EU Ecolabel protocol for testing for laundry detergents
Version 22/06/2016

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Abbreviations

HDD	Heavy duty detergent	DTI	Dye transfer inhibition
CSD	Colour safe detergent	SBL	Soil ballast load
LDD	Light duty detergent	PC	Sodium percarbonate
SR	Stain remover	TAED	Tetra acetyl ethylene diamine
BDW	Basic degree of whiteness	PVP	Polyvinylrrolidone
CM	Colour maintenance	CO	Cotton
PA	Polyamide	PES	Polyester
PES/CO	Polyester/cotton	WO	Wool
SI	Silk		

0. Background

This test protocol serves as a means of proof to show compliance with the criterion "Fitness for use" of the Commission Decision xxx/EC establishing EU Ecolabel criteria for Laundry Detergents. The product shall be fit for use, meeting the needs of users.
The test is for products that fall under the scope of the product group "Laundry detergents", which includes laundry detergents and stain removers. For each of these products, a different performance test is published, as specified in the Section 2.1 "Range of application".
The intention of this performance test for laundry detergents is to show that laundry detergents achieve good washing performance according to soil and stain removal, basic degree of whiteness, colour maintenance and dye transfer inhibition criteria. The product shall meet the requirements for wash performance set out in all the criteria listed in Section 1.

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 compliance with all the test conditions laid down in the following paragraphs. Documentation demonstrating compliance with all the test conditions shall be part of the test report.

2.1 Range of application:

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

- Heavy-duty detergent (HDD) means a detergent used of ordinary washing of white textiles at any temperature
- Colour-safe detergent (CSD) means a detergent used for ordinary washing of coloured textiles at any temperature
- Light-duty detergent (LDD) means a detergent intended for delicate fabrics

2.2 Washing machine types:

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

Table 1. Washing machine and wash programmes specifications

	Cotton wash program (at 30C, 20C[1], 15C[2])	Delicate program[3] (at 30C, 20C[1], 15C[2])
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	1200rpm	600rpm

[1]for cold water products
[2]most of the older machines do not offer cold water programs. Those machines which offer cold water programmes normally heat up the entering water to 21C, which can be used for products that claim to be effective at 20C. For test runs at 15C the heating elements of the washing machine have to be disconnected to prevent the heat up
[3]some newer washing machines offer an equivalent synthetic program

Fuzzy logic type control shall be disabled.

2.3 Water conditions:

Water hardness: 2,5 ± 0,2mmol $CaCO_3$/l. The Ca/Mg ratio shall be 3 ± 0,5.
Water inlet temperature: 20,0 ± 2,0C, except for those products that claim to be effective at lower temperatures. The water inlet temperature for products that claim to be effective at lower temperatures shall be 15,0 ± 2,0C, but the reference product shall be tested in this case at 20,0 ± 2,0C.
The amount of water shall be controlled along the washing process, if possible.
The water hardness and the water inlet temperature shall be reported for the test product and reference detergent.

2.4 Ballast load:

For HDD and 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.

Table 2. Ballast load for HDD and CSD

	Pillowcases	**Hand-towels**
Type	Bleached cotton 1/1 plain weave	Bleached cotton wave-huckaback
Mass per unit area	185±10 g/m^2 of finished fabric	220±10 g/m^2 of finished fabric
Warp	33±1 tex	19±1 threads/cm of 36±1 tex
Weft	363±1 tex	13±1 threads/cm of 97±1 tex
Pieces	Pieces of 1600 mm x 800 mm ± 2% folded in half and sewn along the three open edges thus forming double thickness (finished size: 800x800 mm^2) the shrinkage shall be less than 2% in a test according to ISO 6330	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 to the following specifications.

Table 3. Ballast load for LDD

	Knitted polyester fabric.
Mass	35 ± 3 g
Mass per unit area	200 ± 25 g/m^2
Pieces	30±3cm x 30±3cm, double layer sewn along all four edges

2.5 Stains set

Current AISE stain set as described in Section 2.9.c.
2 sets of stains per wash cycle (in the same batch) should be used. Mark with a water resistant pen each stain as the Figure 1. Fix the stains on the loads with a plastic staple with a gun on the load, as shown in Figure 2 and Figure 3.

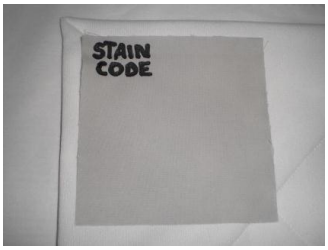

Figure 1 Marking of the stain sets

Figure 2 Marking of the stain sets

Figure 3 Marking of the stain sets

Figure 1-3. Marking of the stain sets

See Figure 4 for an example of how the stains can be fixed

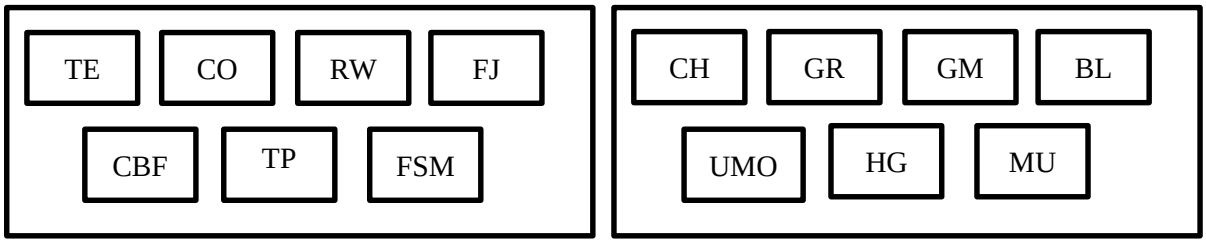

Figure 4. Fixed stains on the load (example)

Abbreviations stand for the type of soiling as indicated in Table 11.
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.

2.6 Stains set size

(12x12) cm^2 (standard stains and colour maintenance) and (5x5) cm^2 (hand-made).

2.7 Soil

Fix the SBL's on the loads as the stains

Table 4. SBL's use

HDD & CSD	**LDD**

Stain removal & basic degree of whiteness	Colour maintenance	Stain removal & basic degree of whiteness	Colour maintenance
4 units of SBL 2004	2 units of SBL 2004	2 units of SBL 2004	2 units of SBL 2004

2.8 Dye donators and dye acceptors to determine dye transfer

2.8.1 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)

2.8.2 Dye acceptors:

- standard cotton according to DIN 53919, part 1 (size 5,5x16 cm)
- polyamide according to ISO 105 F03 1 (size 6x16 cm)

2.9 Wash loads

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

a) Stain removal & basic degree of whiteness for HDD/CSD (power and liquid)

1. A clean all cotton ballast load for the normal cotton wash program to reach a total weight of 4,5kg (see Table 2).

Table 5. Ballast load for testing the whiteness for HDD/CSD (power and liquid)

Total load (kg)	Pillowcases	Hand-towel
4,5 kg ± 0,1kg	12 units	Until weight

2. 2 standard cotton cloths, according to ISO 2267 (size 20x20 cm)
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 shall be 4,5 ±0,1 kg

Table 6. Wash load for HDD and CSD (powder and liquid).

Test: stain removal and basic degree for whiteness

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	Cotton ballast load*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Cotton cloth according to ISO 2267**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Stain set (14 stains x 2 sets per wash, cycle 6-11)									x	x	x	x	x	x				
	Soil: 4 units SBL2004				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

*use the same wash load during all the test

** use the same cotton cloth during all the test

b) Colour maintenance for HDD/SCD (Power and liquid)

1. A clean all cotton ballast load for the normal cotton wash program to reach a total weight of 4,5kg (see Table 2)

Table 7. Ballast load for testing colour maintenance for HDD/SCD (powder and liquid)

Total load (kg)	Pillowcases	Hand-towel
4,5 kg ±0,1kg	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 ±0,1kg

Table 8. Wash load for HDD and CSD (powder and liquid). Test: colour maintenance

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	Cotton ballast load*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Colour maintenance monitor See Table 9**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Soil: 2 units SBL2004				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

*use the same wash load during the entire test
** use the same cotton cloth during the entire test

The colour maintenance monitor sets are shown in Table 9:

Table 9. Monitor dye set

Fabric number of AISE Monitor dye set	Fabric number of AISE Dye set	Dye Class
AISE 1	1	Sulphur black
AISE 3	2	Vat green
AISE 5	3	Vat blue
AISE 8	4	Direct yellow + cationinc 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

c) Stain Removal & basic degree of whiteness for LDD

1. A clean knitted polyester load for the normal delicate wash programs to reach a total weight of 2,5kg (see Table 3)
2. 2 standard cotton clothes, according to ISO 2267, (size 20x20 cm)
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 ± 0,1kg

Table 10 Wash loads for LDD (Powder and liquid).

Test: stain removal and basic degree of whiteness

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	Polyester ballast load*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Cotton cloth according to ISO 2267**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Stain set (14 stains x 2 sets per wash, cycle 6-11). See Table 11								x	x	x	x	x	x				
	soil: 2 units SBL2004				x	x	x	x	x	x	x	x	x	x	x	x	x	x

*use the same wash load during all the test
** use the same cotton cloth during all the test

The stain sets are shown in Table 11

Table 11. Set of stain

Figure 4	Stain	Standard stain			Hand-mad stains*	Stain classes**
TE	Tea		WFK 10J		WE5LTWKC	Drink/bleachable
CO	Coffee			CFT KC H109	WE5LCWKC	Drink/bleachable
RW	Red wine			CFT KC H026	WE5RWWKC	Drink/bleachable
FJ	Fruit juice			CFT CS15		Drink/bleachable
TP	Tomato puree				WE5TPWKC	Food/bleachable
CBF	Carrot baby food				WE5IACBWKC	Food/bleachable, enzymatic
FSM	French squeezy mustard				WE5FSMWKC	Food/bleachable, enzymatic,
CO	Chocolate		WFK 10Z	CFT CS44		Food/ enzymatic
GR	Grass	EMPA 164		CFT CS08		General soil /bleachable, enzymatic,
GR/ MU	Grass/mud				WE5GMWKC	Grease, oil / bleachable, enzymatic, particulate
BL	Blood				WE5DASBWKC	General soil / enzymatic
UMO	Unused motor oil	EMPA 106	WFK 10RM	CFT CS01		Grease, oil/ greasy, particulate
FF	Frying fat (hamburger grease)				Burnt beef WE5BBWKC (on white cotton)	Grease, oil/ greasy, enzymatic
MU	Make up	EMPA 143/2	WFK 10MU	CFT CS17		Cosmetics/ greasy, particulate

* (ex Warwick-Equest) All hand-made stains are also available in 2.5cm diameter. Their code has "2.5"instead of "5"
** (consumer denomination / chemical nature)

d) Color maintenance for LDD

1. A clean knitted polyester load for the normal delicate wash programs to reach a total weight of 2,5kg (see, Table 3)
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 ±0,1kg

Table 12. Wash loads for LDD (powder and liquid). Test: colour maintenance

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	Polyester ballast load*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Colour maintenance monitor. See Table 9**	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	soil: 2 units SBL2004				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

*use the same wash load during the whole test
** use the same cotton cloth during the whole test

2.10 Dosage

In the 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.

Table 13. Detergent dosage

Type of detergent to test	**Reference detergent**				**Market detergent** According to producer recommendation.
	Basic powder	**Sodium percarbonate**	**TAED**	**PVP***	
Powder HDD	70g	12,5g	2,5g	-	Medium soil/medium hard water recommendation. The dosage needs to comply with the Ecolabel criteria
Liquid HDD	70g	-	-	-	
Powder and liquid CSD	70g	-	-	1ml	
Powder and liquid LDD	35ml				Light soil/medium hard water recommendation. The dosage needs to comply with the Ecolabel criteria

* active substance: 45%

2.11 Reference detergent

Table 14. Reference detergents

<table>
<tr><th>Type of detergent</th><th>Reference detergent</th></tr>
<tr><td>HDD</td><td>Reformulation of the IEC A* reference detergent according to IEC 60456 formulation
<table>
<tr><th>Ingredient</th><th>% content</th><th>Tolerance (+/-)</th><th>CAS n.</th></tr>
<tr><td>linear sodium alkyl benzene sulfonate</td><td>11,4</td><td>0,5</td><td>25155-30-0</td></tr>
<tr><td>ethoxylated fatty alcohol $C_{12/14}$ (7EO)</td><td>6,1</td><td>0,3</td><td>68439-50-9</td></tr>
<tr><td>sodium soap (tallow soap)</td><td>4,2</td><td>0,2</td><td>308075-99-2</td></tr>
<tr><td>foam inhibitor concentrate, 12% silicon on inorganic carrier)</td><td>5,1</td><td>0,3</td><td>68989-22-0</td></tr>
<tr><td>sodium aluminium silicate zeolite 4A (80% active substance)</td><td>36,7</td><td>1</td><td>70955-01-0</td></tr>
<tr><td>sodium carbonate</td><td>15,1</td><td>1</td><td>497-19-8</td></tr>
<tr><td>sodium salt of a copolymer from acrylic and maleic acid (sokalan CPS)</td><td>3,1</td><td>0,2</td><td>60472-42-6</td></tr>
<tr><td>sodium silicate (SiO_2:Na_2O = 3.3:1)</td><td>3,9</td><td>0,2</td><td>1344-09-8</td></tr>
<tr><td>carboxymethylcellulose</td><td>1,6</td><td>0,1</td><td>9004-32-4</td></tr>
<tr><td>phosphonate (25% active acid)</td><td>3,6</td><td>0,2</td><td>22042-96-2</td></tr>
<tr><td>protease</td><td>0,5</td><td>0,5</td><td>9014-01-1</td></tr>
<tr><td>sodium sulfote</td><td>rest</td><td>rest</td><td>7757-82-6</td></tr>
</table>
Homogenize powder detergent, better with a sample divider or if not shake the detergent gently.
The ingredients shall be mixed prior to use. The maximum storage time after mixing is 7 days
Dosage powder HDD: 70g IEC A* + 12.5g sodium percarbonate + 2.5 TAED
Dosage liquid HDD: 70g IEC A*</td></tr>
<tr><td>LDD</td><td>
<table>
<tr><th>Ingredient</th><th>% technical grade</th><th>Tolerance (+/-)</th><th>CAS n.</th></tr>
<tr><td>fatty alcohol ethoxylate $C_{12/14}$ (EO=7)[a]</td><td>35</td><td>0,5</td><td>68213-23-0</td></tr>
<tr><td>low foaming fatty alcohol $C_{12/14}$ with approx 4mol EO and approx 5 moles PO (tehylenoxide/higher alkylene oxide -co-polymer)[b]</td><td>15</td><td>0,3</td><td>68439-51-0</td></tr>
<tr><td>sodium docecyl sulfonate [c]</td><td>7,5</td><td>0,2</td><td>68411-30-3</td></tr>
<tr><td>modified polycarboxylate (suitable for liquid detergents)[d]</td><td>15</td><td>0,3</td><td></td></tr>
<tr><td>ethanol</td><td>5</td><td>0,1</td><td>64-17-5</td></tr>
<tr><td>distilled water add to 100%</td><td>rest</td><td></td><td></td></tr>
</table>
</td></tr>
</table>

	Manufacturing process: 1. Mix fatty alcohol ethoxylate C12/14 (EO=7) and sodium dodecyl sulfonate heating to 40C 2. When the mixture will be homogenized, add low foaming fatty alcohol ethoxylate. Mix and homogenize 3. Add ethanol 4. Add modified polycarboxylate and mix 5. Finally, add water (until 100%) The bottle shall be agitated before use Dosage, power or liquid LDD: 35ml/wash cycle
CSD	Reformulation of the IEC A* reference detergent according to IEC 60456 formulation
	Dosage: 70g IEC A* + 1ml PVP

[a] example: dehydol LT-7 (cognis)
[b] example: dehypon LS 45 (cognis)
[c] example: maranil paste A55 (cognis)
[d] example: sokalan HP 25 (BASF)

2.12 Number of cycles

- A set of 15 washing machine cycles for the determination of:
  - stain removal testing from cycle number 6 to cycle number 11- final Y-value (HDD/CSD/LDD)
  - basic degree of whiteness- final Y-value (HDD/CSD/LDD)
- 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.
- Dye transfer inhibition: for CSD and HDD/LDD (only in the case that colour care is claimed), 3 replicates with new dyes donators and acceptors in each wash. Grey scale determination.

Table 15. Cycles for each type of products

	Colour claim	**Stain removal**	**Basic degree of whiteness**	**Colour maintenance**	**DTI**
HDD	Yes	✓	✓	✓	✓
	No	✓	✓	×	×
CSD		✓	✓	✓	✓
LDD	Yes	✓	✓	✓	✓
	No	✓	✓	×	×

2.13 Wash programme

Table 16 shows the different wash programmes 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 should be tested at 30C.

Table 16. Different wash programs

Test product	**Temp efficient**	**Wash programme test product**	**Wash programme reference product**	**Water inlet temperature test product**	**Water inlet temperature reference product**	**Heating Element***
HDD/ CSD	30C	30C, normal cotton program, 1200rpm	30C, normal cotton program, 1200rpm	20,0 ± 2,0C	20,0 ± 2,0C	on
HDD/ CSD	20C	20C, normal cotton program, 1200rpm	30C, normal cotton program, 1200rpm	20,0 ± 2,0C	20,0 ± 2,0C	on
HDD/ CSD	15C	20C, normal cotton program, 1200rpm	30C, normal cotton program, 1200rpm	15,0 ± 2,0C	20,0 ± 2,0C	off
LDD	30C	30C, delicate program, 600rpm	30C, delicate program, 600rpm	20,0 ± 2,0C	20,0 ± 2,0C	on

LDD	20C	20C, delicate program, 600rpm	30C, delicate program, 600rpm	20,0 ± 2,0C	20,0 ± 2,0C	on
LDD	15C	20C, delicate program, 600rpm	30C, delicate program, 600rpm	15,0 ± 2,0C	20,0 ± 2,0C	off
SR	30C	30C, normal cotton program, 1200rpm	30C, normal cotton program, 1200rpm	20,0 ± 2,0C	20,0 ± 2,0C	on

* of the washing machine of the test product

2.14 Pre-treatment

Pre-treatment of ballast load (cotton and polyamide) and standard cotton fabric for HDD/CSD or LDD should be done in 3 washes at 60C, normal cotton programme without pre-wash. The basic powder, optical brightener-free, of European Colour fastness Establishment (ECE) standard detergent for colour fastness (ISO 6330) of a dosage of 85g per 4,0kg load is used (95,6g of detergent per 4,5kg load)
It is recommended to dry ballast load after pre-treatment.

2.15 Drying and flattering

Drying (no tumble drying) and flattering: 2 points (150C) without steam after each wash cycle just the stains for HDD/CSD or LDD.

3. Methods

3.1 Stain removal and basic degree of whiteness

3.1.2 Test procedure

The monitors used for the evaluation of the stain removal, must be chosen from the same production lot.
The appropriate amount is stored at low temperatures (according to the suppliers' recommendations) under the exclusion of light and oxygen. The material is cut into pieces of (12x12) 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 (for HDD/CSD and LDD 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 (15 cycles).

3.1.2 Reflectance measurement

Final Y-value measurement for stain removal and basic degree of whiteness, and stain removers determination can be described as follows:

- Measuring geometry: d/8°
- D65/10° observer

- With UV-filter (420nm cut off) (the UV filter must in any case be adopted if 420 nm is outweighed by the optical brightener)
- Measuring diameter Minimum 20 mm
- Gloss without
- Calibration Measurements shall be carried out at the latest 8h after calibration with white tile and black trap

For each standard stain (12x12cm) 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 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

Table 9) and ballast load (see Table 2 or Table 3).
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 for the colour maintenance test 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 will be as follows:

- Measuring geometry: d/8°
- D65/10° observer
- With UV-filter (420 nm cut off) (the UV filter must in any case be adopted if 420 nm is outweighed by the optical brightener)
- Measuring diameter minimum 20 mm
- Gloss without
- Calibration measurements shall be carried out at the latest 8h 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. Test of 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. Test of colour fastness. Instrumental 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. Test of 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:C061997 "*Textiles. Test of colour 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 is 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 ±2C.
The same liquor concentration and water hardness is used as in the washing machine. The product in test (amount for 1l) is dispersed in 1l of lukewarm water using a magnetic stirrer and then rapidly heated until the liquor reaches 40C.

Dye donator (0,3g) and dye accepter (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 (40C) machine. Temperature raises 2C up to 60C and the wash is continued for 20 min at this temperature.

Table 17. DTI wash cycle composition (detergent: CSD (powder and liquid) /LDD*

Cycle number	1	2	3
Composition	Cotton + polyamide + donator		

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

Both dye acceptors (CO and PA) are used for all 4 dye donators.
After washes the textiles are removed and rinsed twice for 1 min in running warm water and then in cold running water for 10 min (same hardness as the test). Textiles are dried hanging in the air (no direct sun).
To assess the dye transfer after one wash, colour differences between the standard cotton or polyamide piece washed without and with dye donator is determined.
Results must be reported as "grey scale" figures. The colour differences are calculated according to EN ISO 105-J03: 2009 "*Textiles. Test 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. Method for the instrumental assessment of the degree of staining of adjacent fabrics*". They are based on EN 20105-A03:1995 "*Textiles. Test for colour fastness. Grey scale for assessing staining".* The measurement for all products to be compared is performed using one common calibration under the same conditions.

- Measuring geometry: d/8°
- D65/10° observer
- With UV-filter (420nm cut off) (the UV filter must in any case be adopted if 420 nm is outweighed by the optical brightener)
- Measuring diameter minimum 20 mm
- Gloss without
- Calibration measurements shall be carried out at the latest 8h after calibration with white tile and black trap

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 (3 failures are allowed)

$$\Delta Y = (\text{average reference} - \Delta) - (\text{average product} + \Delta)$$

$$\Delta Y \leq 10 \text{ to pass the test}$$

4.2 Basic degree of whiteness

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

$$\Delta Y = (\text{average reference} - \text{average product})$$

The product passes the test if:

- For HDD powder products: $\Delta Y < 2,0$
- For HDD liquid and CSD (powder and liquid) products: $\Delta Y < 3,0$

- For LDD products: $\Delta Y < 2,0$

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. The colour maintenance is measured as

$$(\Delta \text{ grey scale}) = \text{average reference} - \text{average product}$$

Each product category must achieve: Δgrey scale ≤ 1,0 to pass the test (2 failures are allowed)

4.4 Dye transfer inhibition (DTI)

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. The dye transfer inhibition is measured as

$$(\Delta\text{grey scale}) = \text{average reference} - \text{average product}$$

Each product category must achieve: Δgrey scale ≤ 1,0 to pass the test (1 failure is allowed on maximum 1 (out of 4) dye)
See Annex 1 for a complete example.

5. Results and reporting

An excelsheet template can be found on the EU Ecolabel website to report the data of the performance test of laundry detergents (Sheets: Test report data and calculation LD).
The filled in templates (2 sheets) together with the requirements of the laboratory to conduct the performance test shall be provided by the applicant.

Annex 1. Example CSD liquid

Link to the excel sheet