Report from the Expert Group on laboratory alignment for the measurement of tyre rolling resistance installed under Regulation (EC) No 2020/740 and listed on the Commission registry of Expert Groups to the European Commission - 2023

Inter-laboratory Alignment Procedure for Rolling Resistance Measurement in accordance with Annex V to Regulation (EU) 2020/740 of the European Parliament and of the Council of 25 May 2020 on the labelling of tyres with respect to fuel efficiency and other parameters, amending Regulation (EU) 2017/1369 and repealing Regulation (EC) No 1222/2009.

Content

1. Executive Summary

Tyres, mainly because of their rolling resistance, account for 20 % to 30 % of the fuel consumption of vehicles. A reduction of the rolling resistance of tyres may therefore contribute significantly to the energy efficiency of road transport and thus to the reduction of emissions. Fuel-efficient tyres are cost-effective since fuel savings more than compensate for the increased purchase price of tyres stemming from higher production costs.

The Regulation (EU) No 2019/2144 of the European Parliament and of the Council of 27 November 2019 on type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users sets out minimum requirements for the rolling resistance of tyres.

Technological developments make it possible to significantly decrease energy losses due to tyre rolling resistance beyond those minimum requirements. To reduce the environmental impact of road transport, it is therefore appropriate to lay down provisions to encourage end-users to purchase more fuel-efficient tyres by providing harmonised information on that parameter.

The Regulation[1] (EU) No 2020/740 of the European Parliament and of the Council establishes a framework for the provision of harmonised information on tyre parameters through labelling, allowing end-users to make an informed choice when purchasing tyres. The information to be provided under Articles 4, 5, 6 and 7 of the Regulation (EU) No 2020/740 on the fuel efficiency class, the external rolling noise class, and the wet grip class of tyres shall be obtained by applying the harmonised testing methods referred to in Annex I of the Regulation (EU) No 2020/740. The fuel efficiency class must be determined on the basis of the rolling resistance coefficient (RRC) according to the specified 'A' to 'E' scale and measured in accordance with UNECE Regulation No 117 and its subsequent amendments.

As described in the Annex V to the Regulation (EU) No 2020/740, the procedure for inter-laboratory comparison for rolling resistance (RR) should be based upon the generation of assigned RRC values. For the definition of these "**assigned values"**, the establishment of reference laboratories is essential.

A Network of Laboratories (including an Expert Group) was created under Regulation (EC) No 1222/2009[2], composed of volunteer test laboratories (Technical Services, Tyre Manufacturers) to perform inter-laboratory comparison tests on different samples of tyres, in order to establish reference data for rolling resistance measurements. The alignment method for laboratories has to measure tyre rolling resistance at the worldwide level.

The 'Expert Group on laboratory alignment for the measurement of tyre rolling resistance' was set up on 3/9/2010. Main activities of the group were dedicated to the creation of an alignment method for laboratories having to measure tyre rolling resistance in accordance with the Regulation (EC) 1222/2009. The group met several times in 2010/2011 for the alignment of reference laboratories for the measurement of tyre rolling resistance under the Regulation, and in 2013/2014 for the first assessment of the stability and validity of the assigned values of the initial alignment according to Annex V, point 3 of the Regulation. An Intermediate check was initiated by the expert group and performed in 2015 to further improve the alignment process. This check showed that the system of Reference Laboratories was stable with the 10 participating labs, illustrating that the evolution of some machines could be compensated (or eliminated) by the other labs. The main difference for the assigned values was due to the tyre evolution, not the labs evolutions. In 2016/2017, the re-assessment of the assigned values of the reference laboratories alignment was performed. In 2018 a new intermediate check procedure was performed. the global results showed a complete stability since there was no significant change on C1/C2 and C3 machines. Thus, it was decided that the group could continue using their then current equations. In 2019, the re-assessment of the assigned values of the reference laboratories alignment was performed. In 2020 a new intermediate check procedure was performed. the global results showed a complete stability since there was no significant change on C1/C2 and C3 machines. Thus, it was decided that the group could continue using their then current equations. In 2021, the re-assessment of the assigned values of the reference laboratories alignment was performed. In 2022, a new intermediate check procedure was performed. the global results showed a complete stability since there was no significant change on C1/C2 and C3 machines. Thus, it was decided that the group could continue using their current equations.

The alignment of the assigned values of the reference laboratories has been done as per Annex V of Regulation (EU) 2020/740.

Due to the periodic review of the stability of the Network of Reference Laboratories according to the Regulation, a new round of alignment among the Reference Laboratories was done in 2023. This final report includes the new alignment equations for C3 machines that will be applicable as of **April 1st, 2024,** and will apply to the labelling of

[1] Official Journal of the European Union, L342/46-58, 22.12.2009: REGULATION (EC) No 1222/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 November 2009 on the labelling of tyres with respect to fuel efficiency and other essential parameters

[2] Official Journal of the European Union, L342/46-58, 22.12.2009: REGULATION (EC) No 1222/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 November 2009 on the labelling of tyres with respect to fuel efficiency and other essential parameters

the tyres in the scope of Regulation (EU) 2020/740[3]**.** For C1/C2 machines, the Network of References Laboratories confirmed the stability and accepted the validity of the assigned values of 2021.Hence, the current equations for C1/C2 machines, that were valid until December 31st, 2023, are still valid from **January 1st, 2024** onwards.

A document giving the application rules on how to handle the process of changing alignment equations, both for Reference and Candidate Laboratories is included in Annex F.

2. Introduction

The Regulation (EU) No 2020/740 was setting a labelling classification based upon absolute rolling resistance coefficient (RRC) values. Under Annex I to the Regulation, the rolling resistance (RR) shall be measured according to the UN-ECE Regulation R117 and its subsequent amendments.

According to the experience gained by the European tyre industry from previous Round-Robin tests for tyre rolling resistance, and to the previous rounds of the inter-laboratory alignment procedure for tyre rolling resistance measurement under Regulation (EC) No 1222/2009 performed in 2011 and 2014, the deviations in test results observed could reach up to more than 1 N/kN between laboratories.

Due to this observed dispersion between measurement machines, a machine alignment procedure is necessary to get comparative Rolling Resistance Coefficient (RRC) values and give an appropriate competitive playground for the declaration of RRC labelling values according to the Regulation (EU) 2020/740.

2.1. Members of the Expert Group

Conveners (revolving):

IDIADA (Spain),
TÜV SÜD (Germany),
UTAC (France).

Tyre manufacturers:

Apollo,
Bridgestone,
Continental,
Goodyear,
Michelin,
Pirelli,
ETRTO (European Association)

Independent Test Laboratories:

IDIADA (Spain),
RDW (Netherlands),
TÜV SÜD Product Service (Germany),
UTAC (France)

Observers:

NOKIAN (Tyre manufacturer),
ETRMA (European Association),
JASIC (Japan),

2.2. Approach for laboratory alignment

[3] Official Journal of the European Union, L177 of 5.6.2020: REGULATION (EU) 2020/740 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 May 2020 on the labelling of tyres with respect to fuel efficiency and other parameters, amending Regulation (EU) 2017/1369 and repealing Regulation (EC) No 1222/2009.

The procedure is based upon the generation of assigned RRC values as described in Annex V to Regulation (EU) 2020/740.

The Expert Group proposed a two-steps process for laboratory alignment:

In the first step, a Network of Laboratories for the definition of assigned values was created. According to Annex IVa of Regulation 1222/2009, the last assigned values of each alignment tyre were determined by the Network of Reference Laboratories in 2021. After two years the network has to assess the stability and validity of the assigned values.

No member has changed their C1/C2 machine since the previous alignment campaign. One member has changed their C3 machine (Goodyear from M/C # 5 to M/C # 289.B). One member (Pirelli) has removed their C3 machine (US2-45127). One new member (Apollo) has been added to the group of participants for C3 (TS-16-10-008).

This Network of Reference Laboratories is operating the RR test machines and equipment as listed in Annex A.

The preparation of the laboratory alignment procedure consisted in the following actions:

- Assess number of alignment tyres for each category C1/C2 and C3,
- Fix details of alignment tyres (class, dimension, load index, standard or reinforced),
- Set up logistics, shipment between laboratories,
- Recommend tyre storage conditions,
- Establish the test procedure and test conditions for inter-laboratory comparison.

Based on the assigned values the Laboratories in the Network are correlated and aligned versus this “virtual reference laboratory”.

In the second step, once the Laboratories Network has been established and the alignment vs. the assigned values has been completed, any Candidate Laboratory can be aligned with any of the Network Laboratories.

2.3. Procedure for Inter-laboratory alignment

The Network of Laboratories was created Sept 3, 2010, by the Committee on the Labelling of Tyres under Regulation (EC) 1222/2009 and has been reactivated in 2013, 2016, 2018, 2020 and 2022 in order to assess the stability and validity of the assigned values.

2.3.1. Choice of laboratories

According to the rules described in the “Guideline working document on reference laboratories as defined in Commission Regulation (EU) No 1235/2011 of 29 November 2011 amending Regulation (EC) No 1222/2009 of the European Parliament and of the Council with regard to the wet grip grading of tyres, the measurement of rolling resistance and the verification procedure”, one new member (RDW) fulfilled the conditions to be added to the previous group of participants in 2015 to the Network of Laboratories. Since 2019, no member has been added.

The 11 Laboratories participating to the Inter laboratory alignment process are identified as follow:

Laboratory Name	Laboratory ID
TÜV SÜD	Lab0
UTAC	LAB1
IDIADA	LAB2
Michelin	LAB3
JASIC	LAB4
Goodyear	LAB5
Continental	LAB6
Bridgestone	LAB7
Pirelli	LAB8
RDW	LAB9
Apollo	LAB10

Description and information of the machines to be used for the inter-laboratory alignment are given in Annex A.

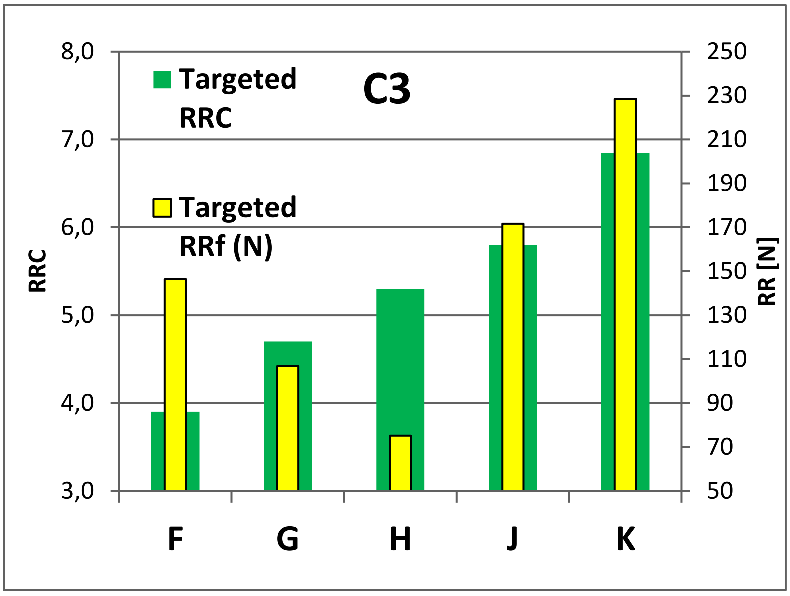
2.3.2. Choice of alignment tyres

Five sets of alignment tyres for C3 category (F to K) were selected by the Expert Group; selection of tyres was accomplished in such way to cover the Load Index and Rolling Resistance, coefficient and force, ranges in conformity with the requirements of Regulation ECE R117.

Compared to the alignment tyres used for the previous 2021 alignment campaign, the tyre K for C3 category, had a Speed Symbol G instead of K, with a new expected RRC value around 6.9N/kN.

Final selection of alignment tyres, aligned RRC and RR force:

C3	Brand / Size / Design	Targeted RRC	delta RRC	Targeted RRf (N)
F	GYR 385/55R22.5 160K FUELMAX T	3,9		146
G	MIC 245/70R17.5 X LINE ENERGY T TL 143/141J	4,7	0,8	107
H	CON 215/75R17.5 Hybrid LS3	5,3	0,6	75
J	MIC 295/80R22.5 X MULTIWAY 3D XZE TL 152/148M	5,8	0,5	172
K	CON 13R22.5 HDC1 ED	6,9	1,1	228
	Range	**3,0**		**153,3**



The alignment tyres were provided by industry.

Test conditions:

C3	Brand / Size / Design	Tyre Class	LI	SS	Speed [km/h]	Test Load [N]	Infl. press. [kPa]	Rim ["]	Warm-up [min]	Targeted RRC	delta RRC	Targeted RRf (N)
F	GYR 385/55R22.5 160K FUELMAX T	C3	160	K	80	37 523	900	11,75	180	3,9		146
G	MIC 245/70R17.5 X LINE ENERGY T TL 143/141J	C3	143	J	60	22 722	875	7,50	150	4,7	0,8	107
H	CON 215/75R17.5 Hybrid LS3	C3	126	M	80	14 175	900	6,00	150	5,3	0,6	75
J	MIC 295/80R22.5 X MULTIWAY 3D XZE TL 152/148M	C3	152	M	80	29 602	700	9,00	180	5,8	0,5	172
K	CON 13R22.5 HDC1 ED	C3	156	G	60	33 354	875	9,00	180	6,9	1,1	228
	Range									**3,0**		**153,3**

2.3.3. Pre-tests on each batch of tyres

As stipulated by the Expert Group, the industry provided the alignment tyres with minimum production variation. But as tyres are never strictly identical, a process of initial measurement of each tyre (4 times) was established in order to assess the tyre category set´s individual variance; each of the laboratories providing initial measurements did tests with one whole batch of alignment tyres (same category, brand and design).

C3	Provided by	Pretested by	Brand / Size / Design
F	Goodyear	IDIADA	GYR 385/55R22.5 160K FUELMAX T
G	Michelin	Michelin	MIC 245/70R17.5 X LINE ENERGY T TL 143/141J
H	Continental	RDW	CON 215/75R17.5 Hybrid LS3
J	Michelin	UTAC	MIC 295/80R22.5 X MULTIWAY 3D XZE TL 152/148M
K	Continental	TUEV	CON 13R22.5 HDC1 ED

2.3.4. Alignment tests for C3 tyres

Each sample of each set of 13 C3 tyres ID F, G, J, K and 12 C3 tyres ID H has been tested 4 times on one of the 10 machines dedicated to this class of tyres.

3. Results

The analysis of the results of the pre-tests shows that all the Rolling Resistance Machines used comply with the requirement on Sigma m of Regulation (EU) No 2020/740.

All the results have been collected and recorded on the template report shown in Annex B.

The data formats to be used for the computations and results are included in Annex V of Regulation (EU) No 2020/740:

- The measured RRC values corrected from drum diameter and temperature shall be rounded to 2 digits after the comma.
- Then the computations will be made with all digits: There will be no further rounding except on the final alignment equations.
- All standard deviation values will be displayed with 3 digits after comma.
- All RRC values will be displayed with 2 digits after comma.
- All alignment coefficients (A1l, B1l, A2c and B2c) will be rounded and displayed with 4 digits after comma.

Deliverables of the Network of Reference Laboratories Expert Group:

- For pre-tests:

- Raw data and aligned data
- Qualification of the data
- Precision and uncertainty values
- Correction factor for each batch
- Conclusions

- For alignment tests:

- Raw data and aligned data
- Qualification of the data
- Precision and uncertainty values
- Assigned values
- Qualification of the assigned value
- Alignment equations for reference laboratories
- Precision and uncertainty of predicted values

3.1. Pre-tests results

Each tyre of one batch has been tested on one machine four times and the average and the standard deviation of the three last measurements has been calculated.

The pre-tests batches include at least one additional tyre for each batch and the group decide to choose the alignment tyres to be use in each batch by considering the following criteria appropriate and effective:

Excludes any tyre that has got a standard deviation above the limit (5.0 %) for the three last measurements (Raw values), then in case all the tyres respect the standard deviation condition (Raw values), then remove any tyre who do not make the tyre batch distributed evenly.

The analysis, based on the three last measurements (out of four) for each tyre, results in exclusion of the following samples from the batches:

Batch F Tyre N°0, N°10 & N°12
Batch G Tyre N°4, N°5 & N°12
Batch H Tyre N°2 & N°9
Batch J Tyres N°0, N°7 & N°11
Batch K Tyres N°4, N°6 & N°8

Each remaining tyre from the batch has been re-identified as F0, F1… F10 till K0…, K9, K10.

Then, the repeatability of the pre-tests data was analysed, these data include the variation of the RR measurement process as well as the evolution of the tyres during the pre-tests. The goal of the pre-tests was to analyse the variation within a batch of tyres and to use the results to apply a correction factor. The data and the analysis of these data are given in Annex C to this report.

Another outcome from these pre-tests was the maximum variation of the measured RR coefficient for a set of 11 carefully selected tyres:

- For C3 = -3.90%, +0.04%

Even if we could consider that these results are not bad for manufactured products, a correction factor will be used to normalize the values for future computerization of regression function for each machine.

3.2.Alignment tests results

Each tyre has been tested on one machine four times and the correction factor of the tested tyre was applied to each measurement then the average of three corrected last measurements has been calculated. The data and the analysis of these data are given in Annex D to this report.

Based on the experience gained during the previous inter-laboratory rounds in 2011, 2015, 2017, 2019 and 2021, all individual data have been used for the calculation of the linear regression function for each laboratory.

4. Conclusion

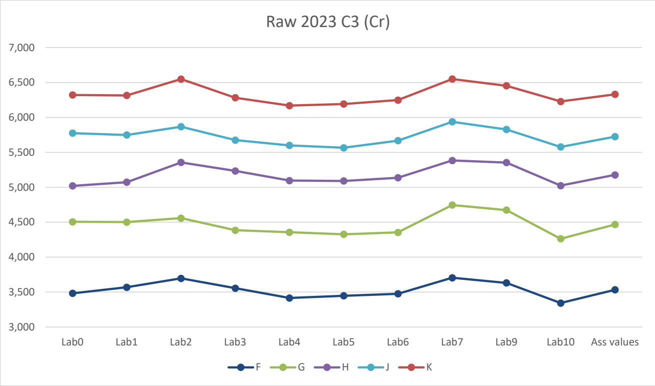
Pre-tests are still needed to monitor the dispersion of each batch of tyres and to improve the accuracy of alignment equation for each machine. Independent from the variation from one laboratory to another (if they are compliant with the requirement of Annex V of Regulation (EU) No 2020/740), the system is robust.

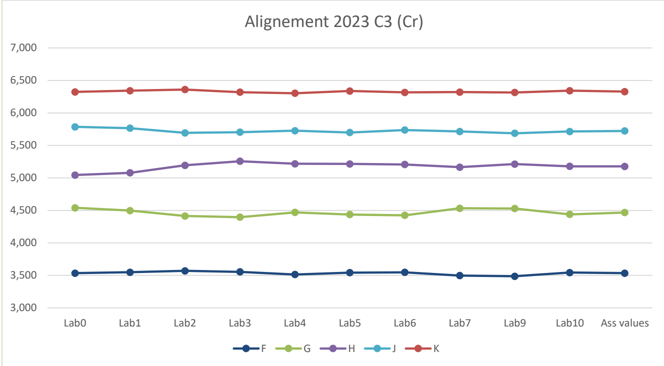
The experience gained confirms that a first test in the same conditions is necessary before starting the series of measurements.

The statistical analysis confirms that the correlation is very high.

The accuracy of measured values is improved by this alignment procedure:

Maximum deviation from assigned values before alignment For C3 = -5.35% / +6.25%	Maximum deviation from assigned values after alignment For C3 = -2.56% / +1.61%





Other documents are annexed to this report:

- Annex E: the template for candidate / reference laboratory alignment.
- Annex F: Proposal of guidance on how to handle the process of changing alignment equations, both for Reference and Candidate laboratories.

Annex A – Equipment information

	TUV SUD N°0		UTAC N°1		IDIADA N°2		Michelin N°3		JASIC N°4		Goodyear N°5	
ADDRESS	TÜV SÜD Product Service GmbH Daimlerstrasse 15 85748 Garching/Munich, Germany		Groupe UTAC Autodrome de Linas-Montlhéry 91319 Montlhéry Cedex France		IDIADA Automotive Technology, S.A. Workshop homologation Division Pol Ind L'Albornar, AP2 exit 12 E-43710 SANTA OLIVA		CERL Michelin - Magasin F43 Compte J-B MATHIEU Zone Industrielle de Ladoux 63118 Cébazat France		Bridgestone Corporation Technology Centre 3-1-1, Ogawahigashi-cho, Kodaira-shi, Tokyo 187-8531 Japan		Goodyear Innovation Center Luxembourg Avenue Gordon Smith L-7750 Colmar-Berg Luxembourg	
Contact person	Andreas HENDL Alexander KNOERZER Lars NETSCH		Nicolas Luneau		Oscar COMAJUAN Ricard ANADON		Jean-Baptiste MATHIEU		Jun MAKINO Kazunori SUZUKI		Florian NICOLAS	
Tel +email	00 49 89 32950 -757 or -787 andreas.hendl@tuvsud.com alexander.knoerzer@tuvsud.com		Mobile : +33 6 31 85 83 31 nicolas.luneau@utac.com		+34 977166016 oscar.comajuan@idiada.com ricard.anadon@idiada.com		+33 666551835 jean- baptiste.mathieu1@michelin.com		+81 423426331 jun.makino@bridgestone.com kazunori.suzuki2@bridgestone.com		+352 81994733 florian_nicolas@goodyear.com	
Tyre type	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3
Location	Garching - Germany		Linas-Montlhéry - France		Santa-Oliva - Spain		Ladoux - France		Tokyo - Japan		Colmar-Berg - Luxembourg	
Machine Identification #	H8	H4	BAN0226-VL	BAN0226-PL	10223	10259	1P/V V6	RRPL A1	RG	RE	M/C # 4	M/C # 289.B
Machine operational	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Machine complies to performance criteria Network Laboratories	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Measurement method	Power	Power	Torque	Torque	Torque	Torque	Deceleration	Deceleration	Force	Force	Torque	Torque
Drum diameter [m]	2.0	1.7	2.0	2.0	1.7	1.7	2.706	2.706	2	3	2	2
Drum surface	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel
Max. test load [kg]	1835	10194	2000	6000	1500	7000	2039	8155	1500	8000	1250	6118

	Continental N°6		Bridgestone N°7		Pirelli N°8		RDW N°9		Apollo N°10	
ADDRESS	Continental Reifen Deutschland GmbH Jaedekamp 30 30419 Hannover		Bridgestone Europe Italian Branch Via del Fosso del Salceto, 13/15 – 00128 Rome, Italy		Pirelli Tyre SpA Sperimentazione Indoor via Chiese; 51 20126 Milano ITALY		RDW Testcentrum Talingweg 76 8218 NX Lelystad The Netherlands		C1/C2: Apollo Tyres Global R&D Strootsweg 24 Enschede 7547 RW Netherlands	C3: Apollo Tyres (Hungary) Kft. H-3212 Gyöngyöshalász, Apollo út 106. Hungary
Contact person	Rainer HEIN		Italo FUNARO		Andrea VERGANI		Xander van der Berg		Ralph Greve	Rédei Tamás
Tel +email	+49 5119764770 rainer.hein@conti.de		+39 335 7355198 +39 06 5056312 italo.funaro@bridgestone.eu		+39 335 78 80 251 andrea.vergani@pirelli.com		+31 6 469 495 51 xvandenberg@rdw.nl		+31 (0) 53 4888 170 ralph.greve@apollotyres.com	+36-30-212-9486 tamas.redei@apollotyres.com
Tyre type	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3	C1 / C2	C3
Location	Hannover - Germany		Rome - Italy		Milan - Italy	-	Lelystad - The Netherlands		Enschede - The Netherlands	Gyöngyöshalász - Hungary
Machine Identification #	M1320	M1190	T34001	HU-2	MIQ 2094	-	OPS 26 - P1	OPS 26 - P2	Testmachine 15	TS-16-10-008
Machine operational	yes	yes	yes	yes	yes	-	yes	yes	yes	yes
Machine complies to performance criteria Network Laboratories	yes	yes	yes	yes	yes	-	yes	yes	yes	yes
Measurement method	Torque	Torque	Torque	Torque	Torque	-	Torque	Torque	Torque	Torque
Drum diameter [m]	2	2	2	1.7	2	-	2	2	2	2
Drum surface	Smooth steel	Smooth steel	Smooth steel	Smooth steel	Smooth steel	-	Smooth steel	Smooth steel	Smooth steel	Smooth steel
Max. test load [kg]	1529	8155	1275	6120	2000	-	2000	5000	1450	6000

Annex B – Data report template (for pre-test and test protocols)

TIRE ROLLING RESISTANCE TEST PROTOCOL

Test Lab

General Data

Test Lab/Location:		**Report No.**	
Test-Rig:		**Test Date:**	
Drum Ø [m]:	2.0	**Drum Surface:**	smooth steel
Test Conditions:	UN R117 Annex 6	**Test Method:**	Torque method

Test-Rim

Width x Diameter [´´]:		**Material:**	

Tire

Tire-ID:	/	**Tire Class (C1, C2, C3):**	1
DOT-Nr.:		**Brand-/Trade Name:**	
Tire Manufacturer:		**Reinforced yes/no:**	
Size:		**Speed Index:**	
Nominal Diameter [m]:	0.686	**Load Index:**	98

Set Test-Data

Setting	Warm-up [min]:	Speed [km/h]:	Load [daN]:	Camb. [°]:	p_{cold} [kPa]:	T_{amb} [°C]:
1			589.0	0	210	25.0
2			589.0	0	210	25.0
3			589.0	0	210	25.0
4			589.0	0	210	25.0

Measurements

Rec.	Speed [km/h]:	Load [daN]:	T_{amb} [°C]:	
1	80.0	588.4	25.7	Remark: Average ambient temperature during whole process
2	80.0	588.4	25.7	
3	80.0	588.4	25.4	
4	80.0	588.4	25.6	

Results (non corrected results)

Rec.	Skim Test Load (N)	F_r [N]:	Temp_corr ?	F_{PL} [N]:	Automatic Calc. c_r [N/kN]
1	100	58.70	0	26.90	9.98
2	100	58.30	0	26.90	9.91
3	100	58.70	0	27.20	9.98
4	100	58.80	0	27.20	9.99

Corrected Results (Temperature 25°C, Drum diameter 2.0m)

Rec.	Correction Formula	Automatic Calc. F_r [N]:	F_{PL} [N]:	Automatic Calc. c_r [N/kN]
1	0.008	59.03	27.05	10.03
2		58.63	27.05	9.96
3		58.89	27.29	10.01
4		59.08	27.33	10.04

Aligned Results acc. EU 1235/2011 (Temperature 25°C, Drum diameter 2.0m)

1	Slope	0.9830			10.04
2	Intercept	0.1840			9.97
3					10.02
4					10.05

Reference Lab Test Protocol Version 1.2 20 October, 2014

Comments:

If Fr (N) in fields H31 to H34 and RRC in fields T31 to T34 are already temperature corrected, enter Temp_corr = 1 (otherwise (

Temperature correction coefficient for C1 is 0.008, for C2 and C3 with LI<=121 it is 0.01 and for C3 with LI>121 it is 0.006.

Annex C - Pre-tests results

1. Pre-tests results & Correction Factors for C3 tyres

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
F00	3.95	3.92	3.96	3.94	**0.995**	**Min**	96.627%
F01	3.90	3.90	3.90	3.90	**1.006**	**Max**	103.148%
F02	3.91	3.90	3.94	3.92	**1.002**	**Range**	6.521%
F03	3.85	3.81	3.86	3.84	**1.022**		
F04	3.95	3.92	3.94	3.94	**0.997**		
F05	3.96	3.88	3.94	3.93	**0.999**		
F06	3.90	3.91	3.93	3.91	**1.002**		
F07	3.89	3.88	3.91	3.89	**1.008**		
F08	3.95	3.92	3.93	3.93	**0.997**		
F09	4.01	4.02	4.00	4.01	**0.978**		
FSpare_1	3.87	3.77	3.77	3.80	**1.031**		
FSpare_2	4.06	4.05	4.07	4.06	**0.966**		
			Avg_total	**3.92**			

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
G00	4.47	4.42	4.44	4.44	**1.006**	**Min**	98.857%
G01	4.50	4.49	4.47	4.49	**0.996**	**Max**	101.323%
G02	4.45	4.44	4.44	4.44	**1.006**	**Range**	2.466%
G03	4.47	4.44	4.44	4.45	**1.004**		
G04	4.43	4.41	4.39	4.41	**1.013**		
G05	4.53	4.51	4.49	4.51	**0.991**		
G06	4.45	4.41	4.41	4.42	**1.010**		
G07	4.53	4.48	4.49	4.50	**0.993**		
G08	4.44	4.42	4.41	4.42	**1.010**		
G09	4.53	4.51	4.49	4.51	**0.991**		
GSpare_1	4.53	4.52	4.51	4.52	**0.989**		
GSpare_2	4.54	4.51	4.45	4.50	**0.993**		
			Avg_total	**4.47**			

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
H00	5.51	5.48	5.47	5.49	**0.993**	**Min**	98.385%
H01	5.51	5.47	5.46	5.48	**0.995**	**Max**	101.186%
H02	5.42	5.43	5.41	5.42	**1.006**	**Range**	2.801%
H03	5.43	5.38	5.37	5.39	**1.011**		
H04	5.44	5.44	5.41	5.43	**1.004**		
H05	5.47	5.46	5.45	5.46	**0.998**		
H06	5.45	5.44	5.44	5.44	**1.001**		
H07	5.48	5.46	5.45	5.46	**0.998**		
H08	5.48	5.45	5.43	5.45	**0.999**		
H09	5.45	5.47	5.43	5.45	**1.000**		
HSpare_1	5.57	5.54	5.51	5.54	**0.984**		
HSpare_2	5.37	5.39	5.40	5.39	**1.012**		
			Avg_total	**5.45**			

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
J00	5.86	5.84	5.83	5.84	**1.003**	**Min**	99.345%
J01	5.92	5.87	5.84	5.88	**0.997**	**Max**	101.467%
J02	5.91	5.89	5.87	5.89	**0.995**	**Range**	2.122%
J03	5.91	5.90	5.88	5.90	**0.993**		
J04	5.93	5.89	5.86	5.89	**0.994**		
J05	5.85	5.81	5.80	5.82	**1.007**		
J06	5.89	5.85	5.83	5.86	**1.000**		
J07	5.91	5.87	5.84	5.87	**0.997**		
J08	5.93	5.89	5.86	5.89	**0.994**		
J09	5.90	5.86	5.84	5.87	**0.999**		
JSpare_1	5.78	5.77	5.77	5.77	**1.015**		
JSpare_2	5.86	5.81	5.77	5.81	**1.008**		
			Avg_total	**5.86**			

Tyre	Test_2	Test_3	Test_4	Avg	Correction_factor		
K00	6.56	6.56	6.57	6.56	**0.982**	**Min**	98.176%
K01	6.46	6.45	6.42	6.44	**1.000**	**Max**	103.043%
K02	6.54	6.53	6.47	6.51	**0.989**	**Range**	4.867%
K03	6.58	6.55	6.53	6.55	**0.983**		
K04	6.53	6.48	6.48	6.50	**0.992**		
K05	6.35	6.32	6.30	6.32	**1.019**		
K06	6.51	6.50	6.47	6.49	**0.992**		
K07	6.47	6.42	6.39	6.43	**1.003**		
K08	6.53	6.51	6.50	6.51	**0.989**		
K09	6.53	6.48	6.46	6.49	**0.993**		
KSpare_1	6.28	6.25	6.23	6.25	**1.030**		
KSpare_2	6.28	6.25	6.23	6.25	**1.030**		
			Avg_total	**6.44**			

Annex D - Alignment tests results - Cr (N/kN)

1. Raw data

1.1. C3 tyres

	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	Corrected individ values 2-4: 2	3	4	sigma
TÜV	F0	3,53	3,50	3,51	3,49	3,500	0,010	0,995	3,482	3,48	3,49	3,47	0,010
UTAC	F1	3,58	3,55	3,55	3,54	3,548	0,008	1,006	3,569	3,57	3,57	3,56	0,008
Idiada	F2	3,67	3,70	3,67	3,70	3,690	0,017	1,002	3,696	3,71	3,68	3,71	0,017
Mi	F3	3,50	3,48	3,48	3,48	3,480	0,000	1,022	3,555	3,56	3,56	3,56	0,000
JASIC	F4	3,44	3,43	3,43	3,42	3,427	0,006	0,997	3,415	3,42	3,42	3,41	0,006
GY	F5	3,46	3,45	3,45	3,45	3,450	0,000	0,999	3,447	3,45	3,45	3,45	0,000
Conti²	F6	3,52	3,48	3,46	3,46	3,467	0,012	1,002	3,475	3,49	3,47	3,47	0,012
BS	F7	3,69	3,70	3,67	3,66	3,677	0,021	1,008	3,705	3,73	3,70	3,69	0,021
RDW	F9	3,67	3,65	3,64	3,63	3,640	0,010	0,997	3,630	3,64	3,63	3,62	0,010
Apo	F10	3,47	3,43	3,42	3,40	3,417	0,015	0,978	3,343	3,36	3,35	3,33	0,015
									3,532				

	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	Corrected individ values 2-4: 2	3	4	sigma
TÜV	G0	4,50	4,50	4,48	4,46	4,480	0,020	1,006	4,505	4,53	4,51	4,49	0,020
UTAC	G1	4,55	4,54	4,51	4,50	4,520	0,020	0,996	4,501	4,52	4,50	4,48	0,020
Idiada	G2	4,65	4,55	4,57	4,48	4,533	0,047	1,006	4,559	4,58	4,60	4,51	0,048
Mi	G3	4,41	4,34	4,40	4,36	4,367	0,031	1,004	4,385	4,36	4,42	4,38	0,031
JASIC	G4	4,29	4,31	4,28	4,31	4,300	0,017	1,013	4,357	4,37	4,34	4,37	0,018
GY	G5	4,38	4,37	4,36	4,37	4,367	0,006	0,991	4,326	4,33	4,32	4,33	0,006
Conti²	G6	4,34	4,31	4,31	4,31	4,310	0,000	1,010	4,354	4,35	4,35	4,35	0,000
BS	G7	4,80	4,78	4,77	4,79	4,780	0,010	0,993	4,746	4,75	4,74	4,76	0,010
RDW	G9	4,55	4,64	4,64	4,60	4,627	0,023	1,010	4,674	4,69	4,69	4,65	0,023
Apo	G10	4,33	4,30	4,30	4,31	4,303	0,006	0,991	4,264	4,26	4,26	4,27	0,006
									4,467				

	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	Corrected individ values 2-4: 2	3	4	sigma
TÜV	H0	5,08	5,07	5,06	5,03	5,053	0,021	0,993	5,020	5,04	5,03	5,00	0,021
UTAC	H1	5,16	5,12	5,10	5,08	5,100	0,022	0,995	5,073	5,10	5,07	5,05	0,022
Idiada	H2	5,40	5,32	5,37	5,29	5,327	0,040	1,006	5,357	5,35	5,40	5,32	0,041
Mi	H3	5,16	5,19	5,17	5,18	5,180	0,010	1,011	5,235	5,25	5,22	5,23	0,010
JASIC	H4	5,11	5,09	5,08	5,06	5,077	0,015	1,004	5,096	5,11	5,10	5,08	0,015
GY	H5	5,15	5,11	5,10	5,09	5,100	0,010	0,998	5,091	5,10	5,09	5,08	0,010
Conti²	H6	5,15	5,14	5,13	5,12	5,130	0,010	1,001	5,137	5,15	5,14	5,13	0,010
BS	H7	5,44	5,42	5,40	5,37	5,397	0,025	0,998	5,384	5,41	5,39	5,36	0,025
RDW	H9	5,41	5,37	5,35	5,35	5,357	0,012	0,999	5,354	5,37	5,35	5,35	0,012
Apo	H10	5,05	5,03	5,02	5,02	5,023	0,006	1,000	5,024	5,03	5,02	5,02	0,006
									5,177				

	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	Corrected individ values 2-4: 2	3	4	sigma
TÜV	J0	5,83	5,83	5,81	5,79	5,810	0,020	0,994	5,775	5,80	5,78	5,76	0,020
UTAC	J1	5,81	5,79	5,76	5,75	5,767	0,022	0,997	5,749	5,77	5,74	5,73	0,022
Idiada	J2	6,01	5,89	5,94	5,87	5,900	0,036	0,995	5,868	5,86	5,91	5,84	0,036
Mi	J3	5,73	5,74	5,71	5,69	5,713	0,025	0,993	5,676	5,70	5,67	5,65	0,025
JASIC	J4	5,65	5,63	5,64	5,63	5,633	0,006	0,994	5,600	5,60	5,61	5,60	0,006
GY	J5	5,56	5,53	5,53	5,53	5,530	0,000	1,007	5,566	5,57	5,57	5,57	0,000
Conti²	J6	5,71	5,68	5,67	5,65	5,667	0,015	1,000	5,668	5,68	5,67	5,65	0,015
BS	J7	5,97	5,98	5,95	5,93	5,953	0,025	0,997	5,938	5,96	5,93	5,91	0,025
RDW	J9	5,86	5,83	5,81	5,80	5,813	0,015	1,003	5,828	5,84	5,82	5,81	0,015
Apo	J10	5,61	5,61	5,60	5,55	5,587	0,032	0,999	5,578	5,60	5,59	5,54	0,032
									5,725				

	Mesures	1	2	3	4	moy 2-4	sig 2-4	Corr Factor	Corrected avg	Corrected individ values 2-4: 2	3	4	sigma
TÜV	K0	6,48	6,48	6,43	6,41	6,440	0,036	0,982	6,323	6,36	6,31	6,29	0,035
UTAC	K1	6,35	6,32	6,33	6,31	6,316	0,010	1,000	6,316	6,32	6,33	6,31	0,010
Idiada	K2	6,67	6,61	6,63	6,62	6,620	0,010	0,989	6,549	6,54	6,56	6,55	0,010
Mi	K3	6,43	6,41	6,40	6,36	6,390	0,026	0,983	6,283	6,30	6,29	6,25	0,026
JASIC	K4	6,25	6,22	6,22	6,22	6,220	0,000	0,992	6,169	6,17	6,17	6,17	0,000
GY	K5	6,09	6,08	6,08	6,07	6,077	0,006	1,019	6,192	6,20	6,20	6,19	0,006
Conti²	K6	6,33	6,28	6,31	6,30	6,297	0,015	0,992	6,248	6,23	6,26	6,25	0,015
BS	K7	6,56	6,50	6,52	6,58	6,533	0,042	1,003	6,551	6,52	6,54	6,60	0,042
RDW	K9	6,59	6,55	6,52	6,50	6,523	0,025	0,989	6,454	6,48	6,45	6,43	0,025
Apo	K10	6,30	6,29	6,25	6,28	6,273	0,021	0,993	6,228	6,25	6,21	6,24	0,021
									6,331				

2. Qualification of reference machines

2.1. Sigma m for C3 machines (based on corrected raw data)

Laboratory	Sigma F	Sigma G	Sigma H	Sigma J	Sigma K	**Sigma m**
Lab0	0,010	0,020	0,021	0,020	0,035	**0,023**
Lab1	0,008	0,020	0,022	0,022	0,010	**0,017**
Lab2	0,017	0,048	0,041	0,036	0,010	**0,033**
Lab3	0,000	0,031	0,010	0,025	0,026	**0,022**
Lab4	0,006	0,018	0,015	0,006	0,000	**0,011**
Lab5	0,000	0,006	0,010	0,000	0,006	**0,006**
Lab6	0,012	0,000	0,010	0,015	0,015	**0,012**
Lab7	0,021	0,010	0,025	0,025	0,042	**0,027**
Lab9	0,010	0,023	0,012	0,015	0,025	**0,018**
Lab10	0,015	0,006	0,006	0,032	0,021	**0,019**

3. Statistical analysis of the Interlaboratories results – Cr (N/kN)

1. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre F

1.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	3.482	0.010	0.286	0.020
01	3	3.569	0.008	0.212	0.015
02	3	3.696	0.017	0.469	0.035
03	3	3.555	0.000	0.000	0.000
04	3	3.415	0.006	0.168	0.012
05	3	3.447	0.000	0.000	0.000
06	3	3.475	0.012	0.333	0.023
07	3	3.705	0.021	0.566	0.042
09	3	3.630	0.010	0.275	0.020
10	3	3.343	0.015	0.447	0.030

1.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
3.471	3.493	4.303	3.457
3.560	3.577	4.303	3.550
3.676	3.716	4.303	3.653
3.555	3.555	4.303	3.555
3.408	3.421	4.303	3.401
3.447	3.447	4.303	3.447
3.462	3.488	4.303	3.447
3.681	3.728	4.303	3.653
3.619	3.642	4.303	3.606
3.326	3.359	4.303	3.305

Confidence_interval_T_up	Demi_amplitude_T
3.507	0.025
3.588	0.019
3.739	0.043
3.555	0.000
3.429	0.014
3.447	0.000
3.504	0.029
3.757	0.052
3.655	0.025
3.380	0.037

1.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	1.89	7.14
01	1.05	4.12
02	20.63	21.70
03	0.42	0.00
04	10.43	2.39
05	5.50	0.00
06	2.43	9.66
07	22.88	31.72
09	7.46	7.17
10	27.31	16.10

1.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	3.532
Repeatability_standard_deviat	0.012
Limit_of_repeatability	0.033
Repeatability_exp_uncertainty	0.024
Reproducibility_stand_deviat	0.121
Limit_of_reproducibility	0.339
Reproducibility_exp_uncertaint	0.242

1.5. *Results of measurement uncertainties in percentage*

Variable	Cr
Repe_exp_uncert_percent	0.67
Repro_exp_uncert_percent	6.85

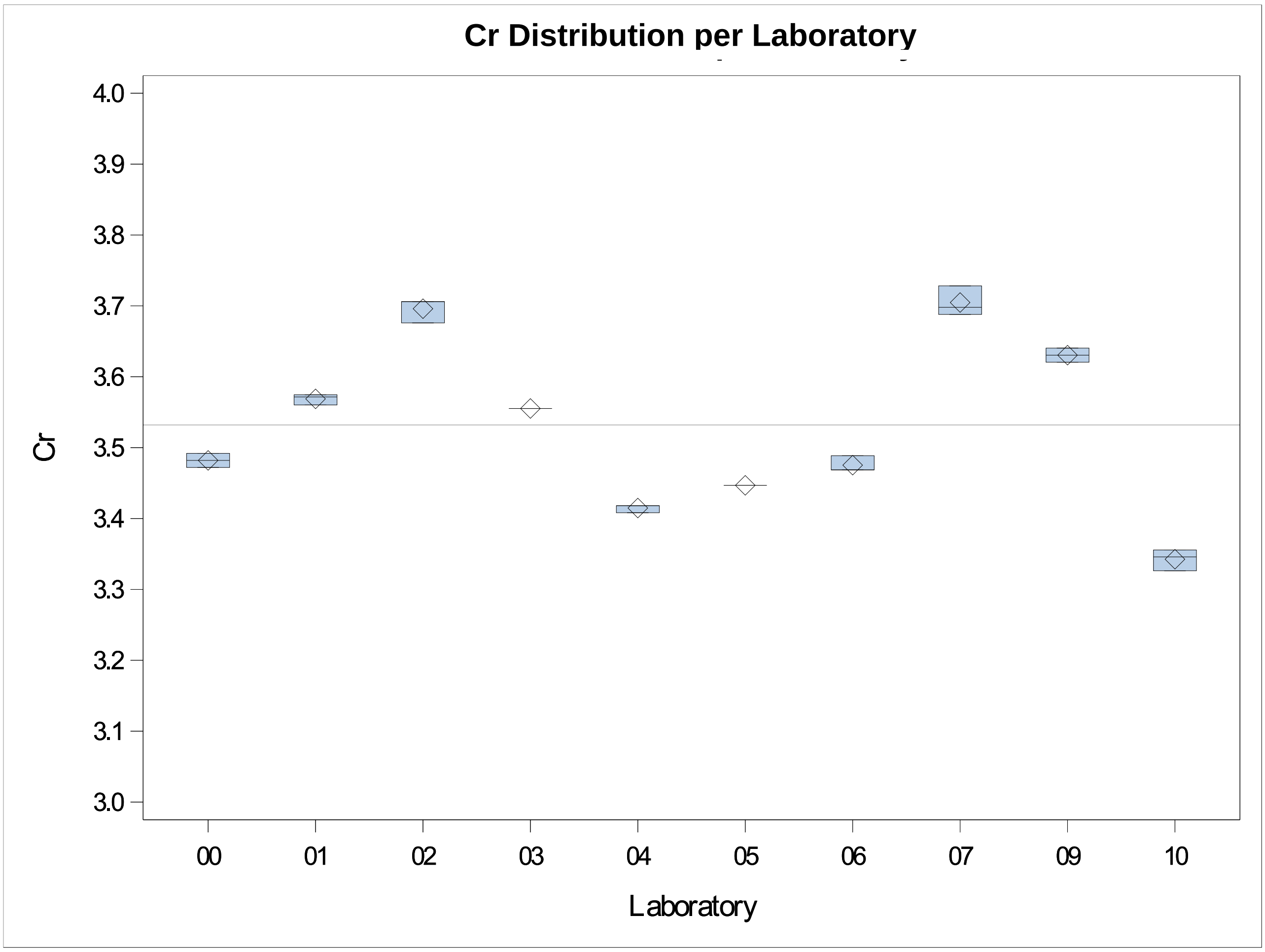
1.6. *Part of variation in percent of the laboratories on the total variation*

Variable	Cr
Variation_part_labo	99.05

1.7. Trueness study - Estimation and significativity of the bias

Laboratory	Number of non-missing values, Cr	Bias	Inc_bias	IC_inf_bias	IC_sup_bias	Significant Bias
00	3	-0.050	0.114	-0.274	0.175	NO
01	3	0.037	0.114	-0.187	0.261	NO
02	3	0.164	0.114	-0.060	0.389	NO
03	3	0.024	0.114	-0.201	0.248	NO
04	3	-0.117	0.114	-0.341	0.107	NO
05	3	-0.085	0.114	-0.309	0.139	NO
06	3	-0.056	0.114	-0.281	0.168	NO
07	3	0.173	0.114	-0.051	0.397	NO
09	3	0.099	0.114	-0.125	0.323	NO
10	3	-0.189	0.114	-0.413	0.035	NO

1.8. Box-plot graphics



2. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre G

2.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	4.505	0.020	0.446	0.040
01	3	4.501	0.020	0.452	0.041
02	3	4.559	0.048	1.042	0.095
03	3	4.385	0.031	0.700	0.061
04	3	4.357	0.018	0.403	0.035
05	3	4.326	0.006	0.132	0.011
06	3	4.354	0.000	0.000	0.000
07	3	4.746	0.010	0.209	0.020
09	3	4.674	0.023	0.499	0.047
10	3	4.264	0.006	0.134	0.011

2.2. *Confidence interval of the average per laboratory at the level 95%*

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
4.482	4.528	4.303	4.455
4.478	4.524	4.303	4.451
4.505	4.613	4.303	4.441
4.350	4.419	4.303	4.308
4.337	4.377	4.303	4.313
4.320	4.333	4.303	4.312
4.354	4.354	4.303	4.354
4.735	4.758	4.303	4.722
4.647	4.700	4.303	4.616
4.257	4.270	4.303	4.249

Confidence_interval_T_up	Demi_amplitude_T
4.555	0.050
4.552	0.051
4.677	0.118
4.461	0.076
4.400	0.044
4.341	0.014
4.354	0.000
4.771	0.025
4.732	0.058
4.278	0.014

2.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	0.65	8.04
01	0.52	8.21
02	3.75	44.87
03	3.02	18.69
04	5.40	6.12
05	8.81	0.65
06	5.70	0.00
07	34.72	1.96
09	19.01	10.81
10	18.42	0.65

2.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	4.467
Repeatability_standard_deviat	0.022
Limit_of_repeatability	0.063
Repeatability_exp_uncertainty	0.045
Reproducibility_stand_deviat	0.159
Limit_of_reproducibility	0.445
Reproducibility_exp_uncertaint	0.318

2.5. *Results of measurement uncertainties in percentage*

Variable	Cr
Repe_exp_uncert_percent	1.00
Repro_exp_uncert_percent	7.12

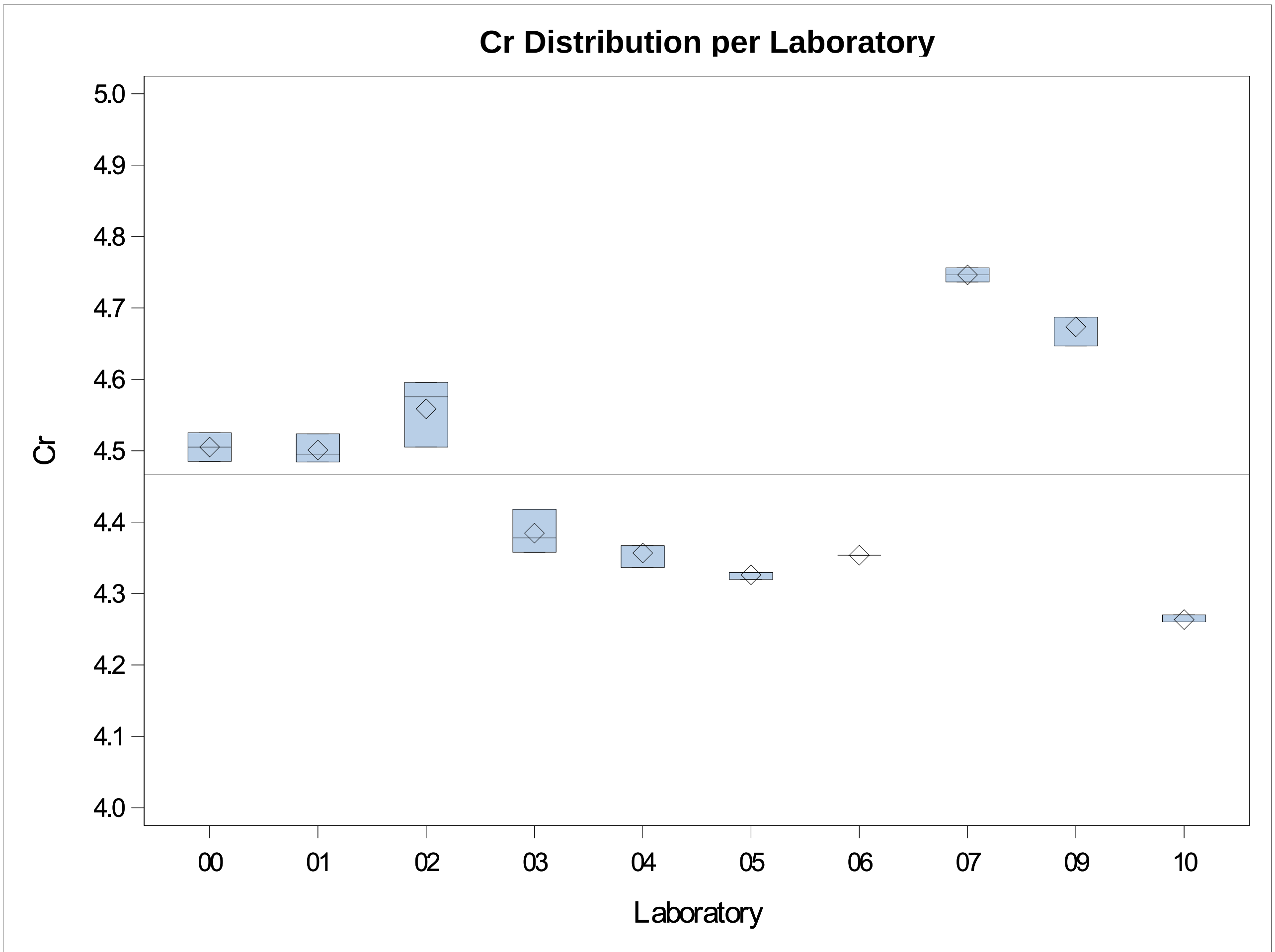
2.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	98.01

2.7. Trueness study - Estimation and significativity of the bias

Laboratory	Number of non-missing values, Cr	Bias	Inc_bias	IC_inf_bias	IC_sup_bias	Significant Bias
00	3	0.038	0.150	-0.256	0.332	NO
01	3	0.034	0.150	-0.260	0.328	NO
02	3	0.092	0.150	-0.202	0.386	NO
03	3	-0.082	0.150	-0.376	0.211	NO
04	3	-0.110	0.150	-0.404	0.184	NO
05	3	-0.141	0.150	-0.435	0.153	NO
06	3	-0.113	0.150	-0.407	0.181	NO
07	3	0.279	0.150	-0.015	0.573	NO
09	3	0.207	0.150	-0.087	0.501	NO
10	3	-0.203	0.150	-0.497	0.090	NO

2.8. *Box-plot graphics*



3. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre H

3.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	5.020	0.021	0.412	0.041
01	3	5.073	0.022	0.432	0.044
02	3	5.357	0.041	0.759	0.081
03	3	5.235	0.010	0.193	0.020
04	3	5.096	0.015	0.301	0.031
05	3	5.091	0.010	0.196	0.020
06	3	5.137	0.010	0.195	0.020
07	3	5.384	0.025	0.466	0.050
09	3	5.354	0.012	0.216	0.023
10	3	5.024	0.006	0.115	0.012

3.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
4.997	5.043	4.303	4.969
5.048	5.098	4.303	5.018
5.311	5.403	4.303	5.256
5.224	5.246	4.303	5.210
5.079	5.113	4.303	5.058
5.080	5.102	4.303	5.066
5.125	5.148	4.303	5.112
5.356	5.412	4.303	5.322
5.341	5.367	4.303	5.325
5.017	5.030	4.303	5.010

Confidence_interval_T_up	Demi_amplitude_T
5.071	0.051
5.127	0.054
5.458	0.101
5.260	0.025
5.134	0.038
5.116	0.025
5.162	0.025
5.446	0.062
5.383	0.029
5.038	0.014

3.3. ***Between and within contribution for the factor laboratory***

Laboratory	CEi	CDi
00	13.37	10.98
01	5.88	12.32
02	17.51	42.43
03	1.82	2.62
04	3.57	6.04
05	4.00	2.56
06	0.88	2.58
07	23.25	16.19
09	16.98	3.42
10	12.73	0.86

3.4. ***Global average, results of precision values and measurement uncertainties***

Variable	Cr
Global_average	5.177
Repeatability_standard_deviat	0.020
Limit_of_repeatability	0.055
Repeatability_exp_uncertainty	0.039
Reproducibility_stand_deviat	0.144
Limit_of_reproducibility	0.403
Reproducibility_exp_uncertaint	0.288

3.5. ***Results of measurement uncertainties in percentage***

Variable	Cr
Repe_exp_uncert_percent	0.76
Repro_exp_uncert_percent	5.56

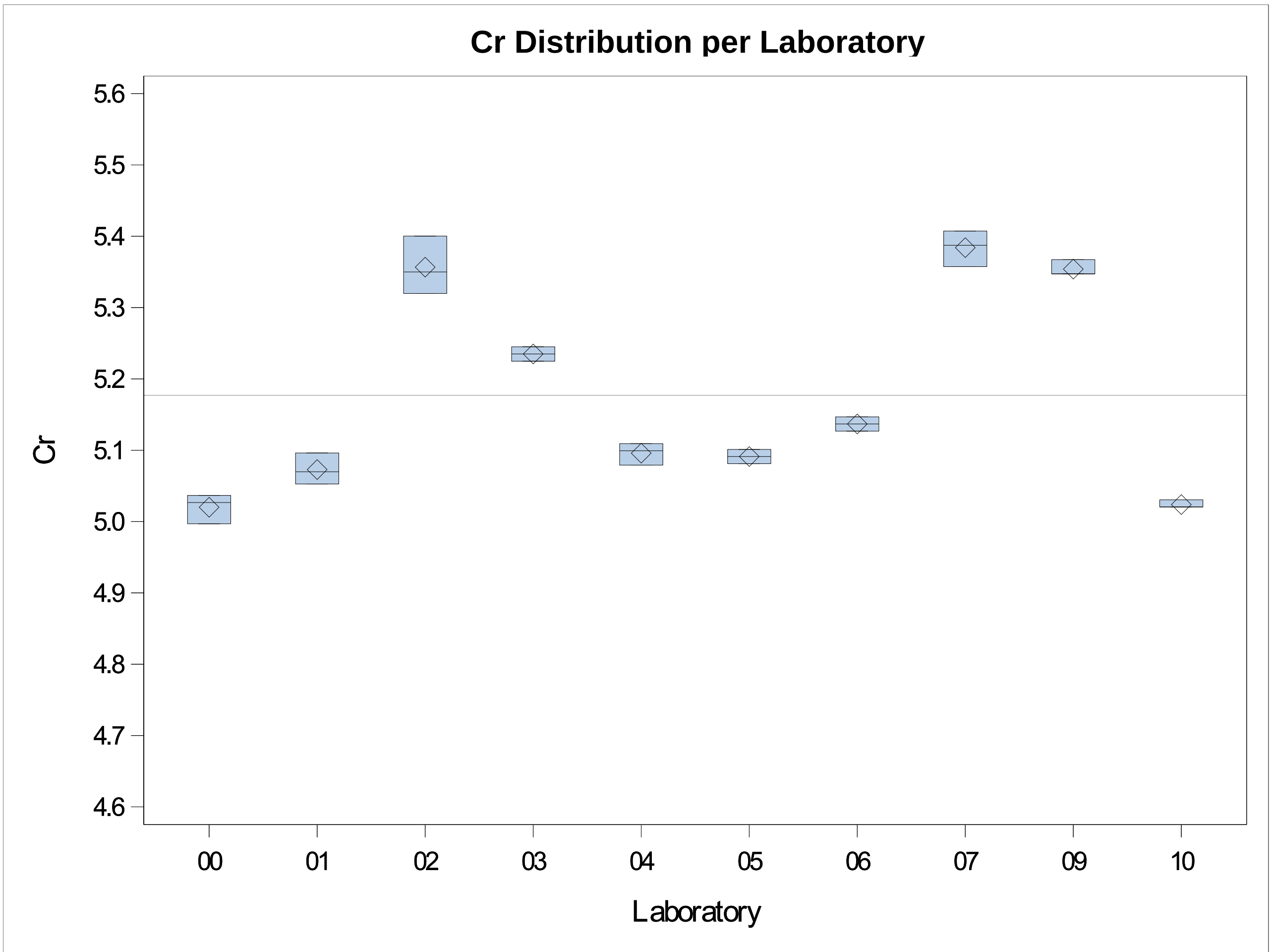
3.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	98.12

3.7. Trueness study - Estimation and significativity of the bias

Laboratory	Number of non-missing values, Cr	Bias	Inc_bias	IC_inf_bias	IC_sup_bias	Significant Bias
00	3	-0.157	0.136	-0.423	0.109	NO
01	3	-0.104	0.136	-0.370	0.162	NO
02	3	0.180	0.136	-0.086	0.446	NO
03	3	0.058	0.136	-0.208	0.324	NO
04	3	-0.081	0.136	-0.347	0.185	NO
05	3	-0.086	0.136	-0.352	0.180	NO
06	3	-0.040	0.136	-0.306	0.226	NO
07	3	0.207	0.136	-0.059	0.473	NO
09	3	0.177	0.136	-0.089	0.443	NO
10	3	-0.153	0.136	-0.419	0.113	NO

3.8. Box-plot graphics



4. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre J

4.1. *Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions*

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	5.775	0.020	0.344	0.040
01	3	5.749	0.022	0.377	0.043
02	3	5.868	0.036	0.611	0.072
03	3	5.676	0.025	0.440	0.050
04	3	5.600	0.006	0.102	0.011
05	3	5.566	0.000	0.000	0.000
06	3	5.668	0.015	0.270	0.031
07	3	5.938	0.025	0.423	0.050
09	3	5.828	0.015	0.263	0.031
10	3	5.578	0.032	0.575	0.064

4.2. *Confidence interval of the average per laboratory at the level 95%*

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
5.753	5.798	4.303	5.726
5.725	5.774	4.303	5.695
5.827	5.909	4.303	5.779
5.648	5.704	4.303	5.614
5.593	5.606	4.303	5.585
5.566	5.566	4.303	5.566
5.651	5.685	4.303	5.630
5.909	5.966	4.303	5.875
5.811	5.845	4.303	5.790
5.542	5.615	4.303	5.499

Confidence_interval_T_up	Demi_amplitude_T
5.825	0.049
5.803	0.054
5.957	0.089
5.738	0.062
5.614	0.014
5.566	0.000
5.706	0.038
6.000	0.062
5.866	0.038
5.658	0.080

4.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	1.73	8.01
01	0.40	9.49
02	13.93	26.05
03	1.61	12.66
04	10.59	0.67
05	17.02	0.00
06	2.17	4.73
07	30.81	12.76
09	7.24	4.75
10	14.48	20.87

4.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	5.725
Repeatability_standard_deviat	0.022
Limit_of_repeatability	0.062
Repeatability_exp_uncertainty	0.044
Reproducibility_stand_deviat	0.129
Limit_of_reproducibility	0.362
Reproducibility_exp_uncertaint	0.259

4.5. Results of measurement uncertainties in percentage

Variable	Cr
Repe_exp_uncert_percent	0.78
Repro_exp_uncert_percent	4.52

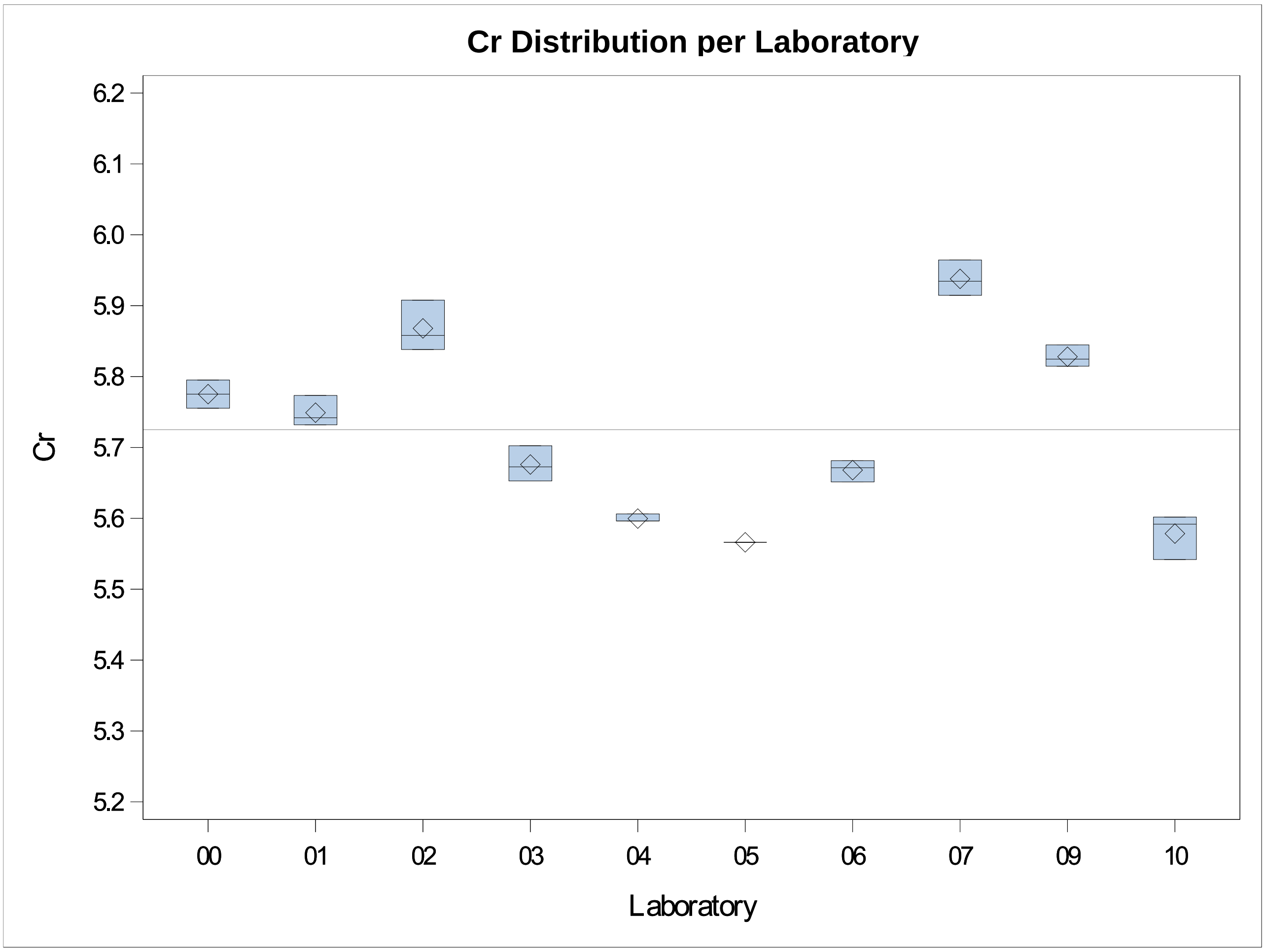
4.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	97.05

4.7. Trueness study - Estimation and significativity of the bias

Laboratory	Number of non-missing values, Cr	Bias	Inc_bias	IC_inf_bias	IC_sup_bias	Significant Bias
00	3	0.051	0.121	-0.187	0.289	NO
01	3	0.024	0.121	-0.214	0.262	NO
02	3	0.143	0.121	-0.095	0.381	NO
03	3	-0.049	0.121	-0.287	0.189	NO
04	3	-0.125	0.121	-0.363	0.113	NO
05	3	-0.158	0.121	-0.397	0.080	NO
06	3	-0.057	0.121	-0.295	0.181	NO
07	3	0.213	0.121	-0.025	0.451	NO
09	3	0.103	0.121	-0.135	0.341	NO
10	3	-0.146	0.121	-0.384	0.092	NO

4.8. Box-plot graphics



5. Results of interlaboratories tests on Coefficient of rolling resistance (Cr) – Tyre K

5.1. Average, standard deviation, coefficient of variation in percentage, expanded uncertainty in repeatability conditions

Laboratory	N	Average	Standard_deviation	Coefficient_of_variation_perc	Repeatability_exp_uncertainty
00	3	6.323	0.035	0.560	0.071
01	3	6.316	0.010	0.151	0.019
02	3	6.549	0.010	0.151	0.020
03	3	6.283	0.026	0.414	0.052
04	3	6.169	0.000	0.000	0.000
05	3	6.192	0.006	0.095	0.012
06	3	6.248	0.015	0.243	0.030
07	3	6.551	0.042	0.637	0.083
09	3	6.454	0.025	0.386	0.050
10	3	6.228	0.021	0.332	0.041

5.2. Confidence interval of the average per laboratory at the level 95%

Confidence_interval_av_low	Confidence_interval_av_up	T	Confidence_interval_T_low
6.282	6.363	4.303	6.235
6.305	6.327	4.303	6.292
6.538	6.560	4.303	6.525
6.254	6.312	4.303	6.218
6.169	6.169	4.303	6.169
6.186	6.199	4.303	6.178
6.231	6.266	4.303	6.211
6.503	6.598	4.303	6.447
6.425	6.482	4.303	6.392
6.205	6.252	4.303	6.177

Confidence_interval_T_up	Demi_amplitude_T
6.410	0.088
6.340	0.024
6.574	0.025
6.348	0.065
6.169	0.000
6.207	0.015
6.286	0.038
6.654	0.104
6.515	0.062
6.280	0.051

5.3. Between and within contribution for the factor laboratory

Laboratory	CEi	CDi
00	0.04	24.22
01	0.14	1.77
02	26.94	1.89
03	1.32	13.08
04	14.92	0.00
05	10.98	0.67
06	3.90	4.44
07	27.29	33.68
09	8.48	11.98
10	6.00	8.26

5.4. Global average, results of precision values and measurement uncertainties

Variable	Cr
Global_average	6.331
Repeatability_standard_deviat	0.023
Limit_of_repeatability	0.064
Repeatability_exp_uncertainty	0.045
Reproducibility_stand_deviat	0.141
Limit_of_reproducibility	0.395
Reproducibility_exp_uncertaint	0.282

5.5. Results of measurement uncertainties in percentage

Variable	Cr
Repe_exp_uncert_percent	0.72
Repro_exp_uncert_percent	4.46

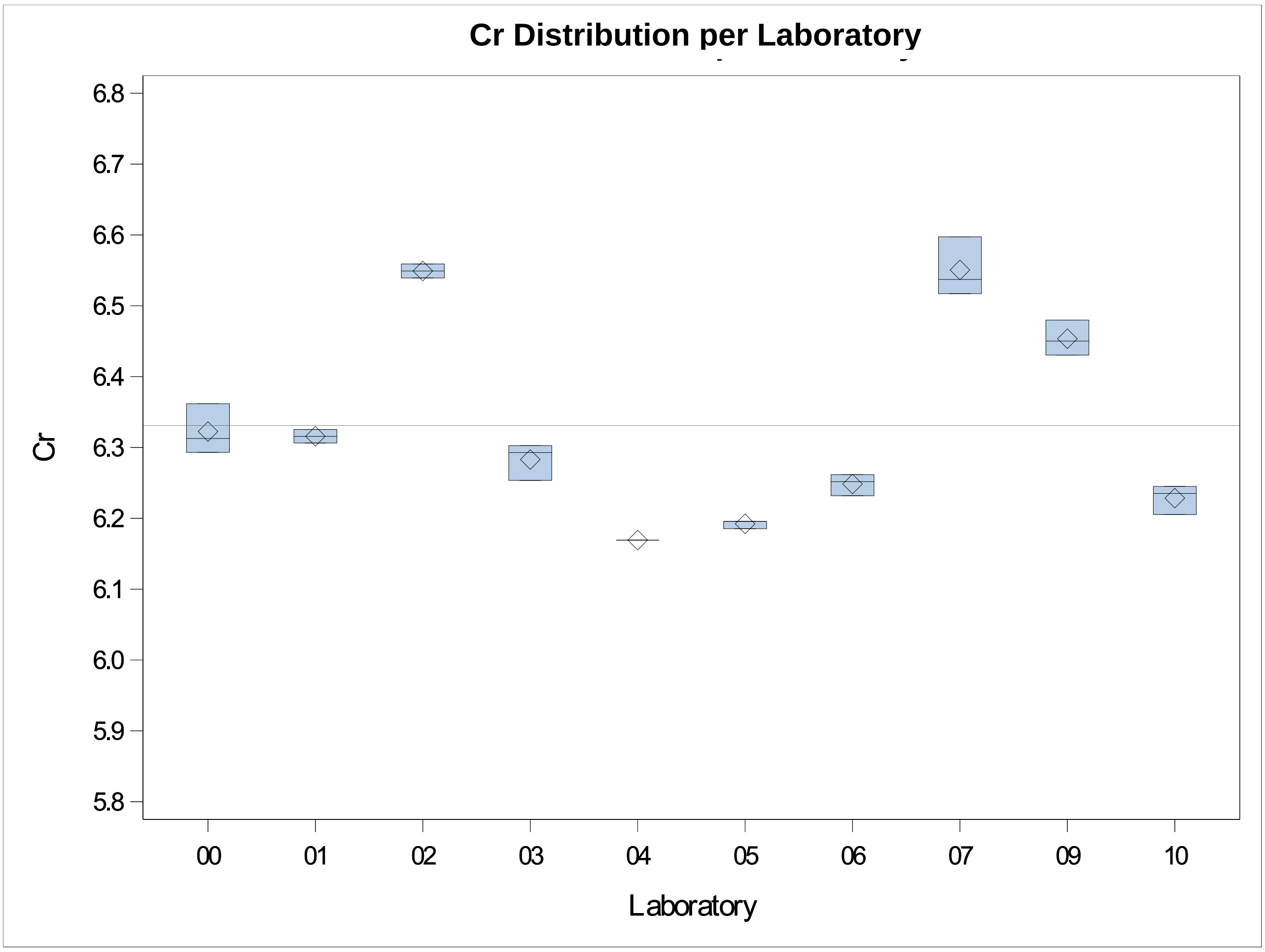
5.6. Part of variation in percent of the laboratories on the total variation

Variable	Cr
Variation_part_labo	97.40

5.7. Trueness study - Estimation and significativity of the bias

Laboratory	Number of non-missing values, Cr	Bias	Inc_bias	IC_inf_bias	IC_sup_bias	Significant Bias
00	3	-0.009	0.133	-0.269	0.251	NO
01	3	-0.015	0.133	-0.276	0.245	NO
02	3	0.218	0.133	-0.042	0.478	NO
03	3	-0.048	0.133	-0.308	0.212	NO
04	3	-0.162	0.133	-0.422	0.098	NO
05	3	-0.139	0.133	-0.399	0.121	NO
06	3	-0.083	0.133	-0.343	0.177	NO
07	3	0.219	0.133	-0.041	0.479	NO
09	3	0.122	0.133	-0.138	0.382	NO
10	3	-0.103	0.133	-0.363	0.157	NO

5.8. Box-plot graphics



Calculation of assigned values

1. Estimation of the variance of assigned values on corrected values for C3 tyres

Batch	**Assigned value**	Repeatability standard deviation	Reproducibility standard deviation	Variance Assigned values	Standard deviation Assigned values	Number of laboratories	Number of repetitions	Inf	Sup	Laboratory Variance
F	3.532	0.012	0.121	0.001	0.038	10	3	3.455	3.608	0.014
G	4.467	0.022	0.159	0.002	0.050	10	3	4.367	4.567	0.025
H	5.177	0.020	0.144	0.002	0.045	10	3	5.087	5.268	0.020
J	5.725	0.022	0.129	0.002	0.040	10	3	5.644	5.806	0.016
K	6.331	0.023	0.141	0.002	0.044	10	3	6.243	6.420	0.019

Regression functions

1. Regression functions for C3 machines – Cr (N/kN)

Lab.	Intercept $B1_l$	Standard error Intercept	Slope $A1_l$	Standard error Slope	s (Residual standard deviation)	R^2
Lab0	0,1128	0,1077	0,9826	0,0210	0,0807	0,9936
Lab1	-0,0807	0,0780	1,0170	0,0152	0,0564	0,9969
Lab2	-0,0431	0,0657	0,9777	0,0124	0,0479	0,9978
Lab3	-0,0462	0,0788	1,0131	0,0154	0,0574	0,9968
Lab4	0,0563	0,0358	1,0127	0,0071	0,0266	0,9993
Lab5	0,0332	0,0372	1,0180	0,0074	0,0275	0,9993
Lab6	0,0747	0,0394	0,9990	0,0078	0,0294	0,9992
Lab7	-0,1771	0,0604	0,9922	0,0113	0,0429	0,9982
Lab9	-0,1513	0,0681	1,0019	0,0129	0,0486	0,9977
Lab10	0,3136	0,0297	0,9684	0,0059	0,0232	0,9995

Annex E - 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)

Tyre : Make - Size – Designation	$RRC_{1,c}$ (kg/t)	$RRC_{2,c}$ (kg/t)	$RRC_{3,c}$ (kg/t)	$RRC_{4,c}$ (kg/t)	………	$RRC_{n+1,c}$ (kg/t)

Candidate machine measurement repeatability: σ_m (kg/t): _____
All the information included by the company in this form will be 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	$RRC_{2,l}$(kg/t)	RRC $_{3,l}$(kg/t)	RRC $_{4,l}$(kg/t)	RRC avg. (kg/t)

3. Alignment equation

Regression formula[4]: **RRC = aligned value (kg/t)**
$RRC_{m,c}$ = candidate's measurement (kg/t)

$RRC = a * RRC_{m,c} + b$

a = ______ **b = ______**

$a = A1_l * A2_c$
$b = A1_l * B2_c + B1_l$
Coefficient of determination[5]: R^2 = ______
Date: ______________________
Stamp and Signature: ________________________

[4]**$A1_l$, $B1_l$, $A2_c$ and $B2_c$ are the coefficients defined in annex V of Regulation (EU) N° 2020/740**
RRC is the assigned value of the rolling resistance coefficient aligned to EU Reference.
$RRC_{m,l}$ is the individual measured value of the rolling resistance coefficient by the reference laboratory (l) (including temperature and drum diameter corrections)
$RRC_{m,c}$ is the individual measured value of the rolling resistance coefficient by the candidate laboratory (c) (including temperature and drum diameter corrections)
[5]**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.**

Annex F - Proposal of 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 (April 1, 2024), will be aligned with the old equation and a test result generated ***after*** the date of entry into force (April 1, 2024), 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 (April 1, 2024):
➔ Apply the alignment equation applicable from (April 1, 2024).

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 April 1, 2024, the tyre is declared non-compliant and the procedure defined in Annex V of Regulation (EU) N° 2020/740 shall be applied

If the Label grade was originally based on an alignment report generated before April 1, 2024, the alignment equation applicable before April 1, 2024 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 V of Regulation (EU) N° 2020/740 shall be applied.

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