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Procedure for Demonstrating Equivalence of Vehicle Test and Indoor Drum Test Facilities for Tyre Abrasion and Determining the Transfer Function for Indoor Drum Test Facilities [DRAFT]

UNECE Task Force on Tyre Abrasion (43rd session). online, 02-02-2026

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Rationale and background

- A new Annex 4 (document TA-43-3) to the draft UN Regulation on abrasion is proposed as an EC contribution to the **‘technical proposal, based on available test results, to secure inclusion of both the vehicle test method on public roads and the indoor drum test method’**
- The Annex describes a procedure for demonstrating equivalence of vehicle test and indoor drum test facilities. It addresses the issue of ensuring testing method *equivalence* (i.e., beyond correlation), through legally binding criteria. This enables the robust application of one set of limits interchangeably for both methods, enabling harmonisation.
- It incorporates the notion of **technology neutrality** (same equivalence criteria apply to each test facility, whether drum or circuit).
- The facilities prove equivalence **once**, without the need of periodic verification.
- For drum facilities, equivalence is valid for the nominal parameters used during the equivalence exercise.
- A separate draft **guidance document** gives further details on the testing procedure (document TA-43-2)



Rationale and background

Earlier versions of the concept method (see TA-39-9, TA-41-4) were discussed with contracting parties and key TF TA stakeholders.

Following their feedback, the following changes were made:

- Equivalence exercise is **significantly simplified** (fewer facilities, simpler logistics: no need to store tyres between exercises).
- A flexible **governance mechanism** for the equivalence exercise is described.
- The requirement for **periodic verification was removed**.
- Added concept of defining equivalent facility comparing with three non-equivalent circuits.
- Added concepts of generic (all drums) “a” factor, in addition to the drum facility specific “a” factor.
- Some elements borrowed from French proposal (TA-39-3, with very similar aim but technical differences worth discussing in depth) and their latest proposals.



Definitions

Facility: Circuit or Drum

- **ED/EC:** Equivalent Drum/Circuit, i.e. Drum/Circuit that has proven equivalence
- **AD/AC:** Assessed Drum/Circuit that wants to prove equivalence

Baseline value (for each tyre): The average ALI of the available facilities that tested this tyre (excluding the facility under assessment). Note that the value is recalculated after removal of tyres that their absolute difference is [>0.25] from the baseline.

ALI: Abrasion level index (i.e. only ratio of candidate to reference tyre abrasion level)

* For the purpose of the initial entry into force of this Regulation, the circuits that provided the data for the definition of the abrasion limits shall be deemed Equivalent Circuits (EC).



Transfer function for Drums

All indoor drum facilities (both equivalent and under assessment) shall apply the following transfer function to their results:

$$\text{ALI}(\text{drum,TF}) = a [\text{ALI}(\text{drum}) - 1] + 1$$

Where a = a value between [1, 2] can be:

Generic for all drums (when method equivalence is proven)

Specific for the drum under assessment

Different requirements are applied depending on the selected “a”.



Organisation of an inter-facility equivalence exercise

The **coordinating body** is responsible for organising the inter-facility equivalence exercise, collecting the test data, and issuing the final equivalence report. It may be:

- a Type Approval Authority,
- a designated Technical Service,
- the Facility under assessment, or
- An Equivalent facility.
- Any other entity

Reporting. The coordinating body shall compile the results, calculate the baseline values according to paragraph 4.2, determine the specific transfer function for the drum under assessment, if applicable, and issue an Equivalence Report for the facility under assessment.

The abrasion levels of the reference tyres shall also be reported; for circuit facilities, the abrasion level normalised to the relevant reference temperature shall be included.



Equivalence procedure outline

Steps

1. Selection of (a) **tyres** and (b) **participating facilities**
2. Abrasion tests at participating facilities to **establish baseline** (reference values)
3. Application of technology neutral criteria to **establish equivalence** (existing or new facilities)



Step 1a. Selection of exercise tyres

Exercise tyres: At least [six] tyres shall be selected so that:

- (i) they cover an ALI range of at least [0.5] units, with an even distribution across the range
- (ii) they are a mix of normal and 3PMSF tyres with a ratio between 1:2 and 2:1.

If a facility under assessment is designed for testing only normal or 3PMSF tyres, the equivalence of the facility shall be restricted to the corresponding tyre category and the requirement under paragraph 4.1.1.1 (ii) shall not apply.



Step 1b. Selection of facilities

Facilities: In addition to the facility under assessment, the participating facilities shall be selected based on the type of assessment being performed:

First Eq. Circuits those used in limits definition			
Required facilities	Additional facilities	Drum	Circuit
≥ 3 equiv. or not circuits	only equiv. or not circuits	Y (specific "a")	Y
≥ 2 equiv. circuits	any equiv. (circuits>drums)	Y (specific "a")	Y
≥ 1 equiv. circuits	any equiv. (circuits>drums)	Y (generic "a")	Y



Step 2. Establishment of baseline values

Facilities shall carry out the tests according to Annex 3 of [this] regulation. Each exercise tyre shall be tested **at least** once.

The results of each equivalent drum facility shall be adjusted using their transfer function (generic or specific transfer function)

For each exercise tyre, if more than one test result is available, the baseline value shall be the arithmetic mean of the ALI results reported by the participating facilities, excluding the facility under assessment.

Any result whose absolute difference from the mean exceeds [0.25] shall be excluded and a new mean shall be calculated with the remaining results.

For cases that at least two facilities are required, if fewer than two valid data points remain after exclusion, data from an additional facility shall be added or an additional tyre shall be tested



Step 3. Demonstration of equivalence of a facility

Drum under assessment and transfer function

- Generic value “a” shall be applied to drum facilities using a generic transfer function
- Value “a” shall be calculated based on the results of the inter-facility exercise (equation given in Annex 4) for new drum facilities using a specific transfer function

An under-assessment facility demonstrates equivalence by fulfilling the following criteria:

- For each exercise tyre, the candidate’s ALI result (adjusted via transfer function if applicable) differs from the baseline value by no more than $\pm[0.25]$; and
- For all exercise tyres, the correlation coefficient (R^2) between the candidate facility’s results and the baselines shall be greater than $[0.85]$.

Drum laboratories that prove equivalence under this procedure are recognised for the specific test parameters used during the exercise.

The test reports and analysis shall be made available to the Type Approval Authority.

* Note: The R^2 equation should refer to assessed / baseline facilities, not drum and vehicle. This will be corrected in the next version of the draft.



Examples (circuit vs circuits)

This example uses the **average** of the circuits and focuses on the 6 tyres:

C1, C2 and C4 are equivalent. C3 not (no further analysis was carried out because only 5 tyres remained after removing outlier)

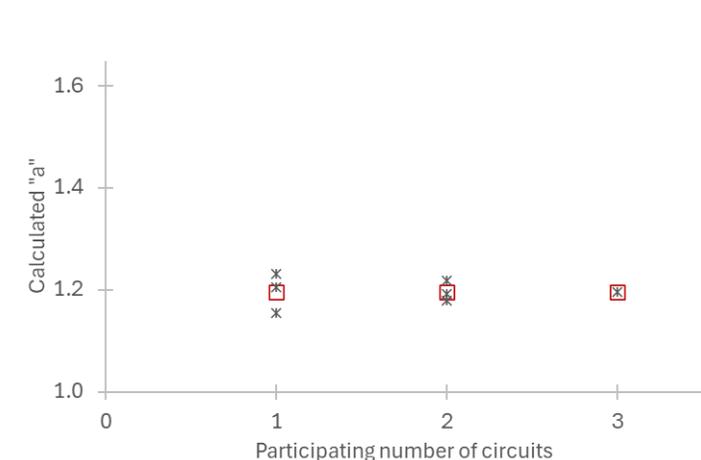
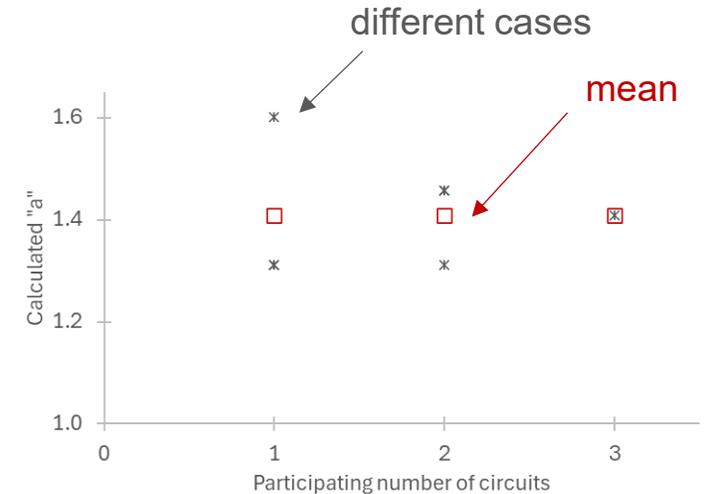
The 0.25 can be easily achieved

AC vs circuits	a	R2 >0.85	ave abs <0.1	ave	min	max	<0.25	
C1 vs C2, C3, C4	1.00	0.87	0.082	-0.035	-0.163	0.123	pass 6/6	excluding one tyre from C3
C2 vs C1, C3, C4	1.00	0.94	0.060	-0.019	-0.097	0.063	pass 6/6	excluding one tyre from C3
C3 vs C1, C2, C4	1.00	0.27	0.185	0.168	-0.050	0.404	pass 5/6	
C4 vs C1, C2, C3	1.00	0.96	0.033	-0.022	-0.117	0.020	pass 6/6	excluding one tyre from C3
C1 vs C2, C4	1.00	0.90	0.073	-0.003	-0.090	0.120	pass 6/6	excluding C3
C4 vs C1, C2	1.00	0.95	0.046	0.011	-0.075	0.105	pass 6/6	excluding C3
C1 vs C2	1.00	0.90	0.075	-0.005	-0.080	0.140	pass 6/6	
C1 vs C4	1.00	0.87	0.072	-0.002	-0.130	0.110	pass 6/6	
C4 vs C2	1.00	0.97	0.043	-0.003	-0.050	0.080	pass 6/6	
C2 vs C1	1.00	0.85	0.098	0.028	-0.140	0.190	pass 6/6	
C4 vs C1	1.00	0.87	0.095	0.025	-0.110	0.140	pass 6/6	

Examples (drum vs circuits)

This example uses a **single** test for each tyre and drum, but the **average** of each tyre and circuit. It focuses on the 6 tyres:

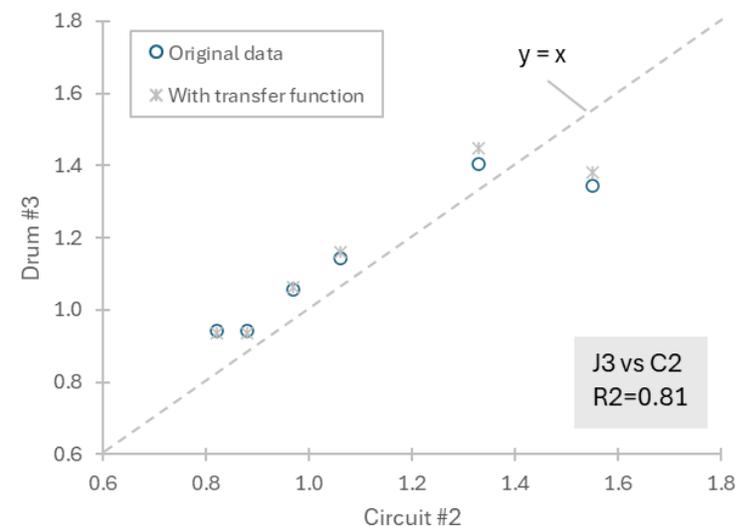
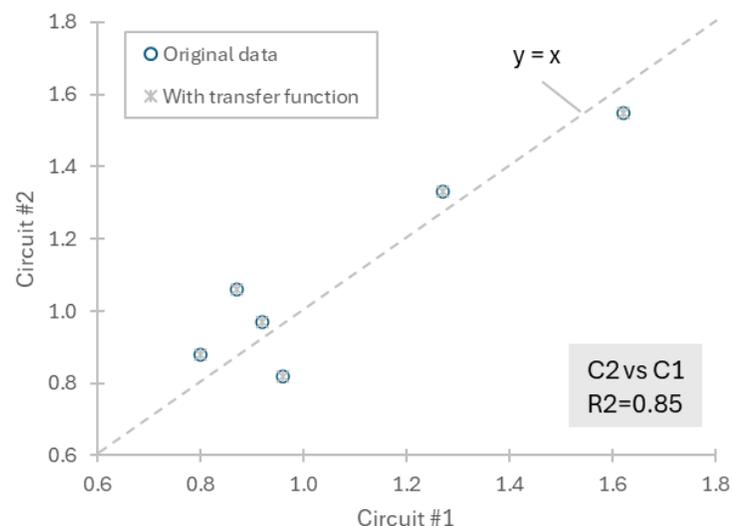
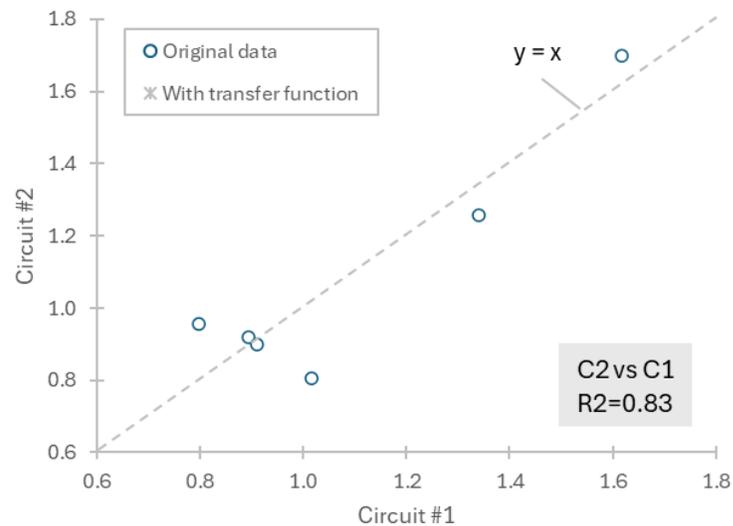
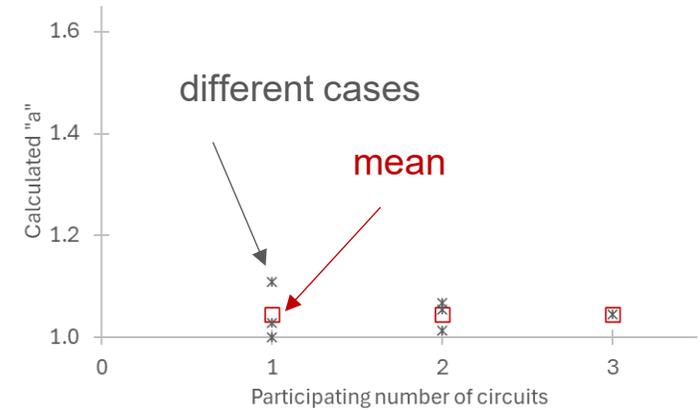
AD vs circuits	a	R2 > 0.85	ave abs < 0.1	ave	min	max	< 0.25
J1 vs C1, C2, C4	1.41	0.75	0.121	-0.067	-0.187	0.087	pass 6/6
J1 vs C1, C2	1.46	0.76	0.125	-0.063	-0.180	0.124	pass 6/6
J1 vs C1, C4	1.46	0.82	0.103	-0.061	-0.170	0.084	pass 6/6
J1 vs C2, C4	1.31	0.66	0.134	-0.078	-0.212	0.116	pass 6/6
J1 vs C1	1.60	0.85	0.098	-0.046	-0.138	0.156	pass 6/6
J1 vs C2	1.31	0.60	0.156	-0.079	-0.223	0.136	pass 6/6
J1 vs C4	1.31	0.71	0.112	-0.076	-0.202	0.096	pass 6/6
J2 vs C1, C2, C4	1.20	0.94	0.055	0.040	-0.044	0.105	pass 6/6
J2 vs C1, C2	1.22	0.91	0.066	0.046	-0.060	0.124	pass 6/6
J2 vs C1, C4	1.18	0.91	0.067	0.044	-0.056	0.144	pass 6/6
J2 vs C2, C4	1.19	0.97	0.036	0.031	-0.016	0.058	pass 6/6
J2 vs C1	1.21	0.81	0.114	0.059	-0.100	0.216	pass 6/6
J2 vs C2	1.23	0.96	0.041	0.033	-0.019	0.100	pass 6/6
J2 vs C4	1.15	0.97	0.032	0.028	-0.012	0.072	pass 6/6



Examples (drum vs circuits)

Only J2 is equivalent. For J1 and J3 no combinations of circuits could prove equivalence.
 For the determination of the “a” factor two circuits decrease the uncertainty of the value

AD vs circuits	a	R2 >0.85	ave abs <0.1	ave	min	max	<0.25
J3 vs C1, C2, C4	1.05	0.74	0.121	0.054	-0.200	0.170	pass 6/6
J3 vs C1, C2	1.05	0.71	0.133	0.059	-0.222	0.186	pass 6/6
J3 vs C1, C4	1.01	0.69	0.127	0.055	-0.216	0.206	pass 6/6
J3 vs C2, C4	1.07	0.81	0.102	0.048	-0.162	0.118	pass 6/6
J3 vs C1	1.00	0.57	0.164	0.066	-0.276	0.274	pass 4/6
J3 vs C2	1.11	0.81	0.108	0.052	-0.169	0.119	pass 6/6
J3 vs C4	1.03	0.80	0.097	0.045	-0.156	0.138	pass 6/6



Examples of R2



Discussion

Periodic check: The new proposal removed the periodic checks and the complications related to it.

Costs: The new proposal has decreased the number of necessary equivalent facilities to one or two depending on the case (from three)

Governance: The new proposal introduced the concept of coordinating body. This covers cases of tests within a tyre manufacturer (e.g. a new drum comparison with their circuit) to complicated cases of many facilities from competitions (need of an external entity)

Creation of equivalent facility from non equivalent facilities: The definition of equivalent facilities a priori remained. However, a concept of creating an equivalent facility by comparing with three (non-equivalent) circuits was introduced.



Thank you



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