Summary of Results

LVD-ADCO cross border market surveillance project 2013

LED- and compact fluorescent lamps

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Author: Evert van Wilgenburg (project leader)
Final editors: Hannu Mattila / Mika Toivonen (LVD AdCo)

Table of contents

Summary 3

1 Introduction 4

2 Background 4

3 Scope of the project 4

4 Results 5

5 General remarks 9

6 Conclusions 10

Acknowledgements: 11

Summary

This report summarizes the results obtained in the LVD-ADCO cross border market surveillance project 2013 on the LED- and compact fluorescent lamps. The overall non-compliance of the tested products was very high: 86 % of the tested products were non-compliant if both the technical requirements of the applicable EN standards and the administrative requirements of EU legislation were taken into account. 57 % of the tested lamps were non-compliant with the technical requirements and 73% of the tested lamps did not fulfil the administrative requirements, to be precise.

A total of 123 LED- or compact fluorescent lamps were tested by 10 EU/EEA counties.

Participating EU/EEA countries: NL, NO, SE, DK, FI, LU, BE, GE, ES, CH

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1 Introduction

LVD-AdCo is the Administrative Cooperation group for the Market Surveillance Authorities (MSA) in the field of the Low Voltage Directive. LVD-ADCO agreed to organize a cross-border market surveillance campaign (a joint action, JA) regarding LED and compact fluorescent lamps. This decision was motivated by an increasing consciousness of shortcomings found on LED and compact fluorescent lamps in investigations performed by the Market Surveillance Authorities.

From 2006 till now several JAs have been organized by MSAs and they have resulted in a clearer profile of market surveillance throughout the Community. JA projects can be seen as a useful means to clearly demonstrate the effectiveness of market surveillance in the context of the functioning of the internal market.

The purpose of this JA was to increase the public awareness of shortcomings commonly found in LED-lamps and CFLs found on the EU/EEA market. That is, partly, expected to have an effect in the progress, so that in the future LED and compact fluorescent lamps would comply better with the safety requirements/provisions of EU legislation and the associated EN standards and thus eventually to contribute to the increased safety in the context of the LVD.

2 Background

Several market surveillance authorities have become aware of an increased number of shortcomings in LED Lamps, LED replacement tubes and compact fluorescent lamps. Some shortcomings could be related to the faulty application of standards or where standards were not applied; there has been a lack of demonstration of good engineering practice based on state of the art. In addition, some of the deficiencies could be related to insufficient requirements in the standards. Some issues, on the other hand, could be associated to the use of new techniques which were not fully covered by the latest standards.

The international symposium “Unsafe Light Sources” was organized by LVD AdCo (NL-chair) and held on the 8th of March 2012 in the Netherlands. The symposium offered information to economic operators and stakeholders and made them aware of the situation at that time. The stakeholders were recommended to make changes in the production of LED lamps and CFLs as soon as possible in order to make them comply with the relevant legislation. An important fact was that participants were informed before the meeting and they were not able to invalidate the findings by the member states.

3 Scope of the project

The project focused on LED lamps and compact fluorescent lamps (CFLs). Additionally, some LED tubes i.e. double-capped LED lamps (retrofit type and conversion kits) were also investigated. Main focus was set on shortcomings in relation to the isolation requirements (creepage distances/clearances and high voltage tests), bad connections at the main terminals and the use of fuses and fusible resistors.

The project itself was limited to products likely be used by normal consumers and/or non-professionals. Within the context of this specific project sampling was not completely random. Products that were suspected to show non-compliances were selected from the market by MSA inspectors.

4 Results

A total of 123 tests have been included in the results of this report. The 123 samples are divided as follows: 37 CFLs, 66 LED lamps and 20 LED tubes. For 16 lamps the references for brand and/or type were missing, but in all those cases there was some form of reference e.g. brand and/or type on the packaging. For 4 lamps the CE marking was missing. The majority of lamps were manufactured in China.

Fig. 1 depicts the results for the presence of installation information and instructions for the LED tubes. This important information was missing for 8 samples. For 4 tubes the information was delivered, but evaluated to be not acceptable. For 8 tubes the delivered information was acceptable. The basis for the evaluation of the instructions was the LVD AdCo Recommendation on LED replacement tubes (February 2011- modified April 2012).

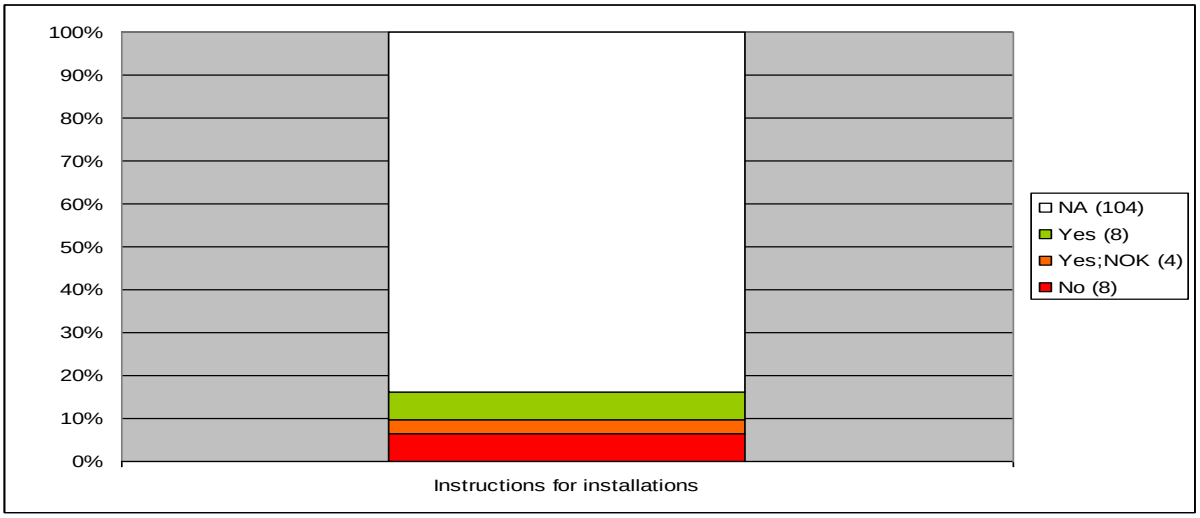

Fig. 1

Fig. 2 shows the results for the presence and evaluation of the Declaration of Conformity (DOC). For 80 samples (65 %) the DOC was missing or it was not acceptable.

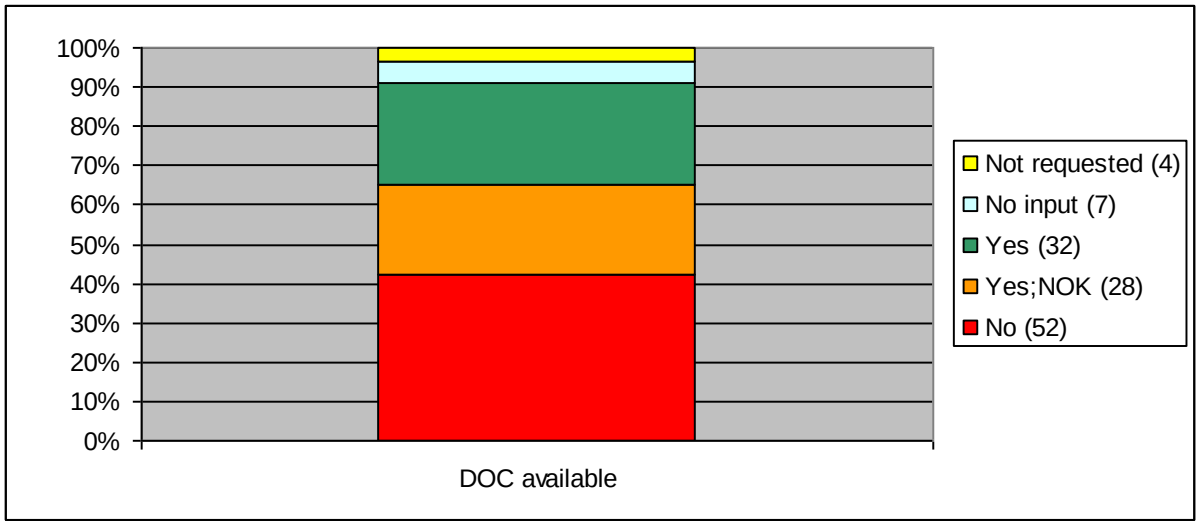

Fig. 2

Fig. 3 shows the results for the presence and evaluation of the technical file (TF). The TF was delivered only for 24 lamps and 11 pcs of those were not acceptable.

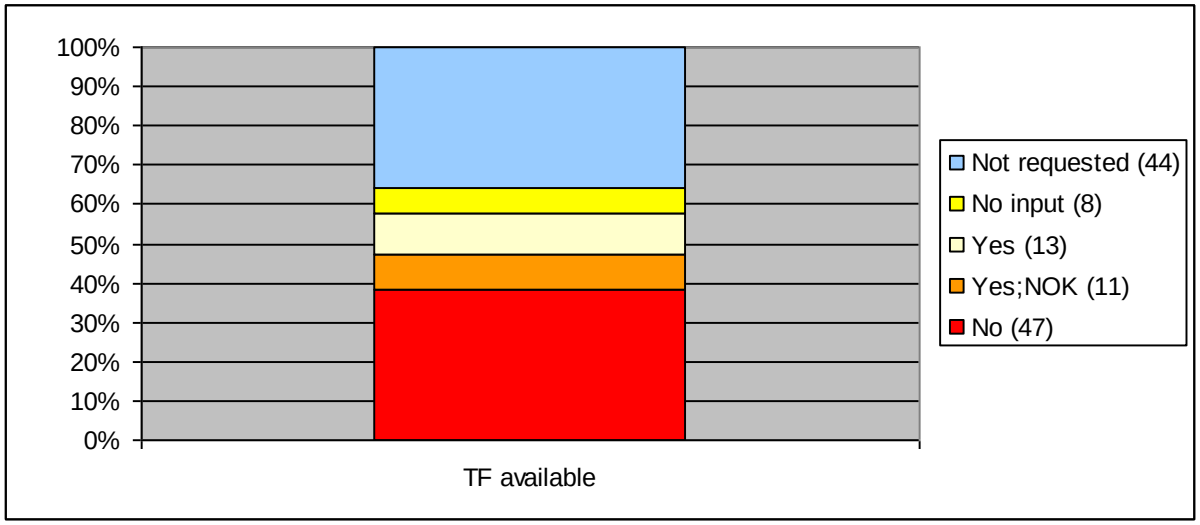

Fig. 3

Fig. 4 represents the results of the technical investigations. The overall results are presented in Fig. 5. After Fig. 4 some comments and remarks of the technical investigations are presented.

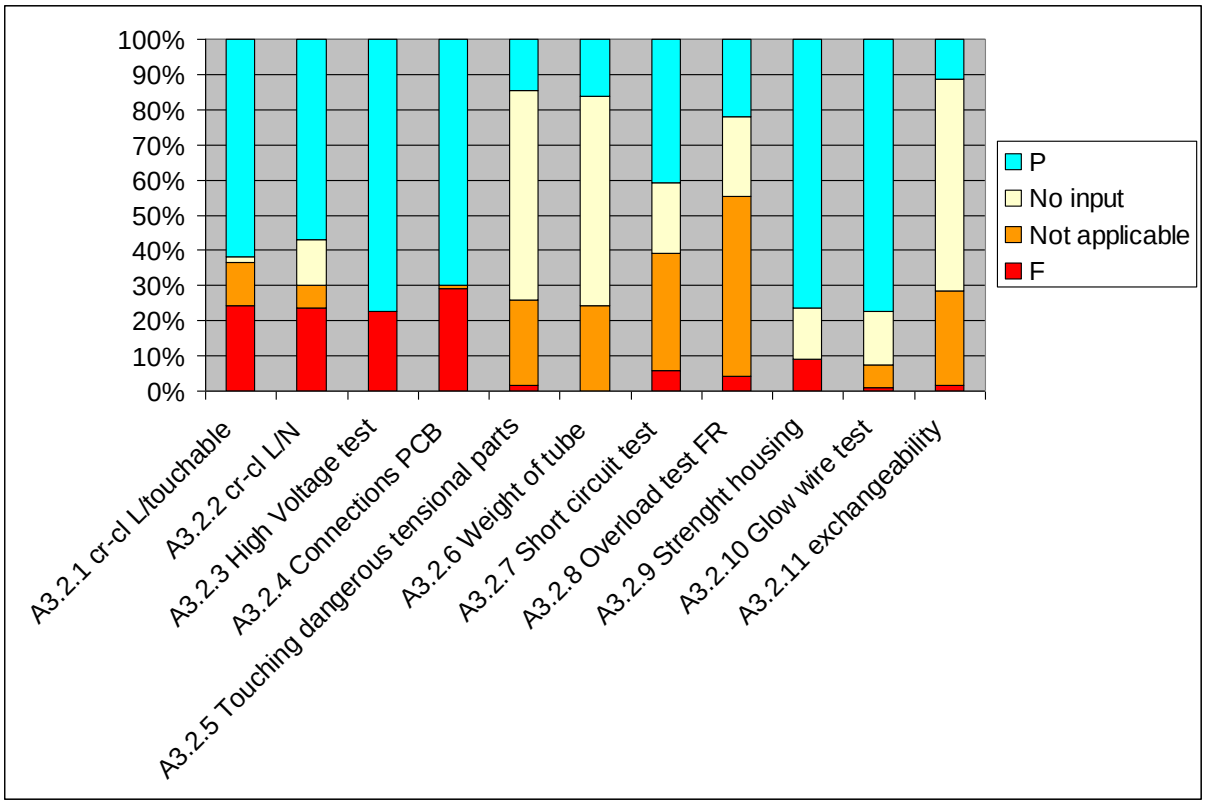

Fig. 4

It should, however, be noted that rather often the participants decided or had to skip parts of the some tests. This could yield, partly, results that are biased and not fully comparable. However, the overall test results could not become better but only worse. So, the outcome does not necessarily present reliable information of the market due to the aforementioned non-coherence in the performed testing. It should also be noted that the sampling was not random but suspicious lamps were selected from the market by the inspectors of MSAs.

A3.2.1 Creepage distance and clearance between live parts and touchable conductive parts

These tests were often not performed for full compliance. For MSAs it was hard to determine this aspect w/o the proper data in the technical file. For practical reasons the high voltage tests were performed, but it should be realized that also the constructional requirements are as important, because they take into account the behaviour of the product throughout its lifetime.

A3.2.2 Creepage distance and clearance between Line and Neutral

It is important that small distances before the fuse or FR (fusible resistor) in the circuit are also taken into account.

A3.2.4 Connections on PCBs

The participants rather often noted that the connection of wires to the PCB is not in compliance with good manufacturer practices. A method that should take care that wires remain in position was often missing. Bad soldering was also found to be another issue. Some of the lamps had been type tested by test houses, which seem to accept non-compliant products based on an interpretation of the standard to be used. This issue is in the meantime brought to the knowledge of CENELEC and OSM.

A3.2.5 Touching of dangerous live parts

This test relates only to LED tubes during the installation and was recorded only twice. This is considered to be an very serious shortcoming.

A3.2.6 Weight of led tube

Some time ago not all LED tubes fulfilled this requirement. During this joint action no failures were detected.

A3.2.8 Overload test FR (fusible resistor)

It is important to read Annex 1 before reading this evaluation. In order to understand the information as transferred to the stakeholders during the international symposium (8th of March 2012), some further explanation seems to be necessary. A further explanation is given in Annex 1.

It must be expected that the usage of fusible resistors in the design could be considered as a deliberate precautionary measure and it must be described in the technical file. The precautionary measure shall perform as intended and it shall create a safe shut down. As described in Annex 1, fusible resistors should actually not be used at all at this moment. The standard(s) do not take into account some specific behaviour of the fusible resistor. To overcome this lack, some additional tests for overload should be performed - undue the fact that this is a test outside the scope of the standard(s). Several tests showed that the usage of fusible resistor could easily lead to a dangerous situation due to the unpredictable behaviour of the fusible resistor during a change in the ballast, which can or might be caused by failing other components in the lamp. Manufacturers seem to expect that if a fusible resistor is used, an overload test does not have to be performed because there has been a safe shut down during the performed short circuit test. However, in that situation it becomes important to perform an overload test in order to see what happens in case of a change in the ballast without a short circuit.

During this joint action the aforementioned tests were not always performed for practical reasons and a standardised method is not available.

A3.2.9 Housing strength

In order to ensure that the lamp cannot be opened accidentally, it is necessary that there would be a detailed test method in the standard for all designs. Most important remark is that such a test method is still missing in the standard. Therefore, only a general requirement is available.

A3.2.10 Glow wire test

It seems that the chosen materials usually comply. Only once a shortcoming was detected.

A3.2.11 Exchangeability

Basically it seems that LED tubes perform better and better as far as this requirement is concerned. the purpose was to check if all possible modes and interchangeabilities can be done without jeopardizing safety; e.g. whether a normal TL fluorescent tube lamp can safely be introduced in a luminaire after that it has to be changed to function correctly with a LED tube and the again the other way around.

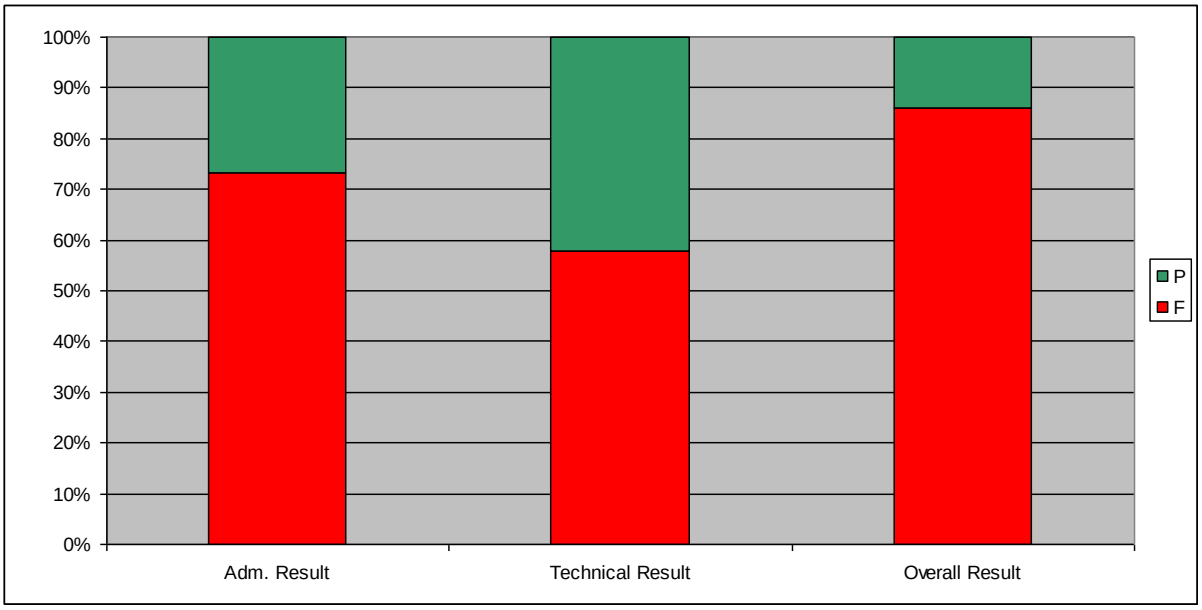

Fig. 5.

To summarize, the overall results (Fig. 5) show that the overall **non-compliance** is very high **86 %**. The technical non-compliance is 57 % and the administrative non-compliance is even worse (73 %).

One should bear in mind that these numbers are expected to be even worse if all the products would have been tested completely. The products were tested only partially and not always all the lamps were tested in the same way.

5 General remarks

In this joint action the Netherlands coordinated the project and Latvia supported in that task. The project coordinator was also supported by some members who volunteered to assist on technical matters. Several documents were made available to the participants as annexes to the project plan and as reporting forms. The market orientation, sampling, technical (including administrative) investigations and reporting of the results of the participants were in general performed as planned.

The purpose of this cross border project was multiple:
- To raise awareness of stakeholders on the subject (i.e. shortcomings in LED-lamps and CFLs),
- To encourage manufacturers to change the construction of the lamp in order to bring them in compliance with the LVD,
- To increase the safety of users by prohibiting of placing unsafe products on the EU/EEA market,

- To exchange information on market surveillance practices between the Member States in the area of the LVD,
- To raise the profile of market surveillance in the field of the LVD in the minds of consumer organizations and industry.

No resources were provided to MSAs by the European Commission for the completion of this JA.

6 Conclusions

As the importance and fast penetration of LED- and CFL lamps in the EU/EEA market have clearly been seen, it is of high importance that all the economic operators, stakeholders and consumer (end-users) can trust in the safety and compliance of LED- and compact fluorescent lamps placed on the EU/EEA market.

The manufacturers should verify that the compliance of their products with the requirements of the Low Voltage Directive is always fulfilled. In addition, standards regarding the LED- and compact fluorescent lamps should be updated on regular basis.

Acknowledgements:
All participants are thanked for their willingness to take part in the joint action, especially while funding was not possible.

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Evert van Wilgenburg

Project leader LED and CFL light sources
Member LVD-AdCo

Senior Inspector Market Surveillance Development
Advisor and Product Safety Expert
.....
Division Consumer and Safety
Netherlands Food and Consumer Product Safety Authority
Catharijnesingel 59 | 3511 GG | Utrecht | TVE
Postbus 43006 | 3540 AA | Utrecht
.....
T 0031 (0)88 2233333
M 0031 (0)88 2232981
evert.van.wilgenburg@vwa.nl

Annex 1

What are the consequences when fusible resistors or non harmonized miniature fuses are used

In general the requirement for the creepage and clearance distance are to be determined based on the relevant standard. Special is that for Compact Fluorescence Lamps (CFL) a requirement is missing for the creepage and clearance distance between phase and neutral. This is notified to Cenelec and for the time being the reference is taken from another standard.

It is by the standard accepted that the creepage and clearances are decreased if precautions are taken. In order to comply with the design principles for safe products such precautions must be deliberate designed and obligatory described in the technical file. The precautionary measures must be fit to perform correctly and must be able to create a safe shut down.

If the designer decide to restrict the maximum current for failure mode it is expected that he uses for that purpose a miniature fuse accordingly EN 60127 series. Another (non-harmonized) type of fuse is considered only acceptable if the designer can show evidence that the component is as safe or perform better than the harmonized version. If the current is not limited and a full mains short circuit can occur a special type of fuse (sand filled) must be used following the standard. For this it is important to detect where the fuse is placed in the circuit and that creepage and clearance distance before the fuse in the circuit are not part of the exemption. These are the principles for design and the test that must be performed is only to exclude unintentional failures. So both aspects, design principles and tests, should be followed and described in the technical file.

We see that in daily practice also fusible resistors (FR) are used in the design. The FR is not described in standard definitions and therefore a non standardized component. The FR is described in UL 1412y, but the scope for use is there restricted to the use in audio and video equipment in the secondary circuit only. Based on the design principles it is for that reason not acceptable to use FR in LED and CFL outside their scope and specs.

More important is that there is some evidence that due to the behaviour of FR used in LED and CFL in several accidents caused fire and that dangerous tensional voltages became touchable. This is caused by two factors.
The first is that the housing of the FR is of special material that is able to withstand high temperatures. Benefits are that at high overload the FR housing can withstand the internal developed heat and that the housing will stay intact and only the resistance track will open. However, the behaviour depends on the specifications and must be able to shut down the maximum current that can occur. Nevertheless, if used in LED and CFL the FR is used outside the specs from the manufacturer.

Secondly, it is important to know that in the existing standard for LED en CFL specific behaviour of the FR is not taken into account. This is brought to the attention of CENELEC TC34. The positive behaviour during a short circuit can create danger during overload conditions that occur for a longer time. In daily practice and known from several accidents we determined that there are situations where the current through the FR just left the resistor intact, but the temperature rise can be enormous. The reasons why such currents can exist is not investigated, but it is presumed that other components fail partly or completely, after which the current increase without reaching a short circuit mode. The fire resistance housing, created to withstand the heat dissipation during short circuits, can withstand also higher currents than during normal use occur. It is presumed that more often a snowball effect caused accidents. It starts with a higher current caused e.g. by the failure of a component. The temperature of the FR housing increases and temperatures inside the housing of the product become higher. This influences sometimes other components or the failing component (including connections and printed circuit board) and can increase the current through the FR and causes a higher temperature of the FR housing; and so on.

It showed that during test conditions temperatures of FR housings become at higher temperatures than 300°C before the FR shuts down. In the accidents the users are endangered before that final stage by holes burned in the housing of the product, mains short circuits occurred with sparks outside the housing, fires started or explosions happened. As a consequence of overheating, flammable gasses might play a role.

The conclusion should be that fuses, other as described and defined in EN 60127, and FR in general can not be used outside the scope and specs. So they should not be used in LED and CFL at all.
Because it is not obligatory to use only harmonised standards there is a small escape. Only if the manufacturer can provide evidence that the product is safe under all foreseeable conditions during normal use and all abnormal conditions during the whole life time of the product the use might be acceptable.
The manufacturer must in that case describe the use of the precautionary measure (non harmonized fuse or FR) and all the tests performed and a declaration in the technical file that the product cannot become unsafe undue the use of those components. All specs of the products must be directly available in test reports. The test report must contain the results of the additional tests. The declaration of conformity cannot simply mention the standards used, but must contain an additional declaration in the paragraph of the mentioned standards which explain the exemption to the standard and additional used references.

In the view of the project management than, and only than, under such conditions acceptation might be possible for the use of non harmonized fuses and FR.

Seen the product reports belonging to this joint action this is not executed yet by MSA, because it was not completely clear if unsafe behaviour could be determined during additional tests and whether all precautionary conditions (which should be described in the DOC and TF) are correctly taken. One of the original aims of the project was to establish the compliance of this all and enable MSA to take position.

Summarized:

- Fuseable resistors can only be used in compliance with the relevant standard;
- For now only following the scope of UL 1412 in secondary circuits for audio/video
- If otherwise used it can only be allowed if the specs of the FR includes the use;
- And the technical file extensively describes which precautions are taken in order to prevent that unacceptable behaviour can happen;
- A short circuit test and especially a overload test must be performed;
- All tests in relation to the FR are part of the technical file;
- The file contains all information that the FR is used correctly.

Simply using a FR and mentioning this use in the technical file is considered non compliant.