European Commission

Special review study on durability tests

According to Article 7(2) of Commission Regulation (EU) No 666/2013 with regard to **ecodesign requirements for vacuum cleaners**

FINAL REPORT

Prepared by

VHK for the European Commission

23 June 2016

Energy

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Implements Framework Contract No ENER/C3/2012-418-LOT 2
Specific contract No ENER/C3/2012-418-LOT2/10/FV2015-543/SI2.718562
Contract date: 14 December 2015 (latest signature)
Consortium: VHK, VITO, VM, Wuppertal Institute, ARMINES

Cover: Cylinder vacuum cleaner [picture VHK 2016].

This study was ordered and paid for by the European Commission, Directorate-General for Energy.

Acronyms, units and symbols

Acronyms

a	annum (year)
avg.	average
BAT	Best Available Technology
BAU, BaU	Business-as-Usual (baseline without measures)
BC, BaseCase	the average appliance on the market (per category)
BNAT	Best Not yet Available Technology
CECED	European Committee of Domestic Equipment Manufacturers
CEN	European Committee for Standardization
CLC, Cenelec	European Committee for Electro-technical Standardization
DG	Directorate-General (of the EC)
EC	European Commission
EN	European Norm
EoL	End-of-Life
eq	Suffix, means 'equivalent'
EU	European Union
ICSMS	Information and Communication System on Market Surveillance
IEC	International Electro-technical Committee
MEErP	Methodology for Ecodesign of Energy-related products
MEPS	Minimum Efficiency Performance Standard
NGO	Non-Governmental Organization
SME	Small and Medium-sized Enterprise
StiWa	Stiftung Warentest (German consumer association)
TC	Technical Committee (in ISO, CEN, CLC, etc.)
TR	Technical Report
VHK	Van Holsteijn en Kemna, NL (author)
WEEE	Waste of electrical and electronic equipment (directive)
WG	Working Group (of a TC)
WG6	CLC TC59X/WG6 (working group dealing with the relevant standard)
Which?	UK consumer association
yr	annum (year)

Executive summary

This special review study follows Article 7(2) of Commission Regulation (EU) No 666/2013 on Ecodesign requirements for vacuum cleaners, which specifies that the durability requirements on hose (at least 40 000 oscillations) and motors (at least 500 hours at half-loaded receptacle) shall be reviewed. The study started in December 2015. An interim report was published in March 2016, followed by a stakeholder meeting 25 April 2016 and this final study report in June 2016.

According to the Article 7(2) mentioned above, the Commission should present its findings to the Ecodesign Consultation Forum before 1 September 2016.

The special review study was closely linked to the efforts of Cenelec TC59X/WG6 to produce a harmonised standard, by way of fast-track Unique Acceptance Procedure (UAP), before the durability requirements will be implemented by the 1st of September 2017. The draft text of standard EN 60312-1 was due 19 May 2016 and the timing of the special review was synchronised to supply meaningful input to the standardisation process.

The study team used desk-research, information from industry and consumer associations, several bilateral meetings and the input from the public stakeholder meeting in its analyses.

Durability of the hose

The standard durability test of the hose is relatively unproblematic.
The problem is in the definition of the hose to be tested. The information gathered in this study, including the input from the stakeholder meeting, indicates that testing of the primary hose of a cylinder vacuum cleaner, including proper definition of categories, can be included in the test standard immediately and would be in time for application by the 1st of September 2017.

An appropriate durability test for the secondary hose of upright vacuum cleaners (5% of the market) is not available and will need to be developed. The Commission intends to issue a mandate for development. Inclusion of such a test in the regulation will have to wait for a review of the Regulation.

Durability of the motor

The study shows that the explicit requirement to perform the durability test at half-loaded receptacle makes the test very expensive, less reproducible, unattractive for spot-checks, and opposed by all stakeholders that have to perform that test (industry, consumer associations, market surveillance authorities). The better and generally accepted alternative is a test at empty receptacle.

The combination of a transitional method and a clear reference in the test standard was seen by the majority of stakeholders as the best compromise solution to introduce the change.

A new text was included in the draft for the UAP, recommending –amongst others-- that a test at empty receptacle should take 10% longer than a test at half-loaded receptacle. The transitional method, valuable also for reasons of transparency of the regulatory process, should then actually permit such a test at empty receptacle during 550 hours to be equivalent to the test of 500 hours at half-loaded receptacle prescribed in the regulation.

Table of Contents

Executive summary **4**

Table of Contents **5**

Table of Figures **6**

Table of Tables **6**

1 Introduction **7**
1.1 Assignment 7
1.2 Timing: Shorter deadline 7
1.3 Tasks 8
1.4 Consultation and other activities 9
1.5 Methodology 10

2 Durability testing of the hose **11**
2.1 Introduction 11
2.2 Background: Definition of upright and cylinder vacuum cleaners 12
2.3 Background: *Which?* survey 13

3 Durability test of motors **16**
3.1 Initial options 16
3.2 Solution with least administrative burden 17
3.3 Industry position 18
3.4 Long term perspective 19
3.5 Recommendation for a short term solution 21
3.6 Input from the stakeholder meeting 24

References **25**

Annex I. Hose durability, standard text **27**

Annex II. Operational motor life-time **29**

Annex III. Motor durability text, MSA experience in Germany **30**

Annex IV. Theoretical background: Reduced air flow and longer motor life **31**

Annex V. Minutes Stakeholder Meeting 25 April 2016 ..... **36**

Annex VI. Relevant text of draft EN 60312-1 via UAP **45**

Table of Figures

Figure 1. Upright vacuum cleaner with secondary hose 13
Figure 2. Cylinder vacuum cleaner with primary hose.....13
Figure 3. Upright vacuum cleaner with secondary hose used for curtains (left) and stairs (right).....13
Figure 4. Vacuum cleaner fault classification UK 2015. (Source: Which?) 15
Figure 5. Motor 200W output; nominal efficiency and average OEM costs 20
Figure 6 Vacuum cleaner motor durability in hours versus price.....22

Table of Tables

Table 1. Timeplan of special review study and standard development 8
Table 2. *Which?* fault reports for upright and cylinder vacuum cleaners 14
Table 3. Vacuum cleaner motor durability test (*Stiftung Warentest*, 2016).....23
Table 4. Failed vacuum cleaners (*Stiftung Warentest*, 2016) 23

1 Introduction

1.1 Assignment

This special review study follows Article 7(2) of Commission Regulation (EU) No 666/2013 on Ecodesign requirements for vacuum cleaners[1] (hereafter the Regulation), which specifies that the durability requirements on hose (at least 40 000 oscillations) and motors (at least 500 hours at half-loaded receptacle) shall be reviewed. The study started in December 2015. An interim report was published in March 2016, followed by a stakeholder meeting 25 April 2016. The final study report was published in June. The presentation to the Consultation Forum must take place before 1 September 2016 according to the Article 7(2) mentioned above.

1.2 Timing: Shorter deadline

The special review study was closely linked to the efforts of Cenelec TC59X/WG6 (hereafter 'WG6') to produce a harmonised standard before the durability requirements will be implemented by the 1st of September 2017. At the outset of the study, following Commission standardisation request 'M/540' / 'C(2015) 8753 final', the WG6 was engaged in the amendment of the standard EN 60312-1 via a so-called Unique Acceptance Procedure (UAP). This is a fast-track option that is allowed if there are no major technical changes. In order to meet the deadlines for that UAP, the working group had to hand in the final text by the 19tht of May 2016. Allowing also some time for internal editing, this meant that the special review study had to aim for feedback from stakeholders by the beginning of May 2016.

Following the UAP, the amended EN-standard could be published –assuming that the internal voting procedure within Cenelec runs smoothly—in March 2017 and could then be harmonised by the Commission immediately after. If the deadline for the UAP was missed, the durability requirements in the Regulation would not be covered by a harmonised standard. This implies that any feedback the Consultation Forum might give e.g. in August 2016 may contribute to a long-term vision but will not solve the immediate problem.

In order to solve the timing problem it was decided, in consultation with the Commission Services, to try to synchronise the review study with the time schedule of Cenelec TC59X/WG6. This meant that in fact the stakeholder meeting in April, and any written comments beforehand, had *de facto* an important impact on the way forward with the durability requirements. The Consultation Forum would have to confirm that decision.

[1] Commission Regulation (EU) No 666/2013 of 8 July 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for vacuum cleaners, OJ L 192, 13.7.2013, p. 24–34

Table 1. Timeplan of special review study and standard development

Year	2015	2016									2017	
Month	*12*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9-12*	*17 March 2017*	*1 Sept. 2017*
	Dec	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*June*	*July*	*Aug*	*4 Sept-4 Dec*		
Milestones study	Start			IR	SH		DFR/ FR					
Milestones standard and regulation						UAP draft			CF	UAP voting	EN	Reg

Milestones:

Study:
starts 14.12.2015
IR: Interim report, 14.3.2016;
SH: Stakeholder meeting, 25.4.2016;
DFR: Draft final report, <14.6.2016;
FR: Final report, June (July) 2016 [Study ends].

Standard:
UAP (Unique Acceptance Procedure) : Cenelec TC59X/WG6 deadline, 19.5.2016; voting starts 4 Sept. and ends 4 Dec. 2016;
CF: Presentation to Ecodesign Consultation Forum "no later than 1 September 2016";
EN: EN standard published according to UAP, ready for harmonisation, 17 March 2017;
Reg: Implementation durability requirements in the Regulation, 1 Sept. 2017.

1.3 Tasks

The activities followed stipulations as set out in:

- the Specifications of the Framework Contract, specifically points I.1, 2 and 4, and
- the methodology described in the Contractor's Technical Proposal of the Framework Contract, which amongst others takes into account relevant parts of the Directive 2009/125/EC (recast) of 21 October 2009 establishing a framework for the setting of ecodesign-requirements of energy-related products;

The following activities were part of the assignment:

Task 1

Determining whether the existing methods for determining the durability of the hose and the operational motor lifetime are appropriate.

The existing test methods are described in

- EN 60312-1:2013 - Vacuum cleaners for household use - Part 1: Dry vacuum cleaners - Methods for measuring the performance, point 6.9 includes a test methodology for determining the durability of the hose by its repeated bending.

- EN 60312-1:2013 - Vacuum cleaners for household use - Part 1: Dry vacuum cleaners - Methods for measuring the performance, point 6.10 includes a methodology for determining the operational motor lifetime of the motor.

The consortium shall evaluate the test methods and gather information on their practical application by discussing them with the relevant standardisation technical committees and working groups, industry, test laboratories and consumer or environmental organisations.

Task 2

Determining whether the existing methods for determining the durability of the hose and the operational motor lifetime could be simplified.

The consortium shall evaluate if the methods described in EN 60312-1:2013 could be simplified while maintaining an appropriate accuracy level.

The contractor shall evaluate any alternative test methods for durability of the hose and the operational motor lifetime applied by industry, test laboratories and consumer or environmental organisations.

1.4 Consultation and other activities

The study began 14 December 2015.

The project website www.ia-vc-art7.eu, intended to register and inform interested stakeholders of context, planning, documents and meetings, was launched January 2016[2]. The members of the Consultation Forum were informed by the Commission services on the existence of the project website and the launch of the study. VHK contacted standardisation committee and industry association CECED and consumer associations.

Specifically regarding the relevant industry stakeholders, the contractor met with CLC TC59X/WG 6 in December 2015, to explain purpose and timing of the assignment and learn about activities related to durability testing within this standardisation working group. The German consumer association *Stiftung Warentest* was contacted through ANEC/BEUC. The UK consumer association *Which?* was contacted directly.

The kick-off meeting between contractor and representatives of DG ENER, DG GROW and JRC-IES took place 29 January 2016. JRC-IES is author of a recent durability case study of vacuum cleaners and provided valuable input, e.g. regarding the importance to maintain the switching sequence as proposed in the Regulation.

Also in February, the Commission services and contractor met with a delegation of CLC TC59X/WG6 to have a better understanding of problems and possible solutions related to the assignment.

[2] The project website is not part of the assignment, but it was agreed during the kick-off meeting that communication and logistics of the project would benefit from such a site. The text for the website was approved by the Commission services.

Apart from the above consultations, the contractor engaged in desk-research of standards and other technical data, also building on the 2009 preparatory study, the 2013 impact assessment accompanying the measure, latest draft legislation concerning verification tolerances and specific (JRC-IES) or generic (AEA-Ricardo) studies on durability testing.

On the 25th of April there was a public stakeholder meeting. The minutes and slides of that meeting are found in Annex V. Following the stakeholder meeting VHK assisted in web-conferences of CLC TC59X/WG6 on the 9th of May and the CECED Working Group on Vacuum Cleaners on the 13th of May where the final wording of the draft standard was discussed. The final wording of the relevant clauses of the new draft
EN 60312-1 can be found in Annex VI.

1.5 Methodology

The assignment specifies two tasks, but already during the kick-off meeting it became clear that the issues and options relating to the review of durability test can be combined. In fact, the possible solutions elaborated by CLC TC59X/WG6 already aim at simplification as well as accurate, reliable and reproducible test methods.

It was decided that the contractor was to follow a pragmatic course and try to solve the issues within the available (shorter) time-frame (see section 1.2).

2 Durability testing of the hose

2.1 Introduction

The current test set-up and test-procedure in Clause 6.9, 'Repeated bending of hose' in the harmonised standard EN 60312-1 (see Annex I) has been used for many years by industry and consumer associations and is in principle unproblematic.

For the durability test of the hoses the problem lies with the definition of the hoses: Which hoses (primary, secondary) of which types of vacuum cleaners (cylinder, upright) will need to be subject to the test. There are 3 options:

1. The durability test is applied to the primary hose of a cylinder type vacuum cleaner. The convenor has prepared a text to that effect. The test itself, which has been around and proven for many years, does not pose a problem. The test would cover 95% of all household vacuum cleaners in the EU.
2. The same test would also be applied to the secondary hose of an upright vacuum cleaner. Upright vacuum cleaners represent 45% of the UK market, meaning 5% of the EU-market. The secondary hose is used for 'above the floor' cleaning, i.e. of curtains, stairs, furniture, etc. and is a standard accessory of almost all upright cleaners. The preparatory study has found, and new research in this special review study has confirmed, that the secondary hose is one of the major causes of repairs (13% of repairs amongst *Which?* members in 2015) for upright vacuum cleaners.[3] Applying the same test would not constitute a major technical change in the standard and can thus be realised within the timeframe of the UAP but consensus is needed in order not to jeopardise the whole UAP.
3. A different test method for the secondary hoses of upright vacuum cleaners should be developed. The secondary hoses of upright vacuum cleaners are completely different from the hoses that are used in cylinder vacuum cleaners. They are highly flexible and –above all—they are made to be extended roughly twice their original length. There are no specific tests for these hoses but it is expected that most of the damage comes from prolonging/contracting/pulling the hose, rather than –as is the case with cylinder vacuum cleaner hoses—from bending. In other words, the bending test might be useless in predicting the actual durability of this secondary hose. The solution could be, also subject to the opinion of stakeholders, to develop a dedicated test for the secondary hose of an upright vacuum cleaner (i.e. test with 'repeated stretching' instead of 'repeated bending'), if stakeholders find it worthwhile for such a relatively small market segment. Developing the test will anyway take several years and, because it will contain technical novelties, will not be included in the UAP.

Option 1 can be seen as the easiest and fastest to implement though it would not be technology neutral and 5% of the market, i.e. 40% of the UK-market, would not be covered. Option 2, introducing a possibly futile test, seems not a good idea unless one of the stakeholders has new information on the bending test for secondary hoses of upright cleaners. Option 3 appears to be the most complete one but also the most controversial for getting stakeholders acceptance and the slowest to be implemented.

The stakeholder meeting of 25 April indicated that a combination of options 1 and 3 was the preferred way forward. The test of the primary hose of cylinder type vacuum cleaners, accompanied by the proper definitions, would be included in the draft standard.

[33] Pers. comm. Mr. Matthew Knight, *Which?* (UK consumer association)

A special test for the durability of the secondary hose of upright vacuum cleaners would be developed, albeit with moderate resources, by the CLC TC59X/WG6.

The following sections, included in the interim report, provide some background information to the discussion in the stakeholder meeting.

2.2 Background: Definition of upright and cylinder vacuum cleaners

Both upright and cylinder vacuum cleaners are, for the purpose of the current Regulation, dry vacuum cleaners.
Section 3 of the harmonised standard EN 60312-1:2013 defines dry vacuum cleaners and upright cleaners as follows:

3.1
dry vacuum cleaner
electrically operated appliance that removes dry material (e. g. dust, fibre, threads) from the surface to be cleaned by an airflow created by a vacuum developed within the unit, the removed material being separated in the appliance and the cleaned suction air being returned to the ambient
3.2
upright cleaner
self-standing and floor-supported vacuum cleaner with the cleaning head forming an integral part of or permanently connected to the cleaner housing, the cleaning head normally being provided with an agitation device to assist dirt removal and the complete cleaner housing being moved over the surface to be cleaned by means of an attached handle.

A definition of cylinder vacuum cleaners is given in the draft standards FDIS IEC 62885-2 (Clause 3.21) as follows:

3.21
Cylinder vacuum cleaner.
A portable, dry vacuum cleaner, having a nozzle separated from the cleaner housing by a hose. In use, only the nozzle is guided over the surface area to be cleaned.

NOTE 1 These dry vacuum cleaners are generally floor-supported.
NOTE 2 The dry vacuum cleaner may have detachable nozzles, attachments, and tubes for both floor and above the floor cleaning.
NOTE 3 The nozzle may employ a driven rotating brush to assist in cleaning.

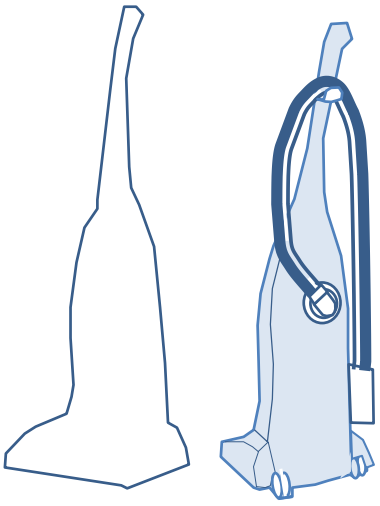

Figure 1. Upright vacuum cleaner with secondary hose (contour front and back)

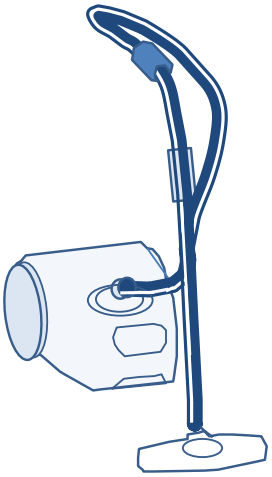

Figure 2. Cylinder vacuum cleaner with primary hose

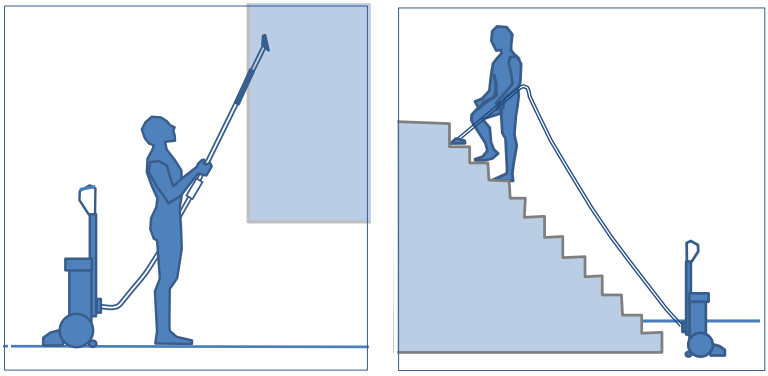

Figure 3. Upright vacuum cleaner with secondary hose used for curtains (left) and stairs (right).

In Annex VI the final definitions of the draft standard are given.

2.3 Background: *Which?* survey

The *Which?* survey showed that defective hoses are a major source for complaints of upright vacuum cleaners.

The 'population' of the survey is only *Which?* members and it comes from an annual reliability survey which covers 11 large domestic appliance categories including upright, cylinder and cordless vacuum cleaners.

Fieldwork took place in the period 28 August - 15 September 2015. The overall sample size is 9055. The total sample (population) sizes for upright vacuum cleaners are 1042, for cylinders 1304 and for cordless 965.

In terms of faults, 350 respondents reported one or more faults from the uprights sample, 287 from the cylinders sample and 198 from the cordless sample. There is no targeting of specific brands in this survey, it merely represents the vacuum cleaners that our members own. See Table 2.

A 'split hose' accounts for 13.7% of the faults recorded for upright vacuum cleaners and only 7.7% of the faults for cylinder vacuum cleaners (see table). Further to this, *Which?* also records how each respondent in the survey classifies the severity of the fault (minor, major or catastrophic). Out of total 350 repairs of upright cleaners 48 concerned a split hose (24 minor, 17 major, 7 catastrophic repairs); 22 out of total 287 repairs of cylinder vacuum cleaners concerned a split hose (9 minor, 9 major and 4 catastrophic repairs). See Figure 4.

Which? mentions that 45% of its members own an upright vacuum cleaner. Ownership of uprights in continental Europe is negligible, implying that uprights constitute around 5% of vacuum cleaners in the EU.

Table 2. *Which?* fault reports for upright and cylinder vacuum cleaners

Upright vacuum cleaners, Faults experienced *(source: Which? 2015)*	
Suction deteriorated	24.3%
Blocked filters	21.7%
Belt broken (drive-belt rotating brush)**	16.9%
Split hose	13.7%
Motor broken	13.4%
Brush not working properly	12.0%
No suction	10.0%
Brush not working at all	9.4%
Casing cracked/chipped/broken	8.9%
Other	8.6%
Broken accessories	8.3%
Overheating	6.3%
Power cable faulty	5.1%
Wheels/castors broken	4.9%
Handle broken	4.6%
Power not working at all	3.7%
Power cutting out	3.1%
Handle loose	2.3%
Controls broken	.6%
Total	**177.7%**

**=77.7% with multiple faults, n=350*
***=maintenance issue; belt costs 2-5 euros*

Cylinder vacuum cleaners, Faults experienced *(source: Which? 2015)*	
Suction deteriorated	19.5%
Blocked filters	17.8%
Other	15.7%
Broken accessories	12.2%
Brush not working properly	10.8%
Casing cracked/chipped/broken	10.1%
Overheating	8.7%
Split hose	7.7%
Motor broken	6.6%
Power cutting out	5.2%
Power cable faulty	5.2%
No suction	5.2%
Brush not working at all	4.9%
Handle broken	3.8%
Power not working at all	3.8%
Controls broken	2.4%
Wheels/castors broken	2.4%
Belt broken (drive-belt rotating brush)	2.1%
Handle loose	1.7%
Total*	**146.0%**

**=46% with multiple faults, n=287*

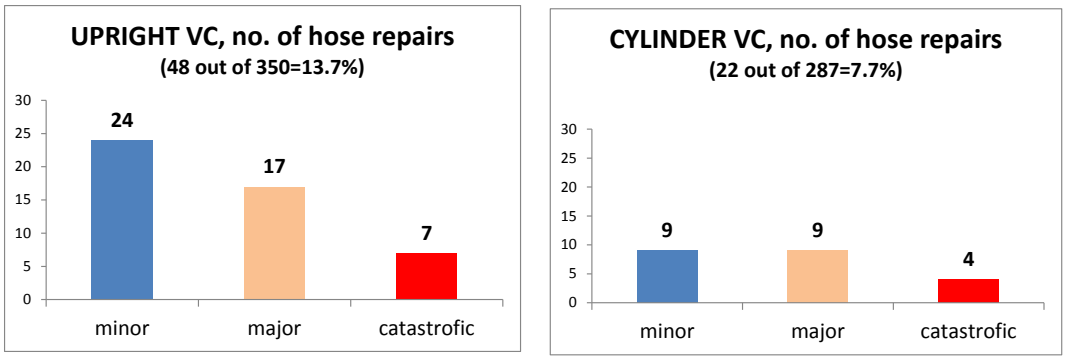

Figure 4. Vacuum cleaner fault classification UK 2015. (Source: Which? Feb. 2016)

3 Durability test of motors

3.1 Initial options

The current harmonised standard EN 60312-1:2013 says in its Clause 6.10 on life test related to the determination of the ability of the vacuum cleaner to maintain its air flow performance that both the suction motor and the motor of the agitation device (e.g. rotating brush) should be subject to the durability test.

A dispute regards the durability tests with a half-loaded receptacle, where again there are three initial options:

1. Keep the test at minimum 500 hours and half-loaded receptacle, as described explicitly in the Regulation. Industry (and apparently also the market surveillance authorities) is against this option because the reproducibility is reported to be bad and very well trained personnel would be required to do the test. An industry argumentation to this issue is added in the Annex II. In addition it can be mentioned that, as 'half-loaded' means 50% of 'fully loaded', the determination of 'fully loaded' is complex and potentially adds to uncertainty. For instance, the maximum volume of the receptacle is not clearly defined for bagless vacuum cleaners. Air data measurement using expensive DMT 8 test dust is needed for bagged vacuum cleaners. [4]
2. Perform the test with an empty bag at minimum 500 hours. The industry is in favour of option 2, but for non-experts it is peculiar that a test with an empty bag would be equivalent to a test with a half-loaded bag at the same amount of hours.
3. Perform the test with an empty bag and more hours. Option 3 makes more sense for a non-expert, i.e. that the test is at longer hours and not at 500 hours to compensate for the fact that the bag is empty. The industry acknowledges that *Stiftung Warentest* (StiWa) is testing up to 600 hours but that this is just to get a verdict of 'Sehr Gut'; they think that for a minimum requirement at entry level this is too harsh and that it should be lower.

It is plausible that testing with a half-loaded receptacle gives problems with reproducibility and/or requires highly trained personnel that works with high precision.

Furthermore, also consumer associations perform durability tests with an empty receptacle and find enough discrimination between the models.

As indicated in Annex III, also some market surveillance authorities seem to prefer testing at empty receptacle as a simple and robust option.

In summary, testing at half-loaded receptacle

- Makes the motor durability test expensive (requires special equipment, manual intervention every so many hours and special test dust DM 8 → ca. 5000 EUR/test reported);
- Makes the motor test less reproducible (deviations in test loading, definition problems for bagless VCs, etc.);
- Is opposed by all consulted stakeholders that have to test: industry, consumer associations and market surveillance authorities (MSAs).
- Makes spot-checks by consumer associations and MSAs very unlikely

[4] chapter 5.9 of EN IEC 60312-1. DMT Type 8 ('DMT8')is a synthetic vacuum cleaner test dust to simulate certain characteristics of real house test. It consists of mineral powder (Dolomite), cellulose particles and cotton fibers.

- Uses implicitly a clause in the EN test standard that was not designed to test motor durability, but to test suction maintenance over life
- Is an option for which a better, simpler and 'proven' alternative is available: testing with empty receptacle. (e.g. used by Stiftung Warentest and others)

In the stakeholder meeting of 25 April there was little dispute that testing at empty receptacle is the better option and should be made possible.

Two problems remained: To find the proper procedure to implement such a change and to find an agreement on the value of **X** hours testing at empty receptacle that would be equivalent to testing 500 hours at half-loaded receptacle.

3.2 Solution with least administrative burden

The main procedural problem is that Annex II of the Regulation is very explicit that the operational motor life-time test should be done with a '*half-loaded receptacle'* and for at least 500 hours and a maximum of 600 hours.

To change the wording in the Regulation from '*half-loaded'* to *'empty'* would require a very tiresome and lengthy amendment procedure.

At the stakeholder meeting VHK presented four options:

- **No action, meaning that the** problems persist and is not preferred;
- **Amendment** of Annex II, Point 8 of Regulation, which takes a long time (possibly one year) and represents a heavy administrative burden because the amendment, which anyway would only be relevant for a few years until the upcoming full review, basically has to follow the same decision making route as a full legislation. At least from the perspective of the tax payer this is not an efficient option.
- **Transitional method** (Commission Communication) that defines a number of **X** hours testing at empty receptacle to be equivalent to 500 hours at half-loaded receptacle. The disadvantage of this solution is that the transitional method is notr referenced in the legislation and may thus create legal disputes, especially when the method is not 'covered' by any other source.
- **Harmonised EN-standard** that defines a number of **X** hours testing at empty receptacle is equivalent to 500 hours at half-loaded receptacle. If it can be included in the UAP timeline (harmonised standard available before 1.9.2017) this would be the procedure with the least administrative burden.

Although in the stakeholder meeting several Member States initially defended the amendment as a matter of principle, in the end a majority of the stakeholders –excluding the environmental NGOs—could agree that the combination of a transitional method, backed up by a reference justifying that method in the harmonised standard, would be an acceptable way forward.

The transitional method would give the necessary trace and transparency of a democratic decision making process, while the harmonised EN-standard would give the required legal and technical robustness to the aforementioned method.

It was suggested to put the transitional method on the agenda of the regulatory committee as soon as possible. Possibly a draft text could be discussed. As soon as there is 100% certainty that the transitional method will be backed up the text in the standard, which will be the case at the end of the UAP-voting procedure on the 4th of December 2016, the transitional method could then be published in the Official Journal. Industry

stakeholders stressed the need for speedy publication because they need to prepare for the new durability requirements being implemented on the 1st of September 2017.

As regards the EN-standard, the CLC TC59X/WG6 has made an effort to formulate a clear justification, without jeopardizing the UAP procedure. The new clause 6.17 of the draft standard mentions, after describing the test with the half-loaded receptacle at 500 hours:

"Alternatively an empty dust receptacle can be used during the test. In this case the recommended testing time shall be increased by 10% of the stated motor life value for testing with a half loaded dust receptacle.

The full text is given in Annex VI.

On 19 May 2016 the convenor of CLC TC59X/WG06 sent the EN 60312-1 draft standard to the secretary of CLC TC59X, who submitted the document to the CEN-Cenelec Management Centre (CCMC) for voting according to the Unique Acceptance Procedure (UAP).

Timeline:

- 4 Sept. 2016: Start of the UAP voting procedure (voting is done by the national standardisation bodies)
- 4 Dec. 2016: End of the UAP voting. A positive vote is expected, because many of the voters on this subject are already in WG6, but there is no 100% guarantee. This is the moment where a transitional method could/should be published.
- 17 March 2017: Publication of the EN standard (this would give max. 5-6 months for the EC to harmonise, which is a feasible time period)
- 17 March – 31 August 2017: Harmonisation of the standard, i.e. publication in the OJ, by the European Commission
- 1 Sept. 2017: Implementation of second stage of Ecodesign requirements, including those on durability of hose and motor.

As regards the wording of the transitional method it is recommended to echo the text of Annex II of the regulation for the test at half-loaded receptacle (also part of the new standard), but also to explicitly permit the alternative testing at empty receptacle and to explicitly set the condition that the motor-life shall then be at least 10% longer than the 500 hour limit.

Furthermore, as also discussed in the stakeholder meeting, it is recommended to take on board the stipulations of the standard regarding testing times for hard floor and carpet with universal vacuum cleaners, filter-change, use of nozzles, etc.

The following sections discuss the decision to take '10% longer' as an equivalence value.

3.3 Industry position

The reason why probably, as mentioned in option 2, the industry believes that the equivalent number of testing hours should also be 500 hours lies amongst others in the type of motor that is used in the household vacuum cleaner (see also Annex IV). This is in most cases a *universal motor*, meaning it is suitable for *AC/DC* operation (although it is usually operated at AC input). This type is low-cost, lightweight, can meet the high speed requirement (8000 rpm and above), delivers high torque at low speed (relevant for start-up) and is easy to regulate (thyristor or 'TRIAC', working on the phase angle). It

is used in vacuum cleaners, power tools and blenders, i.e. applications where it is not supposed to run continuously. The disadvantages of this motor type are that it has low-efficiency (20-30% being a typical value), produces considerable noise, uses a commutator with carbon brushes and can be critical when operating at no load, i.e. the speed goes over the top and the large heat dissipation causes the motor to burn. For that reason, there are safety measures that ensure that the motor is always subject to an external load. From that background it may be plausible that, unlike with other types of motors, the durability of the motor at half-load can be higher than at a low (empty receptacle) load.

Nonetheless, this begs the question why the requirement of a half-load receptacle was introduced in the standard EN 60312-1 in the first place. Industry's answer is that the purpose of the test in Clause 6.10, which was the inspiration of the receptacle being half loaded at the time, is not to test the durability of the motor, but –as mentioned in Clause 6.10.1—*"The purpose of this test is to determine the ability of the vacuum cleaner to maintain its air flow performance with a partly filled dust receptacle, representative of normal household use and household dust."* From that perspective the use of a half-loaded receptacle makes sense.

3.4 Long term perspective

The question is how long universal motors will still be used. For instance, universal motors were previously used in washing machines, but today's washing machines are using predominantly *BrushLess DC motors (BLDC)* or sometimes *Switched Reluctance motors (SR motors)*. Motor controller manufacturers like Texas Instruments[5] are making the case to use BLDC motors also in vacuum cleaners, because they are more energy efficient, better to (speed) control, much less noisy and have a product life of 10 000 hours or more. The high reliability, moderately priced speed control (compared to an AC motor with variable frequency drive) and low-noise are also important reasons why BLDC motors are now used in (variable speed controlled) hermetic compressors for household refrigerators, ventilation fans and many other applications.

It would stand to reason that manufacturers using these BLDC motors would like the durability tests to show the extra quality and life expectancy. Running the test at 600 hours instead of 500 hours would probably help to accomplish that. The big question is, whether the fall-out under universal motors –that are dominating the current vacuum cleaner market—is acceptable at this moment in time or whether it is more prudent to wait for a full review of the Regulation.

In that sense it is also relevant that there is a downside to the use of BLDC motors: They use permanent magnets, which contain Neodymium (20-30 wt.%). Neodymium is identified by the Commission as a 'critical raw material' (CRM), meaning that it is not only relatively scarce but most of its production is in the hands of China, who is reported to use this 'monopoly' to its advantage. In other words, it is hard to come by in Europe without a Chinese 'connection'. This situation may change in the coming years because considerable quantities of Neodymium and other rare earth materials have been found in Greenland and will probably be commercially exploited in the near future (if permits are granted). The situation may also change because European motor manufacturers, faced with the Neodymium scarcity, have made in recent years much progress in SR motors, which do not contain permanent magnets but shown many of the good performance characteristics of BLDC motors.

[5] Texas Instruments, Hardware Design Considerations for an Efficient Vacuum Cleaner Using a BLDC Motor, Application Report SLVA654-June 2014-Revised July 2015.

For these and cost reasons, BLDC motors being an expensive solution, an AC motor (3-speed) with capacitor may be an intermediate proposition. In the consultation on the fan-Regulation leading EU-fan producer *Ebmpapst* proposed the efficiency level of 'AC motor with capacitor' as the minimum efficiency level that is attainable and economical for small fans (<125W). It is cheaper than the BLDC-level, 50% more efficient than universal motors (45% instead of 30% efficiency) and life expectancy is much higher e.g. because it has no carbon brushes. Sellers guarantee minimum life of 3000 h.

Figure 5 gives an overview of indicative efficiencies and OEM-prices for motors with a power output of 200W. Naturally these prices (and efficiencies) vary over a broad range and in time, but it gives a first impression.[6] Note that between OEM-prices and consumer prices (incl. VAT) a factor 5 is typical. This means e.g. that a BLDC motor of € 36 – without the rest of the vacuum cleaner—translates into a consumer price of € 180. For a (low quality) universal motor this value is € 20 and for an AC motor with capacitor this value becomes € 50.

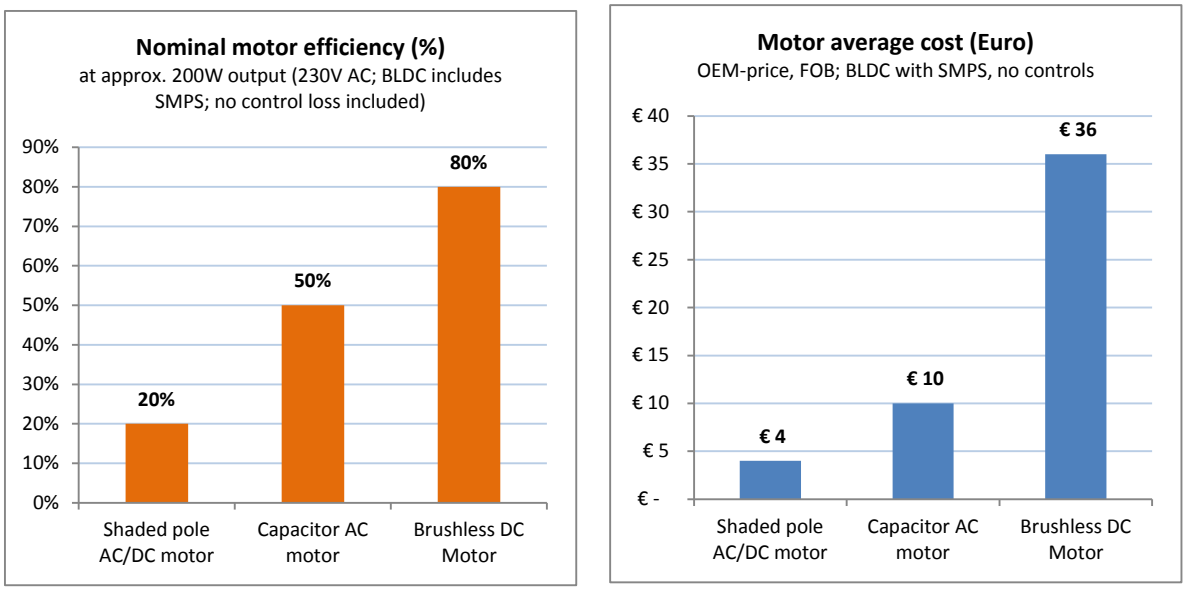

Figure 5. Motor 200W output; nominal efficiency and average OEM costs (source: VHK 2016, based on publicly available prices and declared efficiencies)

For a vacuum cleaner, an appliance that is used only 50 hours per year, no economic calculation is needed to show that a transition from universal AC/DC motors to more efficient types is not economical and thus cannot be enforced through minimum Ecodesign requirements. However, using the Energy Label (Delegated) Regulation, a considerable part of the consumers may want to choose for the more efficient and more durable motor solution if they were made aware in an appropriate way.

This could be done in various ways, but introducing a durability test of thousands of hours does not seem the most appropriate for effective market surveillance. As e.g. the experience with light sources has shown, it takes too long and by the time that the testing is done, the container full of cheap vacuum cleaners that was investigated may be long sold out and the importer untraceable.

[6] EbmPapst position paper on small fans, 2015. Download from www.fanreview.eu

3.5 Recommendation for a short term solution

The previous section indicates that the full review of especially the Energy Label Regulation (EU) No 665/2013 for vacuum cleaners, due before 2 August 2018, will be very interesting. It will be a challenge to shape the measures in a way that facilitates the market transition towards much more durable and efficient vacuum cleaners for at least the top-range of the vacuum cleaners.

In the meanwhile, the long term perspective also indicates that –whatever solution will be chosen for the short term problem of a minimum durability requirement for motors— its importance for market transition will be relative. For that reason it is recommended to find a quick and pragmatic solution.

WG6, with many members also active at global IEC level, informed the study team that at the moment the global FDIS IEC 62885-2 is at IEC Central Office (IEC CO) for the final editing and the French translation before being circulated for voting in March. The text on motor durability testing is given below:

6.17 Operational motor life-time test

6.17.1 Purpose

The purpose of this test is to determine the stationary operational life-time of a **dry vacuum cleaner** suction motor.

6.17.2 Test method

The **dry vacuum cleaner**, equipped as in its normal operation with empty dust receptacle, hose and **tube** (if applicable) and nozzle, is allowed to run intermittently with periods of 14 min 30 s on and 30 s off. If the **dry vacuum cleaner** is provided with an agitation device it shall be running.

The tube grip of **dry vacuum cleaners** with suction hose or the handle of other **dry vacuum cleaners** shall be held as for normal operation at a height of (800 ± 50) mm above the test floor.

The nozzle shall be energized and not be in contact with the floor, but lifted 1 cm off the floor.

End of life is reached when the suction motor stops operating.

NOTE The 30 second off period is not included in the calculation of overall motor life.

This text seems compatible with Annex II, point 8 on 'Operational motor life-time' of the Regulation. It is also in line with the motor durability testing by *Stiftung Warentest*.[7] What is missing is an indication of minimum or maximum number of hours for the test.

The natural way forward is that the text of Clause 6.17 of FDIS IEC 62885-2 will be transposed to the new EN 60312-1 in the UAP, but amended for the missing parts mentioned on the number of hours for the test. In order to be flexible with regard to future requirements, it is not needed to set an explicit (minimum/maximum) number of hours in the new EN 60312-1. The minimum/maximum number of hours is already in the Regulation.

It would be enough, in the new EN 60312-1, to add a sentence regarding the equivalence of half-loaded versus empty receptacle testing. E.g. *"Where testing is done with half-loaded receptacle, it is considered that the operational motor life in hours is equivalent to the operational motor life in hours at empty receptacle plus X %"*. The interim report suggested that if indeed 600 hours (500h + X=20%) is considered too ambitious then a

[7] Pers. Comm. Elke Gehrke (*Stiftung Warentest*)

compromise solution could e.g. be 550 hours (500h + X=10%). [8] This was discussed in the stakeholder meeting. The important issue is that there is a difference and thus an equivalence statement is required.

The German consumer association *Stiftung Warentest* has performed a test with empty receptacle at 600 hours (or until failure), using the switching times as indicated in the Regulation, since 2003. Over the period 2003-2015 the motor durability of in total 190 vacuum cleaners was tested. *Stiftung Warentest* has shared these data with the study team, showing that 170 of 190 vacuum cleaners (89%) reached the limit of 600 hours. This percentage is largely --up to a price of € 400-- independent of the purchase price, as is shown in the table and figure below. It also seems to be fairly constant in time, i.e. the percentage that failed was similar in the period 2003-2008 to that in the period 2009-2015.

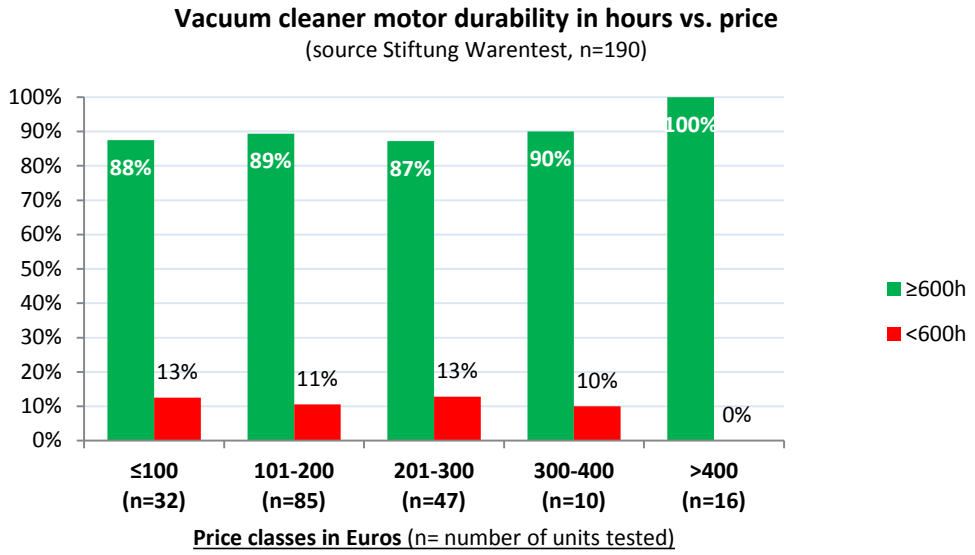

Figure 6 Vacuum cleaner motor durability in hours versus price (source: *Stiftung Warentest*, March 2016; test results 2003-2015 for in total 190 products)

[8] This 550 hours is the 'Working Assumption' in the Ricardo-AEA report on Durability of Products (2015) although it does not specify whether it applies to an empty or half-loaded receptacle.

Table 3. Vacuum cleaner motor durability test (*Stiftung Warentest*, 2016)

	number of units tested			percentage	
Price (Euro)	**total**	**≥600h**	**<600h**	**≥600h**	**<600h**
≤100 (n=32)	32	28	4	87.5%	12.5%
101-200 (n=85)	85	76	9	89.4%	10.6%
201-300 (n=47)	47	41	6	87.2%	12.8%
300-400 (n=10)	10	9	1	90.0%	10.0%
>400 (n=16)	16	16	0	100.0%	0.0%
Total	**190**	**170**	**20**	**89%**	**11%**

The test results for the 20 products that failed to reach the 600h motor life suggest that lowering the threshold to e.g. 550h does not make much of difference. Instead of 20 products (10.5%), 17 products would have failed (8.95%).

Table 4. Failed vacuum cleaners (*Stiftung Warentest*, 2016)

Hours to failure	**nr.**	**average price**
≤100	3	169
101-200	1	50
201-300	2	155
300-400	4	143
400-500	3	117
500-550	4	245
550-599	3	190
Total	**20**	**166**

Stiftung Warentest mentions that its focus is on products that claim a low energy consumption and that could thus be relatively more expensive than the market average. However, the average price of the 190 vacuum cleaners tested is € 221,-, which is very close to the average mentioned in the Impact Assessment report that accompanied the Regulation, i.e. € 225,-.[9] The 170 products that passed the 600h test cost on average € 227,-. As is shown in the table, the 20 products that failed cost on average € 166,- , but there is also a model of € 340,- that failed.

ICRT (International Consumer Research & Testing) has tested motor life over 1100 vacuum cleaners from 6 EU countries over the years.
Motor life tests were conducted for 550 hours and 90% of models passed, thus confirming StiWa finding of 91% of models passing 550 hours motor life (at empty receptacle).

In an ongoing comprehensive research on vacuum product life ICRT is testing life of motors, hoses, nozzles and electrical parts until failure. First results will be available in July 2016 (after publication of this report).

[9] EC, Vacuum cleaner IA report, SWD 2013/0240.

Note that *Stiftung Warentest* typically tests only one unit.

In case of conformity assessment for the vacuum cleaner Ecodesign Regulation, if one unit fails, three additional units are tested. According to the latest Draft Regulation on verification tolerances[10], "*the model shall be considered to comply with the applicable requirements if, for these three units, the arithmetical mean of the values of the relevant parameters as measured in testing and the values calculated from these measurements are within the respective verification tolerances.* " For motor durability testing a verification tolerance of 5% applies.

3.6 Input from the stakeholder meeting

At the stakeholder meeting of 25 April, VHK stressed that it is not possible to use a simple formula that would unambiguously 'translate' a limit of 500 hours at half-loaded receptacle into an equivalent number of hours at empty receptacle. It all depends on individual design parameters such as the motor type, operating points, etc..

The industry agreed, but in order to solve the matter and show a pro-active stand they are willing to accept an increase of 10%, i.e. a limit of 550 hours at empty receptacle.

The consumer associations advocated a limit at 600 hours, as the tests by consumer's associations indicated that this is a realistic possibility.

Some Member States, in particular Italy, reminded that the objective is to make a correction and not to set more ambitious goals. The latter would be a taskin the full review study.

A full review study, including again durability, but possibly also other circular economy aspects, is to be presented in August 2018, meaning that the study for this will start probably within a year.

[10] Draft COMMISSION REGULATION (EU) …/…, amending Regulations (EC) No 1275/2008, (EC) No 107/2009, (EC) No 278/2009, (EC) No 640/2009, (EC) No 641/2009, (EC) No 42/2009, (EC) No 643/2009, (EU) No 1015/2010, (EU) No 1016/2010, (EU) No 327/2011, (EU) No 206/2012, (EU) No 547/2011, (EU) No 932/2012, (EU) No 617/2013, (EU) No 666/2013, (EU) No 813/2013, (EU) No 814/2013, (EU) No 66/2014, (EU) No 548/2014, (EU) No 1253/2014, (EU) 2015/1095, (EU) 2015/1185, (EU) 2015/1188, (EU) 2015/1189 and (EU) 2016/XXX, [Air heating/cooling and chillers Number of the Regulation to be inserted before publication in the OJ] with regard to the use of tolerances in verification procedures. Brussels, 4 Feb. 2016.

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Draft COMMISSION REGULATION (EU) …/…, amending Regulations (EC) No 1275/2008, (EC) No 107/2009, (EC) No 278/2009, (EC) No 640/2009, (EC) No 641/2009, (EC) No 42/2009, (EC) No 643/2009, (EU) No 1015/2010, (EU) No 1016/2010, (EU) No 327/2011, (EU) No 206/2012, (EU) No 547/2011, (EU) No 932/2012, (EU) No 617/2013, (EU) No 666/2013, (EU) No 813/2013, (EU) No 814/2013, (EU) No 66/2014, (EU) No 548/2014, (EU) No 1253/2014, (EU) 2015/1095, (EU) 2015/1185, (EU) 2015/1188, (EU) 2015/1189 and (EU) 2016/XXX, [Air heating/cooling and chillers Number of the Regulation to be inserted before publication in the OJ] with regard to the use of tolerances in verification procedures. Brussels, 4 Feb. 2016.

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Pers. comm. Mr. Matthew Knight, *Which?* (UK consumer association), Feb. 2016

Pers. comm. Ms. Elke Gehrke, *Stiftung Warentest* (German consumer association), Mar. 2016

Pers. comm. Mr. Roberto Lopez, ***ICRT*** *(International Consumer Research & Testing), April 2016*

Ricardo AEA, The Durability of Products --Standard assessment for the circular economy under the Eco-Innovation Action Plan, Report for the European Commission DG

Environment, August 2015.

Annex I. Hose durability, standard text

Repeated bending of the hose
From published IEC 60312-1 and EN 60312-1:2013 (harmonised) respectively:

6.9 Repeated bending of the hose

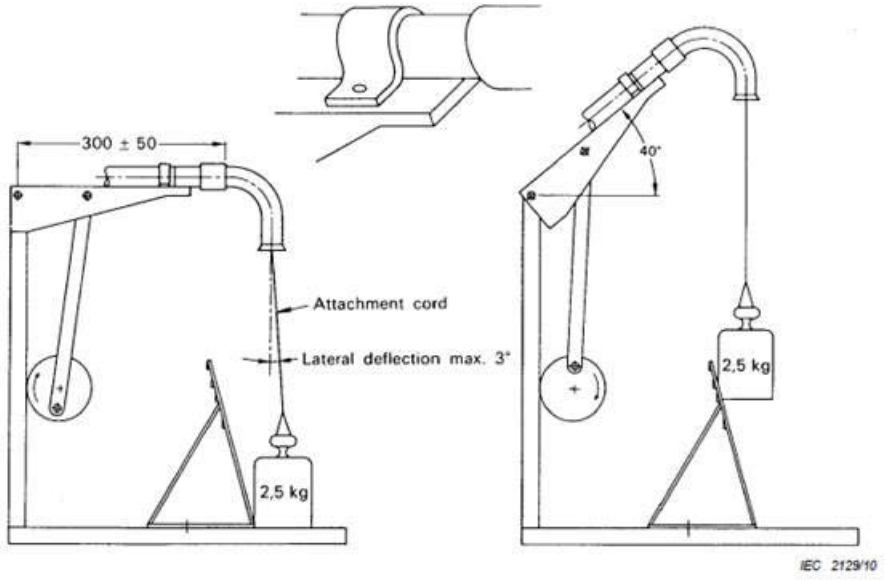
6.9.1 Purpose

The purpose of this test is to determine the ability of the hose to be repeatedly bent, as in normal use of the vacuum cleaner, before damage causes leakage affecting the performance of the cleaner.

NOTE Standard atmospheric conditions according to 4.1 not required.

6.9.2 Test equipment

The test equipment, in accordance with Figure 17, consists of a pivoting lever with a clamping device for the attachment of the hose connector. The lever is operated by means of an oscillator, for instance the crank mechanism shown, to perform a raising and lowering movement with a frequency of (10 ± 1) periods per minute. The initial position of the lever is its horizontal position from which it is raised to form an angle of 40° ± 1° with the horizontal plane.



Dimensions in millimetres

Figure 17 – Equipment for repeated bending of hoses

6.9.3 Test method

The hose connector is clamped to the lever so that the distance between the pivot point of the lever and the hose fitting end of the connector is 300 mm ± 50 mm.

A weight of 2,5 kg is attached to the pendent part of the hose in such a way that, during the oscillation period, it is lifted to a height of 100 mm ± 10 mm above the mounting plate and, during the remainder of the period, rests on the mounting plate to unload the hose completely. To accomplish this movement, the hose may need to be shortened to a length of about 300 mm.

In order to avoid pendulation of the weight loading the hose, it is given a lateral deflection of maximum 3° by means of an adjustable deflection plate.

The number of oscillations performed until the hose is damaged to the extent that it is deemed unusable is recorded.

NOTE It is recommended that the test is discontinued after 40 000 oscillations.

The definition from the FDIS IEC 62885-2 was proposed for the sake of consistency and clarity:

3.21
cylinder vacuum cleaner
a portable, dry **vacuum cleaner**, having a nozzle separated from the cleaner housing by a hose. In use, only the nozzle is guided over the surface area to be cleaned.

NOTE 1 These dry **vacuum** cleaner**s** are generally floor-supported.
NOTE 2 The dry vacuum **cleaner** may have detachable nozzles, attachments, and **tubes** for both floor and above the floor cleaning.
NOTE 3 The nozzle may employ a driven rotating brush to assist in cleaning.

The above text was supplied by the convenor of the CLC TC59X/WG6, Mr Bernard Scheuren.

Annex II. Operational motor life-time

This is from the draft document FDIS IEC 62885-2 which is at IEC CO for the final editing and the French translation before being circulated for voting. This test was the inspiration for the UAP-proposal for the next version of EN 60312-1, but with the additions as discussed and implemented in the new text in Annex VI.

6.17 Operational motor life-time test

6.17.1 Purpose

The purpose of this test is to determine the stationary operational life-time of a **dry vacuum cleaner** suction motor.

6.17.2 Test method

The **dry vacuum cleaner**, equipped as in its normal operation with empty dust receptacle, hose and **tube** (if applicable) and nozzle, is allowed to run intermittently with periods of 14 min 30 s on and 30 s off. If the **dry vacuum cleaner** is provided with an agitation device it shall be running.

The tube grip of **dry vacuum cleaners** with suction hose or the handle of other **dry vacuum cleaners** shall be held as for normal operation at a height of (800 ± 50) mm above the test floor.

The nozzle shall be energized and not be in contact with the floor, but lifted 1 cm off the floor.

End of life is reached when the suction motor stops operating.

NOTE The 30 second off period is not included in the calculation of overall motor life.

Annex III. Motor durability text, MSA experience in Germany

MSAs (Market Surveillance Authorities) need a reliable, not too time-consuming, and not too complex test in order to be able to perform e.g. the test at their own test facilities or at third parties without having any doubt regarding the test results. Baden-Wuerttemberg could perform this e.g. at the LUBW, Landesanstalt für Umwelt, Messungen und Naturschutz if tested in-house.

Baden-Wuerttemberg has within the Federal Republic of Germany a deep focus on testing the energy label and eco-design requirements of vacuum cleaners and performed in December 2014 tests on 20 different vacuum cleaners.

Issue: Measurements had to be given out to third party testing due to complexity and cost intensive test equipment, plus it is necessary to be very familiar with the test ("best lab practise"). The MSAs need of course a tool that help them conduct their work and not make it more difficult.

One solution: The operational motor lifetime could be tested e.g. in-house to have at least the chance to see whether there are issues on the market and then give testing out to third party rather than spending each time ~5000 € to test ONE vacuum cleaner.

Issue here: Half-loaded dust receptacle. How is that measured. You take a full dust bag weigh it and then fill one with 50 % of the weight; or do you take the volume and mark half. What do you do with bag-less systems? This shows that the half-loaded dust receptacle adds an uncertainty to the system.

Therefore, an automated measurement with an empty dust receptacle would be an additional powerful tool to help screening the market for "black sheep".

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Head of Standardization and Compliance
IEC Secretary SC 61J
IEC Convenor SC 61J JWG 1
IEC Convenor SC 59F WG 6
CLC Convenor TC 61 WG 10
Issue Manager EN 60335-2-67, EN 60335-2-68, EN 60335-2-69, EN 60335-2-72, EN 60335-2-79

Annex IV. Theoretical background: Reduced air flow and longer motor life

During the consultation process, vacuum cleaner industry experts claimed that the reduced air flow due to a half-loaded receptacle versus an empty receptacle leads to a longer product life. This technical annex intends to put more nuance to this statement.

Fan basics

In reality, the relationship between motor life and air flow is more complex, as mentioned e.g. in the Ecodesign regulations of fans[11] and the regulation on ventilation units[12]. With an ideal gas, the output (gas) power P_u (in W) of a motor depends on two parameters, i.e. multiplication of air flow q_v (in m/s) and pressure difference Δp (in Pa)[13].

In formula:

$$P_u = q_v \cdot \Delta p$$

This means that when the pressure Δp goes up, e.g. because of a half-loaded receptacle instead of an empty receptacle, the air flow becomes lower at the same power output. In other words, the motor has to work just as hard and in principle there should be no beneficial effect on the motor life.

Rather, it can be expected that there is a negative effect on the motor life from this shift in operating point. It can be assumed that the motor is designed for an ideal operating point (best efficiency point) when the receptacle is empty. The isochoric fan efficiency is defined as $\eta_{fan}=P_u/P_e$, where P_e is the electricity input power (in W).

This best efficiency point (bep) is thus the point with the least heat dissipation, because all energy that is not used for output power is –in some form—waste heat. When you deviate from bep at an empty receptacle, the efficiency becomes worse. Thus the heat goes up and in principle shortens the motor-life. On the other hand, if you choose the bep at a half-loaded receptacle, the efficiency increases when you move from an empty receptacle to a half-loaded receptacle.

Vacuum cleaner fans

A vacuum cleaner fan is not a normal fan. It is a so-called 'blower' or High Pressure, Low Volume (HPLV) fan designed for volume flows in the range of up to 40-50 litres per second (0.04 m³/s) and a high pressure difference in the range of up to 17500 Pa (for top models)[14]. For comparison: A central ventilation fan for a dwelling has a volume flow of 300 m³/h (83 litres per second, 0.083 m³/s) and a pressure difference of 200 Pa.

[11] Commission Regulation (EU) No 327/2011 of 30 March 2011 implementing Directive 2009/125/EC of the European Parliament and of the Council on fans driven by motors with an electric input power between 125W and 500 kW, OJ L 90, 6.4.2011, p. 8.

[12] Commission Regulation (EU) No 1253/2014 of 7 July 2014 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for ventilation units, OJ L 337, 25.11.2004, p. 8.

[13] The pressure difference relates to the difference in pressure between inlet and outlet. On the inlet side there is a normal atmospheric pressure (ca. 1 bar=10^5Pa=100 kPa= 100 000 bar)

[14] E.g. topmodel: max. 41 l/s, max 175 hPa, max fan output power at the nozzle 260W ("airwatts") at 800W motor input (32% efficiency of the entire vacuum cleaner and not the single motor). Speed: nominal 60 000 rpm. Note that a pressure difference above 100 kPa would qualify the fan as a vacuum pump or compressor.

In a vacuum cleaner the HPLV-performance is typically realised with a thin[15] centrifugal fan rotating at very high speed: from 5000 to 20 000 rpm for fans with universal motors; up to 60 000 rpm with e.g. switched reluctance motors. At these conditions, the air is no longer an ideal, incompressible gas but compressibility phenomena start to occur and friction losses are high. As a result, the impeller efficiency[16] is considerably lower than that of a 'normal' fan. This is, for instance, an important reason why vacuum cleaner fans ('fans with speed >8000 rpm') are exempted from the fan regulation.

A characteristic parameter for HPLV-fans is e.g. the 'specific speed' [17].

A definition of specific speed at bep σ_{bep} is

$$\sigma_{bep} = n \cdot \frac{2 \cdot \sqrt{\pi \cdot q_{v,bep}}}{\left(2 \cdot \frac{p_{f,bep}}{\rho}\right)^{0,75}}$$

where

- σ_{bep} is specific speed (-);
- n is fan speed in rounds per second (rps);
- ρ is air density 1.2 kg/m³;
- $q_{v,bep}$ is volume flow rate at bep, in m³/s;
- $p_{f,bep}$ is total fan pressure at bep, in Pa;
- π is the number pi (3.14…).

The limit between a HPLV-fan and a normal fan, according to this definition, is around $\sigma_{bep} < 0.12$. If it is lower it is a HPLV fan[18].

Because of the compressibility phenomena at nominal speed it is fairly unpredictable, i.e. depends on the design details, how the efficiency curve will behave over the full range of operating points. It could well be, depending on motor- and impeller design, that the vacuum cleaner fan starts to behave more like a 'normal' fan, i.e. with relatively higher efficiency than expected, when the air flow is reduced.

Vacuum cleaner motor

Another reason why the efficiency, and thereby the heat dissipation of a vacuum cleaner fan may behave differently from e.g. standard ventilation fans is the motor. Whereas standard fans for continuous operation use AC motors or (brushless) DC motors, most vacuum cleaners in the low- and medium market segment use universal (AC/DC) motors.

As mentioned in the main report, these motors have considerable economical and operational advantages, but they are not energy-efficient (meaning they dissipate considerable heat)and they have a limited lifespan. One of the main factors limiting the life span is wear of the carbon brushes in the commutator, but for our problem –i.e. whether an empty or half-loaded receptacle gives a shorter motor life—the heat dissipation is more relevant.

[15] Meaning a small distance between front and backplate, leaving a very narrow air passages. The geometry, in connection with the rpm speed, is characterised by 'specific speed'.
[16] Ratio between power output (in W) and shaft power input (=output of the motor in W). Efficiencies
[17] There are several possible definitions. This definition is the one proposed by German HPLV-fan industry for the new fan regulation (corrected by VHK for units) for centrifugal fans <10 kW, test categories B and D (Total efficiency). References: Bohl, W. (1982). Strömungsmaschinen. Würzburg: Vogel Verlag (Seiten 42ff.) and Bommes, L.; Fricke, J.; Grundmann, R. (2003). Ventilatoren. Essen: Vulkan-Verlag (Seiten 30ff.). Other definitions, using angular speed ω (in rad/s), can be found in Dixon, S.L., Hall, A.C, Fluid Mechanics and Thermodynamics of Turbomachinery, 7th edition, Elsevier, 2014.
[18] Industry proposal for the review of the fan regulation.

In that sense, the part-load efficiency curve of a universal motor –in combination with the blade design—is more relevant. Dario Brivio, expert of Nicotra-Gebhardt, although recognizing the disadvantage, lists a number of advantages of 'high-slip' motors like AC motors e.g. in combination with forward-curved centrifugal impellers[19]. The 'slip' is the difference between the actual rotor speed and the synchronous speed that fits the AC-frequency. 'High-slip' motors are much more 'tolerant' than the 'no-slip' motors like brushless DC motors. Whereas with brushless DC or SR motors the motor speed is maintained with increased torque, the speed (rpm) of universal motors decreases considerably with increased load/torque. Depending on where the bep lies, this usually results in lower efficiency and thus more heat dissipation.

Other influences

Some manufacturers of bagless vacuum cleaners claim that the pressure-drop and air-flow is independent of how full the receptacle is because the load does not block the airflow. In that case it would hardly matter for motor life how 'full' the receptacle is.

Other influences concern the quality of the filter/bag and in some cases how the cooling of the motor is conceived. E.g. for some motors it is reported that some of the suction air of the vacuum cleaner by-passes the receptacle/filter to cool the motor.

The following graphs were taken from Patent application EP2641523 A1 of Eurofilters Holding N.V. (publication date 25.9.2013), showing pressure difference ('Unterdruck' in kPa), air flow ('Luftstrom' in l/s or dm^3/s), electric input ('Aufnahmeleistung' in W) and gas power output ('Luftleistung' in W) of some vacuum cleaners, with various filters and possibly in dependence of the receptacle-load ('Staubmenge' in g of test-dust DMT8). The tests were performed in accordance with test standard EN 60312. The main claim of the inventor is that with their filter-bag design the airflow is reduced by only 5-15% in a partly loaded receptacle.

Note: The graphs are only shown as an illustration of the influence of the filter and typical efficiency curves and no conclusions regarding the merits of the patent application nor the quality of the tests are intended.

Conclusion

It is not a universal truth that a fan producing a lower air flow will thus have a longer motor-life. For a 'normal fan' even the reverse would be true. For a vacuum cleaner fan, with its specific characteristics, the statement might be true but it depends very much on the design-choices that were made regarding a multitude of parameters.

[19] Dario Brivio, An analysis of the efficiency of centrifugal fans, Nicotra Gebhardt, input consultation review of fan regulation (EU) 327/2011, 2015.
http://www.fanreview.eu/downloads/Nicotra%20An%20analysis%20of%20the%20efficiency%20of%20centrfugal%20fans_R13-1.pdf

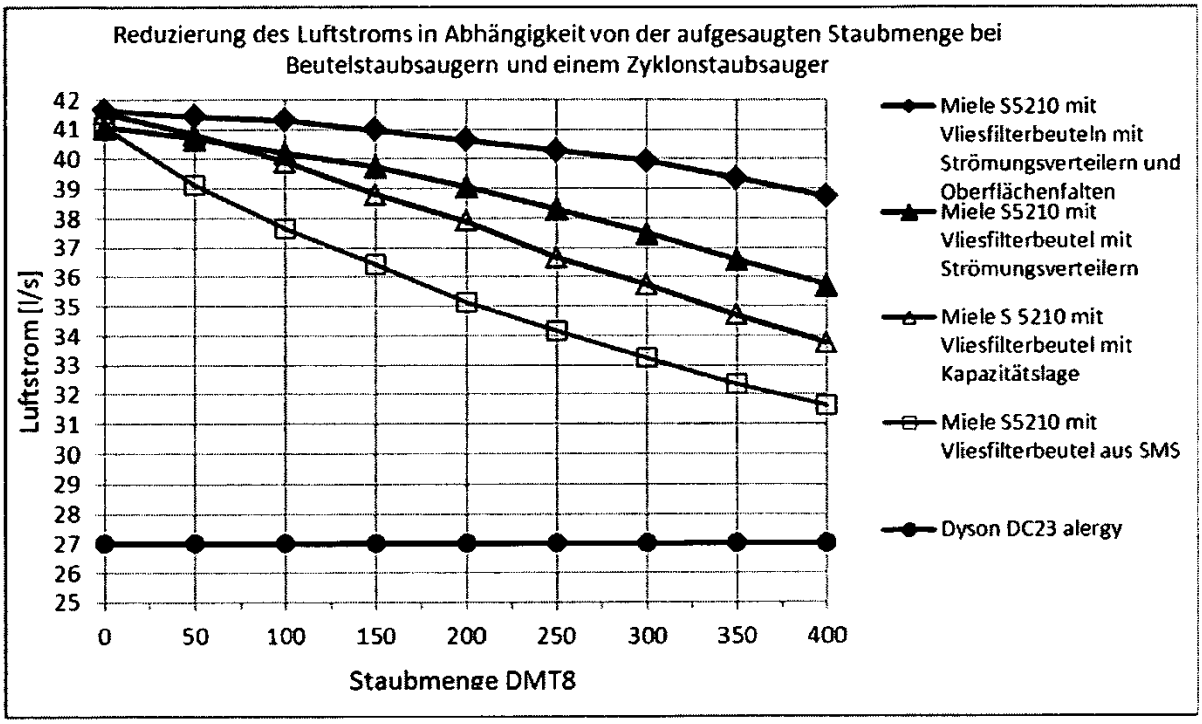

Fig. 3: Reduzierung des Luftstroms beim Aufsaugen von 400 g DMT8 Prüfstaub in Anlehnung an EN 60312 bei einer Aufnahmeleistung von 2200 W (Miele S5210) und 1400 W (Dyson DC23 alergy)

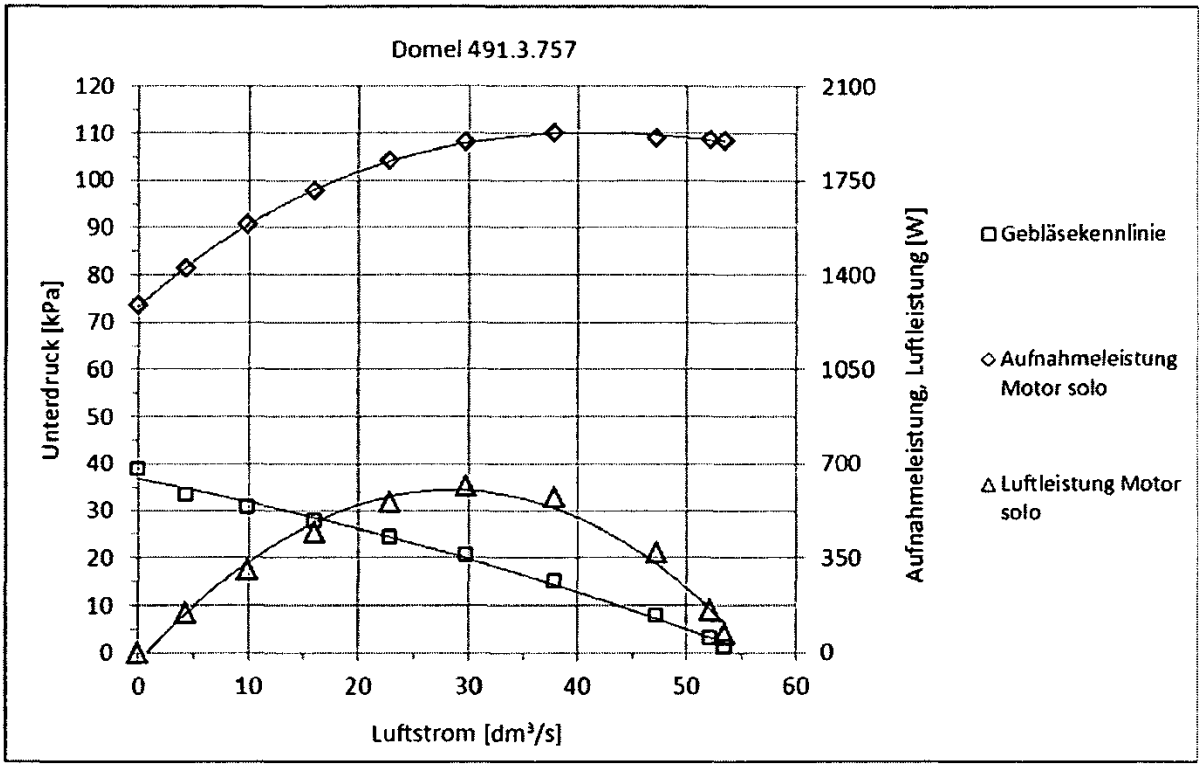

Fig. 4: Luftkenndaten einer Motor-Gebläseeinheit mit hoher Aufnahmeleistung

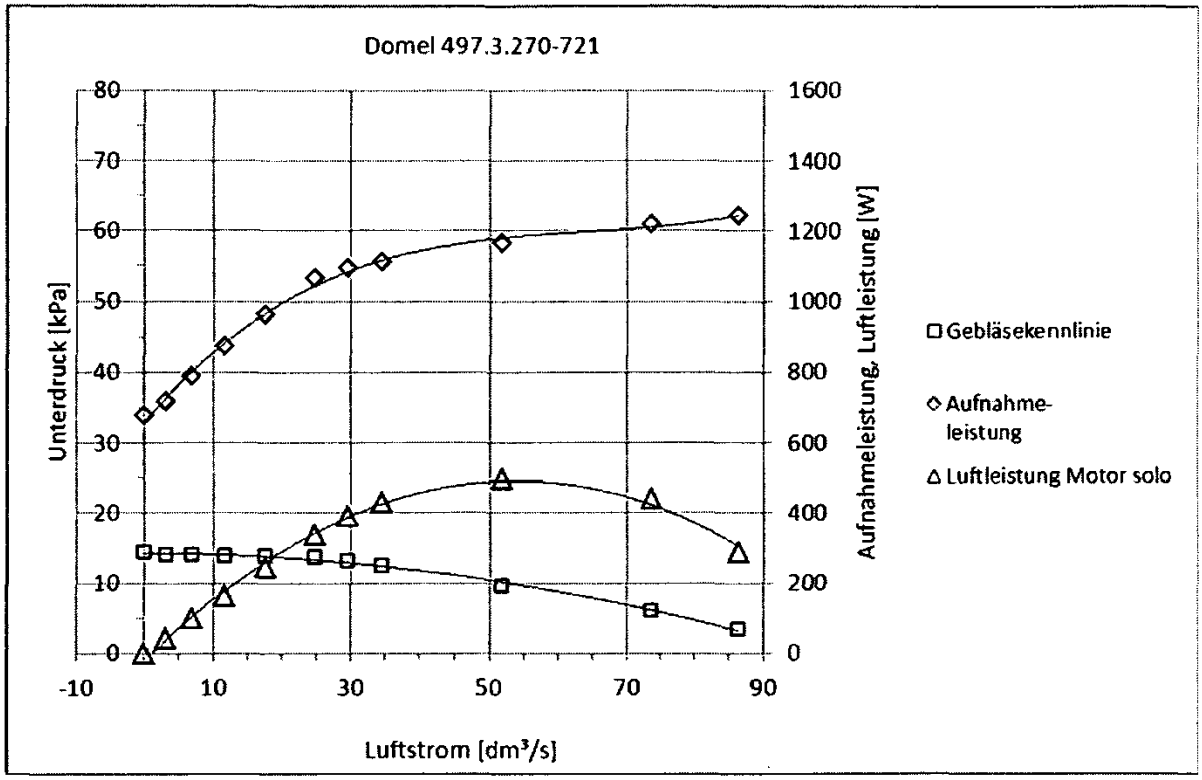

Fig. 5: Luftkenndaten einer Motor-Gebläseeinheit zur Verwendung gemäß einer bevorzugten Ausführung der vorliegenden Erfindung

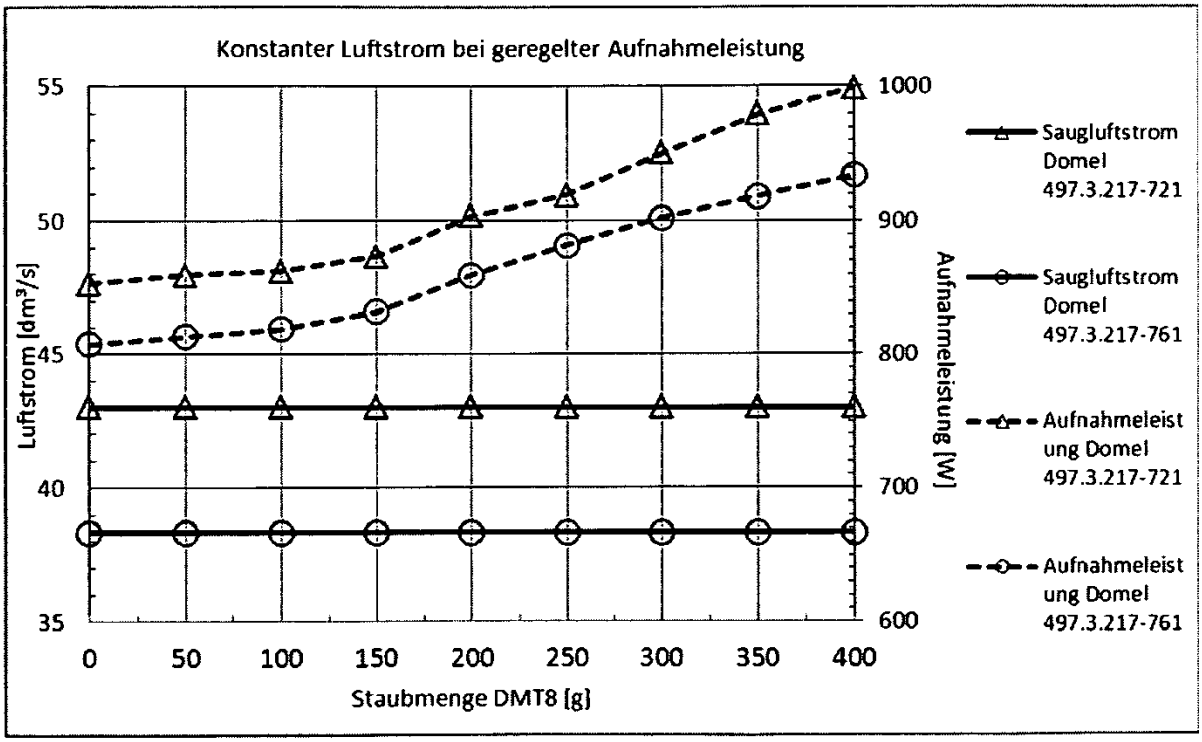

Fig. 6: Staubsauger mit konstant hoher Saugleistung und einer Aufnahmeleistung von unter 1000 W

Annex V. Minutes Stakeholder Meeting 25 April 2016

Final Minutes of the Stakeholder meeting regarding the special review study on vacuum cleaners

Place: Albert Borschette Congress Center, Brussels
Date: 25th of April 2016, 10.00-13.00 h.
The list of attendants is attached as a table at the end of the document.
Notes of the rapporteur are in *italic*.

The European Commission services (DG ENER.C.3) welcomed the participants to this meeting organised in the Commission's premises. He opened the meeting by giving a short introduction on the subject of today. This stakeholder meeting is taking place in the context of the partial review study on vacuum cleaners. It is a follow up on the interim report published by the Commission's consultant. The meeting will be chaired by the consultant. Points of discussion are the durability tests for the hose and motor of vacuum cleaners.

René Kemna (Chair) started the presentation. The agenda for the meeting was explained. The sequence was to first discuss the durability tests of the hoses, followed by the test of the motors. In the end there is a possibility to discuss any other business.

Durability test hoses

The Chair presented three options for durability testing of hoses:

1. Only test the primary hose of cylinder type vacuum cleaner, which means 5% of the market is missing .
2. Also test the secondary hose of an upright type vacuum cleaner with the same bending tests as for primary hoses of the cylinder type. The possibility exist that this test is futile.
3. Also test the secondary hose of the upright type vacuum cleaner with a new test (still to be developed)

The Chair asked the stakeholders to give their preferred option.

CECED / Philips proposed to go for option three in which a new test is developed for secondary hoses. The properties of the secondary hose are completely different than those of a primary hose.

Italy asked how long it would take to develop a decent test procedure for a secondary hose. **CECED** responded that defining a reliable test procedure would take a lot of time. If the normal procedure is followed this would be the earliest in 2019. With a fast track procedure the earliest possibility would be 2018. The latter could only be achieved if there is a complete consensus on the procedure.

The Chair commented on the timing depends on accuracy and reproducibility of tests, usually involving a round-robin by the manufactures. No test procedures for secondary hoses were found during the research, so no reference material is available. His estimation is that defining a new test procedure would take at least 2 to 3 years.

Belgium expressed that option three would be preferable, but that the issue of the hose is not the most important. Belgium repeated that today's meeting includes the issue of the motor testing. Belgium claimed that a vacuum cleaner hose can easily be changed or repaired. For motors, this is more difficult. Therefore, Belgium suggested that the issue of testing the motor durability is of more importance. Additionally, Belgium asked how much time is needed to test the required 40.000 oscillations of the vacuum cleaner hose. **CECED / Vorwerk** responded that this is a matter of weeks, not months.

The Chair asked the stakeholders if they had other questions concerning the topic of the hose.

UK asked in which countries the 5% market share of option one could be found. They wondered whether this estimation includes only the share of upright vacuum cleaners in the UK or also those in other EU countries. This number seemed little conservative to them, since upright cleaners are supposedly also used in Italy. **The Chair** confirmed that the 5% concerns mostly England and Ireland. **CECED** added that the type of vacuum cleaners used in Italy is of the 'stick' type and not upright.

The Chair concludes that for now only the primary hose will be tested and a test method for the secondary hose will be defined later. In the mandate for vacuum cleaners a statement should be made which requires the development of a specific test on the durability of secondary hoses. This test should be introduced at the review of the whole regulation.

CECED / WG6 responded that they were open to include the upright vacuum cleaner in the future standardisation work.

Sweden raised the concern that investigating the inclusion of this small market segment may take too many resources from the Commission.
After a short discussion with **the Commission services**, it appeared that the ressources from the Commission are relatively low on this issue as the main part, i.e. the budget for this research, does not come from the Commission. **The convenor of WG 6** claimed that the resources could be a problem in the future. If so, priorities should be set in accordance with the regulation enforcement.

The Chair repeated that the industry themselves pay for the standardisation, not the Commission.

Dyson asked for the background on the data on the categorisation of the faults (minor, major and catastrophic).

WHICH? Responded that a 'minor' complication is an issue which does not really affect the performance of the product. A major issue is a fault that does affect performance, but is bearable and does not lead to replacements. If a fault is defined as 'catastrophic', it means that the vacuum cleaner was discarded by the consumer.

Belgium inquired about the possibility of legal warranty aspects. Would any information requirements on legal warranty be beneficial as a commercial strategy? **The Chair** commented that this subject could be discussed in the AOB section as it is outside the scope of the assignment.

The **UK** commented on the earlier conclusion from the Chair. They agreed with the choice for option three. However, they emphasized that a correct definition of the types (e.g. the 'stick' versus the 'upright' type) was essential to avoid a possible loophole. **The Chair** agreed and suggested that this is a task for standardization and responsibility of WG6. Additionally it appeared that in case of a different test for the upright hose, the

regulation might need to be amended in case that test does not follow what is in the regulation '*the hose, if any, shall be durable so that it is still useable after 40 000 oscillations under strain*' and '*The hose shall be considered useable after 40 000 oscillations under strain if it is not visibly damaged after those oscillations. Strain shall be applied by means of a weight of 2,5 kilogram*'.

Durability tests motors

The Chair presented four options, with a preference of the consultant for option 4:

1) No action, which means no solution to the problem and therefore no actual option.
2) Amendment of Annex II, point 8, which will require a long time, plus will bring a heavy administrative burden. This is neither a preferred option.
3) Writing a transitional method which defines a number of X hours of testing at an empty receptacle is equivalent to 500 hours of testing at a half-loaded receptacle. The problem here is that a transitional, method is not a harmonised standard and has no legal power.
4) A harmonised EN-standard could define a number of X hours of testing at an empty receptacle is equivalent to 500 hours of testing at a half-loaded receptacle. If this can be incorporated in the UAP timeline this is the most preferred option by the consultant.

The Chair asked the stakeholders if there is any objection to option four.

The Netherlands responded that they have issues altering a regulation statement by means of a harmonised standard. The standard is linked to the regulation by the words ‘is equivalent’, which is undesirable according to NL. In this situation members and manufacturers may agree, but for the future this may set an undesired precedent . NL believed that an amendment to Annex II is the best solution. It is not ideal in terms of timing, but if all stakeholders agree on this solution, the Commission may be flexible in the procedure.

Sweden had no principal objection to option four. Sweden doubted however if it is acceptable to change a regulation by means of a text in the standard. But they want to be pragmatic and asked for the view of the Commission on this matter.

Italy was not concerned that option four will cause a precedent, the same sort of solution is already applied for the washing machines. In the end, it is the Commission who harmonises the standard in consultation with the Member States in the commission of harmonisation. The most important aspect, is that a solution is found for this error for which also the Member States as co-legislator have to take their responsibility.

The **UK** shared the concerns of Sweden. They are not against this solution for now, but they would like some assurances for the treatment of similar issues in the future.

Belgium requested a short comment of the Commission on the process of writing the standard and the harmonization. **The Commission services** explained that the usual procedure starts with the assessment of a candidate standard. Then it is verified if the standard covers the legislation. After this, the standard can be harmonised. In some cases there are clauses excluded. The Commission services also stated that the creation of a precedent is a possible danger. However, the current durability test for the regulation is not appropriate and has to be corrected. Option four is a temporary pragmatic solution subject of the full review study with a more permanent solution in a possible review. A legal expert will be consulted to check if this solution is acceptable. and will be.

The Chair wanted to clarify that using the wording 'equivalent' between two sets of parameters simply means that there is a relationship, i.e. in this case between the load of the receptacle and the durability of the motor. It may thus be expressed as a formula and using formulas is quite a normal practice in legislation. Hence, it is not a point of principle. If this would be the case, all formulas should be eliminated from regulations.
Furthermore, he stated, it is obvious to all that Annex 2 point 8 is incorrect. The point now is how this will be corrected. Should tax money be spent on a long amendment procedure? Should there be a transitional method, with –at best—questionable legal status but the possible advantage of being transparent? And/or should there be an equivalence statement, or formula if that is preferred, in the harmonised EN standard?

The Netherlands wanted to know how long it would take to make a transitional method. It would only require one sentence. NL can understand that the discussion is not a point of principle. However, that comments from Member States showed concerns about this solution. In the overall review of the regulation Annex 2 point 8 should be correct. The proposed transitional method could easily flow into the new regulation. It would be better if the introduced change comes from the side who repaired legislation.

Italy accepted this solution. They also wanted to inform the stakeholders on the process that will develop when deciding to go for the transitional method: when prepared by Commission, the transitional method would be circulated for written comments or raised at 'any other business' or an additional point at the next regulatory committee for Ecodesign. There would not be a vote, but a discussion and an agreement between co-legislators.

The Chair wanted to know when the next regulatory committee is, but the **Commission services** said there was no meeting planned at the moment. Also, he mentioned that there are two timing issues here to resolve. First should be decided how the standardization workgroup should proceed. This should be discussed today and perhaps by additional written comments in the next weeks. The second issue is on how to define the test method. A transitional method could work and it is a visible item. The chair could see this is a fall-back position and suggested to discuss this solution.

Belgium agreed and stated that both three and four are acceptable options. It is important to solve this matter while not drawing attention to this solution too much. On the matter of the amount of hours acceptable for X, Belgium suggested to go for 600 hours.

Italy reacted to this by stating that changing the requirements is not an option. Italy emphasized that the only task now was to find the best fit of unloaded operation hours for 500 hours of half-loaded operation. The consultants should indicate what is equivalent (and not more)

The Chair answered that the consensus amongst experts, as indicated in the report, is that a technical equivalence cannot be derived from simple physics but that all depends on the individual design parameters, i.e. the type of motor, best efficiency point of the motor, etc.. E.g. for some motors the empty receptacle would be worse and for other motors it would be better than the half-loaded receptacle in terms of durability. In the end, also based on the partial evidence and uncertainties indicated in the report, the stakeholders at the table have to make a 'political' decision.
We can also look at it from the other side. Stating less than 500 hours at empty receptacle to be equivalent is evidently not plausible and also stating that 500 hours empty is equivalent to 500 hours half-loaded suggests a technical anomaly whereby there is no relation between load and durability. What would be the risk if we take 550 or 600 hours. There would be no issue for the best motors on the market, but it may affect

the worst motors. For those motors, it might require the installation of some better quality or longer brushes, which would cost the manufacturer an additional few cents. For the consumer this would be e.g. €5 extra. This seems acceptable. This merely leaves the matter of choosing between 550 and 600 hours. There is no scientific solution to this. We have to discuss what is reasonable and acceptable.

Italy re-iterated that this is not about giving a new signal or looking forward. This should not be about pushing for better quality, because the ambition level of the current regulation has already been decided upon. There should just be a value of X that is equal to the original 500 hours.
CECED / Philips confirms that it is not clear if half-loaded or empty is better or worse for motors. CECED discussed the matter internally and decided to take a pro-active stand and found a value for X of 550 hours to be acceptable. There may not be a clear scientific background for this value, but it is defined with a sense of realism.

BEUC shared the preliminary results of tests conducted by their experts. These results showed that 600 operating hours is possible for empty bag testing and this has their preference. **CECED / CLC / Vorwerk** commented that the 600 operational hours is the limit for 'best in test' products. By setting X to 600 hours, the level of the best tested motors would now be the market entry level. This should not be the intention.

Belgium requested how representative the test sample was. They also concluded that not going to 600 but staying at 550 would not save many of the non-compliant appliances, since most units seemed to fail between 500 – 550 hours. **BEUC** commented that the question on sampling can be discussed later in consultation with the experts who conducted test.

The Chair pointed out the moment on which the test appliances failed with use of table 3 at page 18 of the report. He showed that if a vacuum cleaner failed, it could be after any amount of operating hours. The distribution of the failure times is quite evenly distributed.
Additionally he shared that test results of ICRT (1100 tests) and Stiftung Warentest (200 tests) showed that at 550 operating hours, 10% of the units would not pass. This seems a reasonable cut-off and raising it to 600 would increase that number by very little. From that point of view any number equal to or above 550 would make sense.

CECED / Philips wanted to discuss the topic of motors in nozzle. There is an ongoing discussion on usage of the nozzle motor of the multipurpose vacuum cleaner . This means the usage is half the time on hard floor and half the time on carpet. Because the nozzle motor is used only on carpet, the proposal is to operate the nozzle motor only during half of the durability test for a multi-purpose vacuum cleaner, 275 hours during the 550 hours test*. For a dedicated (hard-floor or carpet) VC a possible nozzle motor would be tested the whole time. In that way the durability test would be in line with the energy efficiency test.
[Note: We assume that active nozzle operation should follow manufacturer's instructions, so if active use of the nozzle is prescribed in both hard floor and carpet 'mode' it should be tested 550 hours. CECED to confirm..]*

Belgium wanted to know if this concerns exclusively upright vacuum cleaners or also other types. And if so, are these other types also battery operated or not? **CECED / Philips** confirmed all types were mains operated only.

Sweden commented on the interpretation of table 3 in the report. It may be possible for manufacturers to adapt the design of quality process to have less variation in failure hours.

Regarding the topic of the energized nozzle, it is acceptable if they are not working all the time. Sweden was not sure this was ever defined in the regulation.

The Chair asked for more opinion on the nozzles.

The Netherlands wanted to know what the differences in costs are between 550 and 600 testing hours. The Netherlands sensed from the discussion that 550 hours for X would be reasonable, but 600 may be on the safe side. Costs however are most likely be in favour of 550 testing hours. **CECED / Philips** replied that the time to test 500 operating hours is 3 weeks and for 600 hours only time will be added. The operational costs remain the same. The costs will not be that much higher. **Vorwerk / CECED** added that adding the 3 days of time *[..at 550 hours]* may be a bigger issue in terms of laboratory availability than money.

The Chair suggested that the empty bag test method is much more simple than the half-loaded test. For sake of the report it is interesting to know how much money can be saved with this simple test method. **CECED / Philips** does not know. They might be able to do an educated guess but they do not have any calculations on this. **The Chair** asked what is needed for the test. He assumed this is only a timer and no climate restrictions apply to these tests, as opposed to the half-loaded test that requires manual intervention every 50 hours. **CECED / Philips** there are some prescriptions on the setting of the environment but in general it is correct.

Belgium found it unclear how the nozzle motors were defined and how they should be included. According to them, the nozzle is not touching the floor and is thus unloaded. Therefore it would not matter if usage is defined as 50% or 100% of the time. This would also avoid another equivalent. Belgium proposed to keep 500/550/600 for any brush motor, but keep in mind that the testing condition are not reflecting real life usage.

The Chair requested comments from the consumer associations on this matter. This may be a compensation for not going for 600 testing hours. If the nozzle motor is included and operated unloaded, this is according to you (consumer associations) a bad situation.

CECED / Philips reacted to this with the information that in general operating the brush full speed and unloaded could negatively influence the lifetime, depending on the motor type. Testing with the nozzle unloaded may be heavier than test with the nozzle on the floor. To test the whole system at 500 – 600 hours would not be acceptable.

WHICH? added to the discussion that consumers do not change the initial setup of their vacuum cleaner and do not change nozzles when changing floors. Following the manufacturers guidelines would not necessarily reflect real life usage.

CECED explained that there cannot be different test settings for the different test topics. If Energy consumption and dust pickup is tested for a universal vacuum cleaner at 50% hard floor and 50% carpet, the same configuration should be applied for durability.

Italy added that creating a separate cycle for energy and durability is not appropriate. Should be tested in same configuration.

The Chair questioned why this issue not in the clause of the new FDIS- IEC standard?

CENELEC (Bernard Scheuren) replied that even at IEC there is room for improvement.

The Chair asked how long it would take for the ICE tests to adapt to the global numbers on durability of vacuum cleaners.

CENELEC replied that final voting is planned for end of April and no later than May. CENELEC has the deadline at 19th of May and until then amendments can be included.

The Chair summarized that the decision making is consistent with EU regulation but not with other countries. He questioned if this meant that a manufacturer coming from the USA has to redo the durability test of a vacuum cleaner or if they can optionally refer to an 'equivalent' statement to. **IEC** replied that this is unfortunately the current situation. **Italy** commented to this that it is acceptable to have a global regulation or standard with regional modifications. It is not ideal, but a common procedure. **The Chair** pointed out that it is peculiar if an imported product has to be retested with a lighter test. **Belgium** mentioned that there is no obligation to follow the standard. Market surveillance may accept other tests as well.

The Commission services wondered if the proposed amendments can be applied in the UAP process. Current suggestions to change test method do not seem to be minor changes. What are the risks?

CENELEC / Vorwerk replied that the draft for the UAP has to be finished by the 19th may. Until 2 weeks before this deadline, technical adoptions can be discussed. Even major ones. The UAP will be accepted if there are no comments by Member States *(in CENELEC fora)*. There is a risk that National Committees *(in CENELEC)* reject the amendments for vacuum cleaners. This should be checked first. The adoptions will not be accepted if it causes the whole UAP to be rejected. If there is a broad consensus in WG6, it can be done.

Dyson stated that none of the discussed methods, including those written into the standard, avoid the risks which also applied for the tests of the original regulation. There were no gauge R&R's between labs for the tests in the regulation then and there won't be for the new methods before they come into force.

Belgium notes that if the Commission prefers, they can opt for the transitional method and keep in standard what they like. They do not have to harmonise the test hours in the standard. This will be included in the transitional method

The Commission confirmed that there are choices but it is by far preferable that there would be information in the standard itself that points out the relationship between durability and loading of the receptacle. If not, it could be difficult to defend the method indicated in transitional method given that it is not a self-evident relationship. So, if the transitional method is the preferred approach, then at least the transitional method and standard should be developed in parallel with same info. **The Chair** again pointed out the questionable legal status of the transitional method and thus the very strong wish that such a transitional method would be backed up by information in the standard.

The Chair decided to insert a short break for internal consultation for the shareholders.

After the break **The Chair** concluded that a transitional method is preferred. Industry offers 550 hours for X, even though consumer associations would prefer more. Optionally, a formula could be used to replace the term 'is equivalent'. As far as the standard is concerned, there should be at least some sort of recognition that there is relation between load and durability of the motor. This information can be more or less specific, up to a definition that echoes the transitional method, depending on what is possible within Cenelec in order not to jeopardise inclusion in the UAP. The same would go for the special provisions on the nozzle testing hours.

AOB

The Chair recalled that there were two additional points brought on topic during the discussions. One concerning warranties and one about the vacuum cleaner definitions.

CECED stated that they do not feel like discussing warranties, since it has been on the agendas of several other meetings. CECED explained that there will not be added anything obliged to the manufacturer.

Belgium commented on this topic , which is currently discussed within Belgium administrations. There is the aspect commercial warranty, which is voluntarily applied by manufacturers. Another aspect is minimum legal guarantee. This is now a fixed value in Directive 1999/44/EC. Member states are allowed to go beyond this fixed value. Another construction could be that the Directive 1999/44/EC, when it would be amended, explicitly refers to Ecodesign defining minimum legal warrantee per product group. Setting a minimum guarantee of x years for a product Y would mean no life time testing is required for market surveillance.

The Chair acknowledged that the topic is interesting but not relevant to discuss here today. The Chair opted to continue to the topic on definitions.

The Chair requested **CECED** what they would like to define better. **CECED** replied that they are fine for now and have correct definitions for the current standard of the 19th of May. In the future they may request more information on this.

The Chair asked all stakeholders to provide comments and/or additional data within 2/3 weeks (indicatively before 15 May) and closed the meeting.

Participants

Last name	First name	Affiliation
Aarts	Sanne	*VHK (minutes)*
Bisson	Evelyne	*FR/Ministère de l'energie*
Chalancon	Pirere	*CECED/Vorwerk & Co KG*
Desai	Pratik	*Which? (UK consumers association)*
Detragiache	Maria Chiara	*Orgalime*
Fayole	Chloe	*ECOS*
Gosling	Robert	*DYSON*
Halatsch	Andreas	*DE/German Environmental Agency*
Kemna	René	*VHK (Chair)*
Knight	Matthew	*Which?*
Lopes	Carlos	*Swedish Energy Agency*
Mailleux	Felix	*CECED*
Malizou	Angeliki	*BEUC/ANEC*
Marchal	Eric	*CECED/Groupe SEB*
Moreno Acedo	Juan	*European Commission, DG ENER C.3*
Presutto	Milena	*ENEA (Italy)*
Rambaldi	Matteo	*CECED*
Rimmer	Edward Michael	*UK DECC*
Scheuren	Bernhard	*CECED/CENELEC/Vorwerk*
Soenen	Bram	*BE/ Belgian Ministry of Environment*
Sothirajah	Barany	*AMDEA*
Strehler	Thomas	*CECED/BSH*
Toivanen	Juha	*FI/Energy Authority*
Van den Boorn	Roy	*VHK*
Van Wolferen	Paul	*CECED/Philips*
Vermoesen	Bruno	*CECED/BSH*
Siderius	Hans-Paul	*Netherlands Enterprise Agency*

NOTE:

A DRAFT version of these minutes was sent out to participants on 3rd of May 2016, with a deadline for comments until 11th of May 2016. The underlying version of the minutes, which incorporates the comments received of the participants to the draft version, is thus considered FINAL and was published on the project website 12th of May 2016.

Annex VI. Relevant text of draft EN 60312-1 via UAP

On 19.5.2016 the convenor of CLC TC59X/WG06 sent the EN 60312-1 draft standard to the secretary of CLC TC59X, who submitted the document to the CEN-Cenelec Management Centre (CCMC) for voting according to the Unique Acceptance Procedure (UAP).

Timeline:

- 4 Sept. 2016: Start of the UAP voting procedure (voting is done by the national standardisation bodies)
- 4 Dec. 2016: End of the UAP voting. A positive vote is expected, because many of the 'voters' on this are already in WG6, but there is no 100% guarantee.
- 17 March 2017: Publication of the EN standard (this would give max. 5-6 months for the EC to harmonise, which should be enough for EC DG GROW)
- 17 March – 31 August 2017: Harmonisation of the standard, i.e. publication in the OJ, by the European Commission
- 1 Sept. 2017: Implementation of second stage of Ecodesign requirements, including those on durability of hose and motor.

The following shows the new texts in the draft standard EN 60312-1 for

- Clause 6.9 on the hose bending test
- Clause 6.17 on the operational motor life-time
- Clause 4.6 on operation of the vacuum cleaner (referenced clause)
- Annex ZZ for Ecodesign, linking the specific clauses of the standard to the requirements in the Ecodesign Commission Regulation (EU) No. 666/2013.

Regarding the hose bending test 6.9

1.) Add a note in 6.9.3 Test method after the 2nd para:

NOTE 2.5 kg is the total of the weight, the attachment cord and its attachment to the hose.

3.) Add in 3 Definitions a new definition at the end:

3.xx
cylinder vacuum cleaner
portable dry vacuum cleaner having a nozzle separated from the cleaner housing by a hose so that, in use, only the nozzle is guided over the surface area to be cleaned

Note 1 to entry: Cylinder vacuum cleaners are generally floor-supported.

Note 2 to entry: The cylinder vacuum cleaner may have detachable nozzles, attachments, and tubes for both floor and above the floor cleaning.

Note 3 to entry: The nozzle may employ a driven rotating brush to assist in cleaning.

3.) Add in 6.9.1 Purpose after the 1st para

This test is only applicable to hoses that constitute the primary structural link between the floor-supported main body of a cylinder vacuum cleaner and a separate cleaning head or cleaning head/tube assembly that, in normal use, is used to clean a floor from an upright standing position (see Figure x).

This test is not applicable to hoses that, in normal use, remain affixed at both ends to a vacuum cleaner with a cleaning head that, in normal use, forms an integral part of, or is permanently connected to, the vacuum cleaner housing. This configuration can often be found on upright vacuum cleaners. (see Figure y). Such hoses may be released at one end to allow other cleaning tasks to be carried out (see Figure z).

NOTE A test regarding durability of such hoses is under development.

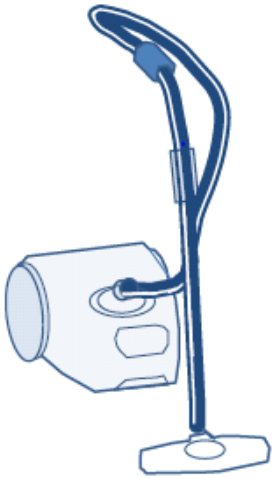

Figure x – Typical cylinder vacuum cleaner with primary hose

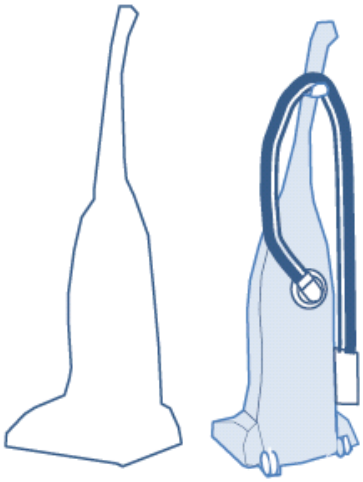

Figure y – Typical upright vacuum cleaner with secondary hose (contour front and back)

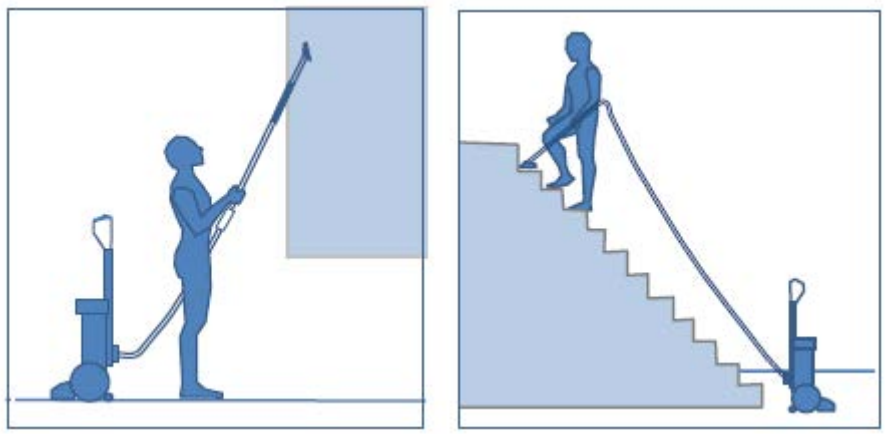

Figure z – Typical upright vacuum cleaner with secondary hose used for cleaning curtains (left) and stairs (right).

This test are not applicable for:

- Hoses that are permanently housed within other components of a vacuum cleaner, or that cannot be removed from a vacuum cleaner without the use of tools;
- Hoses that join two or more components, where, in all usage modes, the structural link between those components is provided by features other than the hose itself (an example is shown in Figure zz);
- Hoses that are provided as additional accessories or where another primary hose is provided for general use.

Figure zz – Example of a hose joining two or more components.

4.) Add at the end of 6.9.3 Test method as an additional sentence within the same clause

Additionally, breaking or damaging of the conductors, or an increase of more than 10 % of the conductor resistance, is considered to be a failure for current-carrying hoses.

Regarding operational motor life-time

Add new wording:

6.17 Operational motor life-time test

6.17.1 Purpose

The purpose of this test is to determine the stationary operational life-time of a **dry vacuum cleaner** suction and agitation device motor.

6.17.2 Test method

The **dry vacuum cleaner**, equipped as in its normal operation with hose and **tube** (if applicable) and nozzle, shall be operated as stated in 4.6. It is allowed to run intermittently with periods of 14 min 30 s on and 30 s off in maximum power setting.

This test is operated with a half loaded receptacle; hence the dust receptacle shall be loaded with 50% of the amount of test dust required according to 5.9.

Alternatively an empty dust receptacle can be used during the test. In this case the recommended testing time shall be increased by 10% of the stated motor life value for testing with a half loaded dust receptacle.

The tube grip of **dry vacuum cleaners** with suction hose or the handle of other **dry vacuum cleaners** shall be held as for normal operation at a height of (800 ± 50) mm above the test floor.

The nozzle shall not be in contact with the floor, but lifted 1 cm off the floor.

If the **dry vacuum cleaner** is provided with an agitation device it shall be running. If manufacturer's instructions require different settings of the agitation device for use on carpets and use on hard floor, the agitation device shall be operated with the respective settings for 50% each of the total testing time.

Test with half loaded dust receptacle:
After 50 h ± 5 h of operation, the vacuum cleaner shall be equipped with a clean dust receptacle and new filters (see 4.5).This procedure, with the receptacle loaded with the same amount of test dust as for the first cycle, shall be repeated in steps of 50 h ± 5 h.

Test with empty dust receptacle:
After 100 h ± 5 h of operation, the vacuum cleaner shall be equipped with a clean dust receptacle and new filters (see 4.5)

Changing or maintenance of dust receptacles and filters shall be carried out in accordance to the manufacturer's instructions and this shall be recorded, see **4.5 .**.End of life is reached when the suction motor and, if applicable, the agitation device stops operating or the recommended testing time has elapsed.

NOTE The 30 second off period is not included in the calculation of overall motor life.

<u>VHK clarification related to new Clause 6.17 above:</u> Note that the text above does not specify the total number of hours for testing, because this is explicitly regulated in Commission Regulation (EU) No 666/2013, i.e. 500 hours at half-loaded receptacle. This gives flexibility for the legislator to change the requirement, without the need to change the standard. Also note that the standard specifies testing conditions, i.e. filter change frequency and 10% higher hours, for alternative testing with empty receptacle. It does not explicitly allow testing with empty receptacle for compliance with the regulation. This stipulation needs to be part of the transitional method text (see also minutes of stakeholder meeting). Finally note that the text on agitation device operation for universal vacuum cleaners is new (see minutes stakeholder meeting for argumentation).

Regarding multiple nozzles / settings (referenced in clause 6.17)

Add new wording in 4.6:

4.6 Operation of the vacuum cleaner

The tube grip of cleaners with suction hose or the handle of other cleaners shall be held as for normal operation at a height of (800 ± 50) mm above the test floor.

During measurements where the agitation device of an active nozzle is not used as in normal operation, the agitation device shall be running but not in contact with any surface.

The following wording regarding declaration and compliance shall also apply to EN 60704-2-1, and EN 60335-2-2. For declaration and compliance purposes, related tests for a given cleaning task shall be conducted with the same dry vacuum cleaner setting configurations such as cleaning head and cleaning head setting.

NOTE 1: Related tests are all tests related to a given cleaning task. They include tests relevant to the Energy Labelling and Ecodesign requirements for **cordless dry vacuum cleaners**.

NOTE 2: Related tests are:

- tests measuring the dust removal from carpet, the energy consumption for cleaning a carpet and the noise level on carpet;
- tests measuring the dust removal from hard floor with crevices and the energy consumption for cleaning a hard floor with crevices and the noise level on hard floors (for noise measurement regarding Energy Label / Ecodesign refer to Regulations 665/2013 and 666/2013).

The dry vacuum cleaner setting configurations, such as cleaning head and cleaning head setting, shall be used and adjusted in accordance with the manufacturer's instructions for the surface to be cleaned (e.g. carpet or hard floor) for the test to be carried out. Any separate electrical specific vacuum motor settings shall be set for maximum continuous airflow and, unless the manufacturer’s instructions states otherwise, any manually operated air by-pass opening for reduction of the suction power shall be closed.

In the absence of unambiguous instructions within the user manual the product shall be tested with settings that are in accordance with any explicitly clear text, symbol or pictogram that is identifiable on the product.

If, after following the above order of checks, the tester believes the device under test to be in a configuration that is ambiguous, or that multiple configurations are possible with no way to clearly determine which is the most suitable for a given task, then the manufacturer shall be contacted for additional guidance.

Complete details of the settings used for each cleaning task are to be recorded in the test documentation.

Where a manufacturer publishes/declares values for the performance of its product, e.g. in the Technical Documentation, it must provide accurate and unambiguous details of the settings that were used during the test procedure.

Note Performance in other settings/combinations may differ from the results in the declaration settings, however the standard does not address those results.

VHK clarification related to new Clause 4.6 above: Note that the text above aims to address (potential) loopholes in the current text, where it is not explicitly forbidden for manufacturers to use switch nozzles (part of the multiple nozzle delivered with the vacuum cleaner) or settings between ‘related tests’. Now it is explicitly stated that the same nozzle and setting shall be used for all ‘related tests’, including –through the reference in clause 6.17—the motor operational life-time test. Also note that it is allowed to use different settings, to differentiate settings between hard floor and carpet tests.

Annex ZZ
(informative)

Relationship between this European Standard and the ecodesign requirements of Commission Regulation (EU) No 666/2013 aimed to be covered

This European standard has been prepared under a Commission's standardisation request **'M/540' / 'C(2015) 8753 final'** to provide one voluntary means of conforming to the ecodesign requirements of Commission Regulation (EU) No 666/2013 of 8 July 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for vacuum cleaners [OJEU L 192 of 13 July 2013].

Once this standard is cited in the Official Journal of the European Union under that Regulation, compliance with the normative clauses of this standard given in Table ZZ.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding ecodesign requirements of that Regulation and associated EFTA Regulations.

Table ZZ.1 – Correspondence between this European Standard and Commission Regulation (EU) No 666/2013 of 8 July 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for vacuum cleaners [OJEU L 192 of 13 July 2013] and Commission's standardisation request 'M/540' / 'C(2015) 8753 final'

Ecodesign requirements of Regulation No 666/2013 [OJEU L 192]	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
annual energy consumption	6.16	
rated input power		see list of harmonised standards (OJEU 2014/C 272/06) EN 60335-2-2:2010/A11:2012 EN 60335-2-2:2010/A1:2013 IEC 60335-2-2:2009/A1:2012
dust pick up on carpet (dpu_c)	5.3 in conjunction with 6.Z1.2	
dust pick up on hard floor (dpu_{hf})	5.2	
dust re-emission	5.11	
sound power level	6.15	The reference to verification given in Annex ZZ of EN 60704-2-1:2015 shall not apply.
durability of hose	6.9	
operational motor lifetime	6.17	

WARNING 1: Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2: Other Union legislation may be applicable to the products falling within the scope of this standard.