



EUROPEAN COMMISSION  
DIRECTORATE-GENERAL FOR ENERGY

Directorate C - Renewables, Research and Innovation, Energy Efficiency  
C.4 - Energy Efficiency: Buildings and Products

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## **Guideline regarding the Candidate Laboratory alignment procedure applying for ANNEX IVa of Regulation (EC) 1222/2009 - Laboratory alignment procedure for the measurement of rolling resistance**

### **PURPOSE**

This guideline aims to clarify the process for candidate laboratory alignments. It refers to the findings described in the document “Final Report - Review study on the Regulation (EC) No 1222/2009 on the labelling of tyres”, March 2016, including the proposal for amendment of Annex IVa of the Tyre Labelling Regulation. The Expert Group on laboratory alignment of tyre rolling resistance, installed under Regulation (EC) N° 1222/2009, suggested it as method to increase the accuracy and reproducibility of the rolling resistance tests.

### **DEFINITIONS**

For the purpose of the laboratory alignment procedure, the following definitions apply:

- (1) "Reference laboratory" means a laboratory that is part of the network of laboratories, the name of which have been published for the purpose of the alignment procedure in the *Official Journal of the European Union*, and is able to achieve the accuracy of test results determined in section 3 with his reference machine.  
The Reference laboratory shall comply with ISO/IEC 17025.
- (2) "Candidate laboratory" means a laboratory intended to measure new test tyres, upon alignment of his candidate machine to a reference laboratory according to this document;  
The Candidate laboratory shall comply with ISO/IEC 17025.
- (3) "Alignment tyre" means a tyre measured by both the candidate and reference laboratory to perform machine alignment
- (4) "Alignment tyres set" means a set of five or more alignment tyres for the alignment of one single machine;
- (5) "Assigned value" means a theoretical value of the Rolling Resistance Coefficient of one alignment tyre as measured by a theoretical laboratory which is representative of the network of reference laboratories that is used for the alignment procedure;
- (6) "Machine" means every tyre testing spindle with one specific measurement method.  
For example, two spindles acting on the same drum shall not be considered as one machine. One spindle able to measure tyre rolling resistance through different methods shall not be considered as one machine.
- (7) "New test tyre" means a tyre which has not been previously used in a rolling deflected test which elevates the tyre's temperature to higher than that generated in rolling resistance tests or has not been exposed to a temperature higher than 40 deg C.  
Repetition of allowed test procedures is permitted (example ISO 28580).

## PRINCIPLE

The measured ( $m$ ) Rolling Resistance Coefficient obtained by a machine in a candidate laboratory ( $c$ ),  $RRC_{m,c}$ , shall be aligned through one reference laboratory of the network of its choice.

## CLARIFICATIONS ON TYRE SELECTION REQUIREMENTS

A set of five or more alignment tyres shall be selected for the alignment procedure in compliance with the criteria below. One set shall be selected for C1 and C2 tyres together, and one set for C3 tyres.

- (a) The set of alignment tyres shall be selected so as to cover the range of different  $RRC$ s of C1 and C2 tyres together, or of C3 tyres. In any event, the difference between the highest  $RRC_m$  of the tyre set, and the lowest  $RRC_m$  of the tyre set shall be, before and **after** alignment, at least equal to
  - (i) 3 N/kN for C1 and C2 tyres, and
  - (ii) 2 N/kN for C3 tyres.
- (b) The  $RRC_m$  in the candidate or reference laboratories ( $RRC_{m,c}$  or  $RRC_{m,l}$ ) based on declared  $RRC$  values of each alignment tyre of the set shall be distributed uniformly.
- (c) Load index values shall adequately cover the range of the tyres to be tested, ensuring that the Rolling Resistance Force (RRF) values also cover the range of the tyres to be tested.
- (d) The ratio of rolling resistance force (Fr) between the highest Fr and the lowest Fr of the tyre set shall be, before alignment, at least equal to 2 for the sets of C1/C2 and C3 tyres.

Each alignment tyre shall be checked prior to use and replaced when:

- (a) it shows a condition which makes it unusable for further tests, and/or
- (b) there are deviations of  $RRC_{m,c}$  or  $RRC_{m,l}$  greater than 1.5 per cent relative to earlier measurements after correction for any machine drift.

## CLARIFICATIONS ON THE PROCEDURE FOR THE ALIGNMENT OF A CANDIDATE LABORATORY

The candidate or reference laboratory shall calculate:

- (a) the measured value of each alignment tyre for each measurement as specified in Annex 6, paragraphs 6.2 and 6.3, of UNECE Regulation No 117 and its subsequent amendments (i.e. corrected for a temperature of 25°C and a drum diameter of 2 m),
- (b) in the case of reference laboratories, the mean value of the three last measurements of each alignment tyre (measurements 2,3 and 4)  
or in the case of candidate laboratories the mean value of the  $n$  last measured values

of each alignment tyre (measurements 2 to n+1),  
and

(c) the standard deviation ( $\sigma_m$ ) as follows:

$$\sigma_m = \sqrt{\frac{1}{p} \cdot \sum_{i=1}^p \sigma_{m,i}^2}$$

$$\sigma_{m,i} = \sqrt{\frac{1}{n-1} \cdot \sum_{j=2}^{n+1} \left( Cr_{i,j} - \frac{1}{n} \cdot \sum_{j=2}^{n+1} Cr_{i,j} \right)^2}$$

where:

i is the counter from 1 to p for the alignment tyres

j is the counter from 2 to n+1 for the n last repetitions of each measurement of a given alignment tyre

n+1 is the number of repetitions of tyre measurements (n+1=4 for reference laboratories and n+1 ≥4 for candidate laboratories)

p is the number of alignment tyres (p ≥ 5).

One reference laboratory (*l*) of the network shall calculate the linear regression function on the n last measured values (measurements 2 to n+1) of the candidate laboratory (*c*). The regression coefficients, A2<sub>c</sub> and B2<sub>c</sub>, shall be calculated as follows:

$$RRC_{m,l} = A2_c \times RRC_{m,c} + B2_c$$

where:

*RRC<sub>m,l</sub>* is the individual measured value of the rolling resistance coefficient by the reference laboratory (*l*) (including temperature and drum diameter corrections)

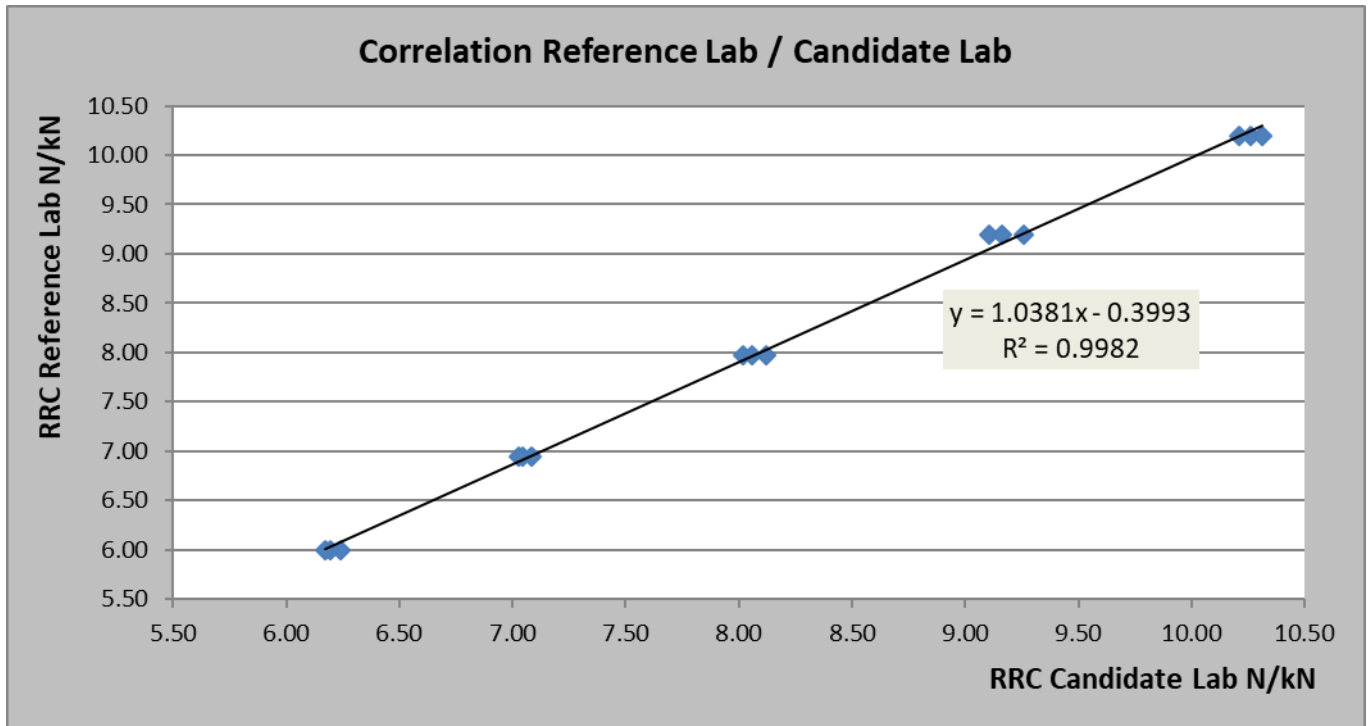
*RRC<sub>m,c</sub>* is the individual measured value of the rolling resistance coefficient by the candidate laboratory (*c*) (including temperature and drum diameter corrections).

If the coefficient<sup>2</sup> of determination R<sup>2</sup> is lower than 0.97 the candidate laboratory shall not be aligned.

The aligned *RRC* of tyres tested by the candidate laboratory is calculated as follows:

$$RRC = (A1_1 \times A2_c) \times RRC_{m,c} + (A1_1 \times B2_c + B1_l).$$

Example:



<sup>2</sup> The coefficient of determination  $R^2$  is defined as the sum of squares due to the regression divided by the total sum of squares. Usually,  $R^2$  is interpreted as representing the percentage of variation of the dependent variable explained by variation of the independent variables.

### CLARIFICATIONS ON REQUIREMENTS APPLICABLE TO CANDIDATE LABORATORIES

Candidate laboratories shall repeat the alignment procedure at least once every second year for every machine and always after any significant machine change or any drift in machine control tyre monitoring data.

A common set of at least five different tyres, conforming to the selection requirements as specified above shall be measured in accordance with the requirements of the procedure specified in Annex 6 of UNECE Regulation No117, firstly by the candidate laboratory and later on by one reference laboratory. More than five alignment tyres may be tested at the request of the candidate laboratory.

The alignment tyre set shall be provided by the candidate laboratory to the selected reference laboratory.

The candidate laboratory (*c*) shall comply with the specifications of Annex 6 of UNECE Regulation No117 and its subsequent amendments and preferably have standard deviations ( $\sigma_m$ ) as follows:

- (i) not greater than 0.075 N/kN for C1 and C2 tyres, and
- (ii) not greater than 0.060 N/kN for C3 tyres.

If the standard deviation ( $\sigma_m$ ) of the candidate laboratory is higher than the above values with four measurements, the last three ones being used for the computations, then the number  $n+1$  of measurement repetitions shall be increased as follows for the entire batch of tires:

$$n + 1 = 1 + (\sigma_m / \gamma)^2, \text{ rounded up to the nearest higher integer value}$$

where:

$$\gamma = 0.043 \text{ N/kN for Class C1 and C2 tyres}$$

$$\gamma = 0.035 \text{ N/kN for Class C3 tyres.}$$

### **GUIDANCE ON HOW TO HANDLE THE PROCESS OF CHANGING ALIGNMENT EQUATIONS, BOTH FOR REFERENCE AND CANDIDATE LABORATORIES**

1. The applicable alignment equation is determined based on the measurement date:  
A Rolling Resistance test result generated *before* the date of entry into force of the new EGLA alignment equations (December 2, 2019), will be aligned with the old equation and a test result generated *after* the date of entry into force (December 2, 2019), will be aligned with the new equation.
2. If a Candidate Laboratory or another machine was aligned before this date, its current alignment equation is still valid for 2 years following its alignment report issue date.
3. If a validation check on a Label grade is done by a Testing Service or another Test Laboratory after this date, it can be done according to the following multi-steps approach:
  - (a) For a validation test result generated from December 2, 2019:  
➔ Apply the alignment equation applicable from December 2, 2019.

After this first step (a), if the results confirm the level of the Label grade, the tyre is declared compliant.

If the results do not confirm the level of the Label grade the second step (b) shall be applied.

- (b) If the Label grade was originally based on an alignment report generated after 2nd December 2019, the tyre is declared non-compliant and the procedure defined in annex IVa of Regulation (EC) N° 1222/2009 shall be applied

If the Label grade was originally based on an alignment report generated before December 2, 2019, the alignment equation applicable before 2nd December 2019 will be applied to these validation results.

After this second step (b), if these new results confirm the level of the Label grade, the tyre is declared compliant.

If these new results do not confirm the level of the Label grade, the tyre is declared non-compliant and the procedure defined in annex IVa of Regulation (EC) N° 1222/2009 shall be applied.

## **Template for candidate / reference laboratory alignment**

### **1. General information of Applicant (Candidate laboratory)**

**Company:** \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ P.O. Box: \_\_\_\_\_

Contact person: \_\_\_\_\_ Position: \_\_\_\_\_

Telephone: \_\_\_\_\_ Fax: \_\_\_\_\_ E-mail: \_\_\_\_\_

a) Tyre manufacturer  b) Independent laboratory

Is your company integrated in a Group?  Yes  No

If yes, indicate which one: \_\_\_\_\_

**Candidate machine identification**

Trade Mark: \_\_\_\_\_ Serial number: \_\_\_\_\_

Test Lab location: \_\_\_\_\_ Year of make: \_\_\_\_\_

**Date of last calibration:** \_\_\_\_\_

The laboratory is certified/accredited/compliant to ISO 17025

The facility is certified / compliant to ISO /TS 16949

The laboratory complies with the specifications of ISO 28580 Annex A on test equipment tolerances

Drum Ø [mm]: \_\_\_\_\_

Drum Surface: \_\_\_\_\_

Drum material: \_\_\_\_\_

**Where to send the test tyres after testing:**

Address: \_\_\_\_\_

City: \_\_\_\_\_ P.O.Box: \_\_\_\_\_

Contact person: \_\_\_\_\_

**Test tyres provided:**

Tyre type:  C1/C2  C3

Method:  Force  Torque  Power  Deceleration

**Test results of the n+1 measurements (corrected for drum diameter and room temperature)**

(The n last measured values ( 2 to n+1 ) of the candidate laboratory are used for the regression analysis)

Tyre : Make - Size – Designation	RRC <sub>1,c</sub> (N/kN)	RRC <sub>2,c</sub> (N/kN )	RRC <sub>3,c</sub> (N/kN )	RRC <sub>4,c</sub> (N/kN )	.....	RRC <sub>n+1,c</sub> (N/kN)

**Candidate machine measurement reproducibility:  $\sigma_m$  (N/kN):** \_\_\_\_\_

All the information included by the company in this form will remain confidential.



**2. General information of the Reference laboratory**

**Company:** \_\_\_\_\_

**Address:** \_\_\_\_\_

**City:** \_\_\_\_\_ **P.O. Box:** \_\_\_\_\_

**Contact person:** \_\_\_\_\_ **Position:** \_\_\_\_\_

**Telephone:** \_\_\_\_\_ **Fax:** \_\_\_\_\_ **E-mail:** \_\_\_\_\_

a) Tyre manufacturer       b) Independent laboratory

**Reference machine identification**

**Trade Mark:** \_\_\_\_\_ **Serial number:** \_\_\_\_\_

**Test Lab location:** \_\_\_\_\_ **Year of make:** \_\_\_\_\_

**Date of last calibration:** \_\_\_\_\_

The laboratory is certified/accredited/compliant to ISO 17025

The facility is certified / compliant to ISO /TS 16949

The laboratory complies with the specifications of ISO 28580 Annex A on test equipment tolerances

**Drum Ø [mm]:** \_\_\_\_\_

**Drum Surface:** \_\_\_\_\_

**Drum material:** \_\_\_\_\_

**Test characteristics:**

**Method:**       Force       Torque       Power       Deceleration

**Test results, average of measurement 2 – 4, corrected for drum diameter and temperature:**

Tyre : Make - Size – Designation	RRC <sub>2,l</sub> (N/kN)	RRC <sub>3,l</sub> (N/kN)	RRC <sub>4,l</sub> (N/kN)	RRC avg. (N/kN)

