REVISED EU ECOLABEL PERFORMANCE TEST FOR LAUNDRY DETERGENTS

FINAL DRAFT

Version of 20/06/2014

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BACKGROUND

With the objective to review the existing EU Ecolabel laundry detergents performance test, the project named LADECO (LAundry DEtergent ECOlabel) was initiated at the end of 2009. Technological Center LEITAT was commissioned undertake the revision of this test protocol.

This test protocol serves as a prove to show compliance with Criterion 6 – Washing performance (fitness for use) of the Commission Decision establishing EU Ecolabel criteria for Laundry Detergents.

TEST PROTOCOL

1.- TEST CRITERIA

- Soil and Stain Removal (SR)
- Basic degree of whiteness (BDW)
- Colour Maintenance (CM)
- Dye Transfer Inhibition (DTI)

2.- MATERIALS AND CONDITIONS

The Test Institute must be able to prove the compliance with all test conditions laid down in the following paragraphs. The documentation of the compliance with all test conditions shall be part of the test report.

2.0. Range of application:

In the context of the EU Ecolabel, this performance test can be applied to the following types of laundry detergents:

- HDD (Heavy Duty Detergent) means detergents used for ordinary washing of white textiles at any temperature.
- CSD (Colour Safe Detergent) means detergents used for ordinary washing of coloured textiles at any temperature.
- LDD (Low Duty Detergent) means detergents intended for delicate fabrics.

See Annex 1 for all definitions found in this document.

2.1. Washing machine types:

Programmable electronic Miele household washing machines which fulfil the following requirements:

Table 1. Wash cycle characteristics

	Cotton wash program (at 30°C, 20°C[1], 15°C[1])	Delicate program[2] (at 30°C, 20°C[1], 15°C[1])
Duration Main Wash	50 – 70 min	30 – 40 min
Total Program Duration	100 – 120 min	55 – 65 min
Water Quantity Main Wash	(15 ± 2) L	(20 ± 2) L
Total Water Quantity	(55 ± 5) L	(64 ± 5) L
Number of Rinse Cycles	3	3
Final Spin Speed	1200 rpm	600 rpm

[1]For cold water products

[2]Some newer Miele washing machines offer an equivalent synthetic program

Fuzzy logic type control shall be disabled.

Please note that most of the older Miele washing machines do not offer cold water programs. Those Miele machines which offer cold water programs normally heat up the entering water to 21 °C, which is useful for products which claim to be efficient at 20 °C. For test runs at 15 °C the heating elements of the washing machine have to be disconnected in order to prevent the heat up.

2.2. Water Hardness:

2.5 mmol/L ± 0.2 mmol/L calculated as CaCO3 (250 ppm = 14 ± 0.5 °dH). The Ca/Mg ratio will be 3 ± 0.5.

2.3. Water Inlet Temperature:

20.0 ± 2.0 ºC.

Products which claim to be efficient at a wash temperature lower than 20 °C shall be tested at 15°C. In this case, the water inlet temperature will be different to the wash temperature for tested product (15.0 ± 2.0 ºC) and reference detergent (20.0 ± 2.0 ºC).

The water inlet temperature shall be reported for the test product and reference detergent.

2.4. Amount of water:

If possible, to be controlled along the washing process (recommendation).

2.5. Ballast load:

- For HDD/CSD: cotton ballast load

The base load of cotton shall consist of cotton pillowcases and cotton huckaback hand-towels conforming to the following specifications. The values are for new (unwashed) textiles:

- *Pillowcases:* Bleached cotton 1/1 plain weave

Mass per unit area (185 ± 10) g/m^2 (of finished fabric)

Warp (33 ± 1) tex

Weft (363 ± 1) tex

Pieces of (1 600 mm x 800 mm) ± 2% folded in half and sewn along the three open edges thus forming double thickness (finished size: (800x800) mm2) the shrinkage shall be less than 2% in a test according to ISO 6330.

- *Hand-towels* Bleached cotton weave-huckaback:

Mass per unit area (220 ± 10) g/m^2 (of finished fabric)

Warp (19 ± 1) threads/cm of (36 ± 1) tex

Weft (13 ± 1) threads/cm of (97 ± 1) tex

Size

Length (1000 mm ± 50 mm)

Width (500 mm ± 30 mm)

- For LDD: polyester ballast load

The base load shall consist of double knitted polyester in pieces conforming with the following specification. Knitted polyester fabric:

Mass: (35 ± 3) g

Mass per unit area: (200 ± 25) g/m2

Size: (30 ± 3) cm x (30 ± 3) cm, double layer sewn along all four edges.

2.6. Stains Set:

Current A.I.S.E. Stains Set (See Annex 2).

2 sets of stains/wash cycle (same batch). Mark, with a water resistant pen, each stain, as the next example:

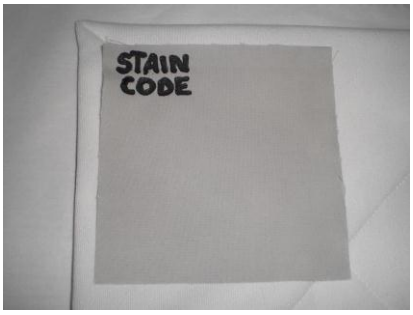

Figure 1. Stain market with a water resistant pen

Fix the stains on the loads with a plastic staple with a gun on the load, as the example:

Figure 2. Plastic staple

Figure 3. Plastic staple gun

See an example of how the stains can be fixed:

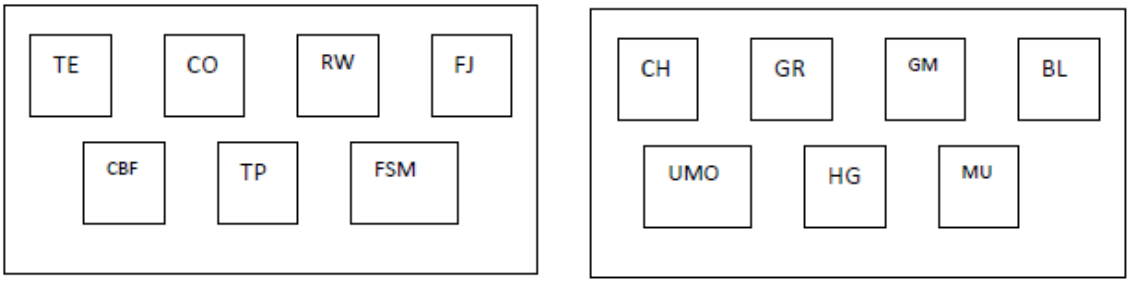

Figure 4. Fixed stains on the load (example)

Alternatively, the stains can be stitched together beforehand to make a full test strip. Then, this strip must be fixed on a hand towel before washing.

2.7. Stains Set Size:

(12 x 12) cm^2 (standard stains and colour maintenance) and (5 x 5) cm^2 (hand made).

2.8. Soil:

SBL 2004:

- 4 units/wash for HDD/CSD powder or liquid for stain removal and basic degree of whiteness.

- 2 units/wash for HDD/CSD/LDD powder or liquid for colour maintenance.

- 2 units/wash for LDD powder or liquid for stain removal and basic degree of whiteness.

See next table:

Table 2. Use of SBL

	HDD & CSD		LDD	
	Stain Removal & Basic Degree of Whiteness	Colour Maintenance	Stain Removal & Basic Degree of Whiteness	Colour Maintenance
SBL2004	4	2	2	2

Fix the SBL's on the loads as the stains.

2.9. Dye Donators and Dye Acceptors to determine Dye Transfer:

3.9.1. Dye Donators:

- Direct Black 22 (weight 0.3g)
- Direct orange 39 (weight 0.3g)
- Direct red 83.1 (weight 0.3g)
- Acid Blue 113 (weight 0.3g)

3.9.2. Dye Acceptors:

- Standard cotton according to DIN 53919, part 1 (size 5.5 x 16 cm)
- Polyamide according to ISO 105 F03 (size 6 x 16 cm)

2.10. Wash Loads:

Each test series has to be started with a new wash load. This load consists of:

A) Stain Removal &Basic Degree of Whiteness for HDD/CSD:

1. A clean all cotton ballast load for the normal cotton wash program to reach a total weight of 4.5 Kg (see 3.5 for specs).

Table 3. Total cotton loads (kg)

Total load (kg)	Pillowcases	Hand-towel
4.5 kg ± 0.1 kg	12 units	Until weight

2. 2 standard cotton cloth, according to ISO 2267, size: (20x20) cm^2.
3. 14x2 stain removal monitors included in the washes 6 to 11 (2 replicates)
4. 4 pieces of soil ballast added to all washes

The total load per wash including ballast load, SBL, cotton cloth and monitors will be 4.5 ± 0.1 Kg

Table 4. Wash load for HDD and CSD.

TEST: STAIN REMOVAL & BASIC DEGREE OF WHITENESS																			
PRODUCT: HDD & CSD (Powder and Liquid)																			
TEST		Pre-treatment			Basic degree of whiteness					Stain removal & Basic degree of whiteness						Basic degree of whiteness			
CYCLE		-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LOADS	a[1])	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	b[2])	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	c)									✓	✓	✓	✓	✓	✓				
	d)				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

a) Cotton ballast load

b) Cotton cloth according to ISO 2267

c) Stain set (14 stains x 2 sets per wash, cycle 6-11). See Annex 2.

d) Soil: 4 units SBL2004

[1] Use the same wash load during all the test

[2] Use the same cotton cloth during all the test

B) Colour Maintenance for HDD/CSD:

1. A clean all cotton ballast load for the normal cotton wash program to reach a total weight of 4.5 Kg (see 3.5 for specs).

Table 5. Total cotton loads (kg)

Total load (kg)	Pillowcases	Hand-towel
4.5 kg ± 0.1 kg	12 units	Until weight

2. Colour Maintenance monitor
3. 2 pieces of soil ballast added to all washes

The total load per wash including ballast load, SBL, cotton cloth and monitors will be 4.5 ± 0.1 Kg

Table 6. Wash load for HDD and CSD.

TEST: COLOUR MAINTENANCE																		
PRODUCT: HDD & CSD (Powder and Liquid)																		
TEST		Pre-treatment			Colour Maintenance													
CYCLE		-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LOADS	a[3])	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	b[4])				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	c)				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

a) Cotton ballast load

b) Colour Maintenance Monitor. See Annex 4.

c) Soil: 2 units SBL2004

[3] Use the same wash load during all the test

[4] Use the same cotton cloth during all the test

C) Stain Removal & Basic Degree of Whiteness for LDD:

1. A clean knitted polyester load for the delicate wash programs to reach a total weight of 2.5 Kg (see 3.5 for specs).
2. 2 standard cotton clothes according to ISO 2267, size: (20x20)cm^2.
3. 14x2 stain removal monitors included in the washes 6 to 11
4. 2 pieces of soil ballast added to all washes

The total load per wash including ballast load, SBL, cotton cloth and monitors will be 2.5 ± 0.1 Kg.

Table 7. Wash loads for LDD.

TEST: STAIN REMOVAL & BASIC DEGREE OF WHITENESS																			
PRODUCT: LDD (Powder and Liquid)																			
TEST		Pre-treatment			Basic degree of whiteness					Stain removal & Basic degree of whiteness						Basic degree of whiteness			
CYCLE		-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LOADS	a[5])	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	b[6])	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	c)									✓	✓	✓	✓	✓	✓				
	d)				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

a) Polyester ballast load

b) Cotton cloth according to ISO 2267

c) Stain set (14 stains x 2 sets) per wash, cycle 6-11). See Annex 2.

d) Soil: 2 units SBL2004

[5] Use the same wash load during all the test

[6] Use the same cotton cloth during all the test

D) Colour Maintenance for LDD:

1. A clean knitted polyester load for the delicate wash programs to reach a total weight of 2.5 Kg (see 3.5 for specs).
2. Colour Maintenance monitor.
3. 2 pieces of soil ballast added to all washes

The total load per wash including ballast load, SBL, cotton cloth and monitors will be 2.5 ± 0.1 Kg.

Table 8. Wash loads for LDD.

TEST: COLOUR MAINTENANCE																			
PRODUCT: LDD (Powder and Liquid)																			
TEST		Pre-treatment			Colour Maintenance														
CYCLE		-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LOADS	a[7])	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	b[8])				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	c)				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

a) Polyester ballast load

b) Colour Maintenance Monitor. See Annex 4

c) Soil: 2 units SBL2004

2.11. Dosage:

In case of **powder detergents** dose detergent in the dispenser machine device, and in the case of **liquid detergents** dose detergent in the tumble using a plastic dosage unit.

[7] Use the same wash load during all the test

[8] Use the same cotton cloth during all the test

Table 9. Detergent dosage

Type of detergent to check	Reference detergent				
	Basic Powder	Sodium Percarbonate	TAED	PVP[1]	Market detergent
Powder HDD	70 g	12.5g	2.5g		Producer recommendation*
Liquid HDD	70g	-	-	-	Producer recommendation*
Powder or liquid CSD	70g	-	-	1ml	Producer recommendation*
Powder or liquid LDD	35ml				Producer recommendation**

* Medium soil/medium hard water recommendation. The dosage needs to comply with the Ecolabel criteria.

** Light soil/medium hard water recommendation. The dosage needs to comply with the Ecolabel criteria.

[1] active substance: 45%

Homogenize powder detergent, better with sample divider. If a sample divider can not be used, shake the package gently.

2.12. Reference Detergent:

- HDD: Reformulation of the IEC A* reference detergent according to IEC 60456 formulation depending on the product type (See Annex 3.A).

- CSD: See Annex 3.A.

- LDD: See Annex 3.B.

2.13. Number of cycles:

3.13.1. A set of 15 washing machine cycles for the determination of:

- Stain Removal Testing -from cycle nr. 6 to cycle nr. 11- final Y-Value- (HDD/CSD/LDD)

- Basic Degree of Whiteness – final Y-Value- (HDD/CSD/LDD)

3.13.2. A separate set of 15 additional cycles, run separately for colour maintenance CSD and HDD/LDD (only in the case that colour care is claimed). Grey scale determination.

3.13.3. Dye Transfer Inhibition: For CSD and HDD/LDD (only in the case that colour care is claimed), 3 replicates with new dye donators and acceptors in each wash. Grey Scale determination.

Table 10. Cycles for each type of product

	Colour Claim	Stain Removal	Basic Degree of Whiteness	Colour Maintenance	DTI
HDD	Yes	✓	✓	✓	✓
	No	✓	✓	✘	✘
CSD	-	✓	✓	✓	✓
LDD	Yes	✓	✓	✓	✓
	No	✓	✓	✘	✘

2.14. Wash Program:

The next table shows the different wash programs for the Ecolabel performance test.

With low temperature and cold-water wash products, the washing performance will be determined at the lowest stated temperature at which the detergent is claimed to be effective. The reference detergent must be tested at 30ºC.

Table 11. Different wash programs

Test	Tª	Wash program	Wash program	Water inleTª	Water inlet Tª	Heating

product	efficient	test product	reference detergent	(test product)	(ref. product)	element disconnected[1]
HDD/CSD	30°C	30°C, normal cotton program, 1200 rpm	30°C, normal cotton program, 1200 rpm	(20.0±2.0)°C	(20.0±2.0)°C	No
HDD/CSD	20°C	20°C, normal cotton program, 1200 rpm	30°C, normal cotton program, 1200 rpm	(20.0±2.0)°C	(20.0±2.0)°C	No
HDD/CSD	15°C	20°C, normal cotton program, 1200 rpm	30°C, normal cotton program, 1200 rpm	(15.0±2.0)°C	(20.0±2.0)°C	Yes
LDD	30°C	30°C, delicate program, 600rpm	30°C, delicate program, 600 rpm	(20.0±2.0)°C	(20.0±2.0)°C	No
LDD	20°C	20°C, delicate program, 600rpm	30°C, delicate program, 600 rpm	(20.0±2.0)°C	(20.0±2.0)°C	No
LDD	15°C	20°C, delicate program, 600rpm	30°C, delicate program, 600 rpm	(15.0±2.0)°C	(20.0±2.0)°C	Yes

[1] Of the washing machine of the test product

2.15. Pre-treatment of ballast load (cotton & polyamide) and standard cotton fabric:

3 washes at 60°C, normal cotton program without pre-wash. The basic powder, optical brightener-free, of ECE standard detergent for colour fastness (ISO 6330) with a dosage of 85 g per 4.0 Kg load is used (95.6g of detergent per 4.5kg load).

It is recommended to dry the ballast load after pre-treatment.

2.16. Drying and flattering

Drying **(**no tumble drying), and flattering: 2 points (150°C) without steam after each wash cycle, just the stains.

3. METHODS

3.1. Stain Removal and Basic Degree of Whiteness:

3.1.1. Test procedure

The monitors used for the evaluation of Stain Removal, must be chosen from the same production lot. The appropriate amount is stored at low temperatures (according to the suppliers' recommendations) under exclusion of light and oxygen. The material is cut into pieces of (12 x 12) cm^2 and stored until ready for use in the dark and cold.

Two test monitors of each kind are used for every single wash and fixed on different huckaback towel carrier fabrics with the marked right side upwards.

An extra set of four carrier fabrics will be used for the next wash cycle in order to dry the first set in the meantime.

The prepared carrier fabric with the test swatches are evenly distributed in the wash load and washed in the respective programme parallel to washes at the same conditions using the reference detergent. After one wash they are removed from the machine. Afterwards the monitors are removed from the carrier and dried in the dark at ambient conditions lying flat on a sieve.

For Stain Removal, the whole procedure is repeated 6 times (washes 6 to 11).

The cotton fabrics used for the evaluation of Basic Degree of Whiteness must be from the same production lot. The appropriate amount is stored according to the suppliers' recommendations, under exclusion of light and oxygen.

Two tests fabrics will be used for all the cycles (15cycles).

3.1.2. Reflectance measurement:

Final Y-value measurement for Stain Removal and Basic Degree of Whiteness determinations.

Measuring geometry: d / 8^o

D65 / 10^o observer

With UV-filter (420 nm cut off)[9]

Measuring diameter: minimum 20 mm

Gloss: without

[9] The UV filter must in any case be adapted if 420 nm is outweighed by the optical brightener

Calibration: Measurements shall be carried out at the latest 8 hours after calibration with white tile and black trap.

For each standard stain [(12x12)cm^2] the mean of the 48 measurements (2 samples per soil x 4 readings x 6 wash cycles) is calculated. Standard deviation ought to be calculated from 6 washes.

For each natural stain [(5x5)cm^2] the mean of the 24 measurements (2 samples per soil x 2 readings x 6 wash cycle) is calculated. Standard deviation ought to be calculated from 6 washes.

For each cotton cloth the mean of 8 initial measurements (before first cycle) and 8 final measurements (after 15 cycles) is calculated (2 samples x 4 readings). It is necessary to bend the cotton cloth before starting with the measurements.

3.2. Colour Maintenance:

Defined Monitor Set (see Annex 4) and ballast load (see 3.5.). After 15 wash cycles the samples are measured using a spectrophotometer on a defined white background at four defined spots. For all products in comparison a common calibration is used. The measurement will be done according to EN ISO 105-J01:2000 "*Textiles. Tests for colour fastness. General principles for measurement of surfaced colour*". The measurement conditions can be described as follows:

Measuring geometry: d / 8º

D65 / 10º observer

With UV-filter (420 nm cut off)[10]

Measuring diameter: minimum 20 mm

Gloss: without

Calibration: Measurements shall be carried out at the latest 8 hours after calibration with white tile and black trap.

Results must be reported as "Grey scale" figures.

The colour differences are calculated according to EN ISO 105-J03: 2009 "*Textiles. Tests for colour fastness. Calculation of colour differences*". The initial state of the colour is taken as a reference for determining the colour differences. The change in colour is instrumentally assessed as described in EN ISO 105-A05:1997 "*Textiles. Tests for colour fastness. Instrumental*

[10] The UV filter must in any case be adapted if 420 nm is outweighed by the optical brightener

assessment of change of colour for determination of grey scale rating". Mean and standard deviation for each dye is calculated. Mean over the complete dye set is calculated. They are based on EN 20105-A02:1995 "*Textiles. Tests for colour fastness. Grey scale for assessing change in colour."*

3.3. Dye Transfer Inhibition:

Laundering device: Lini-Test.

The Laundering device is described in EN ISO 105-C06:1997 "*Textiles. Tests for color fastness. Colour fastness to domestic and commercial laundering"*. A water Bath containing a routable shaft which supports, radially stainless steel containers (diameter 7.5 ± 0.5 cm, height 12.0 ± 0.5 cm) with 525 ± 50 ml capacity each), the bottom of the containers being 4.5 ± 1 cm from the centre of the shaft. The shaft/container assembly is rotated at a frequency of 40 ± 2 rpm. The temperature of the water bath is thermostatically controlled to maintain the test solution at the prescribed temperature ± 2ºC.

The same liquor concentration and water hardness is used as in the washing machine. The product in test (amount for 1 l) is dispersed in 1 l of lukewarm water using a magnetic stirrer and then rapidly heated until the liquor reaches 40ºC.

Dye donator (0.3 g) and dye acceptor (cotton and polyamide) are placed in the container (no addition of steel balls). Both textiles are not fixed to each other. The volume to give the correct liquor: fabric ratio 100:1 is added and the containers are placed in the preheated (40ºC) machine. Temperature raises 2ºC up to 60ºC and the wash is continued for 20 minutes at this temperature (see next table).

Table 12. DTI wash cycle composition

Test: DTI			
Detergent: CSD (Powder or Liquid) / LDD*			
Cycle n#	1	2	3
Composition	Cotton + polyamide + donator	Cotton + polyamide + donator	Cotton + polyamide + donator

*DTI is performed only in the case that colour care is claimed by product

Both dye acceptors (CO and PA) are used for all 4 dye donators.

After the washes the textiles are removed and rinsed twice for 1 minute in running warm water and then in cold running water for 10 minutes (same hardness as the test). Textiles are dried hanging in the air (no direct sun).

In order to assess the dye transfer after one wash, colour differences ΔE between the standard cotton or polyamide piece washed without and with dye donator is determined.

Results must be reported as “Grey scale” figures.

Measurements are determined according to EN ISO 105-J03:2009 “Textiles. Tests for colour fastness. Calculation of colour differences.” Measurements are taken at two defined areas of the dye acceptor using an appropriate device as described in CIE 15:2004 “Colorimetry”. The instrumental assessments on colour fastness are done according to EN ISO 105-A04:1997 “Textiles. Tests for colour fastness. Method for the instrumental assessment of the degree of staining of adjacent fabrics”. They are based on EN 20105-A03:1995 “Textiles. Tests for colour fastness. Grey scale for assessing staining”. The measurements for all products to be compared are performed using one common calibration and the same conditions.

Measuring geometry: d / 8^{o}

D65 / 10^{o} observer

With UV-filter (420 nm cut off)*

Measuring diameter: minimum 20 mm

Gloss: without

Calibration: Measurements shall be carried out at the latest 8 hours after calibration with white tile and black trap.

**The UV filter must in one case be adapted if 420 nm is outweighed by the optical brightener.*

4. EVALUATION

Each product must achieve the following results:

4.1. Stain Removal

Each product category (HDD, CSD, LDD) follows the same procedure.

All the stains must be evaluated separately (Y final) and referred to the reference detergent and the statistical influence (σ) must be taken into account.

DY = (AVERAGE REFERENCE – σ) – (AVERAGE PRODUCT + σ)

DY ≤ 10 → pass

DY > 10 → fail

3 failures are allowed.

4.2. Basic Degree of Whiteness

Each product category (HDD, CSD, LDD) follows the same procedure. Consider Y final.

For HDD powder products:

ΔY = AVERAGE REFERENCE – AVERAGE PRODUCT ΔY < 2.0 → pass

For HDD liquid and CSD (powder & liquid) products:

ΔY = AVERAGE REFERENCE – AVERAGE PRODUCT ΔY < 3.0 → pass

For LDD products:

ΔY = AVERAGE REFERENCE – AVERAGE PRODUCT ΔY < 2.0 →pass

4.3. Colour Maintenance

Each product category (CSD and HDD/ LDD in the case of colour claim) follows the same procedure.All dyes must be evaluated separately and referred to reference detergent.

Colour Maintenance (Δ GREY SCALE) = AVERAGE REFERENCE – AVERAGE PRODUCT

Δ GREY SCALE < or equal to 1.0 → pass

2 failures are allowed.

4.4. Dye Transfer Inhibition

Each product category (CSD and HDD/ LDD in the case of colour claim) follows the same procedure. Each DTI data must be evaluated separately and compared to the reference detergent.

Dye Transfer Inhibition (ΔGREY SCALE) = AVERAGE REFERENCE – AVERAGE PRODUCT

Δ GREY SCALE < or equal to 1.0 → pass

1 failure is allowed on maximum 1 (of the 4) dye.

See Annex 5 for a complete evaluation example.

Annex 1.

Definitions

Table 13. Definitions

HDD	Heavy Duty Detergent
CSD	Colour Safe Detergent
LDD	Low Duty Detergent
SR	Stain Removal
BDW	Basic Degree of Whiteness
CM	Colour Maintenance
DTI	Dye Transfer Inhibition
SBL	Soil Ballast Load
PC	Sodium Percarbonate
TAED	Tetra Acetyl Ethylene Diamine
PVP	Polyvinylpyrrolidone
CO	Cotton
PA	Polyamide
PES	Polyester

Annex 2:

Table 14. Set of Stains

Stains	Standard Stains			Hand-made Stains* (ex Warwick-Equest)	Stain classes (Consumer denomination/Chemical nature)
Tea		WFK 10J		WE5LTWKC	Drink / Bleachable
Coffee			CFT KC-H109	WE5ECWKC	Drink / Bleachable
Red wine			CFT KC-H026	WE5RWWKC	Drink / Bleachable
Fruit juice			CFT CS15		Drink / Bleachable
Tomato puree				WE5TPWKC	Food / Bleachable
Carrot baby food				WE5IACBFWKC	Food / Bleachable Enzymatic
French Squeezy Mustard				WE5FSMWKC	Food / Bleachable Enzymatic
Chocolate		WFK 10Z	CFT CS44		Food / Enzymatic
Grass	EMPA 164		CFT CS08		General soil / Bleachable Enzymatic
Grass/Mud				WE5GMWKC	General soil / Bleachable Enzymatic Particulate
Blood				WE5DASBWKC	General soil / Enzymatic
Unused motor oil	EMPA 106	WFK 10 RM	CFT C01		Grease, Oil / Greasy Particulate
Frying fat (Hamburger grease)				Burnt Beef WE5BBWKC (on WHITE cotton)	Grease, Oil / Greasy Enzymatic
Make up	EMPA 143/2	WFK 10MU	CFT CS17		Cosmetics / Greasy Particulate

* All Hand-made stains are also available in 2.5 cm diameter. Their code number has “2.5” instead of “5”.

Annex 3:

Reference detergent

A) IEC A* reference detergent according to IEC 60456

Table 15. Reference detergent (base) – Composition IEC A*

INGREDIENTS	% Content in IEC 60456 Base Detergent	Tolerance (±)	Nº CAS
Basic Powder			
Linear sodium alkyl benzene sulfonate	11.4	± 0.5	25155-30-0
Ethoxylated fatty alcohol C12-14 (7 EO)	6.1	± 0.3	68439-50-9
Sodium soap (tallow soap)	4.2	± 0.2	308075-99-2
Foam inhibitor concentrate, 12 % silicon on inorganic carrier)	5.1	± 0.3	68989-22-0
Sodium aluminium silicate zeolite 4 A (80 % active substance)	36.7	± 1.0	70955-01-0
Sodium carbonate	15.1	± 1.0	497-19-8
Sodium salt of a copolymer from acrylic and maleic acid (Sokalan CP5)	3.1	± 0.2	60472-42-6
Sodium silicate (SiO2:Na2O = 3,3:1)	3.9	± 0.2	1344-09-8
Carboxymethylcellulose	1.6	± 0.1	9004-32-4
Phosphonate (25% active acid)	3.6	± 0.2	22042-96-2
Protease	0.5	± 0.5	9014-01-1
Sodium Sulfate	Rest	Rest	7757-82-6

Dosage:

- Powder HDD: 70g IEC A* +12.5g Sodium Percarbonate[11]+2.5g TAED[12]
- Liquid HDD: 70g IEC A*
- Powder / Liquid CSD: 70 g IEC A* + 1ml PVP[13]

[11] CAS : 15630-89-4

[12] CAS: 10543-57-4

[13] Sokalan HP 56 K (PVPVI, 30%)

Homogenize powder detergent, better with sample divider. If you can't use sample divider, shake the detergent gently.

The ingredients shall be mixed prior to use. The maximum storage time after mixing is 7 days.

B) Low Duty Reference Detergent (LDD)

Table 16. Reference detergent (LDD) - formulation

INGREDIENTS	**% (Technical Grade)**	**Nº CAS**
Fatty alcohol ethoxylate C12/14 (EO = 7)[14]	35.0 ± 0.5	68213-23-0
Low foaming fatty alcohol C12/14 with approx. 4 moles EO and approx. 5 moles PO (ethylenoxide/higher alkylene oxide-co-polymer)[15]	15.0 ± 0.3	68439-51-0
Sodium dodecyl sulfonate[16]	7.5 ± 0.2	68411-30-3
Modified polycarboxylate (suitable for liquid detergents)[17]	15.0 ± 0.3	
Ethanol	5.0 ± 0.1	64-17-5
Distilled water add 100 %	Rest	

- Powder or Liquid LDD: 35 ml/wash cycle

Manufacturing process:

1. Mix fatty alcohol ethoxylate C12/14 (EO = 7) and sodium dodecyl sulfonate heating to 40^{o}C.

2. When the mixture will be homogenized, add low foaming fatty alcohol ethoxylate. Mix and homogenized.

3. Add ethanol.

4. Add modified polycarboxylate and mix.

5. Finally, add water (until 100%).

The bottle shall be agitated lightly before use.

Annex 4:

Monitor Dye Set

[14] Example: Dehydol LT-7 (Cognis)

[15] Example: Dehypon LS 45 (Cognis)

[16] Example: Maranil Paste A55 (Cognis)

[17] Example: Sokalan HP 25 (BASF)

Table 17. Monitor Dye Set

Fabric Number of AISE (14) Monitor Dye Set	**Fabric Number of AISE (40) Dye Set**	**Dye Class**
AISE 1	1	Sulphur black
AISE 3	2	Vat green
AISE 5	3	Vat blue
AISE 8	4	Direct yellow+cationic after-treatment (tinofix eco)
AISE 16	5	Reactive red
AISE 20	6	Reactive black (pale shade)
AISE 21	7	Reactive black (heavy shade)
AISE 22	8	Reactive orange
AISE 24	9	Reactive blue
AISE 26	10	Reactive violet
AISE 27	11	Reactive trichromatic combination
AISE 29	12	Reactive trichromatic combination
AISE 33	13	Disperse navy + heat set
AISE 39	14	Acidic red + syntan

Annex 5.

Example CSD Liquid:

Product under test: J and K

Reference detergent: REF

STAIN REMOVAL.

Table 18. Product J, final Y-value

	PRODUCT J												AVERAGE	σ	AVE. + σ
Tea	41,50	40,65	40,14	39,73	40,25	41,97	40,66	40,57	40,38	40,51	41,63	41,56	40,79	0,70	41,49
Coffee	79,28	79,78	78,78	78,17	79,18	80,43	80,79	80,74	79,83	79,59	76,42	76,66	79,14	1,44	80,57
Red wine	69,41	70,40	68,04	68,57	70,99	69,14	70,57	71,05	70,20	69,31	68,25	68,21	69,51	1,11	70,62
Fruit Juice	48,13	49,94	47,58	45,77	49,73	50,18	47,72	48,00	48,79	47,52	46,73	47,23	48,11	1,34	49,45
Tomato Puree	74,98	75,84	76,07	75,76	77,68	78,44	74,00	74,58	75,87	73,08	81,91	81,87	76,67	2,84	79,51
Carrod baby food	85,05	87,17	83,11	84,23	84,29	85,74	85,26	84,88	84,88	84,38	87,67	87,79	85,37	1,47	86,84
French Squeezy Mustard	73,74	74,90	67,58	69,19	72,32	71,58	72,04	72,33	73,89	71,15	74,65	74,87	72,35	2,28	74,63
Grass	59,53	61,69	60,46	61,87	63,66	61,06	63,27	69,54	59,77	58,97	59,17	58,91	61,49	3,00	64,50
Grass/Mud	47,92	50,00	43,66	38,95	49,55	52,17	46,65	50,91	50,48	50,63	47,67	43,32	47,66	3,91	51,57
Chocolate	69,00	72,05	64,94	63,71	70,00	66,92	68,55	68,09	68,13	65,15	64,22	64,13	67,07	2,66	69,73
Blood	63,17	62,21	61,39	62,57	61,67	62,77	64,38	64,50	65,36	63,32	63,61	63,87	63,23	1,19	64,42
Unused Motor Oil	36,44	30,72	34,32	31,11	36,96	33,09	38,25	39,46	38,44	35,97	40,49	38,41	36,14	3,20	39,34
Frying fat (hamburguer grease)	28,17	29,30	29,30	27,02	28,10	28,07	27,89	28,44	26,23	27,68	28,38	29,21	28,15	0,91	29,06
Make up	86,59	84,35	84,23	84,11	86,06	85,52	85,80	84,83	84,91	84,26	84,77	83,70	84,93	0,89	85,81

Table 19. Product K, final Y-value

	PRODUCT K												AVERAGE	σ	AVE. + σ
Tea	40,56	39,89	40,12	40,57	39,96	40,03	39,66	39,86	39,40	39,38	40,02	39,68	39,93	0,38	40,31
Coffee	78,69	79,14	79,50	79,47	78,81	79,29	79,00	78,63	78,71	78,34	79,08	79,55	79,02	0,39	79,41
Red wine	69,81	70,44	69,43	68,87	69,15	68,89	65,94	67,05	71,44	68,91	69,75	69,26	69,08	1,43	70,51
Fruit Juice	47,88	46,78	48,02	49,36	48,92	48,93	46,75	47,15	50,82	49,50	50,09	48,27	48,54	1,30	49,83
Tomato Puree	73,50	75,11	77,18	77,40	75,70	74,63	74,62	72,59	76,47	75,27	73,92	75,00	75,12	1,43	76,55
Carrod baby food	85,38	85,30	85,19	85,06	84,68	84,27	85,12	84,71	83,96	83,13	83,39	82,88	84,42	0,89	85,31
French Squeezy Mustard	68,24	69,39	71,33	72,03	67,28	68,75	69,22	73,60	70,07	70,50	70,65	65,73	69,73	2,13	71,86
Grass	61,28	61,40	62,49	67,53	61,17	58,96	60,32	59,52	62,44	60,70	58,71	59,59	61,18	2,35	63,53
Grass/Mud	41,15	44,90	50,18	50,41	42,41	44,23	44,28	45,95	38,63	38,93	39,26	39,96	43,36	4,08	47,44
Chocolate	67,58	66,33	68,09	68,11	64,49	62,17	66,23	65,31	63,64	65,49	67,54	64,75	65,81	1,86	67,67
Blood	61,77	62,16	68,18	64,78	61,71	63,41	58,38	61,40	64,52	63,64	62,42	64,59	63,08	2,40	65,48
Unused Motor Oil	35,14	28,79	37,61	31,97	38,93	30,93	37,34	30,85	35,72	31,61	33,76	32,81	33,79	3,16	36,95
Frying fat (hamburguer grease)	29,12	29,95	28,70	27,82	27,84	27,95	28,06	28,23	28,69	28,04	28,21	28,31	28,41	0,62	29,03
Make up	86,04	85,03	85,80	84,90	85,36	85,55	84,04	84,72	83,62	82,50	83,93	84,30	84,65	1,02	85,67

Table 20. Reference product, final Y-value

	REFERENCE												AVERAGE	σ	AVE. - σ
Tea	41,40	41,49	42,94	41,68	43,36	41,47	42,22	42,98	42,27	42,14	43,36	41,43	42,23	0,76	41,47
Coffee	79,01	77,04	77,77	76,91	77,31	76,53	75,97	77,64	76,52	77,57	76,88	77,43	77,21	0,78	76,44
Red wine	57,12	57,32	57,37	56,32	56,12	56,85	54,78	56,27	55,35	55,58	54,82	55,92	56,15	0,90	55,25
Fruit Juice	49,83	50,94	50,73	51,19	49,39	52,72	52,93	53,49	49,88	50,51	52,78	50,40	51,23	1,39	49,84
Tomato Puree	78,97	81,47	82,89	79,87	83,07	81,90	81,21	82,02	79,51	80,53	83,97	80,31	81,31	1,54	79,77
Carrod baby food	85,41	85,76	85,10	86,02	84,60	85,78	84,90	83,99	84,57	82,96	84,61	84,86	84,88	0,85	84,03
French Squeezy Mustard	76,60	74,92	77,62	77,52	76,70	77,45	76,35	75,50	75,20	71,66	77,67	74,92	76,01	1,73	74,28
Grass	65,22	62,78	66,63	67,23	65,33	63,68	65,48	63,85	63,73	61,90	64,23	65,47	64,63	1,55	63,08
Grass/Mud	49,77	49,44	54,10	47,76	53,78	47,61	47,51	47,99	50,55	52,73	47,57	52,13	50,08	2,53	47,55
Chocolate	61,51	64,24	61,30	61,86	60,76	61,44	61,30	63,01	62,12	64,80	60,67	64,36	62,28	1,46	60,82
Blood	76,04	77,40	76,11	76,56	76,67	77,33	78,82	77,26	75,44	76,47	77,70	77,91	76,98	0,94	76,04
Unused Motor Oil	41,35	37,98	42,79	34,39	40,45	37,93	40,36	35,39	42,71	36,23	37,54	37,45	38,71	2,79	35,93
Frying fat (hamburguer grease)	26,40	26,35	25,11	26,52	25,73	25,60	25,17	26,95	25,33	25,95	26,94	27,46	26,13	0,77	25,36
Make up	86,17	86,36	85,31	86,07	85,70	85,37	83,39	82,43	84,25	84,23	84,40	83,56	84,77	1,25	83,52

Table 21. Global results

	AVE. + σ		AVE. - σ	CRITERIA "10(σ)"	
	PRODUCT J	PRODUCT K	REFERENCE	PRODUCT J	PRODUCT K
Tea	41,49	40,31	41,47	-0,03	1,16
Coffee	80,57	79,41	76,44	-4,13	-2,97
Red wine	70,62	70,51	55,25	-15,37	-15,26
Fruit Juice	49,45	49,83	49,84	0,39	0,01
Tomato Puree	79,51	76,55	79,77	0,26	3,23
Carrod baby food	86,84	85,31	84,03	-2,81	-1,28
French Squeezy Mustard	74,63	71,86	74,28	-0,35	2,41
Grass	64,50	63,53	63,08	-1,42	-0,45
Grass/Mud	51,57	47,44	47,55	-4,03	0,11
Chocolate	69,73	67,67	60,82	-8,91	-6,85
Blood	64,42	65,48	76,04	11,61	10,55
Unused Motor Oil	39,34	36,95	35,93	-3,42	-1,02
Frying fat (hamburguer grease)	29,06	29,03	25,36	-3,70	-3,67
Make up	85,81	85,67	83,52	-2,29	-2,15

DY = (AVERAGE REFERENCE – σ) - (AVERAGE PRODUCT + σ)

If DY ≤ 10 → pass

If DY > 10 → fail

In all the stains DY must be ≤ 10 (3 failures are allowed)→ Products J and K **pass** the Ecolabel criteria for Stain Removal.

BASIC DEGREE OF WHITENESS

Table 22. Y-value for Basic Degree of Whiteness

	Y-value			
	Final		AVERAGE	REFERENCE - PRODUCT
Product	1st cloth	2nd cloth		
J	83,596	83,836	83,72	0,64
K	82,383	81,934	82,16	2,20
REFERENCE	84,62	84,09	84,36	

Basic Degree of Whiteness ΔY = AVERAGE REFERENCE - AVERAGE PRODUCT

For CSD products ΔY must be < 3.0 → Products J and K **pass** the Ecolabel criteria for Basic Degree of Whiteness.

COLOUR MAINTENANCE

Table 23. Colour Maintenance data

		ΔE			**Grey Scale**			**Δ Grey Scale**	
NUMBER AISE	DYE CODE	PRODUCT J	PRODUCT K	REFERENCE	PRODUCT J	PRODUCT K	REFERENCE	REF - PRODUCT J	REF - PRODUCT K
AISE 1	1	4,37	2,14	4,17	2,5	3,5	2,5	0,0	-1,0
AISE 3	2	3	2,43	4,21	3,5	4,0	3,0	-0,5	-1,0
AISE 5	3	1,85	1,87	2,6	4,5	4,5	4,0	-0,5	-0,5
AISE 8	4	5,11	4,26	8,19	3,5	4,0	3,0	-0,5	-1,0
AISE 16	5	2,53	2,46	3,67	4,0	4,0	3,5	-0,5	-0,5
AISE 20	6	1,06	0,19	1,74	4,5	5,0	4,0	-0,5	-1,0
AISE 21	7	1,31	0,61	1,24	4,0	4,5	4,5	0,5	0,0
AISE 22	8	1,18	1	1,06	4,5	4,5	4,5	0,0	0,0
AISE 24	9	0,81	1,45	2,75	4,5	4,5	3,5	-1,0	-1,0
AISE 26	10	1,45	0,98	2,76	4,0	4,5	3,5	-0,5	-1,0
AISE 27	11	0,35	0,56	0,74	5,0	4,5	4,5	-0,5	0,0
AISE 29	12	1,08	0,7	0,81	4,5	4,5	4,5	0,0	0,0
AISE 33	13	0,57	0,56	0,25	4,5	4,5	5,0	0,5	0,5
AISE 39	14	1	0,42	0,18	4,5	5,0	5,0	0,5	0,0

All the dyes must be evaluated separately and referred to reference detergent.

Colour Maintenance (Δ GREY SCALE) = AVERAGE REFERENCE - AVERAGE PRODUCT

Δ GREY SCALE < or equal to 1.0 → pass

2 failures are allowed.

Products J and K **pass** the Ecolabel criteria for Colour Maintenance.

DYE TRANSFER INHIBITION (with reference detergent 1ml PVP)

- COTTON

Table 24. DTI Evaluation

COTTON	AVERAGE			REF - PRODUCT	
	J	K	REFER.	J	K
D.O. 39	1,0	1,0	1,0	0,00	0,00
D.B. 22	1,5	1,5	1,0	-0,50	-0,50
D.R. 83:1	1,0	2,0	1,0	0,00	-1,00
A.B. 113	3,5	2,5	1,0	-2,50	-1,50

- POLYAMIDE

Table 25. DTI Evaluation

POLYAMIDE	AVERAGE			REF - PRODUCT	
	J	K	REFER.	J	K
D.O. 39	2,0	1,5	4,5	2,50	3,00
D.B. 22	3,5	2,5	3,5	0,00	1,00
D.R. 83:1	4,5	4,5	3,5	-1,00	-1,00
A.B. 113	1,0	1,0	1,5	0,50	0,50

All DTI data must be evaluated separately and compared to the reference detergent.

Dye Transfer Inhibition (Δ GREY SCALE) = AVERAGE REFERENCE - AVERAGE PRODUCT

Δ GREY SCALE < or equal to 1.0 → pass

1 failure is allowed on maximum 1 (of the 4) dyes.

Product J and K **pass**

GLOBAL EVALUATION

Table 26. Global evaluation for Product J

TEST		DOES PRODUCT J PASS THE CRITERIA?	YES
STAIN REMOVAL		YES	YES
BASIC DEGREE OF WHITENESS		YES	YES
COLOUR MAINTENANCE		YES	YES
DTI	COTTON	YES	YES
	POLYAMIDE	YES	YES

Table 27. Global evaluation for Product K

TEST		DOES PRODUCT K PASS THE CRITERIA?	YES
STAIN REMOVAL		YES	YES
BASIC DEGREE OF WHITENESS		YES	YES
COLOUR MAINTENANCE		YES	YES
DTI	COTTON	YES	YES
	POLYAMIDE	YES	YES