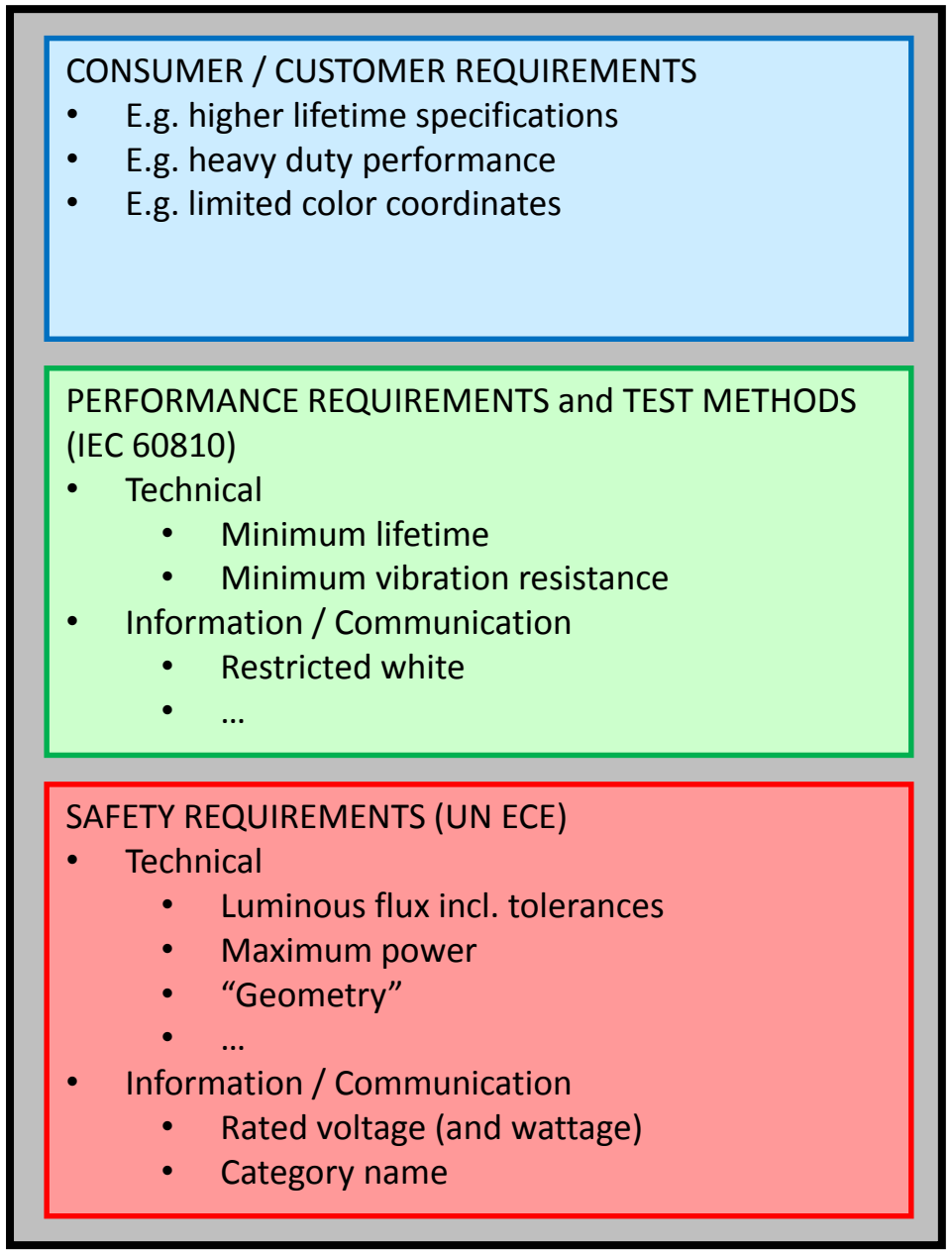
Light Source Requirements

- In general for UN approved light sources
- OEM situation and AFTM situation

- Requirements clustered in
  - Safety
  - Performance
  - Consumer / Customer



LED Replacement Light Source (LEDr) acc. to R37

- Photometric parameters
  - Same as for LED Substitutes
- Electrical parameters
  - Voltage range
  - FailureDetectionSystem-compatibility
  - PWM operation
  - EMC
- Mechanical parameters
  - Size
  - Mass
- Thermal parameters
  - Behavior under high ambient T.

Task for TFSR

CONSUMER / CUSTOMER REQUIREMENTS
- …

PERFORMANCE REQUIREMENTS (IEC 60810)
- Technical
  - …
  - …
- Information / Communication
  - …
  - …

SAFETY REQUIREMENTS (UN ECE R37 / RE5)
- Technical
  - …
  - …
- Information / Communication
  - …
  - …

Collecting the topics / questions

Electrical

Status after TFSR-08:
Discussed and agreed

Nr	Topic	Question		
#1	Voltage range	Does the LEDr have the same voltage - flux behavior as the filament light source?		
#2	PWM operation	Does the LEDr flicker in case of pulse-width modulation (PWM) operation? Also covering PWM dimming for dual-function operation		
#3	Power / electr current	Does the LEDr cause a wrong failure message in the dashboard when it is working correctly? Does the LEDr cause a correct failure message in the dashboard when it has failed? Incl presence detection (Kaltüberwachung)		
		Possible interaction with other electronics		
#4	EMC / EMI	Does the LEDr cause EMC problems in the vehicle?		
#5	Electrical robustness	Is the LEDr as robust against electrical disturbance as the filament lamp?		

Mechanical

Status after TFSR-08:
Discussed and agreed

Nr	Topic	Question		
#1	Vibration / Mass	Does the LEDr have the same mass as the filament lamp and is it as robust against vibration as the filament lamp?		
#2	Maximum geometry	Does the LEDr have the same geometry / maximum outline as the filament lamp? Is the sealing affected by the geometry of the heat-sink		

Thermal

Status after TFSR-08:
Discussed and agreed

Nr	Topic	Question		
#1	1min / 30 min ratio	Could it happen that the LEDr has higher intensity in the beginning (when switched on) and will reduce its intensity significantly as it reaches steady-state temperature?		
#2	High ambient temperature	Could it happen that the LEDr has significantly reduced intensity when it is operated at high ambient temperature?		
#3	Low ambient temperature	Could the de-icing / de-fogging behaviour of a luminaire be different when an LEDr is used?		
#4	Cap temperature	Could the lamp cap get hotter with an LEDr compared with a filament lamp and could this lead to damage of the material of the luminaire?		

Colorimetric

Status after TFSR-08:
Discussed and agreed

Nr	Topic	Question		
#1	Spectral content	In signalling applications with coloured lenses, is the spectral content of the LEDr sufficiently like the spectral content of the incandescent lamp? e.g. • Red lens • Amber lens • Green+red = white • Green+red=amber		
#2	Minimum red content	Is the minimum red content fulfilled? (for RID applications).		

Electrical #1

- Voltage Range

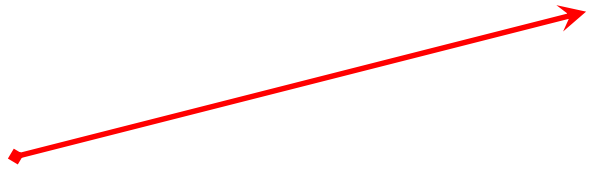
Question:

Does the LEDr have the same voltage - flux behavior as the filament light source?

Answer:

The electronics of the LEDr is designed so that the voltage – flux behavior is equivalent, or more stable, than the filament light source

Status after TFSR-08:
Discussed and agreed



CONSUMER / CUSTOMER REQUIREMENTs

PERFORMANCE REQUIREMENTS (IEC 60810)

SAFETY REQUIREMENTS (UN ECE R37 /RE5)

- The luminous flux shall be tested between 9 V and 14 V

Electrical #2
- PWM operation

Question:

Does the LEDr flicker in case of pulse-width modulation (PWM) operation? Also covering PWM dimming for dual-function operation

Answer:

There are two application cases:

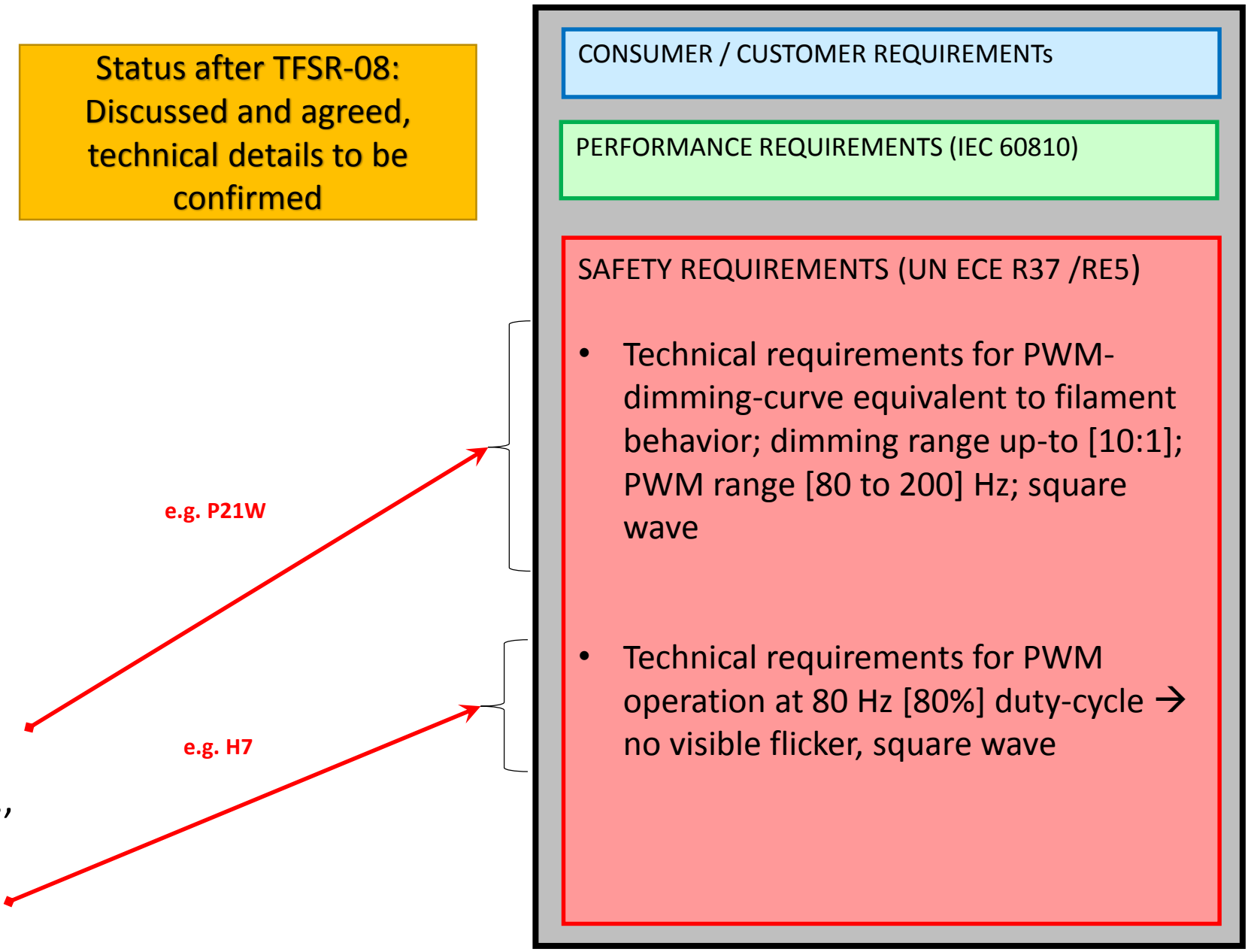
1. PWM for dual function dimming (tail / stop and FrontPos / DRL)

2. PWM for stabilisation (reduce voltage peaks))

→ 1) Dual function is only used for a limited number of categories: e.g., P21W, but not e.g. H7

→ 2) all LEDr are tested for “no visible flicker”

Status after TFSR-08: Discussed and agreed, technical details to be confirmed



Electrical #3
- Failure detection system compatibility

Question:

Does the LEDr cause a wrong failure message in the dashboard when it is working correctly?

Does the LEDr cause a correct failure message in the dashboard when it has failed?

Incl presence detection (Kaltüberwachung)

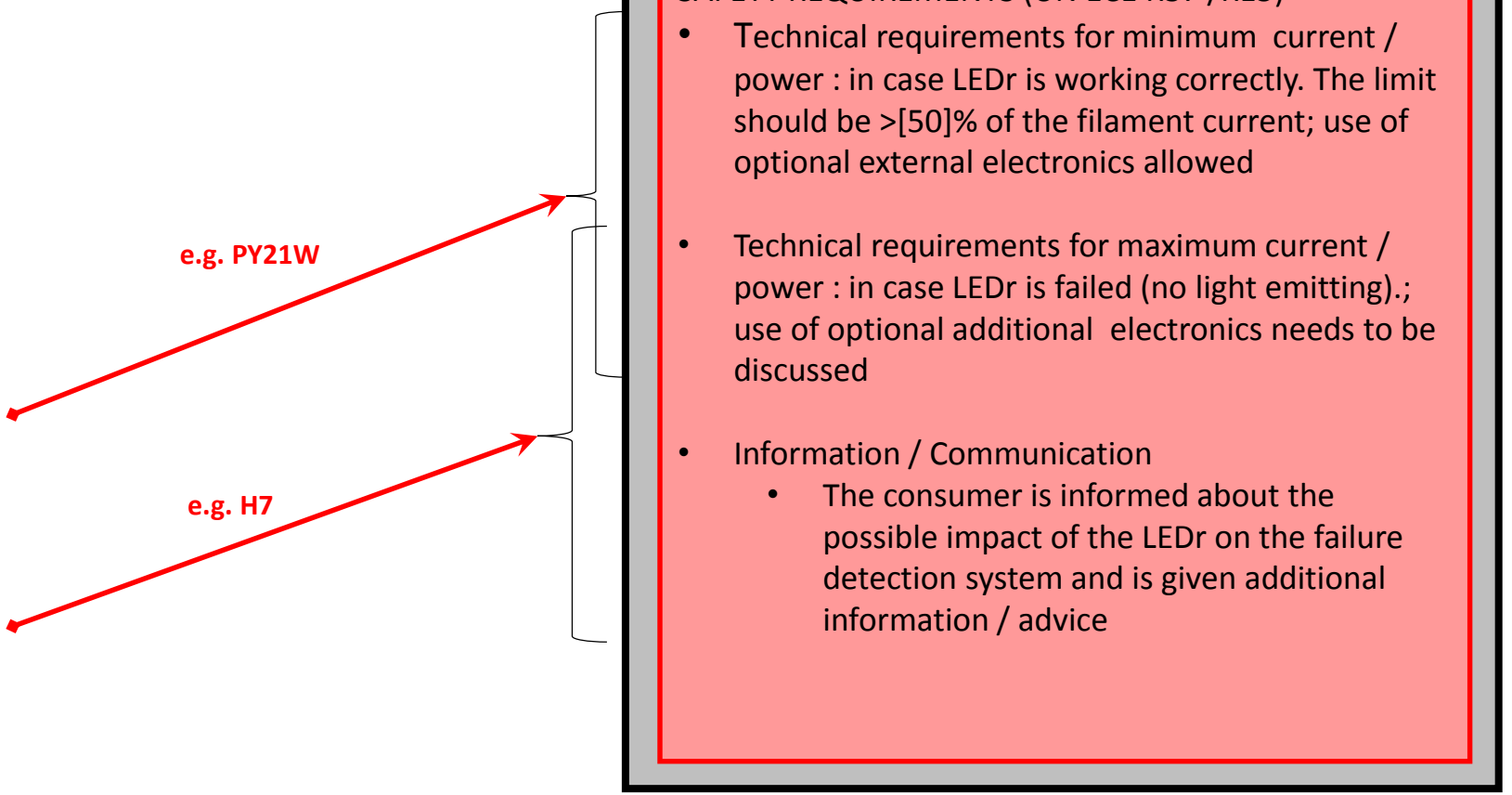
Answer:

Failure detection is mandatory for direction indicators (DI)

→ 1) LEDr for DI – The electronics of the LEDr is designed to ensure compatibility.

→ 2) user information for non-DI application (optional failure detection)

Initial proposal to TFSR-08 Solution A



Electrical #3
- Failure detection system compatibility

Question:

Does the LEDr cause a wrong failure message when it is working correctly?

Does the LEDr cause a correct failure message when it has failed?

Is the LEDr compatible with presence detection (“Kaltüberwachung”) ?

Answer:

For all LEDr the electronics of the LEDr is designed to ensure compatibility.

There shall be no light in the first 2ms.

Discussion during TFSR-08:
Solution B
„high power option“

CONSUMER / CUSTOMER REQUIREMENTs

PERFORMANCE REQUIREMENTS (IEC 60810)

SAFETY REQUIREMENTS (UN ECE R37 /RE5)

- Technical requirements for minimum current / power : in case LEDr is working correctly. The limit should be >[50]% of the filament current; use of optional external electronics allowed
- Technical requirements for maximum current / power : in case LEDr is failed (no light emitting)
- Information / Communication
  - The consumer is informed about the possible impact of the LEDr on the failure detection system and is given additional information / advice

Failure detection system compatibility (non-DI) – two options

Solution A- "high power AND lower power" versions

- „High power" version for vehicles with failure detection (~[20]% of vehicles for low beam)
- „Low power" version for vehicles without failure detection and for vehicles with low threshold (~[80]% of vehicles for low beam)
- User information

Benefit:

- reduction of electronic waste by avoiding additional electronics
- optimized energy efficiency

-> reduced CO2 emission, reduced waste

Disadvantage:

- Increased complexity for the consumer

"mis-use":

Wrong failure message in case of using a "low power" version where a "high power" version is needed " (but the light source is working correctly)

Solution B- only a "high power" version

- Only high power version

Benefit:

- Less complexity for the consumer

Disadvantage

- Increase of electronic waste by adding additional components where they are not necessary
- Artificially increased power consumption where low power consumption could be enabled

-> increased CO2 emissions, increased waste

Discussion during TFSR-08

End of TFSR-08 meeting on 2019-12-10

Electrical #4
- EMC

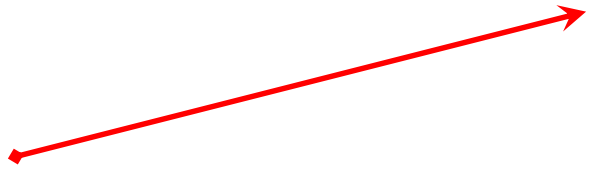
Question:

Does the LEDr cause EMC problems in the vehicle?

Answer:

No, the electronics design of the LEDr is made in such a way that no disturbance occurs; this is regulated in ECE R10 for all ESA in vehicles

Initial proposal:
Same as for substitutes



CONSUMER / CUSTOMER REQUIREMENTs

PERFORMANCE REQUIREMENTS (IEC 60810)

SAFETY REQUIREMENTS (UN ECE R37 /RE5)

- LEDr shall comply with the technical requirements of an Electronic Sub Assembly (ESA) as specified in UNECE R10

Electrical #5

- Electrical robustness

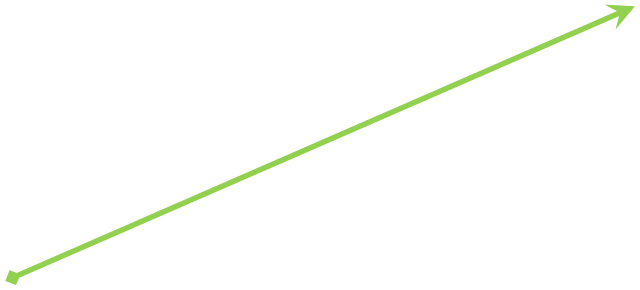
Question:

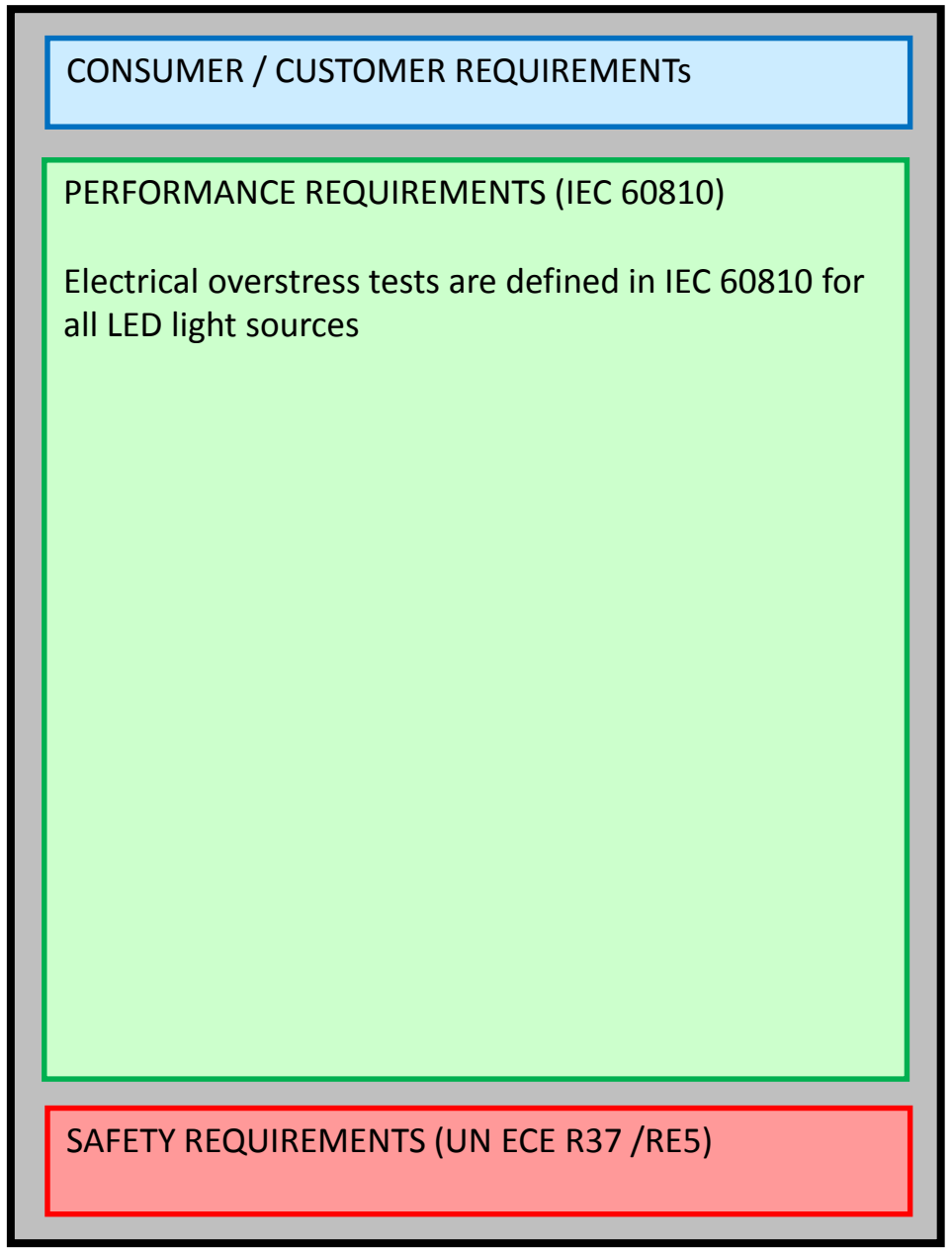
Is the LEDr as robust against electrical disturbance as the filament lamp?

Answer:

Yes, the electronics of the LEDr should be designed so that it can withstand typical electrical overstress, e.g. reverse voltage

Initial proposal:
Same as for all LED light sources



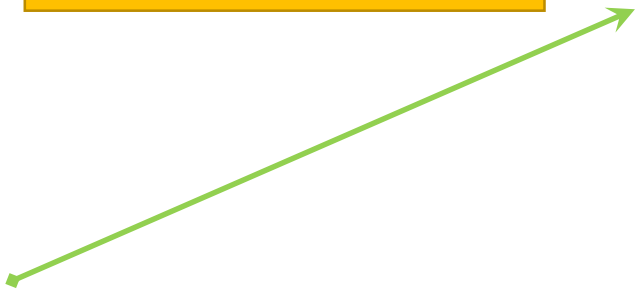


Mechanical #1
- Vibration / Mass

Question:
Does the LEDr have the same mass as the filament lamp and is it as robust against vibration as the filament lamp?

Answer:
No, LEDr have typically a higher mass than a filament lamp,
but the mass of filament lamps is not regulated or standardised. A market survey can give guidance on the typical mass of the different categories.
For each cap-holder system a mass limit can be determined for which the system is designed.
The vibration resistance can be tested on the LEDr directly, using the same test method used to test the vibration resistance of filament lamps.

Initial proposal:
same as for all LED light soures



CONSUMER / CUSTOMER REQUIREMENTs

PERFORMANCE REQUIREMENTS (IEC 60810)

define for each LEDr category a maximum mass and test the vibration resistance

SAFETY REQUIREMENTS (UN ECE R37 /RE5)

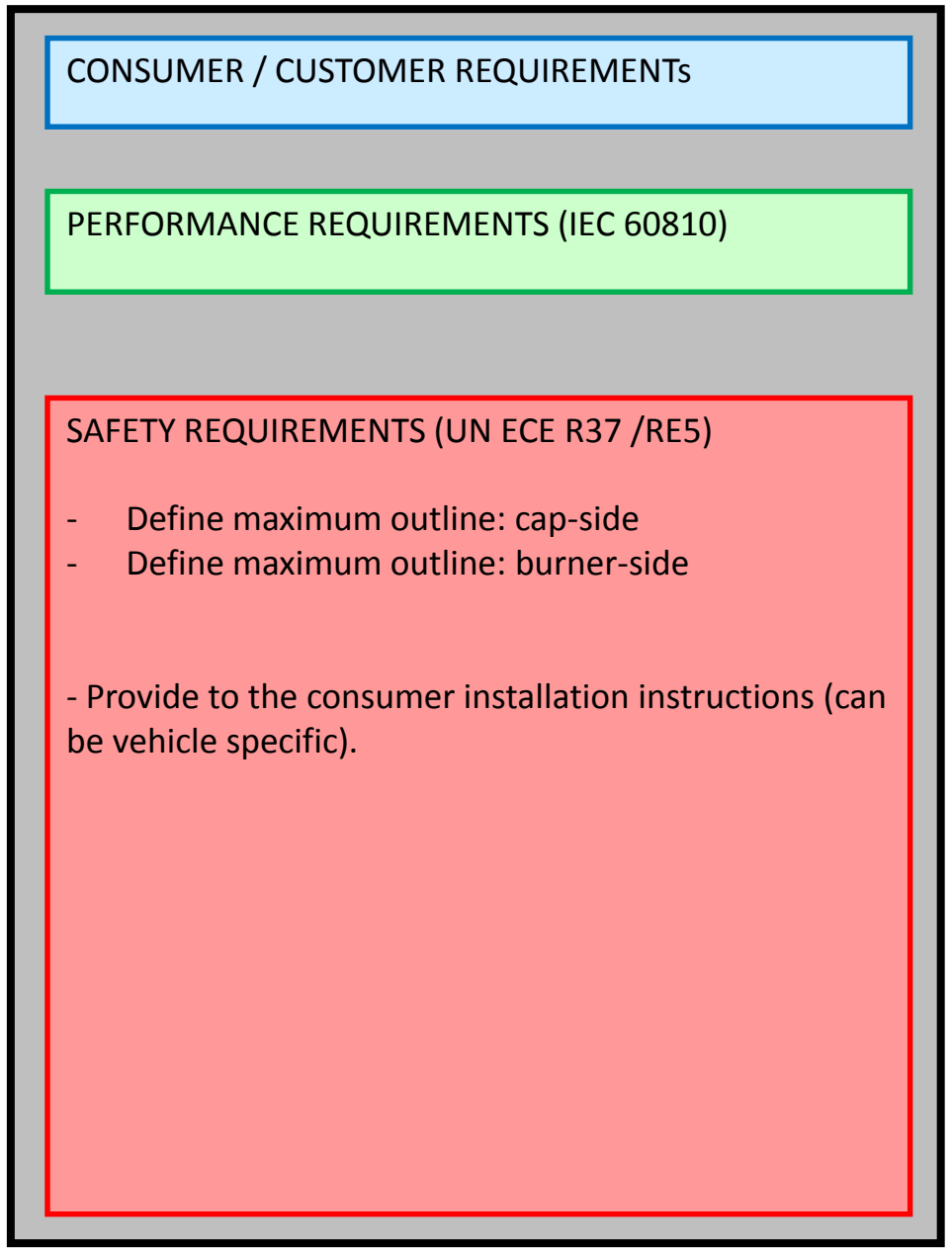
Mechanical #2
- Maximum geometry

Question:
Does the LEDr have the same geometry / maximum outline as the filament lamp?

Answer:
Yes, the “burner-side” of the LEDr has the same maximum outline as the filament lamp to allow safe insertion into the luminaire.

For the “cap-side” of the LEDr there may be a somewhat larger specification
than the filament lamps (per category); this will be reflected in the installation instructions, which can be vehicle-specific.

Initial proposal:
Burner side - same as for substitutes



Thermal #1
- 1min / 30 min ratio (hot-cold-ratio)

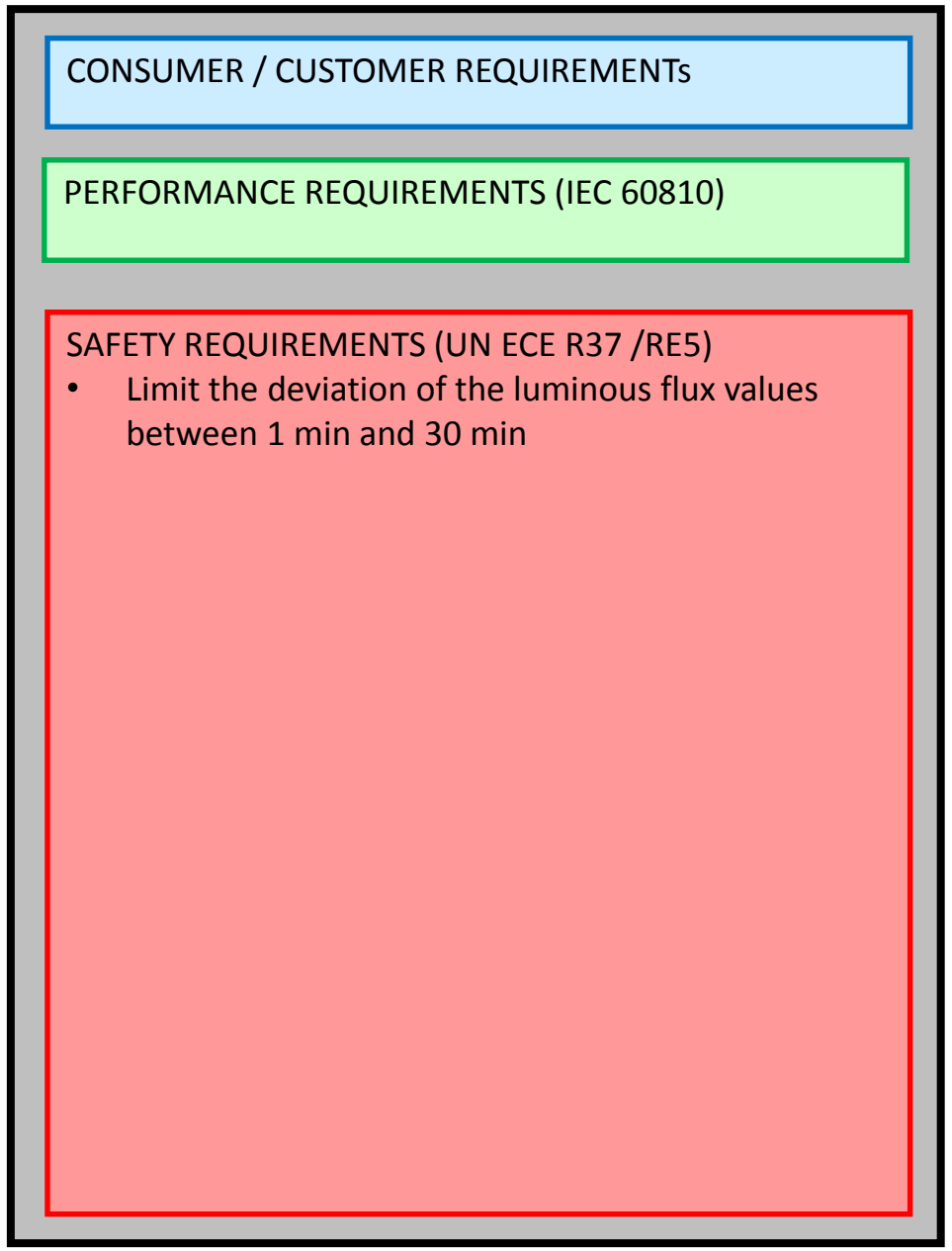
Question:

Could it happen that the LEDr has higher intensity in the beginning (when switched on) and will reduce its intensity significantly as it reaches steady-state temperature?

Answer:

No, there is no significant effect, as the design of the LEDr is such that such excessive lumen-drop from 1 min to 30 min is be prevented.

Initial proposal: same as for all LED light sources



Thermal #2
- High ambient temperature

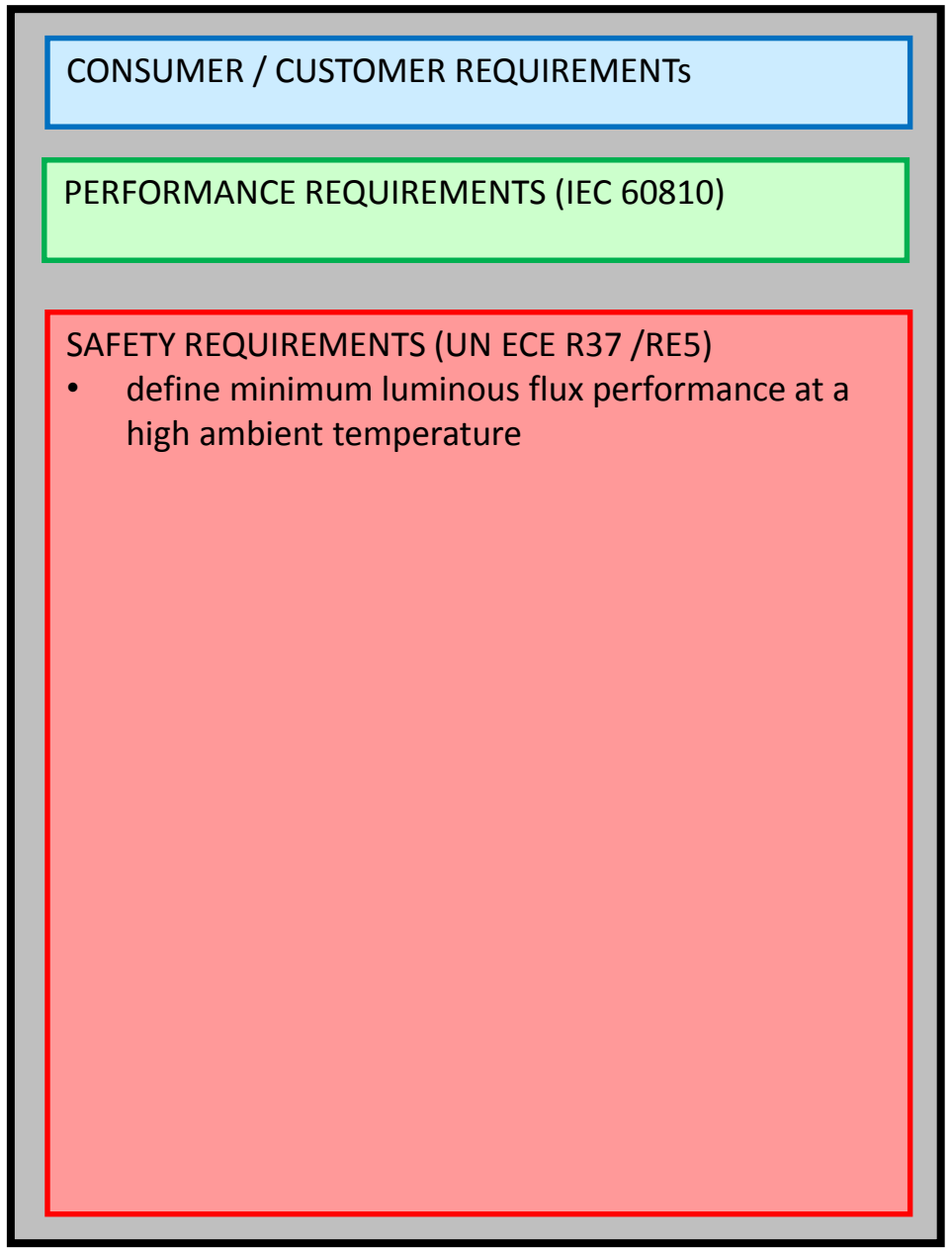
Question:

Could it happen that the LEDr has significantly reduced intensity when it is operated at high ambient temperature?

Answer:

No, there is no significant reduction, as the minimum performance under high ambient temperature is specified.

Initial proposal: same principle as for LED substitutes



Thermal #3
- de-icing / de-fogging

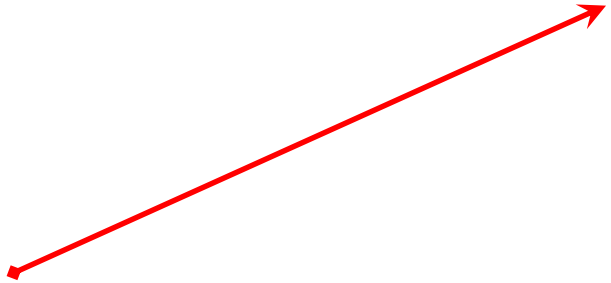
Question:

Could the de-icing / de-fogging behaviour of a luminaire be different when an LEDr is used?

Answer:

Yes, the de-icing / de-fogging behaviour may be different (can become better or worse). It could change due to the different power consumption and energy balance of the LEDr; the consumer is informed about this.

Initial proposal



CONSUMER / CUSTOMER REQUIREMENTs

PERFORMANCE REQUIREMENTS (IEC 60810)

SAFETY REQUIREMENTS (UN ECE R37 /RE5)

- require user information to be included on de-icing / de-fogging.

Thermal #4

- cap-temperature

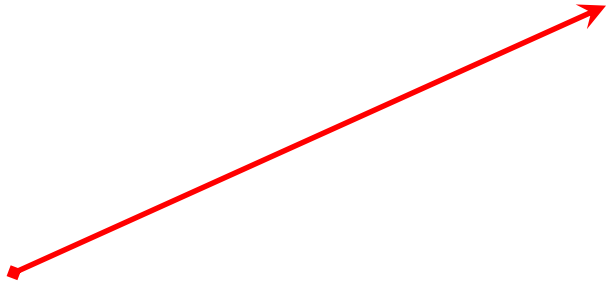
Question:

Could the lamp cap get hotter with an LEDr compared with a filament lamp and could this lead to damage of the material of the luminaire?

Answer:

No, a maximum power or temperature limit for the LEDr avoids this situation. So even though LEDr has less power consumption than the filament lamp, cap temperature is considered relevant.

Initial proposal: same principle as for substitutes



CONSUMER / CUSTOMER REQUIREMENTs

PERFORMANCE REQUIREMENTS (IEC 60810)

SAFETY REQUIREMENTS (UN ECE R37 /RE5)

- either a maximum power limit shall be given for the LEDr or the maximum cap temperature shall be specified for each cap-holder system.

Summary of the proposal

Initial proposal

LED replacement light source

CONSUMER / CUSTOMER REQUIREMENTs

PERFORMANCE REQUIREMENTS (IEC 60810)
Electrical
#5: Electrical robustness
Mechanical
#1: Vibration

SAFETY REQUIREMENTS (UN ECE)
Electrical
#1: voltage range
#2: PWM operation
#3: failure detection compatibility
#4: EMC
Mechanical
#2: Geometry
Thermal
#1: hot-cold-ratio
#2: high ambient temperature
#3: de-icing , de-fogging
#4: cap temperature