

Status Document of the SubWG1 on Headlight Testing

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General Overview

PTI should verify dazzling avoidance of oncoming road users and road illumination.

The cut-off line position is representative enough to guarantee these requirements only if the light distribution beam pattern is proper (e.g. according to type approval requirements).

Common contemporary halogen headlamp easily obtains 2-3 time higher values than the minimum that is required for a new headlamp. Recent development of the headlights technology may have outpaced type approval requirements much more.

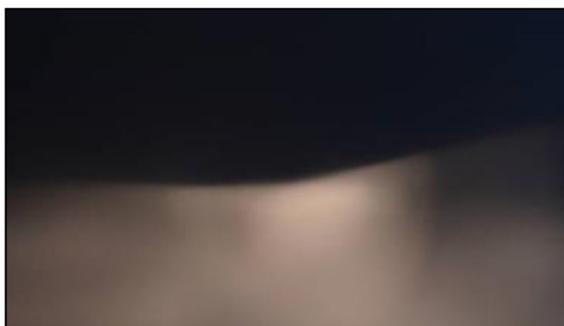
General Overview

Light distribution may be affected by

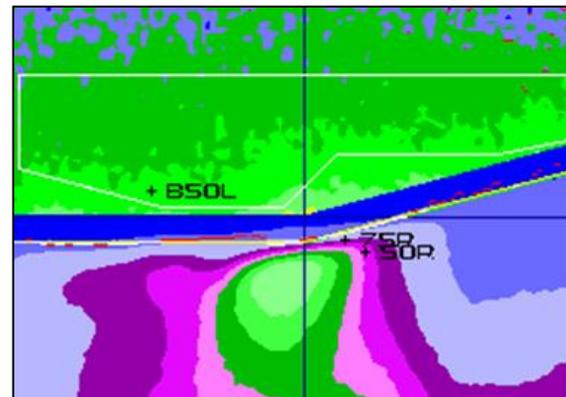
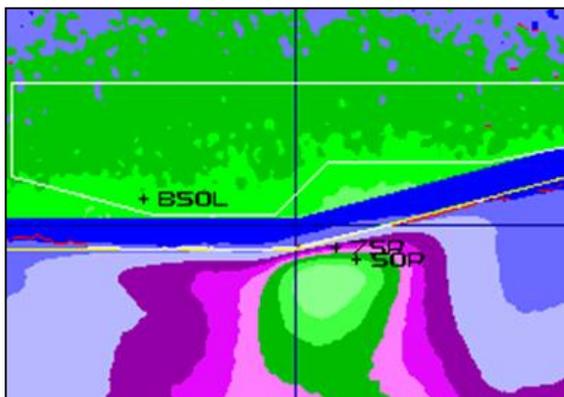
- Differences between type approval and in-use conditions (mass production light source, bulb holder tolerance, special conditions for type approval test – additional headlamp positioning, cut-off verification etc.)
- Improper bulb (flux, geometry, illegal replacements)
- Deterioration of reflective/transparent surface, lens (scratches, mat)
- In use deterioration (ageing)

Example: The same headlamp with the same good quality bulb but slightly twisted within the tolerances of the holder

Normal
Headlight
Tester



Polish
photometric
camera
tester



Cut-Off Line Definition

The definition of cut-off line in ECE Regulations has been changed recently

But neither the old nor the present wording is precise enough to enable a decision during the PTI test whether the cut-off is sufficient to accurately aim the headlamp

Beam patterns become more complex - it is increasingly difficult to identify the cut-off (visually and by the use of algorithms)

Various technologies and different shapes of cut-off lines used by headlamp manufacturers can cause additional test inaccuracies



Irregular cut-off



Sharp but colored cut-off

Cut-Off Line Problems

- No clear definition of cut-off line in current ECE regulation in relation to PTI
- How should the automatic devices determine the cut-off line?
- The visual evaluation by the human eye and brain is problematic, too, because of non-consistency between human individuals

PTI Test Criteria

Unambiguous PTI criteria for road illumination and glare protection are needed

- There are type approval standards – even not perfect and not adequate to present technology possibilities
- 2014/45/EU – too general requirements without necessary details. It refers to ‘requirements’ laid down ‘by type-approval at the date of approval, first registration or first entry into service as well as by retrofitting obligations or by national legislation in the country of registration’
- Present PTI test (visual and cut-off) is based on a historical parabolic design with exchangeable filament bulbs (technology of the 50s of the 20th century)
- Today’s variety of other headlamp designs - there is a general anticipation to be tested using the same equipment

Consistency Across Technologies

Regardless of what kind of technology the testing device uses – visual, photodiode or camera – the PTI test should show the same and accurate results

All light source types and all headlamp types should be measured effectively

Measurements Accuracy Factors

- Floor level
- Chassis and build requirements
- Consistency between the size of the headlamp and of the device lens (amount of light collected into the device)
- Optical design and focal length of the lens of the tester

Measurable Parameters of Headlights Performance

- How much light can be allowed and where during the PTI?
- There are no exact criteria (limit values, tolerances) for headlight and front fog light alignment in 2014/45/EU, it refers to 'requirements' laid down 'by type-approval at the date of approval, first registration or first entry into service as well as by retrofitting obligations or by national legislation in the country of registration'. CITA SubWG1 on Headlight Testing recommendations are probably important to improve this situation.

Cut-Off Measurements

- Horizontal and Vertical cut-off measurement: How should the elbow be identified?
- Algorithms should be defined as requirements. 'Black box' principle should be avoided in the PFI devices.

Device Calibration

What should be calibrated and how?

Awareness

- PTI test should have relevance to road safety needs.
- The personnel making measurements is not aware of problems related with the present situation in headlight testing. The device, procedure and requirements should guarantee minimum illuminated distance and prevent glare to other road users after a test done by an inspector with basic qualification.
- Awareness at type approval level (manufacturers, test houses, legislators) regarding PTI - feedback from CITA to GRE/ WP.29 etc.

Conclusions – from SubWG to WG1

- SubWG1 on Headlight Testing needs guidelines regarding further work.
- As the illuminance is responsible for road illumination and for glare to the other road users, Sub WG1 on Headlight Testing recommends to measure the light intensity which is relevant.
- In some countries such measurements were or are done. Some optical/mechanical light testers have a photodiode or similar sensor to measure intensity in the central point, in point 75R and point B50L for glare.
- Specific PTI requirements (recommendations) regarding road illumination and glare should be prepared or - alternatively - minimum values which should be met and are realistic for in-use conditions should be defined at type approval stage.

Conclusions – from SubWG to WG1

- There is a ready solution which can be used as example (Polish - tester and method):
 - camera measurements,
 - cut-off calculation based on human sight modelling, with dense cut-off sampling, cut-off approximation, verifying cut-off shape, quality and location according to manufacturer's prescription and national law.
 - afterward assessment based on type approval simplified requirements (required presently by Polish national law: value for 50R, 75R, glare zone, and road illumination range of min. 40m).

Conclusions – from SubWG to WG1

- There are two possible concepts of PTI:
 1. Check cut-off line position and verify minimum photometry in points.
 2. Do not care about cut-off (this is manufacturer/service task before PTI). PTI will check whether road illumination is more than minimum and glare doesn't exceed the minimum (chosen relevant photometric values).
- There are other solutions available (headlight tester manufacturers).
- There is a need to communicate a message to GRE and WP.29 that type approval level should take into account the PTI needs or consider PTI rules which will be proposed to it.



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