Joint Action 2014 GPSD

Joint Market Surveillance Action co-funded by the European Union
Agreement No: 666174 - GPSD

Final Technical Report, LED/CFL Light Sources

Covering the period 15 May 2015 – 14 July 2017

Co-funded by
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PROSAFE
Joint Actions
Best Practice

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Disclaimer

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Abbreviations

ANEC	The European consumer voice in standardisation
CEN - CENELEC	European Committee for Standardization
CFL	Compact Fluorescent Lamps
Chafea	Consumers, Health and Food Executive Agency
EEA	European Economic Area
EU	European Union
LED	Light Emitting Diodes
LVD	Low Voltage directive (2006/95/EC and 2014/35/EU) ensures that electrical equipment within certain voltage limits provides a high level of protection for European citizens, and benefits fully from the Single Market
FCL	Failure Code List
GPSD	General Product Safety Directive
ICSMS	Information & Communication System for Market Surveillance
JA2014	Joint Market Surveillance Action coordinated by PROSAFE with an implementation time-frame of May 2015 up to July 2017
MSA	Market Surveillance Authority
PROSAFE	Product Safety Forum of Europe
RAG	European Commission's Risk Assessment Guidelines tool
TUKES	The Finnish Safety and Chemical Agency
WP	Work Package

Executive Summary

This report presents the activities undertaken and the results achieved in the Activity LED/CFL Light sources of "Joint Market Surveillance Action on GPSD Products – JA2014" co-funded by the European Union under Grant Agreement No. 666174 - GPSD.

The activity was carried out by 10 market surveillance authorities from the following Member States: Czech Republic, Croatia, Denmark, Finland, Germany, Latvia, The Netherlands, Norway, Portugal, Sweden, under the coordination of PROSAFE

The LED lamps and the CFLs were chosen for this activity because they represent efficient lighting technologies able to achieve CO2 reduction goals set by the European Union. Well-designed modern LED lighting elements (lamps or modules) consume about 70-80% less energy than traditional incandescent light sources.

Plenty of low-quality, non-compliant and even dangerous LED lamps have been placed on the European market recently. Those lamps have deteriorated the reputation of LED lighting among the consumers. Since 2012, there have been more than 90 RAPEX notifications concerning LED lamps, lighting chains and tubes. In addition, many Article 9 safeguard clause notifications under the LVD for LED lamps and CFLs posing a risk of electric shock or fire have been issued.

The sampling of products in this project was followed a "risk based" and a "market-relevant" approaches. 211 lamps were inspected and encoded in the ICSMS system, 117 lamps (96 LED lamps and 21 CFLs) were tested according to the test plans planned in the activity.

The inspectors checked the completeness and the compliance of the markings, the CE marking and the presence and contents of the Declarations of Conformity. The testing activity was performed by a third-party laboratory accredited for the relevant tests. The (Nordic) Failure Code List was employed to assure uniform initial evaluation of the shortcomings found in the testing.

The lamps were subjected to the most safety relevant tests selected from the applicable harmonized EN safety standards. The results showed that 39% of the tested lamps had defects that will or may endanger the safety of the users (as classified according to FCL by the test laboratory and confirmed by the experts of WP8). Several lamps had many critical defects. In addition, 65% of the lamps had shortcomings concerning the mandatory markings.

The obtained result is a slightly better than that of the previous LVD ADCO joint MS activity on LED lamps in which 57 % of the tested lamps (123 lamps tested) were non-compliant with the technical requirements and 73% of the tested lamps did not fulfil the administrative requirements.

A Risk Assessment Guideline template was developed for LED lamps (CFLs) with 4 different scenarios: isolation, mechanical strength, resistance to flame and ignition, high position of user when accessing the lamps + isolation defect. This Guideline was taken as reference for the consequent decision of RAPEX notifications for the most dangerous lamps. This resulted in 2 lamps being recalled from the market, 13 covered by sales bans and 12 having been voluntarily withdrawn from the market. For 20 lamps, the manufacturer will introduce the needed modifications in next production and for 31 the supporting documentation will have to be modified. (When this report was drafted 8 RAPEX Notifications had been issued and for 9 more lamps RAPEX Notification were expected).

Caution!

The results presented in this report are based on products that were sampled from the markets in the participating countries by experienced market surveillance inspectors that were looking for non-compliant and potentially unsafe products. As in any routine market surveillance activity, the results represent the targeted efforts that authorities undertake to identify unsafe products. They do not give a statistically valid picture of the market situation.

The samples were tested at the accredited laboratory. The performed tests focused on those safety requirements that have the largest impact on consumer safety.

1 Introduction

This is the final technical report prepared for the Activity LED/CFL Light Sources of Joint Market Surveillance Action on GPSD Products – JA2014". The project participants are market surveillance authorities from the European Member States that cooperate under PROSAFE's coordination. One of the work packages of this action (no. 8) focuses on Light Emitting Diodes (LED) lamps and Compact Fluorescent Lamps (CFLs).

A market surveillance project undertaken in 2013 by LVD ADCO showed that the overall nonconformity rate for LED-lams and CFLs was very high (86% of tested 123 lamps did not comply with the technical or administrative requirements). It could also be mentioned that a total of 137 ICSMS notifications ("Safety of LVD notifications") for LED lamps and CFLs have been recorded in the period of 1.1.2013 - 31.8.2015 of which 79 were recorded with the risks involved. Therefore, it was considered a priority by the Member States to carry out a new action on these products.

The report contains the following sections:

Section 1 of the report sets out the basic facts for the activity. The main phases of the activity and the timeline are described and the priority setting is summarised.

Section 2 of the report explains how the test laboratory was chosen for performing the required tests and indicates how sampling was carried out by the market surveillance authorities participating in the activity. Some on-line developments are mentioned.

Section 3 summarises examinations and tests that were carried out by the selected laboratory. The results of the examinations and tests are then presented and analysed. Some added activities are explained for laboratory and officials of the market surveillance authority, such as checking the declarations of conformity for the latter one.

Section 4 of the report presents the way the participating authorities assessed the risks associated with the non-conformities detected and describes the follow-up measures taken with respect to the Economic Operators responsible for placing non-compliant lamps on the EU market.

Section 5 of the report mentions the several liaisons maintained during the activity and the appointments made.

Section 6 sets out observations made from standard based testing, sampling procedures and lessons learned in the activity phases, the importance to involve stakeholders is stressed.

1.1 Participating Member States

The activity was carried out by ten market surveillance authorities from ten Member States (the Czech Republic, Croatia, Denmark, Finland, Germany, Latvia, the Netherlands, Norway, Portugal, Sweden).

Initially, Belgium had joined up the project, but due to lack of resources, the Belgian Authority decided to withdraw from the activity after having attended only the kick-off meeting.

The applicant organisation that also took overall responsibility for the Joint Action was PROSAFE.

1.2 Overview of Key Staff in the Activity

The Activity Leader was Mika Toivonen from The Finnish Safety and Chemical Agency - TUKES. A PROSAFE coordinator, Fabio Gargantini, offered technical support to the leader.

1.3 Main Objectives

The general objectives of the Activity were to continue to create conditions whereby Member States could cooperate successfully on market surveillance activities and to co-ordinate a number of product activities exposing the results of the activities to the largest number of Member States national authorities possible.

The primary objective of this activity was to detect potentially dangerous products, namely LED lamps and CFLs, on the market.

This product specific activity allowed:

- Sharing of best practices, and
- The exchange of experiences in relation to this market surveillance activity on LED Lamps and CFLs.

During the preparatory phase, the Project Group focused on:

- Determining the activities to be undertaken during the course of the project;
- Establishing the project plan;
- Establishing which 'types' of lamps presented the highest risk to consumers;
- Establishing which non-conformities are likely to present a significant hazard to consumers;
- Issuing an invitation to test laboratories to tender for the testing of samples;
- The appointment the test laboratory to undertake the testing of LED Lamps and CFLs collected during the course of the market surveillance exercises.

In the intermediate phase, the Project Group focused on:

- The collection of samples from the market;
- The testing of the samples collected from the market;

During the final phase, the Project Group:

- Undertook the risk assessment on the non-compliant products to ascertain whether they presented a serious risk to consumers;
- Disseminated the results on the testing of products;
- Collected information on the measures taken by market surveillance authorities in relation to non-compliant products.

1.4 The volume of the activity

Although the Grant Agreement estimated around 70 samples of LED lamps or CFLs to be tested, the project managed to negotiate better prices through joint tendering, and, as a consequence, sent 117 models for testing. In total, 211 different lamp models were examined during the inspection activities. During this phase inspectors verified markings, including the CE marking, and performed examination of the EU declarations of conformity.

1.5 The Phases of the Activity

The Activity was a market surveillance action that followed the following stages:

- *Deciding on sampling criteria*
  The Activity decided on how the Member States should carry out sampling, i.e. how many samples would be taken by each authority, when would the sampling take place, should sampling take place in one or more rounds, what criteria would be applied when selecting the specific samples, and how many items should be taken of each product.

- *Sample products (lamps)*
  The Member States decided the sampling criteria to be applied for the selection of products to be inspected. This implied that the market surveillance authorities visited manufacturers, importers, wholesalers and retailers to collect products. This was coordinated and reported back to the Activity.

- *Test products at a laboratory*

The Activity issued a call for tender; selected an appropriate laboratory and the Member States were instructed how to send their products for testing. The products were shipped and the laboratory submitted test reports after the testing had taken place. The Joint Action shared all test reports with all the participants.

- *Risk assessment*
  The participants developed a common approach in the application of the RAPEX risk assessment guideline for the LED lamps and CFLs to assure that the resulting assessments were harmonised to the extent possible. The Member States then assessed the risk for the products applying the agreed approach and any relevant national conditions.

- *Follow-up on non-compliant products and exchange information on follow-up activities*
  The Member State authorities followed up towards the economic operators in their countries, i.e. consulted the economic operators on the results from the risk assessment, agreed on appropriate measures and followed-up that these were properly implemented. The resulting measures were reported to the Joint Action and shared with all participants.

A representation of the flow of activities within the activity "LED lamps and CFLs" (WP8) is shown in the following Figure 1

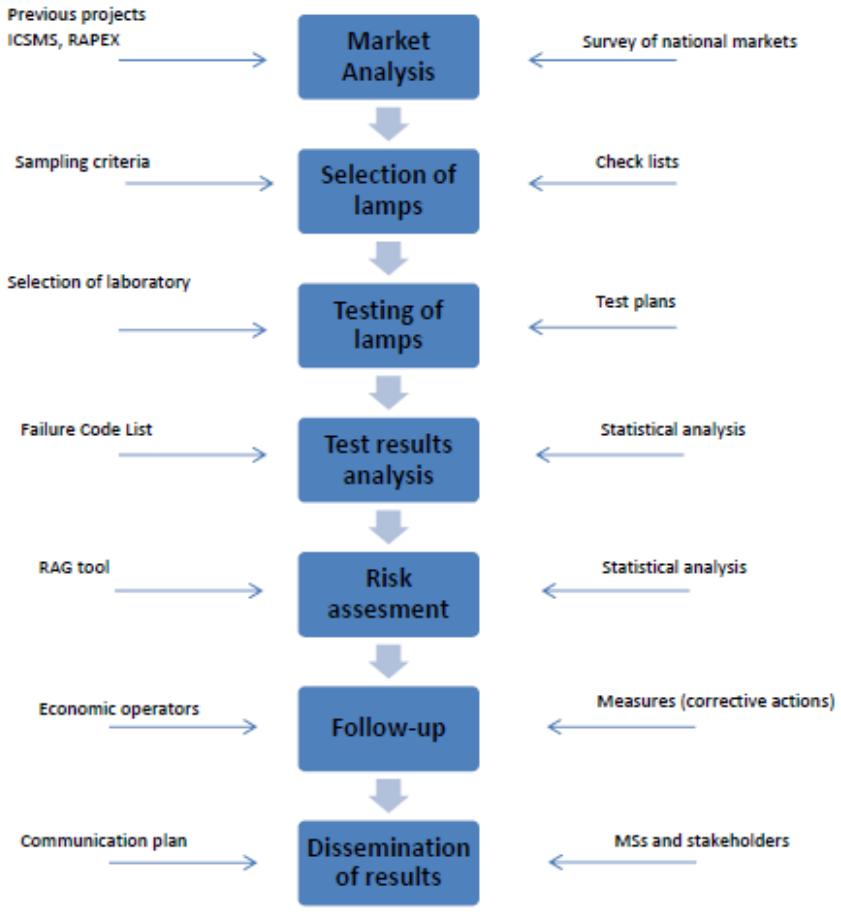


Figure 1 Flow of activities in the "LED lamps and CFLs" product specific MS activity

1.6 Timeline for Activity

Five physical meetings were organised throughout the lifetime of this project. Further details can be found within Figure 2. A summary of these meetings is shown in Figure 2 below for easy reference:

		Month 1 is May 2015																								
Activity		**Month**																								
Text	Delay	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**
		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
WP8 LEDs/CFLs																											
Planning of activities	4																										
Kick-off and planning meeting	4					1-2																					
2nd project meeting	0						13																				
3rd project meeting	0									20																	
4th project meeting	0																09-10										
5th project meeting	0																						8				
6th project meeting	3																									3	
Sampling scheme	44																										
Checklist and/or guidelines	44																										
Develop test criteria	0																										
Joint testing, call for tender	0																										
Joint testing, overview of responses to call for tender	0																										
Joint testing, contract with laboratory	0																										
Joint testing, tests	10																										
Market surveillance activities including sampling	61																										
Risk profile and risk assessment	0																										
Follow-up activities	0																										

Figure 2 Planning of the activity for JA2014/WP8 LED lamps and CFLs

The major activities included:

- *Kick-off meeting*

  The Activity held its two-day kick-off meeting from 1 to 2 September 2015 in Brussels. The purpose and scope of the Activity were further clarified to the participants in the meeting by the Activity Coordinator and the Activity Leader. Also, the roles and responsibilities of the participating authorities were discussed. All participants and stakeholders had an opportunity to express their concerns and proposals to the planning of the Activity. The PROSAFE office explained to the participants how the administrative matters are managed and about the involvement and responsibilities of the participants. In addition, some issues that should be taken into account in the planning and execution of the Activity were clarified.

- *Second Project Meeting*

  The participants met for the second project meeting on 13 October 2015 in Brussels. The meeting focussed on the preparation of the testing schemes for LED lamps and CFLs. The Activity Leader circulated the finalized templates shortly after the meeting to the participants for their comments and suggestions. The prepared testing schemes were used and introduced in the call for tenders. In addition, two technical experts (representing LightingEurope/CENELEC) and the representative of LightingEurope attended the second project meeting. Especially two technical issues, namely the reliable fixing of the conductors (supply wires) on the lamp control gear PCB and the usage of fusible resistors in LED lamps and CFLs, were discussed.

- *Third Project Meeting*

  The third project meeting was held on 20 January 2016 in Brussels. The main purpose of the 3rd project meeting was to select the laboratory for performing the planned tests for the selected lamps. The Activity Consultant presented the results of the laboratory tender process. The Activity Consultant had prepared a detailed matrix with all the answers received from the laboratories. It was circulated to the participants before the meeting.

  The results were discussed and analysed by the members in the meeting. As a result, it was unanimously decided the laboratory with the best value for money offer to performing the required tests. The selection was based on the previously criteria set and agreed by the Member States in the tender process (price, experience, accreditation, etc.).

- *Fourth Project Meeting*

  The fourth project meeting was on 9th-10th August 2016 at the premises of the selected lab.
  Major topics on the agenda included:
  - Laboratory tour;
  - Analysis of the test results (reports) with the help of lab experts and decision on the failure criteria based on (Nordic) FCL: Failure Code List (see Annex A)
  - Agreement on follow-up activities

- *Fifth Project Meeting*

  The fifth project meeting was on 8 February 2017 in Brussels. During the meeting, the participants:
  - Reviewed risk assessments and actions taken;
  - Prepared comments for the final report and newsletter;
  - Presented results and findings from the project to key stakeholders and discussed with them the outcome of the activity. The meeting had also the purpose to get any final input/recommendations from market surveillance authorities and external stakeholders, too. The recommendations were included in this final version of the report.

Considering the good experience gained during the market surveillance project undertaken in 2013 by LVD ADCO, the good knowledge basis developed during that activity and the fact the some of the members of the Activity for LED lamps and CFLs were also members of LVD ADCO, it was possible to manage the activity with only five physical meetings and it was not needed to call for the sixth meeting that was foreseen in the Grant Agreement.

- *Workshops & Final Conference*

  Besides the six main meetings, PROSAFE organised periodic workshops and seminars as part of the events surrounding all the activities within JA2014. The Task Leader and/or Task Coordinator (Consultant) of the activity “LED lamps and CFLs" took part in all these workshops in order to update the rest of the participants and also to encourage the sharing of best practices between various other product-specific activities organised within JA2014.

1.7 Other background information

1.7.1 The importance of LED lamps and CFLs for the environment

Energy saving in lighting is one of the most efficient ways to reduce carbon emissions and to achieve reduction goals set by the European Union. Especially, well-designed modern LED lighting elements (lamps or modules) consume about 70%-80% less energy than traditional incandescent light sources.

CFLs (compact fluorescent lamps) have been a cornerstone technology for energy saving in many general lighting applications since late 80's. CFL technology can be considered relatively mature while LED lamps for general lighting are still in a rapid development phase. Nevertheless, some CFL models still have the potential of delivering considerable residential energy savings and there are still innovations in the qualities of CFLs which means that for some time they are likely to be available in the market alongside with LED lamps even if the technical efficiency gains of LED lamps have clearly been realized. However, the general trend is that consumers are buying fewer CFLs and the market for CFLs will decline rapidly during next few years due to the recent strong march of better quality and more efficient LED lamps. The purchase cost of LED lamps has also been dropped fast during the last few years. CFLs will be totally replaced in the near future by LED lamps.

Especially, the product development pace of LED-lamp is very fast and new types are being introduced on the European market all the time. Short product development and test cycles and rapid technology development, in general, have resulted in that the LED lamps placed on the market have not always complied with the requirements of the applicable EU harmonization legislation.

1.7.2 The safety problems caused by LED lamps and CFLs

Many LED lamps and CFLs that do not comply with essential safety requirements of the low voltage directive (2006/95/EC and 2014/35/EU) have been found on the EU market by Member State market surveillance authorities. The defective lamps could pose a substantial risk of electric shock or fire. In worst cases, the lamps have caused accidents and fires and the reputation of LED lamps has deteriorated among the consumers.

Many of the discovered shortcomings could be associated with the faulty or insufficient application of applicable safety standards or if standards have not been applied, there has been a lack of demonstration of good engineering practice based on state of the art. Furthermore, some issues could be related to the fact that the new LED technique is not entirely covered by the current versions of safety standards for LED lamps.

Since 2012, there have been more than 90 RAPEX notifications for LED lamps, lighting chains and tubes. In addition, many Article 9 safeguard clause notifications under the LVD for LED lamps and CFLs posing a risk of electric shock or fire have been issued. A market surveillance project undertaken in 2013 by LVD ADCO showed that the overall nonconformity rate for LED lamps and CFLs was very high (86% of 123 lamps did not comply with the technical or administrative requirements).

It could also be mentioned that a total of 137 ICSMS notifications ("Safety of LVD notifications") for LED lamps and CFLs have been recorded in the period of 1.1.2013 - 31.8.2015 of which 79 were recorded with the safety risks involved.

1.7.3 Some information on the market for LED lamps and CFLs

It can be estimated from the lamp selection in shops that the market share of CFLs in the lamp market is decreasing constantly (as well as that of the energy saving halogen lamps). The market share for LED lamps could already be over 70 % from all the lamps for conventional non-directional and directional household lamps.

The European market (or at least the market in the EEA countries participating to this Activity) for LED lamps and CFLs is quite heterogeneous. There are many online-offers as well as huge number of brick-and-mortar shops.

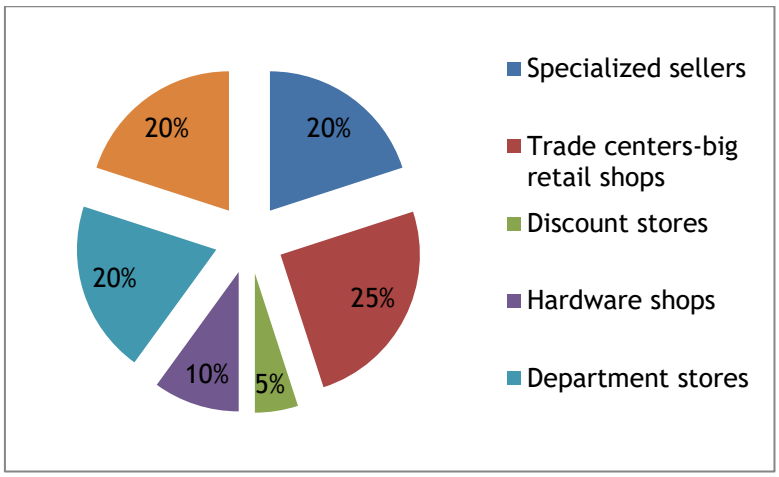
Brick-and-mortar shops are mainly hardware stores as well as retail store chains, but also small stores. In the retail stores, it is possible to find the big popular brands and also some “private label” brands. It is also more and more common to have online offers from retail stores.

In the Internet, it is also possible to find specialised shops for lighting devices. The general internet-marketplaces as Amazon or eBay are also selling LED lamps, in most cases coming directly from non-EU-Countries. The big brands are found very often in most of the internet-shops. The smaller specialised lamp-internet-shops as well as the internet-market places offer quite often unknown brands.

Many small importers sell a wide variety of LED lamps and CFLs via their webpage and do not have a brick-and-mortar store.

Most of the products found on the market of some participating members (e.g. Germany) have not only a label of the brand, but also the complete address of the manufacturer/importer which is definitely a result of Market Surveillance activity in recent years.

A rough estimation of distribution of LED Lamps and CFLs sold in participating countries per type of shop is shown in the Graph 1:



Graph 1 – Distribution of LED Lamps and CFLs per type of shop

It has also been noted that during past few years more and more trademarks have come into market. Most of these brands are not from operators historically active on the lighting/lamps market, probably as spin off of companies involved in electronic technology.

The offered traditional LED lamps becoming cheaper and cheaper in time, have nowadays often even more innovative features (such as color changing and remote control) and have changed in appearance (new glowing "LED filament" like in old incandescent lamps). Other LED products like lighting chains or strips changed the world in lighting and it is possible to find these products at places where lighting in the past was problematic, e.g. due to restrictions in space or environment.

2 Setting up the Product Activity

2.1 Tendering Process for Test Laboratories

The test laboratory was selected following a public tender procedure developed by PROSAFE. It was important, for reasons of transparency and the overall success of the process, to be careful in describing the criteria that the laboratory must meet to participate in the tender as well as the criteria that will be used to make the final selection.

26 laboratories were invited to answer the call for tenders, their names were selected from the Nando system amongst the names of laboratories recognized for LVD and from knowledge of the WP8 members. Seven laboratories answered to the call for tenders.

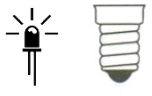
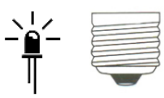
The test laboratory was chosen using the defined selection criteria: price, technical skills, accreditation, ability to undertake the job in time, ability to communicate well in English with the joint action contacts and the ability to provide the extra services to the Joint Action, e.g. consultancy and help in evaluating the test results and data.

The WP coordinator collected the received quotations in a matrix showing the main contents of the offers received; this tool, together with the detailed analysis of the received answers, was used by the participants for the selection of the sub-contracted laboratory which was selected to be the one proposing the best offer considering the expected quality, the required accreditation level, experience, the reporting requirements and price.

2.2 Selecting Products, Sampling

The **Error! Reference source not found.** shows the lamp types for which the investigations were performed b y the members of WP8 and which were tested

The joint action concentrated on the lamps with the most common lamps caps used in Europe, i.e. E14 (small Edison screw - IEC 60061-1 standard sheet 7004-23), E27 (Edison screw - IEC 60061-1 standard sheet 7004-21) and GU10 (IEC 60061-1 standard sheet 7004-121) caps. Lamps with E14 and E27 caps are commonly used in general lighting applications both indoors and outdoors. Many table, floor and ceiling luminaires (pendant lights and chandeliers) are equipped with E14 or E27 lamp bases. On the other hand, GU10 lamps are commonly used in recessed celling luminaires (downlights). In other words, this joint action focused on the retrofit lamps having E14, E27 and GU10 caps which ordinary users/consumers can use to replace conventional older incandescent and halogen bulbs in their luminaire without any required changes or adaptations. Both directional and non-directional lamp types were included.

Lamp type	Examples
LED-lamp with E14 cap 	
LED-lamp with E27 cap 	

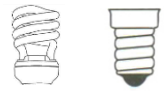
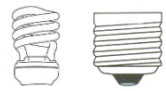
LED-lamp with GU10 cap  	
CFL with E14 cap  	
CFL with E27 cap  	

Table 1 - Types of lamps covered by the Activity on LED lamps and CFLs

The percentage of CFLs was 20% of all lamps investigated in the joint action. That was decided to reflect the trend on the European lamp market in which the market share of CFLs is rapidly decreasing and the market share of LED lamps is increasing, respectively. The aforementioned distribution of lamp technologies to be investigated has also been discussed with the representative of European lighting industry (LightingEurope).

Nearly 30% of the lamps verified in the frame of this activity were selected and/or purchased from the web shops (online shopping).

3 Testing

3.1 The Test Program

The test plan for LED lamps and CFLs was be based on the newest versions of applicable harmonized product safety standards for LED lamps (EN 62560)[3] and CFLs (EN 60968)[4]. One additional test from another product standard was included in the plan in order to determine if there are possible shortcomings in the standards, namely the test for the fixing of conductors on the PCB of the lamp (according to EN 62368-1[5]). Table 1 lists the applicable EN product safety standards (versions and amendments) for CFLs and LED lamps.

CFLs: Self-ballasted lamps for general lighting services — Safety requirements

EN standard	*Reference document (IEC standard)*	*doc date*
EN 60968:1990	IEC 60968:1988 (modified)	
EN 60968:1990/A1:1993	IEC 60968:1988/A1:1991	(1.12.1993)
EN 60968:1990/A2:1999	IEC 60968:1988/A2:1999	(1.10.2002)
EN 60968:2013	IEC 60968:2012	31.10.2015
EN 60968:2013/A11:2014		9.12.2016
EN 60968:2015	IEC 60968:2015/IEC 60968:2015/COR:2015 (modified)	30.3.2018

LED lamps: Self-ballasted LED lamps for general lighting services by voltage > 50 V — Safety specifications

EN standard	*Reference document (IEC standard)*	*doc date*
EN 62560:2012	IEC 62560:2011 (modified)	
EN 62560:2012/A1:2015	IEC 62560:2011/A1:2015 (modified)	4.5.2018

Table 2 - Standards applicable for the tests of LED lamps and CFLs

Note. Generally, the date of cessation of presumption of conformity ("doc") will be the date of withdrawal ("dow"), set by the European standardization organization, but attention of users of these standards is drawn to the fact that in certain exceptional cases this can be otherwise.

For CFLs the manufacturers could use EN 60968:2013 until 31.10.2015 for the presumption of conformity. ("doc" of EN 60698:2013/A11:2014 was 9.12.2016 and "doc" of EN 60968:2015 is 30.3.2018)

For LED lamps the manufacturers can use EN 62560:2012 until 4.5.2018 for the presumption of conformity. ("doc" of EN 62560:2012/A1:2015 is 4.5.2018).

The number of tests to be performed was limited to those which are the most safety relevant and the result of which could be easily be collected and compared. In addition, by limiting the number of tests to those considered most significant, more lamps could be tested.

The detailed instructions for the tests to be performed and the model reporting lists that were developed by WP8 were based, partly, on the similar documents prepared within the project by LVD ADCO in 2013, were delivered to the test laboratory along with the samples.

The tests that were performed are listed in the following Table 3.

CFLs	
EN 60968:2015/C1:2015	
Clause	Test
4.3	General requirements
6.1	Interchangeability
7	Protection against electric shock
8.2	Insulation resistance
8.3	Electric strength
12	Resistance to flame and ignition
14	Creepage distances and clearances
EN 62368-1:2014	
4.6.1 and 4.6.2	Fixing of conductors
	Preparing and filling-in the Test Report
LED lamps	
EN 62560:2012/C1:2012+A1:2015/C1:2015	
Clause	Test
4.2	General requirements
6.1	Interchangeability
7	Protection against accidental contact with live parts
8.2	Insulation resistance
8.3	Electric strength
12	Resistance to flame and ignition
14	Creepage distances and clearances
4.6.1 and 4.6.2	Fixing of conductors
	Preparing and filling-in the Test Report

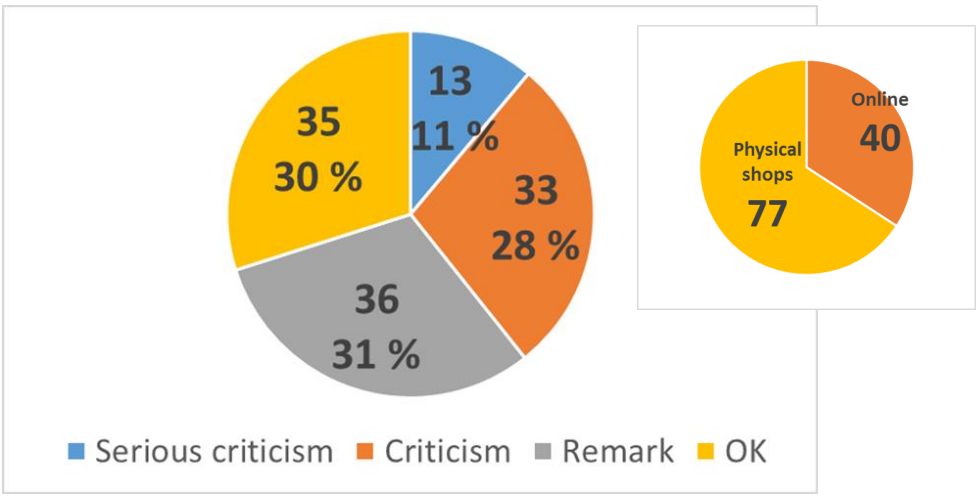
Table 3 - Tests carried out

To ensure a high quality of the campaign's results and to facilitate subsequent analysis it was of outmost importance that the selected tests were carried out as consistent as possible for all the lamps to be tested. The testing finished by the end of July 2016.

In August 2016, the members of WP8 had their third project meeting at the premises of the selected laboratory. This allowed them to discuss in deep with the lab experts about all the test results, to contribute to the determination of the relevant FCL code(s) to each defect found on the lamps tested, to visit the laboratory and the test set-up used for the tests required.

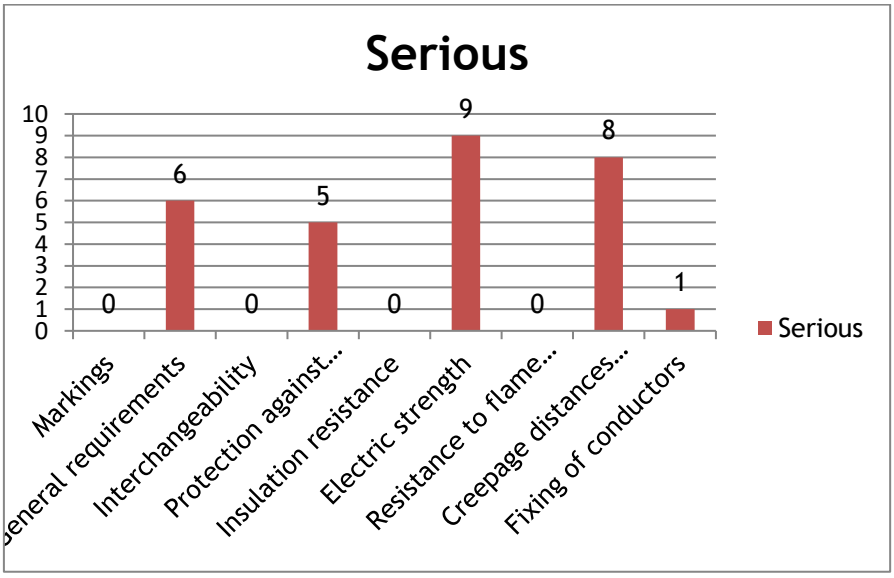
3.2 Results

Error! Reference source not found. gives an "overall non-compliance level" for the 117 models tested as classified according to the Failure Code List (Annex 1).

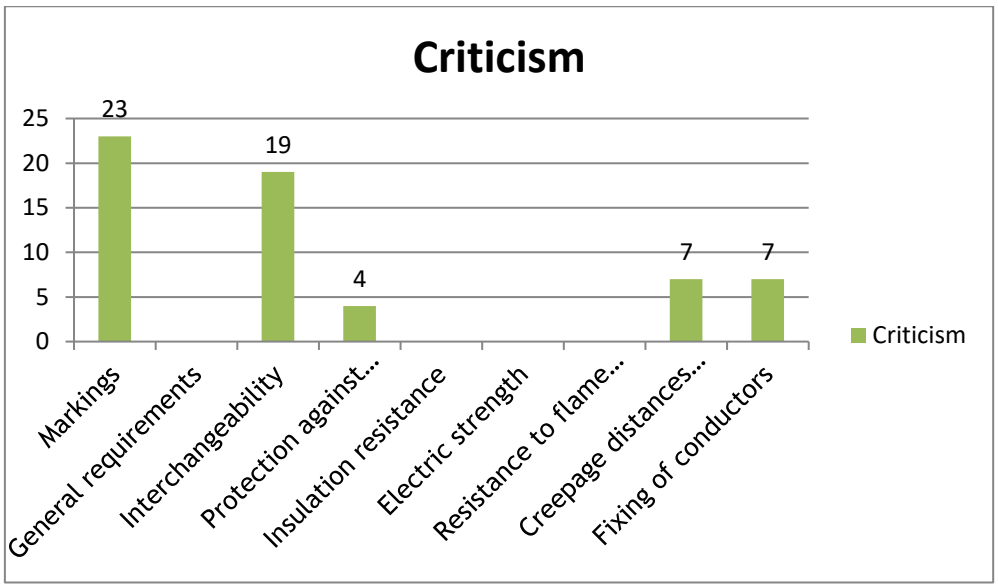


Graph 2 - "Overall" results of the tests

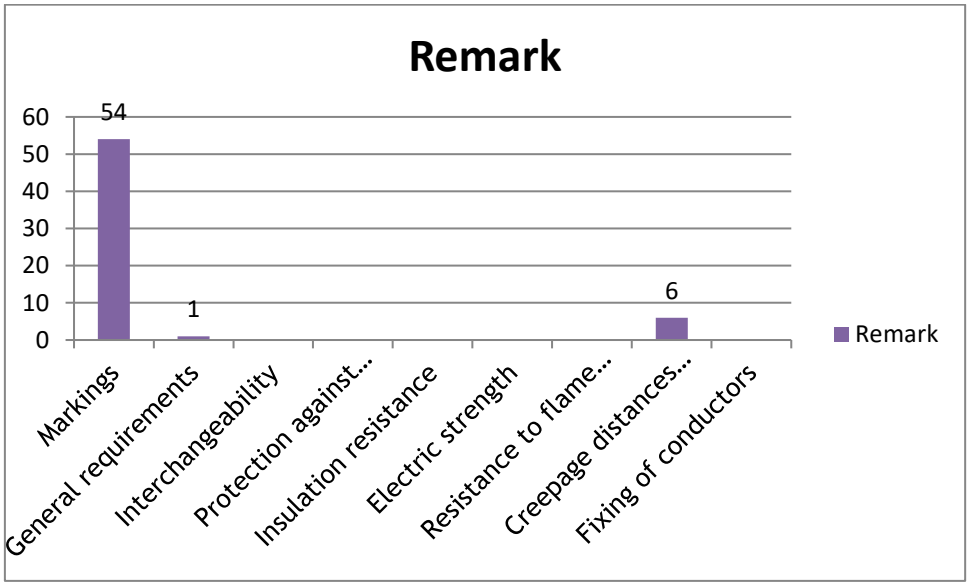
The tests showed that the most common serious non-compliances were related to the general requirements, in which 6 samples tested failed, protection against electric shock failed by 5 samples, the electric strength test failed by 9 samples and the creepage distances and clearances failed by 8 samples.



Graph 3 - Serious criticisms (FCL code 3)

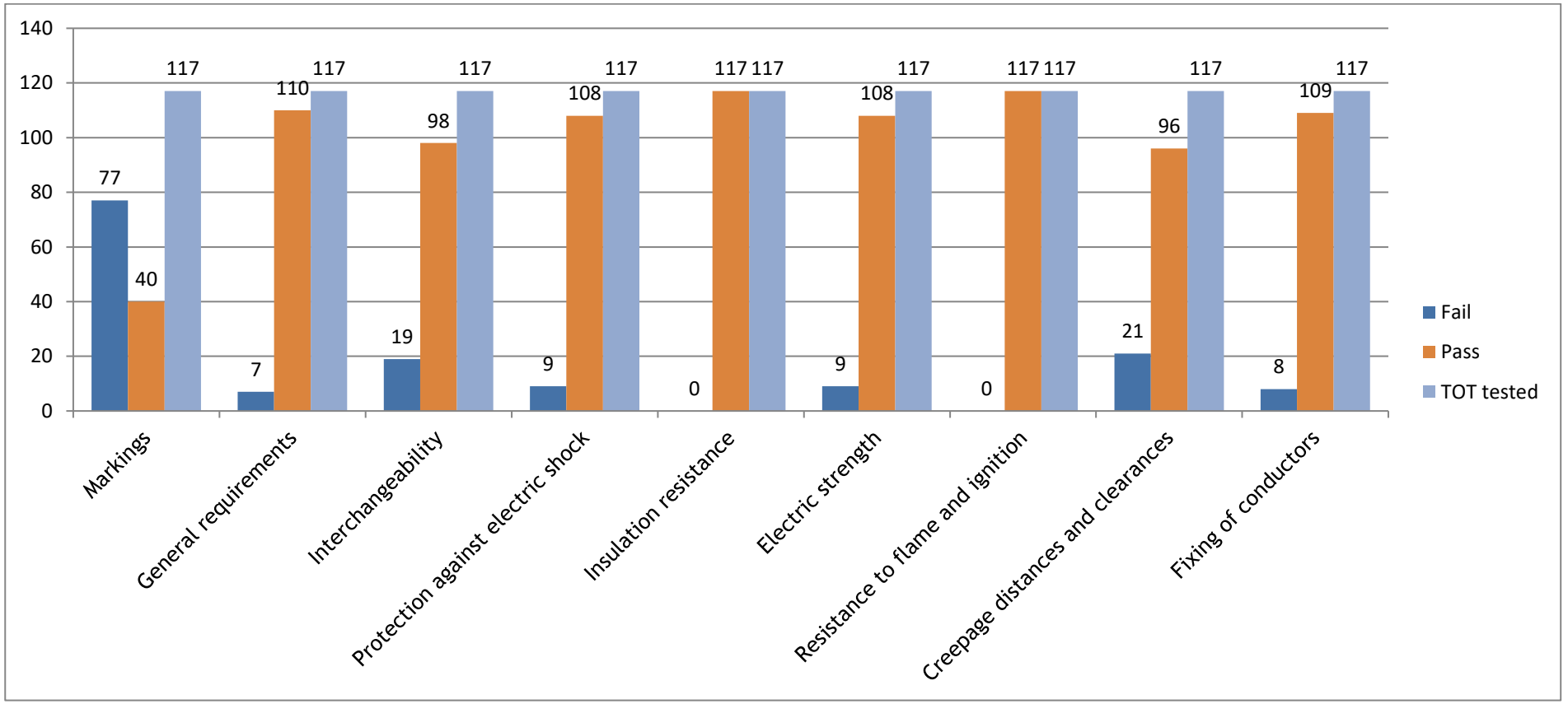


Graph 4 - Criticisms (FCL code 2)



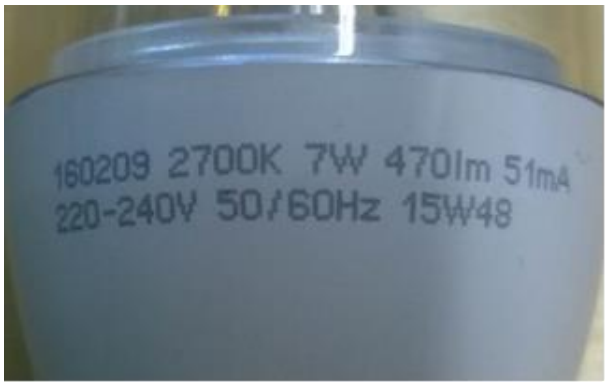
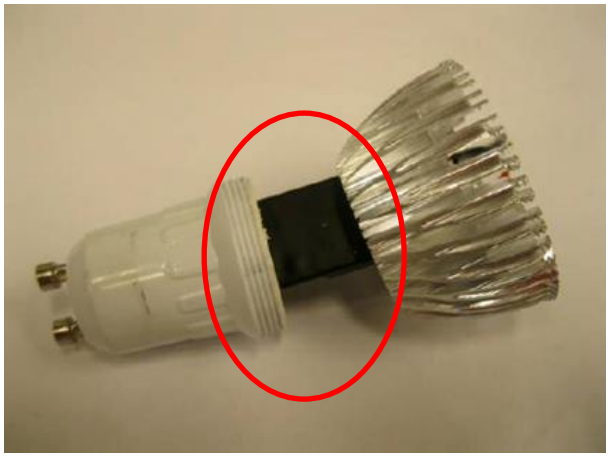
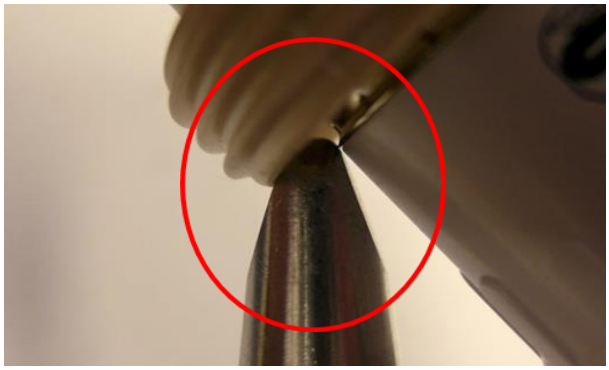
Graph 5 - Remarks (FCL code 1)

The Graph 6 in the next page shows an overview of the results of the tests subdivided per the different types of tests. It has to be noted that some of the models tested showed more than one non-compliance, in some cases even three cumulated serious criticisms.



Graph 6 – Overall results

The Figure 3 shows examples of the main defects that were detected in the tests.

MARKINGS verification of mandatory markings	
GENERAL REQUIREMENTS non-repairable unit which cannot be dismantled without being permanently damaged	
INTERCHANGEABILITY cap interchangeability and cap dimensions (with gauges)	
PROTECTION AGAINST ACCIDENTAL CONTACT WITH LIVE PARTS >internal, basic insulated or live metal parts are not accessible	

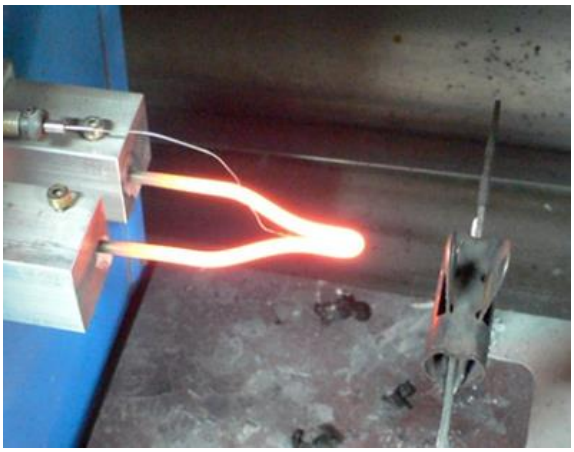
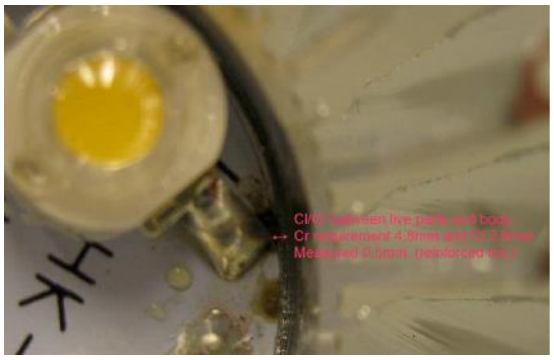
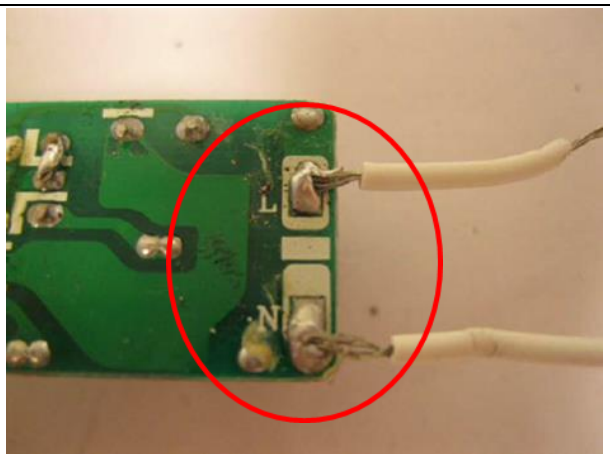
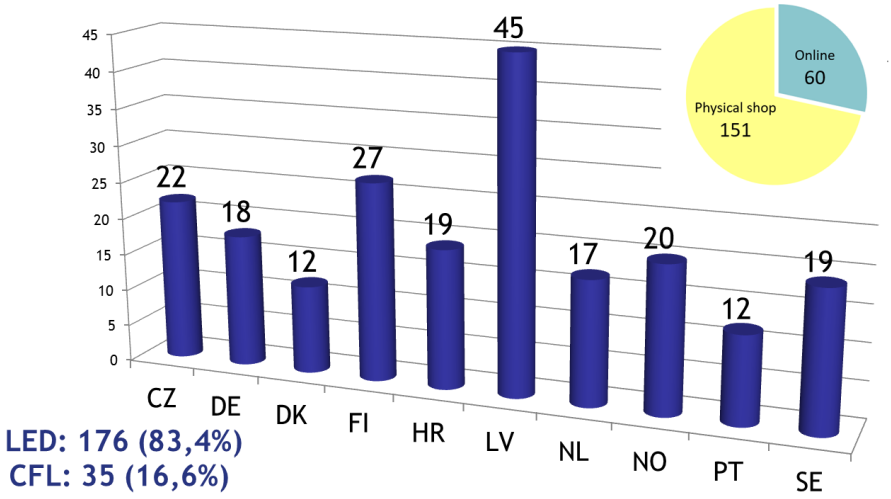
INSULATION RESISTANCE AND ELECTRIC STRENGTH tests between live part and accessible parts	
RESISTANCE TO FLAME AND IGNITION parts of insulating material subjected to the glow-wire test of 650 ºC	
CREEPAGE DISTANCES AND CLEARANCES insulation dimensions (short circuit test)	
FIXING OF CONDUCTORS checking the fixing of the conductors on the PCB of LED lamp control gear	

Figure 3 – Main defects found during tests

3.3 Additional Actions

In total 211 models of LED lamps and CFLs were inspected by the members of WP8 and encoded in the ICSMS system, with the distribution per LED lamp or CFL as shown in the following Graph 7:

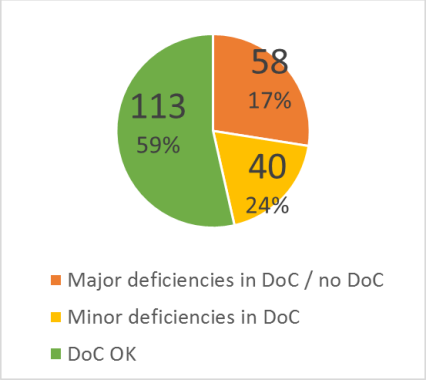


Graph 7 - samples inspected in the frame of the Activity of WP8

In addition to the tests described in this section, the WP8 members carried out inspections of the CE Marking and presence and coherence of the Declaration of Conformity. The results of the verification of CE marking are shown in the following Graph 8.

Graph 8 - verification of presence of CE marking

The results of the verification of the Declaration of Conformity are shown in the following Graph 9



Graph 9 - verification of DoCs

3.4 Conclusions

The lamps have been subjected to the most safety relevant tests. The results show that 39% of the tested lamps had defects that will or may endanger the safety of the users, as classified according to FCL (FCL levels 2 and 3) by the test laboratory and agreed by the members of WP8.

Several lamps had many critical defects: 7 lamps had 3 critical defects and 4 had 2 critical defects, that demonstrates bad or careless approach to the design and construction of the lamp and to selection of components.

The problems related to the lack of the marking of the water contact prevention symbol on CFLs (missing in 18 models) even if from a safety point of view should be considered FCL level 2, were considered as FCL level1. This is because the standard 60968:2015 that requires the symbol was published shortly before the selection of samples for the JA, and its overlapping period with the previous edition, which did not require this marking, ends on 30.03.2018. It may be possible that lamps were produced using the previous edition of the standard.

It should also be noted that 65% of the lamps had shortcomings concerning the mandatory markings.

4 Risk Assessment & Action Taken

4.1 The Risk Assessment Method

The common principles for risk assessment were agreed among the participating authorities. Risk assessments for the tested lamps that showed defects that may endanger or endanger the safety were carried out by the participating authorities.

Risk assessment is the process that a market surveillance authority would apply to assess the risk with a non-compliant product.

The risk is assessed by analysing the (hypothetical) situation where a non-compliant product is placed in the hands of the consumer so the accident happens. In practice, the analysis is done by establishing injury scenarios that describe how the non-compliant product may injure the consumer. Such a scenario consists of a number of steps, and the risk assessor has to estimate the probabilities for each step. The risk assessor also has to identify the severity of the injury. The combination of the overall probability and the severity gives the risk level.

This process contains some inherent uncertainties: two risk assessors can disagree on the injury scenarios, on the steps in the scenarios, on the probabilities of the steps and on the severity of the injury.

Therefore, PROSAFE has introduced risk assessment templates as a tool to facilitate the risk assessment process and increase the homogeneity of the results. A risk assessment template is a compilation of injury scenarios, one for each potential (major) non-conformity in the product that describes how each of the non-conformities may injure a consumer. The template may include guidance on the estimates of the probability factors but will not fix the probabilities.

A risk assessor applies a risk assessment template by deleting the irrelevant scenarios (that relate to non-compliances not present in the particular product), reviewing the remaining scenarios to ascertain that they give an adequate representation of the particular product that is being assessed, and finally estimating the probabilities in the steps in the scenario.

The risk assessment template was developed using the "Risk Assessment Guidelines Application" that has been established to support the use of the RAPEX risk assessment guidelines when assessing the risks of non-food consumer products (under the General Product Safety Directive).

Guiding documents to be used in the assessments were:

- Book on Best practice techniques in market surveillance (PROSAFE)
- EU general risk assessment methodology
- ISO/IEC Guide 51 Safety aspects - Guidelines for their inclusion in standards
- IEC 31010 Risk management — Risk assessment techniques
- CENELEC Guide 32 - Guidelines for Safety Related Risk Assessment and Risk Reduction for Low Voltage Equipment

As consequence of this analysis a RAG template was developed for LED lamps (CFLs) with 4 different scenarios:

- Insulation
- Mechanical strength
- Resistance to flame and ignition
- High position of user when accessing the lamp with possible defect on the insulation due to bad construction and consequent access of the user to live parts.

The template was also uploaded as reference document within the RAPEX Working Group under PROSAFE for the future usage when dealing with the LED lamps and/or CFLs.The developed RAG template is shown in Annex B.

4.2 The Risk Assessment Results

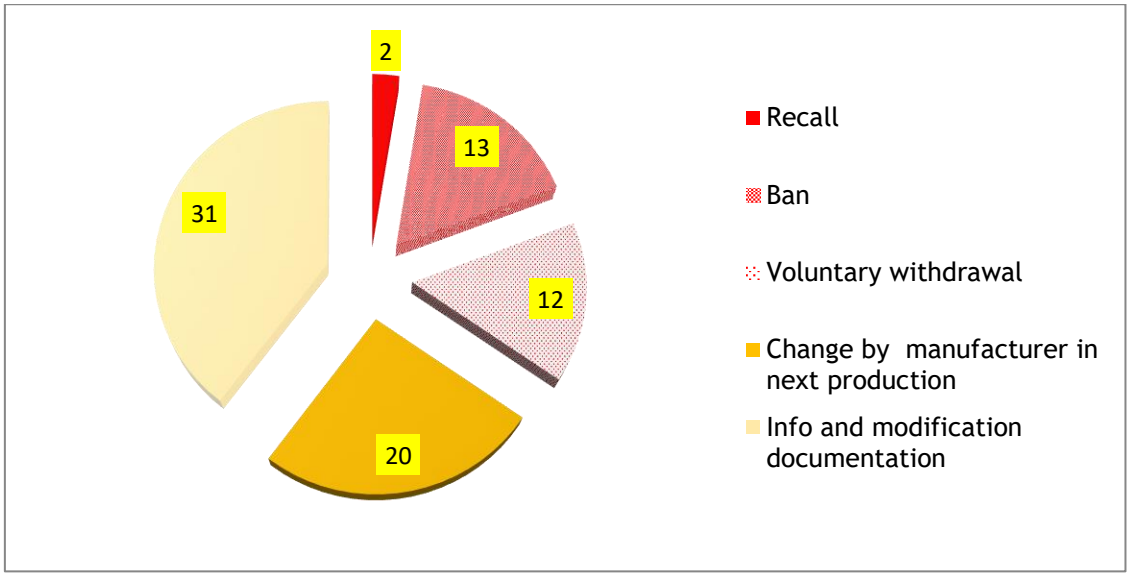
The participating market surveillance authorities assessed the risks presented by the identified non-compliances using the methodology from the RAPEX Guidelines [2]. The conclusion was that the majority of the products carried a low or medium risk. The result can be seen in Table 4.

Risk level	Number of non-compliant samples	Percentage (%)
No risk	35	30%
Low Risk	36	31%
Medium Risk	33	28%
High or Serious Risk	13	11%
	117	100%

Table 4 - Type of risks from products tested

4.3 Action & Measures taken

The following Graph 10 shows the measures taken by the participating Authorities for lamps for which significant problems were detected during the inspection and the testing activities:



Graph 10 - Overview of measures taken against the non-compliant LED Lamps and CFLs

The actions mentioned in the graph have the following meanings:

- Minor measures. The economic operator takes measures against (future deliveries of) the product in line with directions from the market surveillance authority. As indicated in the Graph 8 such measures were minor design changes, minor changes in production or quality control, minor update of marking or in the documentation, etc.
- Sales ban. The product is prohibited from sale permanently or until certain conditions are met.
- Withdrawal. This measure is defined in the GPSD (Directive 2001/95/EC). The distribution, display and the offer of a product which is dangerous to consumers are stopped.

- Recall. This measure is defined in the GPSD (Directive 2001/95/EC). Any means aimed at achieving a return of a product that has already been supplied or made available to consumers.

4.4 RAPEX

The following Table 5 shows the number of RAPEX notifications that were considered as result of the tests:

Country	Number of notifications
CZ	4
FI	2
HR	2
NL	1
LV	3
PT	5
SE	1
TOTAL	18
Published on RAPEX	12
Still to be published	6

Table 5 – Rapex Notifications

At the moment of writing this report 7 RAPEX notifications have not yet been issued.

RAPEX notifications were mainly made under Art. 12 of GPSD/Art. 22 of Reg. 765/2008 for lamps posing serious risks, some were or will be made under Art. 11 of GPSD/Art. 23 of Reg. 765/2008 for lamps posing non-serious risks. For such lamps, notifications should be made, in particular in case a sales ban or a withdrawal from the market have taken place, even if this was done voluntarily by the Economic Operator.

4.5 Impact of the activity

The following can be mentioned as significant points showing the impact that the Activity had for the Market and for the Participant Member States:

- Some dangerous and non-compliant lamps were removed from the market;
- Knowledge of markets of LED lamps and CFLs;
- Increased knowledge of testing of LED lamps and CFLs among MSAs:
  - Test procedures available
  - More uniform approach to evaluate test results
  - Promotion of usage of FCL in classification of defects
- Harmonization of measures/actions
- Risk assessment template available (RAG)
- A way to harmonize risk assessments for lamps (future work: harmonization of probability factors)
- Discussions of problems in lamp safety standards with CENELEC experts
  - EN62560 to be amended regarding the fixing of conductors
  - Issues regarding the usage of fuse resistors in lamps still under discussion
- Promotion of usage of ICSMS among the MSAs: a good tool for joint actions to share information, it should be used more actively.

4.6 Conclusion

The inspection activity went smoothly based on the fact that some members had already experience with verification of LED lamps and CFLs and good knowledge of the relevant technical requirements.

It can be noted that the result of the activity shows a slightly better state than that of previous LVD ADCO joint MS activity on LED lamps carried out in 2013, in which 57 % of the 123 tested lamps were non-compliant with the technical requirements and 73% of the tested lamps did not fulfil the administrative requirements. The possible reasons for this improved result are:

- Big investments on the product development
- LED lamps are designed with an (inherently) increased safety (see the figure below)

Figure 4 - LED lamps are designed with an (inherently) increased safety

- Development of new safety standards for LED lamps
- Active market surveillance of LED lamps carried out by many Member States in the last years
- Active dissemination of information to Economic Operators
- Increased knowledge and demand from consumers that require “better lamps” or lamps having a better ration between cost and efficiency/duration
- “Knowledge of current JA” among Economic Operators

5 Liaisons

5.1 Involvement of Customs

The liaison between Customs and the Activity was limited to sharing of checklists that were developed in the frame of the Activity. The Activity group agreed at an early stage that the sampling of products would take place at the border than rather on the national markets.

The group developed two checklists, one for LED Lamps and one for CFLs. They were made specifically with the intention that they should be very easy to understand and fill in. This was based on the experiences of the group that checklists should be easy to understand and simple to use to avoid misunderstandings and to rule out the possibility for interpretation to the extent possible.

Such checklists should be based on clear and simple rules and indicators that would show when to "raise a flag" and inform the market surveillance authorities that further investigations are required on the product rather than making the customs officers experts on the products.

5.2 Involvement with standardisation Organisations

The following points that were relevant to contents of standards applicable to the tests of the products covered by the activity were discussed together with representatives of the Standardisation Committees involved:

- *The reliability of fixing of the conductors (supply wires) on the lamp control gear (PCBs).*

  The new proposal for the modification of EN 62560, document TC34A_SEC0172_CD (62560 wires new project) was commented by the participants. It was considered that, even if it is a step forward, it should be improved in line with the contents of the similar requirement in 4.6.1 of EN 62368-1.

- *Usage of fusible resistors in lamps*

  The Netherlands held meetings amongst the representatives of the Dutch Authority and representatives of NL/TC 34, NL/TC 108 and a test institute. They agreed that if it is guaranteed that a fusible resistor during normal and abnormal use will only function within the normal specification limits of the fusible resistor, the use of fusible resistors can be considered acceptable until standards cover the issue. Condition is that this should be verifiable in the technical documentation of the lamp. A suitable way forward is that the Technical Documentation contains information of the working conditions under which the fusing resistor will be allowed to operate when mounted in the LED together with a declaration of the manufacturer that he has investigated and assures that the fuse resistors under foreseeable conditions will only operate within the normal specification limits. In addition, there is a draft for fuse resistors IEC PAS 60127-8[6], whose introduction describes limitations and does not foresee the use of fusing resistors for applications as those seen in designs for LED lamps now.

5.3 Involvement of Manufacturers Organisations and Consumers Organisations

The close cooperation with the relevant stakeholders was maintained throughout duration of the joint action and they were invited to the open sessions of project meetings. The stakeholders were:

- LightingEurope (the industry association representing leading European lighting manufacturers, national lighting associations, and companies producing materials
- ANEC (the European consumer voice in standardization, defends consumer interests in the process of standardization and certification)
- CENELEC (the European Committee for Electrotechnical Standardization)

5.4 Involvement of LVD ADCO

The involvement of LVD ADCO was ensured by the fact that many members of the Activity were also members of LVD ADCO and the transfer of information to this group was continuous and efficient.

6 Evaluation, Lessons Learned

The Activity group experienced that checklists were useful in assisting inspectors to identify samples that should be sampled for testing purposes. Checklists will ensure that the inspectors are able to perform adequate investigations before the product is sampled.

The tendering process was found to be very beneficial. Pooling all the testing gave an economy of scale that lead to very competitive quotes from the laboratories. This in turn meant that the laboratory could perform additional tests for the same budget. What also helped decrease the costs were the establishing of efficient communication with the laboratory and a firm test plan with a suitable timeframe.

The European consumer organisation, ANEC and manufacturers organisation LightingEurope were involved in the Activity from the start bringing in their knowledge and offering their perspective to the discussions. This was seen to be extremely useful. The Activity group therefore recommends that market surveillance authorities also cooperate with consumer and manufacturers organisations at a national level to ensure that any relevant knowledge is well conveyed on both directions from stakeholders to Authorities and vice versa.

Economic operators must always cooperate with the market surveillance authorities in order to reduce any risks present in the market. The Activity group therefore recommends that European organisations representing businesses, manufacturers, importers and traders are encouraged to participate in Joint Actions. The group finds it important to maintain a healthy dialogue between all stakeholders to help to identify and prevent possible future safety issues and identify practical solutions.

ICSMS (Information and Communication System for Market Surveillance) has proven to be a good tool for joint actions to share information amongst Member States, it should be used more actively.

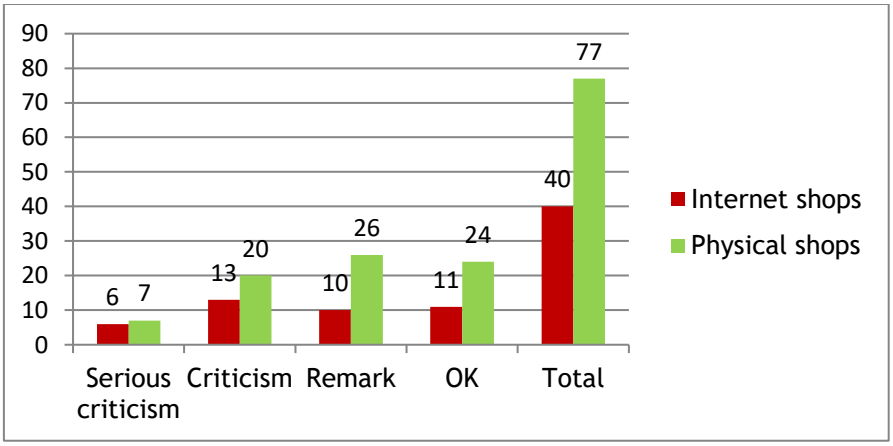
The verification of the documentation and marking can be considered a good tool to get preliminary knowledge of the potential non-compliance to the tests, in fact:

- 7 out of 13 lamps for which the tests revealed defects with serious criticisms (FCL 3) had no EU declaration of conformity available or they had not been drawn up correctly
- 10 out of 33 lamps for which the tests revealed defects with criticisms (FCL 2)) had no EU declaration of conformity available or they had not been drawn up correctly

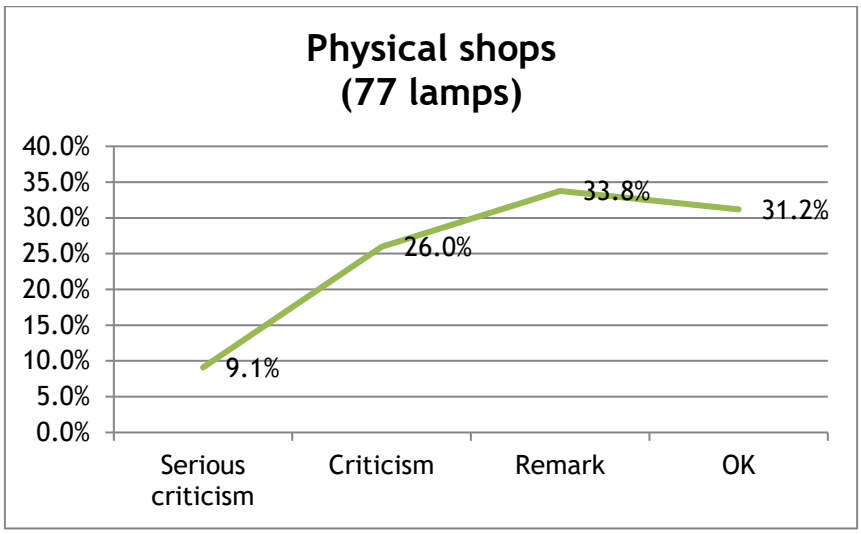
However, it can be concluded that there was no clear correlation between the obtained test results (defects found) and the correctness (or availability) of EU declaration of conformity.

The DoCs were analysed by the participants and the results were encoded into the numerical values (0-2) depending on the “severity” of deficiencies/errors in the content of DoC.

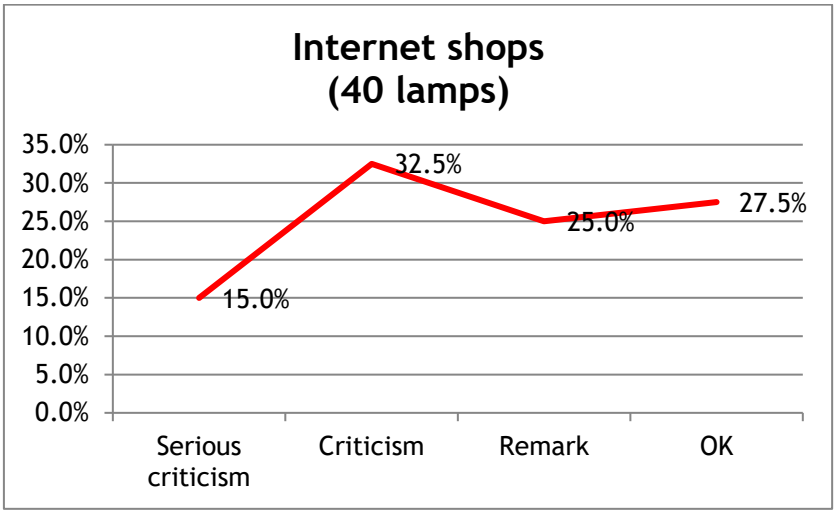
It can be noted that slightly higher percentage value of lamps acquired form internet shops have defects with FCL classes 2 and 3 (see Graphs 11, 12 and 13).



Graph 11 - Classification (FCL coding) of tested lamps acquired either from internet or physical shops



Graph 12- Percentage values of tested lamps acquired from physical with different FCL classes



Graph 13 - Percentage values of tested lamps acquired from physical with different FCL classes

Considering the good results of this Activity and the increasing diffusion of LED lamps on the market, it is considered essential to plan future market surveillance actions on LED lighting, in particular concerning:

- LED luminaires
- Retrofit LED lamps for street (outdoor) lighting (replacements for Metal Halide, High Pressure Sodium and Mercury Vapour lamps)

7 Bibliography

All quotes and references in the text are stated with a number in brackets, e.g. [1]. The full list of references is given below.

1. “Grant Agreement for an Action – Multiple Beneficiaries, Agreement Number 2011 82 01”. Grant Agreement 2011 82 01 – GPSD JA.
2. “Commission Decision 2010/15/EU of 16 December 2009 laying down guidelines for the management of the Community Rapid Information System ‘RAPEX’ established under Article 12 and of the notification procedure established under Article 11 of Directive 2001/95/EC (the General Product Safety Directive)”. Published in the Official Journal of the European Union L22/1.
3. EN 62560:2012/C1:2012+A1:2015/C1:2015 " Self-ballasted LED lamps for general lighting services by voltage > 50 V - Safety specifications"
4. EN 60968:2015/C1:2015 " Self-ballasted fluorescent lamps for general lighting services – Safety requirements"
5. EN 62368-1:2014 "Audio/video, information and communication technology equipment – Part 1: Safety Requirements
6. IEC PAS 60127-8 " Miniature fuses - Part 8: Fuse resistors with particular overcurrent protection"

All standards can be obtained from the national standardisation bodies if nothing else is stated. An overview of these bodies can be found on the website of the European Committee for Standardisation, CEN at www.cen.eu.

Annex 1: The (Nordic) Failure Code List

The (Nordic) Failure Code List was developed by the Market Surveillance Authorities of the Nordic Countries. It is a system for the classification of shortcomings against standards and gravity of offence

	Remark 1	Criticism 2	Serious criticism 3
Technical faults			
Accessible live part in normal use			3
Accessible basic insulated parts on class II products		2	
Luminaries and domestic equipment of class 0	1		
The creepage and clearance distance is less than 10% of the requirement in relevant standard			3
The creepage and clearance distance is more than 10% and less than 50% of the requirement in relevant standard		2	
The creepage and clearance distance is more than 50% of the requirement in relevant standard	1		
Cord extension set with class 0 plug and class 1 outlet	1		
Cord extension set with class 1 plug and class 0 outlet			3
Cord extension set with class 2 plug and class 0 or 1 outlet			3
Class 1 plug mounted on a supply cord without protective earth conductor, changing a class 1 appliance into a class 0 device			3
Phase and earth exchanged by mistake in earthed coupling			3
The equipment lacks thermal cut-outs and/or current cut-outs		2	(3)
The rated current in the equipment is one step too high	1		
The rated current in the equipment is more than one step too high		2	
The rated current in the equipment is so high that it is a fire hazard			3
Marking is incomplete or missing		2	(3)
CE-mark is missing	1	(2)	
Incomplete and wrongful instructions for use and/or mounting which can cause danger		(2)	3
National language operation instructions with necessary safety information are missing		2	
The design diverges from standard or technical documentation		2	(3)
Conductors not adequately attached		2	(3)
Risk of mechanical damage to conductor		2	(3)
Equipment with inadequate conductor (cross-section, insulation)		2	(3)
Cord anchorage is missing		2	(3)
Ip classification does not comply with the requirements		2	(3)
The design diverges from standard or technical documentation (great risk for electrical shock/fire)		2	(3)
Administrative procedures			
Declaration of conformity is missing		2	
Errors in declaration of conformity	1		
Technical documentation is missing		2	
Errors in technical documentation	1	(2)	
Modified product sold with the same type no. etc. as product where sales ban is issued	1		

(a parenthesis indicates that the code could be used in some cases)

Annex 2 - The Risk Assessment Template for LED lamps and CFLs

General Information

Product

Product name:	LED-lamp
Product category:	Lighting equipment
Description:	This is a PROSAFE risk assessment template for LED-lamps. It describes likely accident scenarios linked, partly, to non-conformities with the requirements set in the European harmonized standard EN 62560. Applicable clauses: §7 Protection against accidental contact with live parts §8 Insulation resistance and electric strength after humidity treatment §9 Mechanical strength §11 Resistance to heat §12 Resistance to flame and ignition of the plastic parts of the lamp §13 Fault conditions §14 Creepage distances and clearances between parts of different polarity. How to use: Users should select the scenario(s) that correspond to the non-compliances identified for the product under assessment. All other scenarios can then be deleted. Users should ensure that the steps are correct and that the injury level is appropriate. The probability assigned to each step should be determined according to the exact nature of the non-conformity concerned, as recorded in the test report. Disclaimer: The template has been developed by PROSAFE to help market surveillance officials to assess the risk(s) associated with the non-conformities of a particular product that has been checked and tested during a joint market surveillance action. The template is not authorized or endorsed in any way and is not binding on national market surveillance authorities. The content of the original template is subject to change without notice.

Risk assessor

First name:	PROSAFE Risk Assessment Template
Last name:	
Organisation:	PROSAFE

Address:	Avenue des Arts 41, 2nd floor B-1040 Brussels, Belgium tel: +32 2 8080 996/997 e-mail: info@prosafe.org

Product risks - Overview

Scenario 1 :	**Risk to be determined** - The lamp breaks during operation in a way that energizes the accessible metal part(s) of the lamp (due to insufficient isolation between accessible parts and high voltage (230V) components). The user touches the lamp, gets an electric shock and is electrocuted.
Scenario 2 :	**Risk to be determined** - The user wants to replace the LED lamp. While unscrewing the lamp, the housing of the LED breaks and internal live parts become accessible. The user accidentally gets in touch with live parts and is electrocuted.
Scenario 3 :	**Risk to be determined** - The LED lamp overheats due to a failure in the electronics of the lamp. The plastic housing begins to melt and very hot material drips on some flammable material in the vincinity. The flamable material catches fire that causes lethal burns to the user.
Scenario 4 :	**Risk to be determined** - The user tries to replace a non-functioning LED lamp that installed in a high place. The LED lamp has broken in a way that exposes live parts. The user climbs up a stepladder to reach the luminaire. The used touches the LED lamp, gets an electric shock and is schocked. The user loses his balance and falls down. The user get fractures when hitting the floor.

Overall risk : **Risk to be determined**

Scenario 1 : Other consumers - High/low voltage

Product hazard

Hazard Group: Electrical energy
Hazard Type: High/low voltage

Consumer

Consumer Type: Other consumers - Consumers other than vulnerable or very vulnerable consumers

How the hazard causes an injury to the consumer

Injury scenario: The lamp breaks during operation in a way that energizes the accessible metal part(s) of the lamp (due to insufficient isolation between accessible parts and high voltage (230V) components). The user touches the lamp, gets an electric shock and is electrocuted.

Severity of Injury

Injury: Electric shock
Level: 4 Electrocution

Probability of the steps to injury

	Step(s) to Injury	Probability
Step 1:	Sometime during the lifetime of the LED lamp, a breakdown occurs between live and accessible metal parts due to too small creepage and clearance distances. (The probability depends upon the measured distance compared to the requirement of the standard.)	
Step 2:	The LED lamp breaks down in a way that energises the accessible metal parts permanently.	
Step 3:	The user notices that the lamp doesn't light and will replace it.	
Step 4:	The user doesn't switch off the luminaire before replacing the LED lamp.	
Step 5:	The user touches the accessible metal parts of the lamp with his hands when trying to unscrew the lamp from the luminaire.	
Step 6:	The yser is not electrically isolated from ground and is electrocuted. (Other outcomes of electric shocks are possible and should be considered.)	

Calculated probability: To be determined

Overall probability: To be determined

Risk of this scenario: Risk to be determined

Scenario 2 : Other consumers - High/low voltage

Product hazard

Hazard Group: Electrical energy
Hazard Type: High/low voltage

Consumer

Consumer Type: Other consumers - Consumers other than vulnerable or very vulnerable consumers

How the hazard causes an injury to the consumer

Injury scenario: The user wants to replace the LED lamp. While unscrewing the lamp, the housing of the LED breaks and internal live parts become accessible. The user accidentally gets in touch with live parts and is electrocuted.

Severity of Injury

Injury: Electric shock
Level: 4 Electrocution

Probability of the steps to injury

	Step(s) to Injury	Probability
Step 1:	The user wants to replace or remove the LED lamp from the luminaire.	
Step 2:	The user doesn't switch off the luminaire before touching the LED lamp.	
Step 3:	The quality of the LED lamp is low, so the housing breaks when user tries to unscrew the lamp from the lamp holder. This exposes live parts (e.g. solder joints, electronic components, internal wires).	
Step 4:	The user accidentally touches some of the accessible live parts.	
Step 5:	The user is not electrically isolated from ground and is electrocuted. (Other outcomes of electric shocks are possible and should be considered.)	

Calculated probability: To be determined

Overall probability: To be determined

Risk of this scenario: Risk to be determined

Scenario 3 : Other consumers - Overheating

Product hazard

Hazard Group:	Fire and explosion
Hazard Type:	Overheating

Consumer

Consumer Type: Other consumers - Consumers other than vulnerable or very vulnerable consumers

How the hazard causes an injury to the consumer

Injury scenario: The LED lamp overheats due to a failure in the electronics of the lamp. The plastic housing begins to melt and very hot material drips on some flammable material in the vincinity. The flamable material catches fire that causes lethal burns to the user.

Severity of Injury

Injury:	Burn/ Scald (by heat, cold, or chemical substance)	
Level:	4	2° or 3°, >35% of body surface Inhalation burn requiring respiratory assistance

Probability of the steps to injury

	Step(s) to Injury	Probability
Step 1:	A malfunction occurs in the electronic control gear of the LED lamp during its lifetime, for instance due to accumulation of dirt inside the lamp.	
Step 2:	The LED lamp overheats.	
Step 3:	The plastic housing begins to melt and very hot material will drip on flammable material beneath the lamp.	
Step 4:	The flammable material catches fire.	
Step 5:	The user (is probably asleep and) doesn't notice the fire immediately, so the fire spreads.	
Step 6:	The user will have serious burns. (Other injury severity levels are possible and should be considered.)	

Calculated probability:	To be determined
Overall probability:	To be determined
Risk of this scenario:	Risk to be determined

Scenario 4 : Other consumers - High/low voltage

Product hazard

Hazard Group:	Electrical energy
Hazard Type:	High/low voltage

Consumer

Consumer Type:	Other consumers - Consumers other than vulnerable or very vulnerable consumers

How the hazard causes an injury to the consumer

Injury scenario:	The user tries to replace a non-functioning LED lamp that installed in a high place. The LED lamp has broken in a way that exposes live parts. The user climbs up a stepladder to reach the luminaire. The used touches the LED lamp, gets an electric shock and is schocked. The user loses his balance and falls down. The user get fractures when hitting the floor.

Severity of Injury

Injury:	Fracture	
Level:	3	Ankle Leg (femur and lower leg) Hip Thigh Skull Spine (minor compression fracture) Jaw (severe) Larynx Multiple rib fractures Blood or air in chest

Probability of the steps to injury

	Step(s) to Injury	Probability
Step 1:	The LED lamp breaks in that way that exposes live metal parts permanently or energises accessible metal parts.	
Step 2:	The user touches the accessible live part of the lamp with bare hands when unscrewing the LED lamp from the luminaire.	
Step 3:	The user gets a small electric shock and is schocked.	
Step 4:	The user loses his balance and falls down from the stepladder.	
Step 5:	The user gets fractures.	

Calculated probability:	To be determined
Overall probability:	To be determined
Risk of this scenario:	Risk to be determined