VEHICLE TIRES ROLLING RESISTANCE AND WET GRIP REQUIREMENTS
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1. SCOPE AND FIELD OF APPLICATION

This technical regulation is concerned with the maximum rolling resistance and
minimum wet grip requirements of all new tires, imported, produced or sold in the
Kingdom of Saudi Arabia. However, it does not apply for:

1.1 Professional off-road tires
1.2 Retread tires
1.3 Tires having a nominal rim diameter code ≤ 10 (or ≤ 254 mm) or ≥ 25 (or ≥ 635 mm)
1.4 Motorcycle tires
1.5 Bicycle tires
1.6 Vintage tires
1.7 Tires with a speed symbol of “B”, “C”, “D”, “E” or “F” in accordance with Saudi
standard mentioned in item 2.1, table 4.
1.8 Temporary-use spare tire

2. COMPLEMENTARY REFERENCES

2.1 SASO 445 " Passenger Car Tires – Part 1: Nomenclature, Designation, Marking,
Dimensions, Load Capacity and Inflation Pressure ".
2.2 SASO 447 " Passenger Car Tires – Part 2: General Requirements ".
2.3 SASO 2252 " Motor Vehicles Tires – Tread wear, Traction and Temperature
Resistance Grading ".
2.4 SASO GSO ISO 28580 " Passenger car, truck and bus tires – Methods of measuring
rolling resistance – Single point test and correlation of measurement results "
2.5 SASO ECE 117 " Uniform provisions concerning the approval of tyres with regard to
rolling sound emissions and/or to adhesion on wet surfaces and/or to rolling
resistance ".
2.6 SASO ISO 15222 " Truck and Bus tires - method for measuring relative wet grip
performance – Loaded new tires ".
2.7 SASO 1136 " Multi-Purpose Vehicles, Trucks, Buses and Trailers Tyres - Part 3:
General Requirements ".
2.8 SASO 1134 " Multi-Purpose Vehicles, Trucks, Buses and Trailers Tyres - Truck and
Bus - Part 1: Nomenclature, Designation Marking, Dimensions, Load Capacities and
Inflation Pressures
3. DEFINITIONS

For the purposes of this regulation, the definitions given in standards mentioned in items 2.1, 2.4, 2.5, 2.6 and 2.7 and the following apply.

3.1 Rolling Resistance Force (RRF): The force resisting the motion when a tire rolls on a surface.

3.2 Normal Force (NF): The force exerted on the body by gravity.

3.3 Rolling Resistance: Measure of the force resisting the motion when a tire rolls on a surface.

3.4 Rolling Resistance Coefficient (RRC): Unit of the Rolling Resistance, which is calculated by dividing the Rolling Resistance Force (RRF) by the Normal Force (NF) bared by the vehicle.

\[
(RRC) = \frac{(RRF)}{(NF)}
\]

3.5 Wet Grip: Measure of the tire's ability to deliver grip, on wet surface conditions

3.6 Wet Grip Index (G): Unit of the Wet Grip, which is a function of the tackiness of the rubber compound. It is defined as per the standard mentioned in item 2.5 for C1 tires and the standard mentioned in item 2.6 for C2 and C3 tires.

3.7 C1 tires: tires intended for vehicles of category M1, O1 and O2

3.8 C2 tires: tires intended for vehicles above 3.5 tons of category M2, M3 , N , O3 and O4 with load capacity index in single formation ≤ 121 and speed category symbol ≥ N

3.9 C3 tires: tires intended for vehicles above 3.5 tons of category M2, M3, N , O3 and O4 with one of the following load capacity indices:

i) Load capacity index in single formation ≤ 121 and speed category symbol ≤ M

ii) Load capacity index in single formation ≥ 122

3.10 New vehicle tires: Tires intended for new vehicles and that are supplied to the vehicle manufacturer's assembly plant.

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1) M1: Vehicles used for the carriage of passengers and comprising not more than eight seats in addition to the driver's seat. (Passenger car)
M2: Vehicles used for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass not exceeding 5 tonnes. (Bus)
M3: Vehicles used for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass exceeding 5 tonnes. (Bus)
N: Vehicles having at least four wheels and used for the carriage of goods
N1: Vehicles used for the carriage of goods and having a maximum mass not exceeding 3.5 tonnes. (Pick-up Truck)
N2: Vehicles used for the carriage of goods and having a maximum mass exceeding 3.5 tonnes but not exceeding 12 tonnes. (Commercial Truck)
N3: Vehicles used for the carriage of goods and having a maximum mass exceeding 12 tonnes. (Commercial Truck)
O1: Trailers with a maximum weight not exceeding 0.75 tonnes
O2: Trailers with a maximum mass exceeding 0.75 tonnes, but not exceeding 3.5 tonnes
O3: Trailers with a maximum mass exceeding 3.5 tonnes, but not exceeding 10 tonnes
O4: Trailers with a maximum mass exceeding 10 tonnes
3.11 **Professional off-road tires:** Tires that are primarily used for servicing in severe off-road conditions.

In order to be classified as a “professional off-road tire”, a tire shall have all of the following characteristics:

(a) For C1 and C2 tires:
   i) A tread depth ≥ 11 mm;
   ii) A void-to-fill ratio ≥ 35 percent;
   iii) A maximum speed rating of ≤ Q.

(b) For C3 tires:
   i) A tread depth ≥ 16 mm;
   ii) A void-to-fill ratio ≥ 35 percent;
   iii) A maximum speed rating of ≤ K.

3.12 **Motorcycle tires:** Tires that are fitted on the motorcycles.

3.13 **Bicycle tires:** Tires that are fitted on the bicycles

3.14 **Retread tires:** Old tires that have been recoated with a rubber veneer of tread.

3.15 **Temporary-use spare tires:** Tires designed for use at inflation pressures higher than those established for standard and reinforced tires.

3.16 **Vintage vehicle tires:** Tires that are fitted on the vintage vehicles (i.e. vehicles registered for the first time before 1 October, 1990).

3.17 **Tire Class:** Refers to the class of the tire; i.e. C1, C2 or C3.

3.18 **Tire Type:** A group/family of tires that have the same:
   - Tire Manufacturer
   - Tire Class
   - Tire Structure; i.e. Diagonal, Radial, etc.
   - Category of Use; i.e. Normal, Special, etc.
   - Reinforced or Extra Load (Only for C1 Tires)
   - Tread Pattern

3.19 **Reference laboratory:** means a laboratory that is part of the network of laboratories that has been defined as a reference laboratory in accordance to EU 1235 " The measurement of rolling resistance and the verification procedure " \(^{(2)}\).

3.20 **Candidate laboratory:** Means a laboratory participating in the alignment procedure that is not a reference laboratory.

\(^{(2)}\) Apply the European regulation No. EU 1235 until the adoption of the Saudi standard.
3.21 **Alignment tire**: means a tire that is tested for the purpose of performing the alignment procedure.

3.22 **Alignment tires set**: means a set of five or more alignment tires.

3.23 **Assigned value**: means a theoretical value of one alignment tire as measured by a theoretical laboratory which is representative of the network of reference laboratories that is used for the alignment procedure.

4. **MAXIMUM ROLLING RESISTANCE LIMITS**

The following shall be met by all new tires, imported, produced or sold in the Kingdom of Saudi Arabia.

4.1 **Phases**

The requirements will be enforced in two separate phases:

- **Phase I** extends from 1 November, 2015 until October 31st, 2019.
- **Phase II** extends from 1 November, 2019 onwards.

4.2 **Maximum limits (Table 1)**

4.2.1 The maximum limit for C1 tires shall be 12.0 N/kN in phase I and 10.5 N/kN in phase II.

4.2.2 The maximum limit for C2 tires shall be 10.5 N/kN in phase I and 9.0 N/kN in phase II.

4.2.3 The maximum limit for C3 tires shall be 8.0 N/kN in phase I and 6.5 N/kN in phase II.

<table>
<thead>
<tr>
<th>Tire class</th>
<th>Maximum RRC value (N/kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Phase 1</td>
</tr>
<tr>
<td>C1</td>
<td>12.0</td>
</tr>
<tr>
<td>C2</td>
<td>10.5</td>
</tr>
<tr>
<td>C3</td>
<td>8.0</td>
</tr>
</tbody>
</table>

4.3 **Timeline of compliance with phase I maximum limits**

4.3.1 The phase I maximum limits shall be enforced on C1 and C2 tires as of November 2015.

4.3.2 The phase I maximum limits shall be enforced on the new vehicle C1 and C2 tires as of November 1st, 2016.

4.3.3 The phase I maximum limits shall be enforced on C3 tires as of November 1st, 2016.

4.3.4 The phase I maximum limits shall be enforced on the new vehicle C3 tires as of November 1st, 2017.
4.4 Timeline of compliance with phase II maximum limits

4.4.1 The phase II maximum limits shall be enforced on C1 and C2 tires as of November 1st, 2019.

4.4.2 The phase II maximum limits shall be enforced on the new vehicle C1 and C2 tires as of November 1st, 2020.

4.4.3 The phase II maximum limits shall be enforced on C3 tires as of November 1st, 2020.

4.4.4 The phase II maximum limits shall be enforced on the new vehicle C3 tires as of November 1st, 2021.

4.5 Testing method

4.5.1 The rolling resistance tests of the C1, C2 and C3 tires shall be carried out in accordance with the standard mentioned in item 2.4 or 2.5. Verification testing by the authorities in the Kingdom of Saudi Arabia will be conducted in accordance with item 2.4.

4.5.2 Tests shall be conducted and reported for the worst performing tire in the tire family. The test must be conducted in an ILAC or UNECE accredited laboratory or a laboratory accredited by a local accreditation agency.

The selection of the worst performing tire is left to the discretion of the manufacturer.

4.5.3 Tests shall be conducted on a one-off basis during the lifetime of the tire type. The test report must represent the worst performing tire in the group/family.

5. MINIMUM WET GRIP LIMITS (Table 2)

5.1 The following shall be met by all new tires, imported, produced or sold in the Kingdom of Saudi Arabia.

5.1.1 The minimum wet grip limit for C1 tires shall be 1.10 G.

5.1.2 The minimum wet grip limit for C2 tires shall be 0.95 G.

5.1.3 The minimum wet grip limit for C3 tires shall be 0.65 G.

Table 2: Minimum Wet Grip Requirements

<table>
<thead>
<tr>
<th>Tire class</th>
<th>Minimum wet grip value (G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>1.10</td>
</tr>
<tr>
<td>C2</td>
<td>0.95</td>
</tr>
<tr>
<td>C3</td>
<td>0.65</td>
</tr>
</tbody>
</table>
5.2  **Timeline of compliance with minimum wet grip limits** (Table 4a, Table 4b)

5.2.1 The minimum wet grip limits shall be enforced on C1 tires as of November 1st, 2015.

5.2.2 The minimum wet grip limits shall be enforced on the new vehicle C1 tires as of November 1st, 2016.

5.2.3 The minimum wet grip limits shall be enforced on C2 tires as of November 1st, 2018.

5.2.4 The minimum wet grip limits shall be enforced on the new vehicle C2 tires as of November 1st, 2018.

5.2.5 The minimum wet grip limits shall be enforced on C3 tires as of November 1st, 2020.

5.2.6 The minimum wet grip limits shall be enforced on the new vehicle C3 tires as of November 1st, 2020.

5.3  **Testing method**

5.3.1 The wet grip tests of the C1 tires shall be carried out in accordance with the standard mentioned in item 2.5.

5.3.2 The wet grip tests of the C2 and C3 tires shall be carried out in accordance with the standard mentioned in item 2.6.

5.3.3 Tests shall be conducted and reported for the worst performing tire in the tire family.

The test must be conducted in an ILAC or UNECE accredited laboratory or a laboratory accredited by the local accredited agency.

5.3.4 Tests shall be conducted on a one-off basis during the lifetime of the tire type. The test report must represent the worst performing tire in the group/family.

6.  **CONFORMITY OF PRODUCTION**

6.1 Any tire approved under this Regulation shall be so manufactured as to conform to the performance characteristics of the type of tire approved and satisfy the requirements of item 4 and 5.

6.2 In order to verify conformity, SASO or whomever authorized by it has the right to take a random sample of tires that have been previously approved in accordance with this Regulation or is applying for approval in accordance with the Regulation shall be taken from the series production or local market and tested in accordance with items 2.4, 2.5 and/or 2.6.

6.3 Production shall be deemed to conform to the requirements of this Regulation if the levels measured comply with the limits prescribed in Table 1, with an additional allowance of + 0.3 N/kN for possible mass production variations.
7. ROLLING RESISTANCE AND WET GRIP CLASSIFICATION

7.1 Rolling Resistance Classification

The rolling resistance class rating for C1, C2 and C3 tires shall be determined on the basis of the Rolling Resistance Coefficient (RRC) according to the scale specified in Table 3 below, and measured in accordance with testing method defined in Section 2.4.

Table 3: Grading Scale for Tires Rolling Resistance

<table>
<thead>
<tr>
<th>C1 Tires</th>
<th>C2 Tires</th>
<th>C3 Tires</th>
</tr>
</thead>
<tbody>
<tr>
<td>RRC (N/kN)</td>
<td>Rolling Resistance Class</td>
<td>RRC (N/kN)</td>
</tr>
<tr>
<td>RRC≤6.5</td>
<td>Excellent</td>
<td>RRC≤5.5</td>
</tr>
<tr>
<td>6.6≤RRC≤7.7</td>
<td>Very Good</td>
<td>5.6≤RRC≤6.7</td>
</tr>
<tr>
<td>7.8≤RRC≤9.0</td>
<td>Good</td>
<td>6.8≤RRC≤8.0</td>
</tr>
<tr>
<td>9.1≤RRC≤10.5</td>
<td>Average</td>
<td>8.1≤RRC≤9.2</td>
</tr>
<tr>
<td>10.6≤RRC≤12.0</td>
<td>Poor</td>
<td>9.3≤RRC≤10.5</td>
</tr>
<tr>
<td>N/A</td>
<td>Very Poor</td>
<td>N/A</td>
</tr>
</tbody>
</table>

7.2 Wet Grip Classification

The wet grip class rating for C1, C2 and C3 tires shall be determined on the basis of the Wet Grip Index (G) according to the scale specified in Table 4 below, and measured in accordance with testing method defined in Section 2.5 for C1 tires and Section 2.6 for C2 and C3 tires.

Table 4: Grading Scale for Tires Wet Grip

<table>
<thead>
<tr>
<th>C1 Tires</th>
<th>C2 Tires</th>
<th>C3 Tires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Grip Index (G)</td>
<td>Wet Grip Class</td>
<td>Wet Grip Index (G)</td>
</tr>
<tr>
<td>1.55≤G</td>
<td>Excellent</td>
<td>1.40≤G</td>
</tr>
<tr>
<td>1.40≤G≤1.54</td>
<td>Very Good</td>
<td>1.25≤G≤1.39</td>
</tr>
<tr>
<td>1.25≤G≤1.39</td>
<td>Good</td>
<td>1.10≤G≤1.24</td>
</tr>
<tr>
<td>N/A</td>
<td>Average</td>
<td>N/A</td>
</tr>
<tr>
<td>1.10≤G≤1.24</td>
<td>Poor</td>
<td>0.95≤G≤1.09</td>
</tr>
<tr>
<td>N/A</td>
<td>Very Poor</td>
<td>N/A</td>
</tr>
</tbody>
</table>
8. ROLLING RESISTANCE AND WET GRIP LABELLING REQUIREMENTS

8.1 Timeline of Compliance

8.1.1 The labeling requirements shall be enforced on the imported and locally manufactured C1 and C2 tires as of November 1st, 2015.

8.1.2 The labeling requirements shall be enforced on the imported and locally manufactured C3 tires as of November 1st, 2016.

8.2 Design of the Label

8.2.1 The label must be at least 75 mm wide by 165 mm high. Should the label be printed in a larger format, its content must remain proportionate to the dimensions defined in Figure 1 below.

8.2.2 The label brackets shall be color-coded as detailed below and illustrated in Figure 1.

8.2.2.1 “Excellent” Bracket: Dark Green color.
8.2.2.2 “Very Good” Bracket: Green color.
8.2.2.3 “Good” Bracket: Light Green color.
8.2.2.4 “Average” Bracket: Yellow color.
8.2.2.5 “Poor” Bracket: Orange color.
8.2.2.6 “Very Poor” Bracket: Red color.

8.2.3 A sample of the label is illustrated in Figure 2.

8.3 Information and Values Contained on the Label

The font used in the label should be “Arial” for both Arabic and English as illustrated in the Figure 1.

The fields (a), (b), (c), (d), (e) and (f) of Figure 3 shall comply with the following requirements:

(a) Field a shall include the tire manufacturer/brand name.

(b) Field b shall display key tire information; including tire class, the tire line, tire dimension, load index, speed rating and other technical tire information.

NOTE: The additional technical tire information is left for the manufacturer’s discretion.

(c) Field c shall display the rolling resistance grade of the tire in accordance with the grading scale defined in Table 3 above.
(d) Field d shall wet grip grade of the in tire in accordance with the grading scale defined in Table 4 above.

(e) Field e shall display the logo of the Saudi Standards, Metrology and Quality Organization.

(f) Field f shall include a QR-code automatically generated by the label software.

8.4 Placement and Material of the Label

8.4.1 The label must be printed on a self-adhesive and shall be presented on the tread of each tire.

8.4.2 Ministry of Commerce and Industry, or whomever it chooses to delegate, reserves the right to ban the entry of any tire to the country or its sale in cases where:

8.4.2.1 The SASO tire rolling resistance and wet grip label is not displayed in accordance with the requirements of this standard.

8.4.2.2 The wrong information is reported on the label.

8.5 Label issuing process

For the purposes of tire labeling, the applicant may report self-declared values provided that the methodology through which the results were obtained is supplied; e.g. engineering analysis report, simulation results, in-facility testing report, etc. However, this does NOT eliminate the requirement of providing the test results from an accredited laboratory for the worst performing tire in the family to ensure alignment with the minimum requirements for rolling resistance and wet grip.

8.6 Label verification procedure

The aligned measured rolling resistance coefficient value shall not be greater than the upper limit (the highest RRC) of the declared class by more than 0.3 kg/1 000kg.

9. Laboratory alignment procedure

9.1 Measurement of rolling resistance

9.1.1 Principle

Measuring Rolling Resistance Coefficient \( RRC_{m,l} \) for reference laboratory \( (l) \) shall be aligned to the assigned values of the network of reference laboratories. The \( RRC_{m,c} \) in a candidate laboratory \( (c) \) shall be aligned through one reference laboratory of the network of its choice.

9.1.2 Tire selection requirements

A set of five or more alignment tires shall be selected for the alignment procedure in compliance with the criteria below. One set shall be selected for C1 and C2 tires together, and one set for C3 tires.
9.1.2.1 The difference between the highest $RRC_m$ of the tire set, and the lowest $RRC_m$ shall be at least equal to 3 kg/t for C1 and C2 tires and 2 kg/t for C3 tires.

9.1.2.2 The $RRC_m$ in the candidate or reference laboratories (c or l) based on declared RRC values of each alignment tire of the set shall be spaced out as follows and distributed uniformly $1 \pm 0.5$ kg/t for C1, C2 and C3 tires.

9.1.2.3 The selected tire section width shall be $\leq 245$ mm for machines measuring C1 and C2 tyres, and $\leq 385$ mm for machines measuring C3.

9.1.2.4 The selected tire outer diameter shall be between 510 to 800 mm for machines measuring C1 and C2 and between 771 to 1143 mm for machines measuring C3.

9.1.2.5 Alignment tire shall be replaced when it has a condition which makes it unusable for further tests and/or there are deviations of $RRC_m$ greater than 1.5 percent relative to earlier measurements after correction for any machine drift.

9.1.3 Requirements applicable to the reference laboratories and determination of the assigned values

The assigned values of each alignment tire shall be determined by a network of reference laboratories. After two years the network shall assess the stability and validity of the assigned values.

Each reference laboratory participating in the network shall comply with the specifications detailed in Section 2.5 and its subsequent amendments and have a standard deviation ($\sigma_m$) not greater than 0.05 kg/t for class C1, C2 and C3 tires.

The sets of alignment tires, conforming to the specification of Section 9.1.2 shall be measured in accordance with Section 2.5 by each reference laboratory of the network.

The assigned value of each alignment tire is the average of the measured values given by the reference laboratories of the network for this alignment tire.

9.1.4 The methodology for aligning a reference laboratory to the assigned values shall be conducted in accordance to EU 1235 "The measurement of rolling resistance and the verification procedure" (3).

9.1.5 The methodology for aligning a candidate laboratory shall be conducted in accordance to EU 1235 "The measurement of rolling resistance and the verification procedure" (3).

(3) Apply the European regulation No. EU 1235 until the adoption of the Saudi standard.
Figure 1: Tire Rolling Resistance and Wet Grip Label Dimensions and Color Scale

*Scale 1:1
Figure 2: Tire Rolling Resistance and Wet Grip Label Sample
Figure 3: Tire Rolling Resistance and Wet Grip Label Information Fields