  - Comfort: reduced vibration and outstanding grip.
  - Reduced fuel economy and energy with a very low rolling resistance.

Tyre performance

- **XZM**
  - Resistance to damage: increasing
  - Speed capacity: increasing
  - Long-service life: increasing

- **XZR**
  - Resistance to damage: increasing
  - Speed capacity: increasing
  - Long-service life: increasing
Tyres for heavy capacity forklift trucks

### Field of activity

<table>
<thead>
<tr>
<th>Activity</th>
<th>Tyres sizes</th>
<th>Product benefits</th>
</tr>
</thead>
</table>
| Freight zones                   | XZM                  | **XZM**
The market reference in 20, 24 and 25 inch sizes. For moving extremely heavy loads on abrasive and aggressive surfaces where safety is vital.  
- exceptional impact resistance  
- dependable sturdiness  
- high load capacity  
- very long wear life  
| Foundries and steelworks        | XZM2+                | **XZM2+**  
*NEW PRODUCT for very strong capacity machines*
Its crown and construction have been entirely redesigned in order to increase productivity:  
- increase in wear life (higher volume of rubber)  
- improvement in rigidity (bridged tread pattern and more massive crown)  
- more robust crown: less down-time due to punctures  
| Heavy industry                  | X-STACKER            | **X-STACKER**
Tyre specially designed for Reach Stackers and top loaders travelling in cycles over very short distances. Its smooth tread optimises its wear potential. It is thick and massive, enabling its service life to be increased by around 60% compared with a XZM tyre.  
Like all our handling tyres, this tyre has the benefit of radial technology, offering safety, mileage and a very high level of comfort.  

### Tyre performance

<table>
<thead>
<tr>
<th>Tyre</th>
<th>Resistance to damage</th>
<th>Speed capacity</th>
<th>Long-service life</th>
<th>Stability</th>
<th>Comfort</th>
</tr>
</thead>
<tbody>
<tr>
<td>XZM2+</td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
</tr>
<tr>
<td>X-STACKER</td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
</tr>
</tbody>
</table>
Tyres for aircraft tractors

**Field of activity**
- Airport

**Tyres sizes**
- X-TERMINAL T
  - 280/75 R 22.5 168A8
  - 310/80 R 22.5 175A8
- XZM
  - 225/75 R 15 149A5
  - 250/70 R 15 153A5
  - 7.00 R 15 143A5
  - 7.50 R 15 146A5
  - 8.25 R 15 153A5
  - 315/70 R 15 165A5
  - 355/65 R 15 170A5
  - 9.00 R 20 160A5
  - 10.00 R 20 166A5
  - 11.00 R 20 169A5
  - 12.00 R 20 176A5
  - 12.00 R 24 178A5
  - 14.00 R 24 193A5
  - 16.00 R 25 200A5

**Product benefits**
- **X-TERMINAL T**
  - Versatile tyre for your aircraft tractors (mounts on drive and steer axle).
  - Tyres particularly suitable for certain uses special.
  - They offer an exceptional service life and durability, and an excellent adhesion.

- **XZM**
  - For aircraft tractors travelling short distances (up to 15 km in an hour) at speeds not exceeding 35 km/h (to 12.00 R 24) or 25 km/h (for 14.00 R 24 and 16.00 R 25 tyres).
  - Very robust with excellent wear resistance:
    - massive tread pattern
    - very thick crown and sidewalls protected by internal reinforcements
  - Driving comfort and protection merchandise and mechanics:
    - radial casing cushions reduced vibrations
    - excellent wear resistance

**Tyre performance**
- **X-TERMINAL T**
  - Per increasing performances
  - Resistance to damage
  - Long service life
  - Load capacity
  - Speed capacity
- **XZM**
  - Per increasing performances
  - Resistance to damage
  - Long service life
  - Load capacity
  - Speed capacity

These tires are designed for industrial and cyclical use. Contact your local Michelin representative before mounting these tyres on airport vehicles to obtain a specific use authorization.
Tyres for luggage tractor and urban machines

<table>
<thead>
<tr>
<th>Field of activity</th>
<th>Tyres sizes</th>
<th>Product benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>airports</td>
<td>6.00 R 9 121A5</td>
<td>XZR</td>
</tr>
<tr>
<td></td>
<td>6.50 R 10 128A5</td>
<td>This is the solution for your luggages tractors and urban machines with an exceptionally low cost of use. Tyres with a greater capacity SPEED (50 km / h), exceptionnal robustness, a very low rolling resistance and excellent durability.</td>
</tr>
<tr>
<td>intermodal centres</td>
<td>7.00 R 12 136A5</td>
<td></td>
</tr>
<tr>
<td>urban zones</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tyres sizes:
- 6.00 R 9 121A5
- 6.50 R 10 128A5
- 7.00 R 12 136A5
Ports and intermodal centre

MICHELIN, a range of tubeless radial tyres for port handling for greater:

SAFETY
RELIABILITY
PRODUCTIVITY
Tyres for trailers, terminal tractors and RoRo tractors

Field of activity

Tyres sizes

Product benefits

X TERMINAL-T
This is the 1st versatile solution for your trailers and terminal tractors fitted on 22.5 drop centre rim. Tyre specifically designed for terminal tractors:
The only tyre on the market in this size at the present time.
- Its extremely resistant tread gives the tyre an exceptionally long service life (+70% and even beyond in comparison with the most efficient Michelin commercial vehicle tyre).
- The tread pattern design was specially developed for this application and gives the tyre excellent grip.
- A low rolling resistance
- A versatile solution, a only tyre whether on the drive or steering axle.

XZM
The market reference in the 20-inch size on multi piece rims
- Exceptional impact resistance
- Dependable sturdiness
- High load capacity
- Very long wear life

Tyre performance

<table>
<thead>
<tr>
<th>Tyre</th>
<th>Type</th>
<th>Resistance to damage</th>
<th>Long service life</th>
<th>Load capacity</th>
<th>Speed capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>X TERMINAL T</td>
<td>TL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XZM</td>
<td>TL</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

280/75 R 22.5 168A8
310/80 R 22.5 175A8
9.0 R 20 160A5
10.00 R 20 166A5
11.00 R 20 169A5
12.00 R 20 176A5
12.00 R 24 178A5

ports

intermodal centre

Tyres

sizes

Tyre performance
Tyres for container handling machines (Reach stacker, container handlers…)

**XZM**
Tyre particularly suitable for handling vehicles travelling short distances (between 10 and 15 km in an hour) up to 25 kph over aggressive and abrasive surfaces.
- Its massive tread and very thick crown and sidewalls, protected by internal reinforcements make this tyre very robust with excellent wear resistance.
- Their radial casing cushions vibrations improving ride comfort and security for goods and mechanical components.

**XZM2+**
New product for very strong capacity machines
Its crown and construction have been entirely redesigned in order to increase productivity:
- increase in wear life (higher volume of rubber)
- improvement in rigidity (bridged tread pattern and more massive crown)
- more robust crown: less down-time due to punctures.

**X-STACKER**
Tyre specially designed for Reach Stackers and top loaders travelling in cycles over very short distances.
Its smooth tread optimises its wear potential.
- It is thick and massive, enabling its service life to be increased by around 60% compared with a XZM tyre.
- Like all our handling tyres, this tyre has the benefit of radial technology, offering safety, mileage and a very high level of comfort.

**Tyres sizes**
- XZM:
  - 12.00 R 20 176A5
  - 12.00 R 24 178A5
  - 14.00 R 24 193A5
  - 16.00 R 25 200A5
- XZM2+:
  - 18.00 R 25 207A5
  - 18.00 R 33 214A5
- X-STACKER:
  - 18.00 R 25 207A5

**Tyre performance**

<table>
<thead>
<tr>
<th>Tyre</th>
<th>Resistance to damage</th>
<th>Speed capacity</th>
<th>Long service life</th>
<th>Stability</th>
<th>Comfort</th>
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Introducing the new MICHELIN® X-STRADDEL 2 TYRE, FASTER. SAFER. +30% of productivity
Introducing the new **MICHELIN®** X-STRADDLE 2 TYRE, **FASTER. SAFER.**

+30% of productivity

**X-STRADDLE**
Specific tyres to equip straddle carriers carrying only 1 container.

- More tyre life thanks to a more resistant tread pattern and to a new tread design
- More speed capacity thanks to innovative tread pattern compound and to the reduction of heat accumulation (cooling system).
- A bigger load capacity thanks to a new bead area and an efficient cooling system.

The size 450/95 R 25 202A7 will required to replace the size 16.00 R 25 202 A7 for this use.
- Good stability and shocks resistance

**X-STRADDLE 2**
New generation tyres developed to equip straddle carriers (both types) carrying only 1 container

- More tyre life thanks to a more resistant tread pattern and to a new tread design
- More speed capacity thanks to innovative tread pattern compound and to the reduction of heat accumulation (cooling system).
- A bigger load capacity thanks to a new bead area and an efficient cooling system.

The size 450/95 R 25 202A7 will required to replace the size 16.00 R 25 202 A7 for this use.
- Good stability and shocks resistance

**X-STRADDLE**
Specific tyres to equip straddle carriers (both types) carrying 1 or 2 containers

- Unmatched load capacity
- Long wear life thanks to a massive tread pattern

**Tyre performance**

<table>
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<th>Product benefits</th>
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Advice and recommendations on the use of MICHELIN industrial tyres

The following information is extracted from the Use and Maintenance Guide of Michelin Earthmover Tyres. For more details, consult our website www.michelinearthmover.com or from your Michelin representative.

Introduction

The tyre is the only point of contact between the machine and the ground. Users must ensure that they preserve the life and performance of their tyres. To do so, it is recommended that users adhere to the following safety instructions and usage recommendations. These recommendations are subject to more restrictive local provisions: legal, regulatory requirements, etc.

Choice of tyre

The choice of a tyre must be compliant with legislation and with equipment recommended by the vehicle or tyre manufacturer or by an official organisation (size, load and speed indices, tyre structures, etc.). Moreover, it is necessary to take account of the conditions in which the tyre will be used in order to ensure its performance to meet the users expectations. The type of tread pattern depends mainly on conditions of use encountered: adherence, risk of cuts, rapid wear. The optimum performance of equipment depends largely on the choice of tyre. A tread pattern inappropriate for the work leads to a sharp reduction in the tyres life and may affect vehicle productivity.

In the event of the original vehicle equipment being modified, it is advisable to make sure that the solution offered is compliant with the legislation in force, the machines technical constraints, conditions of use and the manufacturers recommendations, (Please refer to regulations in force in the local country). Therefore, in some countries, a modified machine must receive administrative authorisation. Before being fitted, any second-hand or used tyre must be subjected to careful inspection by a specialist tyre professional in order to guarantee the safety of the user and compliance with the regulations in force (Vehicle checks and maintenance).
Use of tyres

General Recommendations
Never use the tyre beyond the limits of the technical specifications for which it has been approved on the machines. Certain excessive or abnormal geometrical settings for the machine may have an effect on the tyre’s performance. Poor use or wrong choice of tyre can also contribute to premature wearing of certain mechanical parts.

According to the obligations of the legislation, or technical or security recommendations, the two tyres on the same axle must be identical.

Dual mounting
For technical and safety reasons, you must adhere to the recommendations of the manufacturer of the machine. We advise against the following mountings:
- dual mounting of Michelin radial tyres with cross ply (bias) tyres
- dual mounting of a tyre of normal tread depth with a deep treaded tyre
- dual mounting of tyres of the same type which have different remaining tread depths (Some legislation sets a maximum differential.)

According to legislation in force and for technical reasons, it is either mandatory or strongly advised to use two tyres of the same tread design on the same axle.

Fitting

Introduction
Correct fitting, performed in accordance with recommended operating procedures and complying with the safety rules in force, ensures excellent protection for people and material, and allows the tyres’ full potential to be exploited.

Poor fitting can cause damage to the tyres, the vehicle or to people (serious, even fatal injuries).

It is therefore essential that these operations are carried out by people who have been trained and who have the appropriate equipment available, and in accordance with the procedure.

We strongly recommend that tyre fitting is undertaken by a trained tyre professional.

Tubeless industrial tyres can be fitted:
- In tubeless with a tubeless bead seal on all wheels which are mounted on the corresponding tube type size
- In tube type with an appropriate flap and inner tube.

In all cases, it is essential to refer to the technical instructions of the tyre manufacturer, vehicle manufacturer and wheel manufacturer, as well as the user manual for the tyre-fitting machinery or equipment.
General precautions
Operators must always wear appropriate protection equipment.
Operators must know recommended procedure.
Operators must ensure that the vehicle is stopped, secured and properly stabilized (parking brake engaged, blocks ...), motor turned off.

Precautions for removal
a) when removing the vehicle wheel
If the tyre is twin-fitted, fitted with a divided wheel or if the rim shows evidence of damage, the tyres must be deflated prior to removal of the whole fitment (remove the valve core). Failure to observe this could lead to accidents very serious consequences. Ensure that the tyre’s temperature allows it to be removed safely. Comply with the manufacturers’ recommendations and instructions.
b) when the tyre is removed on the vehicle
Completely deflate the tyre before any operation.

Precautions for fitting
- Ensure that the wheel and its components are in good condition
- Check dimensional compliance (tyre and wheel)
- Ensure compatibility between tyres and wheels
- Adhere to the positions, direction of fitting, direction of rotation and any other instructions referred to on the tyre sidewall.
- In the case of multi-piece wheels, replace the O-ring seal
- In the case of tubeless mounting
  ■ with a rubber valve, this must be systematically replaced
  ■ with metallic valves, check the air tightness and continue with the replacement of valve cores or seals if necessary
- In the case of divided wheels (2 piece bolted assembly)
  It is imperative to respect the maximum inflation pressure recommended by the manufacturer. If necessary consult it because instructions may be different depending on the manufacturer.
- After fitting the tyre to the vehicle, a torque wrench must be used to achieve the optimal torque as specified by the machine manufacturer.
- When changing a tyre, it is advisable to also change the tubeless bead seal.
In all cases, it is imperative to change the valve of the tubeless bead seal on each assembly and ensure that the valve hole is not damaged. If this is the case, it is imperative to change the tubeless bead seal because it involved in the sealing.
**Precautions for inflating**
Tyre inflation is an essential factor, not only for optimisation of tyre performance but also in terms of SAFETY. It is necessary for correct machine behavior (road holding and braking) as well as maintaining the tyre's stability. Only use inflation equipment intended for this purpose and fitted with a pressure limiter. No person must be in the immediate proximity of the equipment in order to be out of the path of any potential discharge in the event of an incident.

**Operating pressure**
The inflation pressure that must be strictly adhered to is that recommended by the manufacturer. In the absence of real elements known to determine a pressure (weighing results, driving conditions, etc...), a basic pressure can be viewed on the Fitment Guide but is only given as indicative. The operating pressure can be given only by the Michelin representative or by a qualified professional who is trained to take into account the use criteria of the tyre (ground conditions, cycle lengths, transported materials, etc.). Under-inflation or over-inflation can significantly affect tyre performance.

Rolling underinflated causes an abnormal rise in temperature of the components of the tyre and can cause one tyre degradation. This degradation is irreversible and may lead to destruction of the tyre with brutal deflation. The negative effects of insufficient inflated pressure are not necessarily immediate and even may manifest until some time after correction...

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**Storage and maintenance**
Tyres are rubber-based and are subject to natural ageing. For that storage does not adversely affect the life of the tyre, but it must be under specific conditions, limited in time, and as far as possible inside.
- In premises that are well-ventilated, dry and temperate, protected from direct sunlight and bad weather
- Away from any chemical substances, solvents or hydrocarbons likely to interfere with the nature of the rubber
- Away from any object that could penetrate the rubber (sharp metal, wood, etc.)
- Away from any source of heat, flame, incandescent object, material that could cause sparks or electrical discharges and any ozone sources (transformers, electric motors, soldering devices, etc.).

Poor handling of an unfitted tyre can cause it to be irreparably damaged. In order to eliminate the risk of bead damage and the problems which could result, we strongly advise that:
1. The tyre is not lifted directly by the bead with a crane hook.
2. Flat straps are used (not steel slings or chains).
3. The tyre is lifted under the tread and not on the beads when a fork lift truck is used.
Moreover, accessories must be stored in their original packaging, on surfaces that do not present any danger of cutting, tearing or perforation.

In all cases, for the handling of tyres and accessories, operators must
■ Be equipped with their protective clothing.
■ Observe the safety of the company.
■ Use a suitable material to use.
■ Use of instruments and equipment that is not harmful to tyres.

Operators must always wear their normal protective clothing for handling.

To share best practices and recommendations for storage of tyres or wheel assemblies, consult your Michelin representative.

**Machine checks and maintenance**

**General recommendations**

Ensure that the machine is stationary and secured before any inspection.

Tyres must be inspected regularly in order to detect any unusual wear and potential damage.

Wheel torque must be checked in accordance with the machine manufacturer’s recommendations.

Any perforations, cuts or visible distortion of the tread, sidewalls or flange area must be the subject of a thorough (internal/external) examination of the tyre by a tyre professional. It is the same for any damage to the rim.

In all circumstances, do not put back into operation any tyres that exhibit damage, such as deformed bead or visible bead wire, separations between components, visible cable cords, damage from grease or corrosive particles, marbling or abrasion of the interior rubber resulting from any running at insufficient pressure.

Each time the machine is inspected, check that the valve cap is in good condition. If in doubt, replace it.
Checking for wear
Checking for wear must always be carried out at several points on the tyre. This check can be carried out using a tyre depth gauge or by looking for signs of wear on the tread (noted on the sidewall by a symbol when present).
If the legal or technical limit for wear has been reached, the tyre must be removed and replaced.
A tyre professional must be consulted if there is abnormal wear or a difference in wear between two tyres on the same axle.

Pressure
Given that a tyre loses pressure naturally, it is necessary to adjust it periodically. This check will enable any abnormal loss of pressure to be detected. This check must be carried out on all the vehicle's tyres.
A tyre operated with insufficient pressure will undergo an abnormal rise in operating temperature, which can lead to irreversible damage of internal components and cause its complete destruction with up to rapid deflation of the tyre. The consequences of running with insufficient inflation pressure are not necessarily immediate and may appear even after rectification.
An excessive pressure can cause rapid and irregular wear, resulting in increased susceptibility to impacts (tread damage, rupture of the casing, etc.).

It is recommended that tyre pressures are checked when tyres are cold.
If they are checked after running, the tyres are hot and pressure will not be accurate.
If pressure is checked when hot, the pressure should be readjusted in line with the manufacturer's recommendations (consult your Michelin representative).
Given that pressure increases with temperature, a hot tyre must never be deflated.
Always respect the equality of pressure between dual tyres.
Inflation with nitrogen is not an exemption from the need to check tyre pressure regularly.
In all circumstances, adhere to the pressures recommended by the machine or tyre manufacturers.
Repair
Not all damage can be repaired.
All repairs must be carried out by a trained and qualified professional.
Repairs are preceded as a matter of course by a detailed inspection of the tyre by the professional. A tyre that has been run underinflated or flat may have suffered irreversible damage and only an exhaustive check of the interior of the tyre will enable a diagnosis of whether or not the tyre can be put back into use.
Removal of the tyre is therefore essential in order to assess with certainty its actual condition and the type of repair required.

Product life

Tyres are made from different types of materials and rubber-based components, whose properties are essential to the proper running of the tyre itself. These properties evolve over time.
For each tyre, this evolution depends on many factors, such as climate, storage conditions (temperature, humidity, position, etc.), conditions of use (load, speed, inflation pressure, road damage, etc.) to which the tyre is subjected during its working life.
These ageing factors vary so much that it is impossible to predict the life of a tyre with any accuracy. This is why, in addition to regular user checks, it is recommended to have the tyres regularly checked by a qualified professional, who will determine whether the tyre is fit to continue in operation.
This inspection must be carried out at least once a year.
Michelin may in no way be held responsible for damage that may occur as a result of use contrary to its instructions.

The preceding information is extracted from the USE AND MAINTENANCE GUIDE FOR MICHELIN EARTHMOVER TYRES.
For more details, consult our website www.michelinearthmover.com or from your Michelin representative.
For more information about our products, maintenance and safety advice, or to find your nearest dealer, visit

www.michelinearthmover.com