

# Adaptive Front Lighting Systems (AFS)


Presentation to the 48th Session of GRE  
(9-12 April 2002) Agenda items 1.2. and 4.2.

## Contents

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| 1 Background        | 5 Photometry               |
| 2 Definitions       | 6 Safety                   |
| 3 Functions / Modes | 7 Documentation & Approval |
| 4 The Appearance    |                            |

## Eureka Project EU 1403

### Situations and Possible Modes



Adaptation modes		passing beam	main beam	DRL	Front fog
<b>Country / normal / narrow road</b> road shape surroundings speed / traffic density / traffic direction		x	x		
<b>Motorway / wide road</b> fast driving / motorized traffic only flat road without intersections special signs		x			
<b>Town / lit road</b> restricted speed high traffic density sidewalks / pedestrian		x			
<b>Wet road</b> glossy road surface precipitation		x			
<b>Turns / bends of any road</b>		x	x		
<b>Daytime</b>				x	
<b>Fog</b>					x

w203003

## Eureka Project EU 1403 The Program and the Milestones



### 1994 Phase I

Drivers /Traffic Needs - Improvement Potential  
Possible Functions & Modes Definition - **Feasibility**  
Initial Tests - Market Response

### 1997 Phase II

**Field Studies**  
Scientific Support  
Demonstration Lamps and Vehicles / Road Tests

### 1999 Phase III

Balocco and 44<sup>th</sup> GRE (Apr. 2000) **Presentation**  
Requirements **Draft Specification**  
Support to GTB's work for draft Regulation

w203002

## AFS Acceptance and Market

### Proposed Passing Beams, Customers Ranking



Yes, I need an improved Passing beam lighting for..	Study 1996 France, Italy, Sweden	Study 1995 Germany
<b>Wet roads</b>	rank 1	rank 1
<b>Country roads</b>	rank 2	rank 2
<b>Bends</b>	rank 3	} rank 3
<b>Motorways</b>	rank 4	
<b>Town Situation</b>	rank 5	(rank 4)

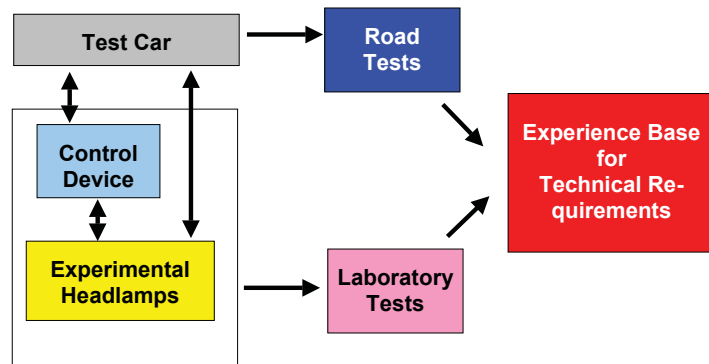
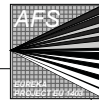
Comparison with other features/ values (1996)

Adverse weather /wet road mode = as airbag (some 650 EUR option at that time)  
Other AFS modes = as front fog lamps

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## Eureka Project EU 1403

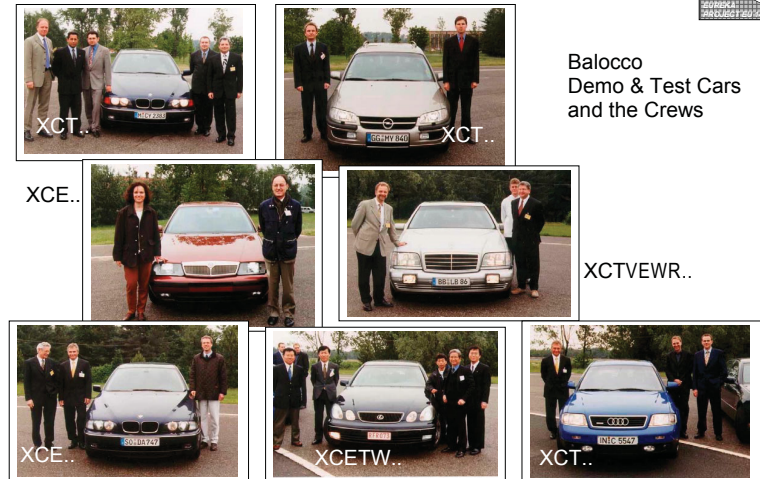
### Phase II Test Activities



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## Eureka Project EU 1403

### Balocco Test Cars and Lamps



Balocco Demo & Test Cars and the Crews

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## Eureka Project EU 1403

### AFS Presentation at Balocco (1999)



Project Presentation in the Premises of Fiat Lancia in Balocco (Italy)

Demo System Explanation at Daytime prior to the Tests



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## Eureka Project EU 1403

### 44th GRE: AFS Presentation

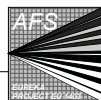


67. On 4 April, late in the evening after the session, a demonstration was given inside the premises of the Palais des Nations of a number of configurations of AFS installed on ten passenger cars (M1) of various types and makes. The GRE experts were provided the opportunity to drive these test vehicles. ...
68. Following the demonstration, all GRE experts acknowledged the experience with the new technology of front lighting, designed to improve the illumination and to adapt it to various driving situations, whilst reducing glare. ...

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## Eureka Project EU 1403

### GTB - AFS Nov 2000 to Nov 2001



#### 90<sup>th</sup> GTB

Paris 11/2000

Special Session Mandate

#### Special 1

First Check and Definition of Tasks

#### 91<sup>st</sup> GTB

Rome 05/2001

Report, Additional Questions

#### Special 2

Main Discussion / Solutions

Light Source Module, R48 Amendment Structure, Photometry, Control, Language / Editorials

#### Special 3

Settlement of Open Points

#### 92<sup>nd</sup> GTB

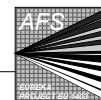
Kyoto 11/2001

GTB Release

w203009

## AFS - Draft Regulation

### System Definition



#### Adaptive front lighting system (AFS) means ..

- ▶ ..a lighting device, providing **two or more differing modes** for automatic adaptation of the beam characteristics to **varying conditions of use**
- ▶ of the **passing beam** and, if it applies, the **main beam** and/or the **day-time running light**;
- ▶ such systems consist of the **system control**, one or more **supply and operating device(s)**, if any, and the **installation units** of the **right** and of the **left** side of the vehicle.

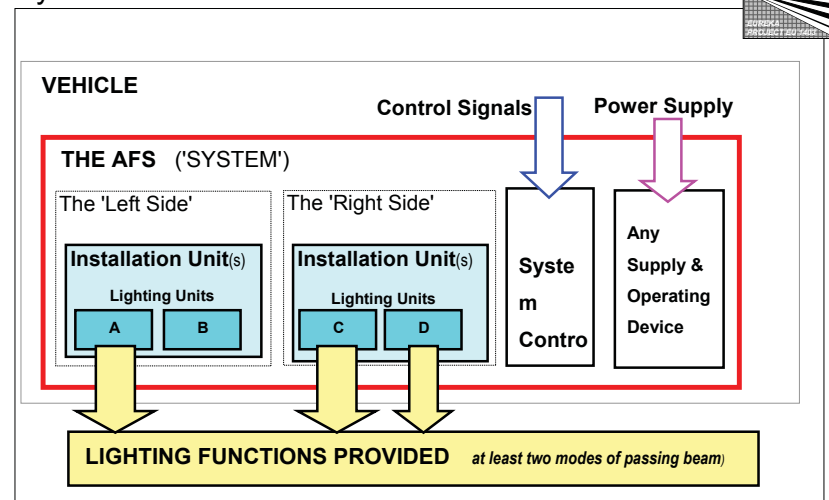
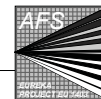
Para. 2.7.25 (AFS definition) of R.48 = scope of new Regulation on AFS

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## 2 The Definitions

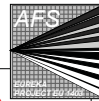
## AFS - Draft Regulation

### System Definition



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## AFS - Draft Regulation System Definition



**Within the passing beam particular photometric provisions are defined..**

**..for the following classes**

- (1) CLASS C (basic) passing beam
- (2) CLASS V (town) passing beam
- (3) CLASS E (motorway) passing beam
- (4) CLASS W (wet road) passing beam

**and the 'BENDING MODES' of them.**

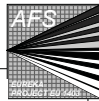
**Within each class differing 'MODES' (including the one or more bending modes) can be provided.**

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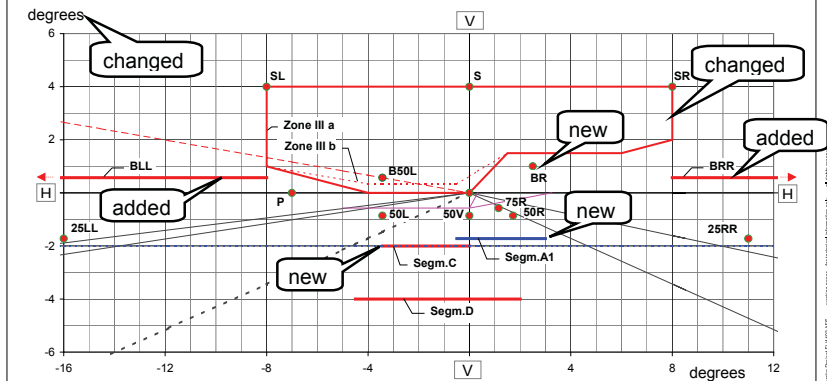
## 3 The Functions and Modes

### 3.1 General / The Class C (Basic) Passing Beam

## Passing Beam Requirements Annex 3, Figure 1

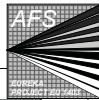


**New/changed elements, compared with R.112/R.98**



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## Passing Beam Requirements Annex 3, Table 1



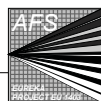
		Position /degrees		class C (basic) passing beam		class V (town) passing beam		class E (motorway) passing beam		class W (wet road) passing beam	
		horizontal	vertical	min	max	min	max	min	max	min	max
Part A	1	B50L	4/ L 3.43	U 0.57	0.4	0.7	0.4	0.7	0.7	0.7	0.7
	2	HV	4/ V			0.7	0.7				
	3	BR	4/ R 2.5	U 1	0.2	2	0.1	1	0.2	2	0.2
	4	Segment BRR	4/ R 8	R 20 U 0.57	4		4		4		6
	5	Segment BLL 4/ and above it	4/ L 8	L 20 U 0.57		0.7		1		1	1
	6	P	L 7	H	0.1					0.1	
	7	Zone III (as specified by Table 3 of			0.7		0.7		1		1
	8	S	V	U 4	0.1		0.1	0.1		0.1	
	9	SL	L 8	U 4	0.05			0.05		0.05	
	10	SR	R 8	U 4	0.05			0.05		0.05	
	11	50 R	R 1.72	D 0.86		6		18		24	
	12	75 R	R 1.15	D 0.57	12		3	12		12	
	13	50 V	D 0.86	6				18		24	
	14	50L	L 3.43	D 0.86	4.2	25	2	25	8	8	35
	15	25LL	L 16	D 1.72	1.4		1	1.4		4	
	16	25RR	R 11	D 1.72	1.4		1	1.4		4	
	17	Segment C and below it	L 3.5 V	D 2			14	14	14	14	20
	18	Segment D (10m-Line) and below it	L 4.5 R 2.0	D 4			14	14	14	14	20
	19	E <sub>max</sub> 3/			20	50	10	50	20	80	35
Part B	1	B50L	4/ L 3.43	U 0.57	0.6		0.6				
	2	HV	4/ V		1		1				
	7	Zone III (as specified by Table 3 of this annex)			1		1		1		1
	14	50L	L 3.43	D 0.86	2		1		4		4
	19	E <sub>max</sub> 5/			12	50	6	50	12	90	24

(bend)

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## Passing Beam Requirements

Annex 3, Table 2



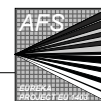
### Emax and cut-off provisions

2	angular position / extend in degrees	Class C (basic) passing beam		Class V (town) passing beam		Class E (motorway) passing beam		Class W (wet road) passing beam	
		horiz.	vertical	horiz.	vertical	horiz.	vertical	horiz.	vertical
2-1	Emax shall not be positioned outside of the rectangle extending (above "Segment A1")	from H = 0,5L to 3R	from V = 0,3D to 1,72D		from V = 0,3D to 1,72D	from H = 0,5L to 3R	from V = 0,1D to 1,72D	from H = 0,5L to 3R	from V = 0,3D to 1,72D
2-2	the "cut-off" and part(s) of shall: - comply with the requirements of paragraph 1. of Annex 9 to this Regulation and be positioned with its "kink" at H = 0 and - be positioned with its "straight horizontal part"								
			at V = 0,57 D		not above 0,57D and not below 1,3D		not above 0,23D and not below 0,57D		not above 0,23D and not below 0,57D

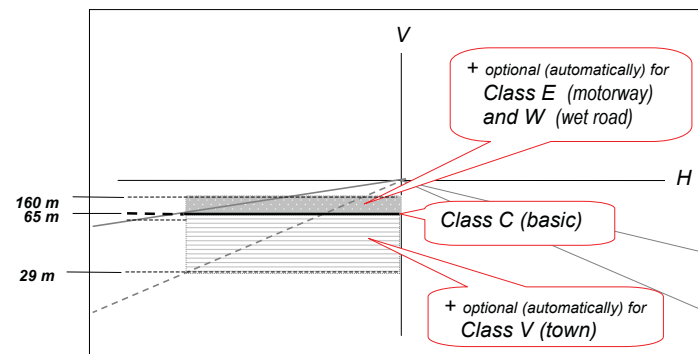
w203017

## Passing Beam Requirements

Annex 3 Table 2.2.



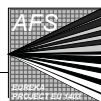
### Optional left side cut-off position



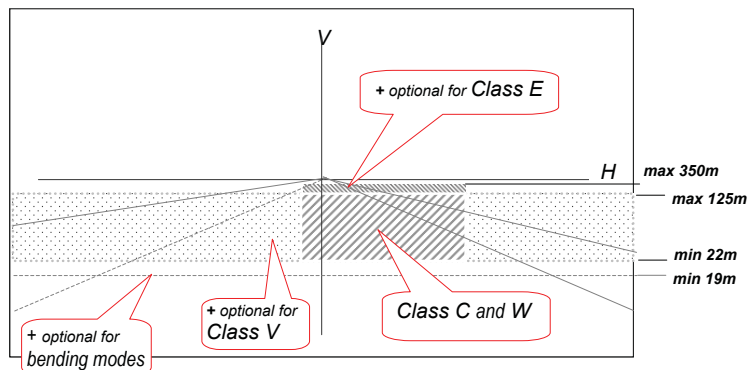
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## Passing Beam Requirements

Annex 3 Table 2.1.



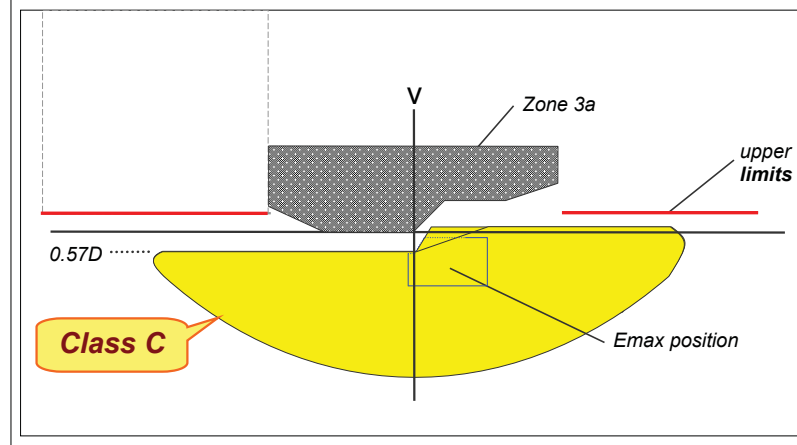
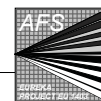
### Optional beam Emax position



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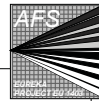
## Class C (basic) Passing Beam

The Beam Pattern, Schematically on Screen



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## Class C (basic) Passing Beam The Automatic Activation



**When the passing beam is switched on:**

**The class C (basic) passing beam:**

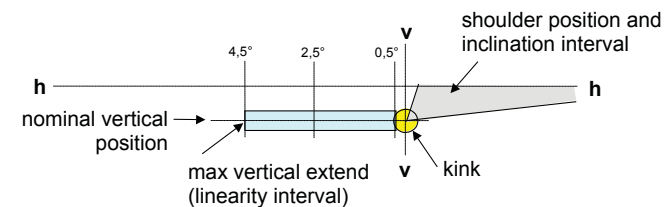
- ▶ **must be emitted**
  - when none of the signals (E-, V-, W-) is present
  - in case of adjustment of the system or parts of (means required)
- ▶ **may be emitted**
  - at any time,
  - in case of failure of any other passing beam mode
- ▶ **is allowed be modified** within the range of requirements and according to the system description, due to the presence of the T-signal and /or any additional specified signal (e.g. indicating that a certain speed threshold is exceeded)

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## Passing Beam Provisions Cut-Off Definitions (2)

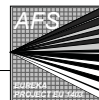


### "Cut-Off" Adjustment

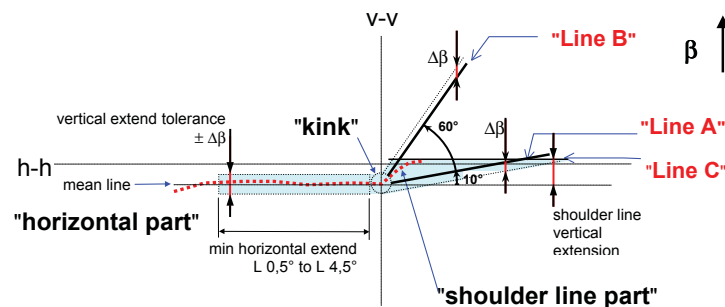


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## Passing Beam Provisions Cut-Off Definitions (1)



### Shape of the "cut-off" line



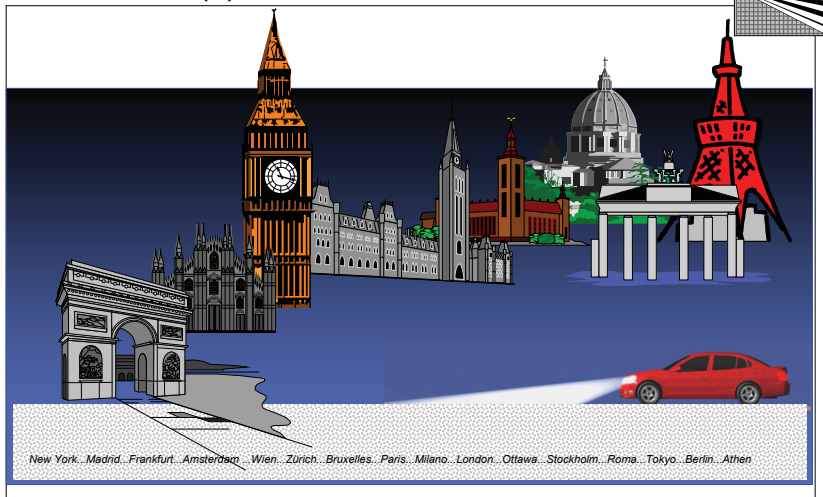
w203022

## 3.2 The Class V (Town) Passing Beam



## Class V (town) Passing Beam

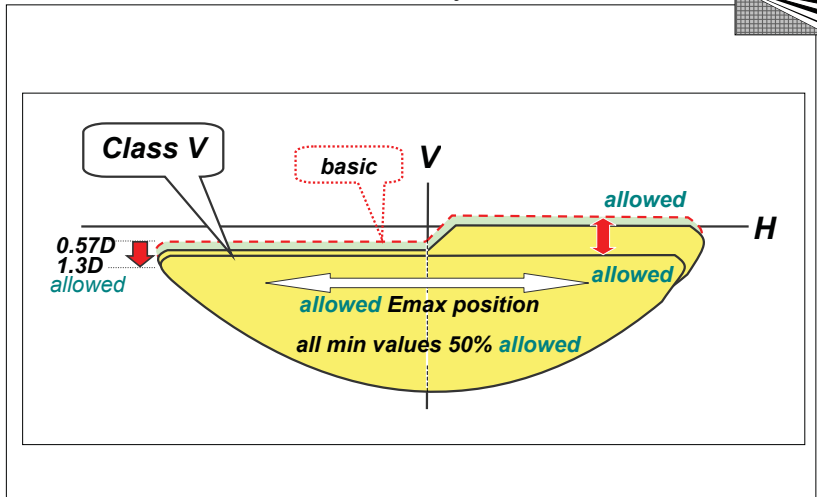
### The Situation (1)



w203025

## Class V (town) Passing Beam

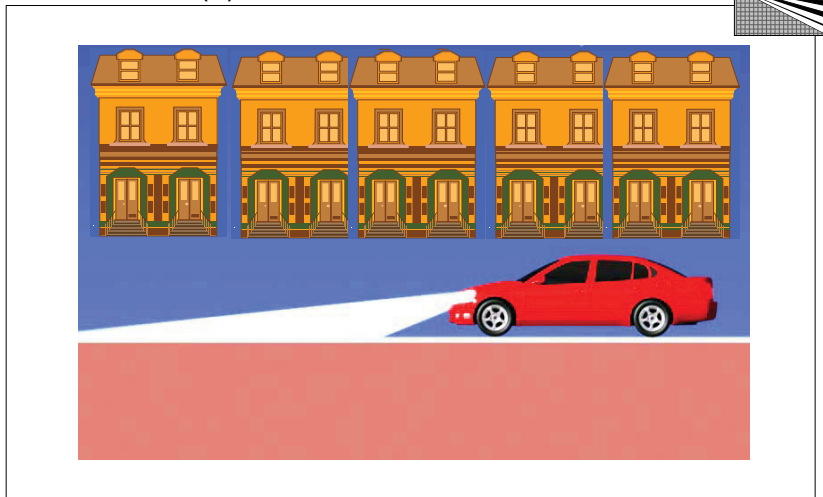
### The Beam Pattern, Schematically on Screen



w203027

## Class V (town) Passing Beam

### The Situation (2)



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## Class V (town) Passing Beam

### The Automatic Activation

#### When the passing beam is switched on:

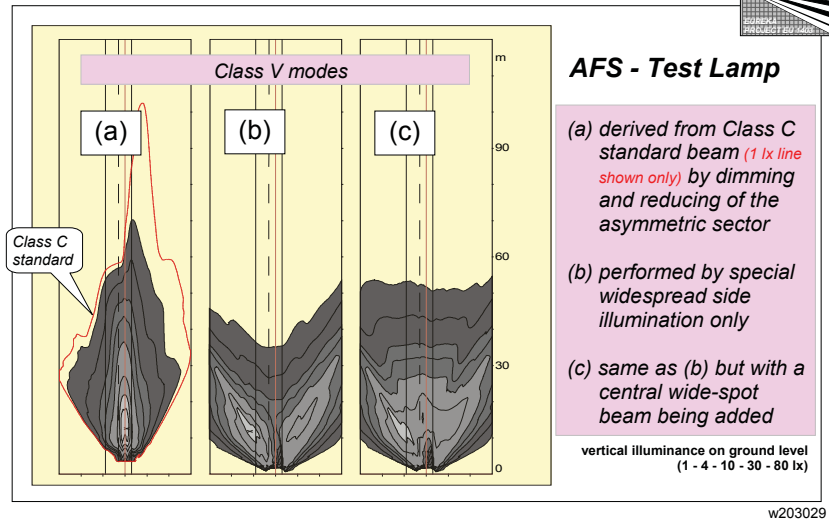
**The class V (town) passing beam may be emitted if the vehicle generates the "V- signal".**

**This is allowed to be generated only:**  
**if the vehicle's speed does not exceed 60 km/h;**  
*notwithstanding the smart application of any light sensors, camera devices, localization sensors, telemetry systems, or others;*

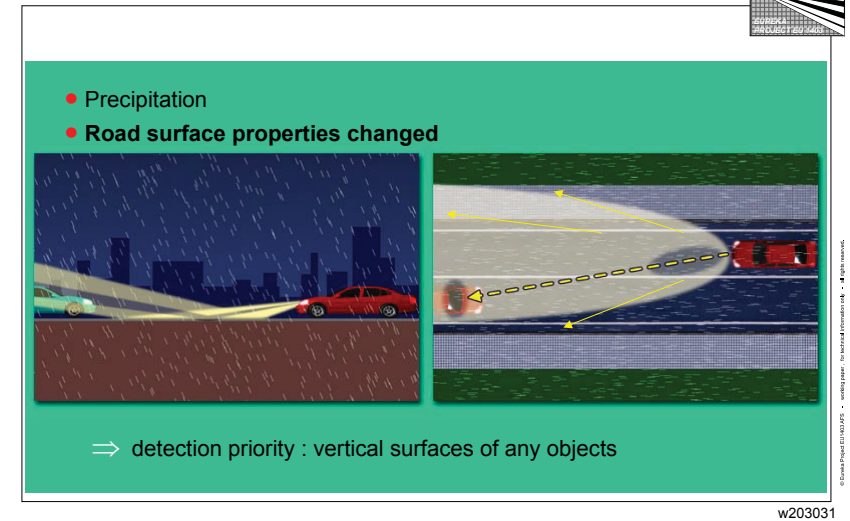
**it is not allowed to be generated at >60km/h**  
*the car's lighting - even if not needed - has the priority for redundancy reasons*

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## AFS Passing Beams (Examples) Bird's Eye View Comparison

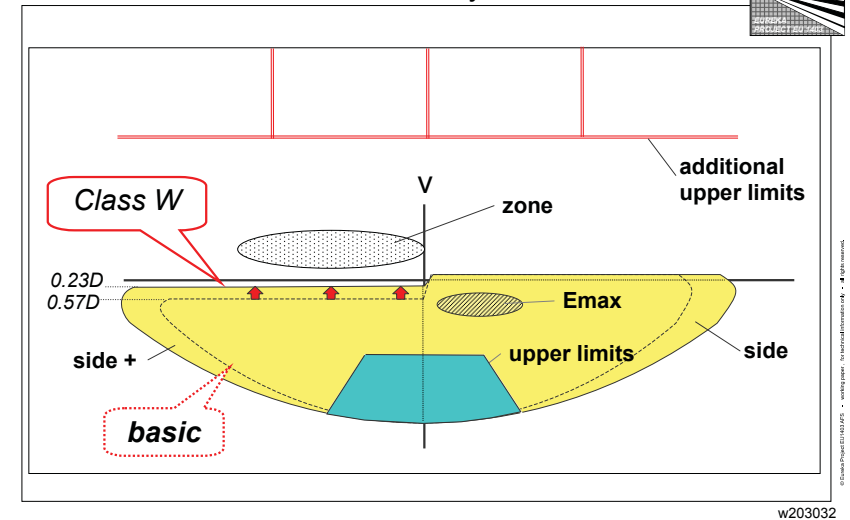


## Class W (wet road) Passing Beam The Situation



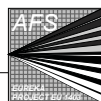
## 3.3 The Class W (Wet Road) Passing Beam

## Class W (wet road) Passing Beam The Beam Pattern, Schematically on Screen





## Class W (wet road) Passing Beam The Automatic Activation



### When the passing beam is switched on:

The class W (wet-road) passing beam may be emitted, if the vehicle generates the "W-signal".

This is allowed to be generated only:

#### a) in general

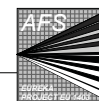
- if wet road and/or rain or snowfall is detected and
- the front fog lamp (if any) is not switched on

#### b) especially

- windshield wiper has operated for  $\geq 2$  min, and/or
- road wetness is automatically detected by any special means

w203033

## Class W (wet road) Passing Beam Functionality – Requirements on the 25m Screen

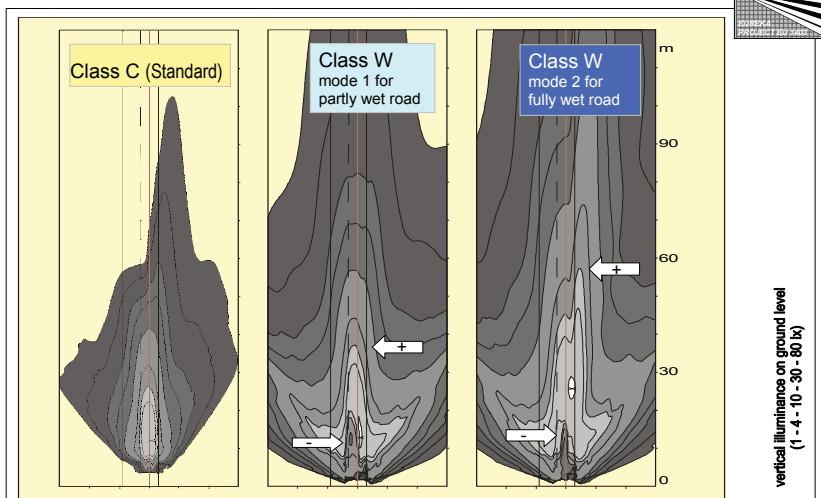
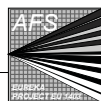


### Passing beam requirements comparison

<u>lx @25m</u>	Class W	grade 2 fully wet road	grade 1 partly wet road	Class C any type of road
<b>E<sub>max</sub></b> (fixed position area, including 50R and 75R)		$\leq 100$	$\leq 80$	$\leq 50$
foreground <b>segment D</b> (10m)		$\leq 4$	$\leq 8$ lx	$\leq 18$
<b>segment C</b> (20m)		$\leq 10$	$\leq 20$ lx	(no req.)
road curb minimum illumination <b>25RR/LL</b>		$\geq 4$	$\geq 4$	$\geq 1,4$
direct illuminance values <b>B50L, BR, BRR</b>		$\leq 0,7..5$	$\leq 0,7..5$	$\leq 0,4..2$

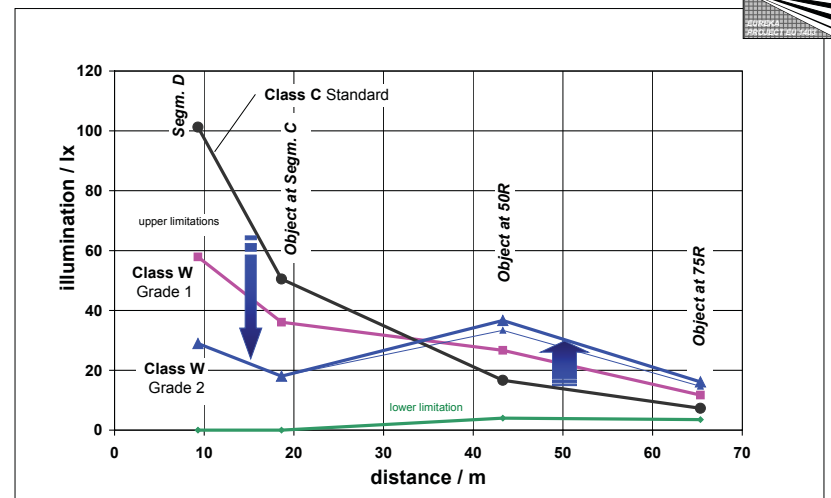
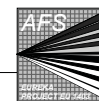
w203035

## AFS Passing Beams (Examples) Bird's Eye View Comparison



w203034

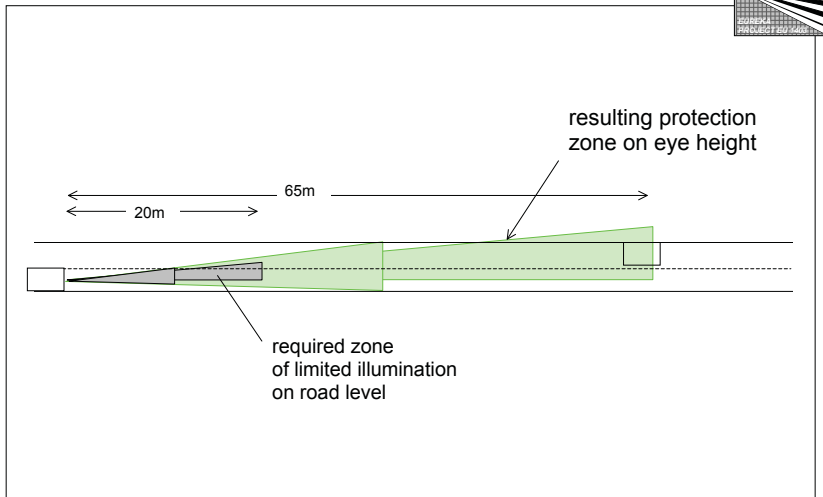
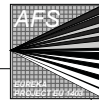
## Class W (wet road) Passing Beam Functionality - Illumination of Objects on the Road



w203036

## Class W (wet road) Passing Beam

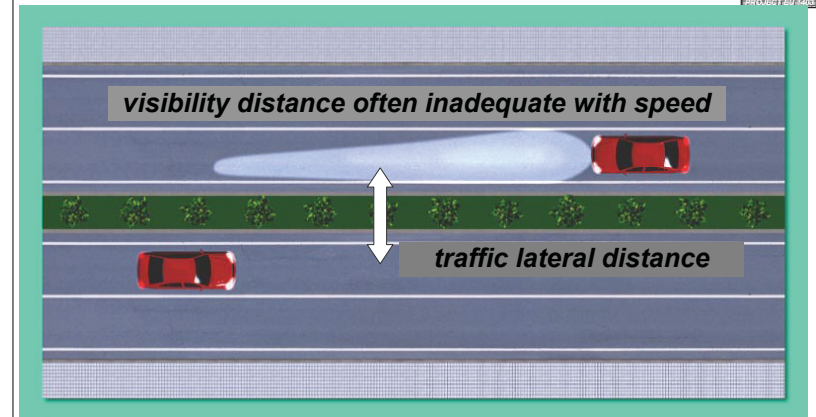
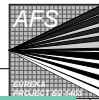
### Functionality – Reflex Glare Reduction Zone



w203037

## Class E (motorway) Passing Beam

### The Situation



w203039

## 3.4 The Class E (Motorway) Passing Beam

## Class E (motorway) Passing Beam

### The Situation - Background



#### 1968 Agreement

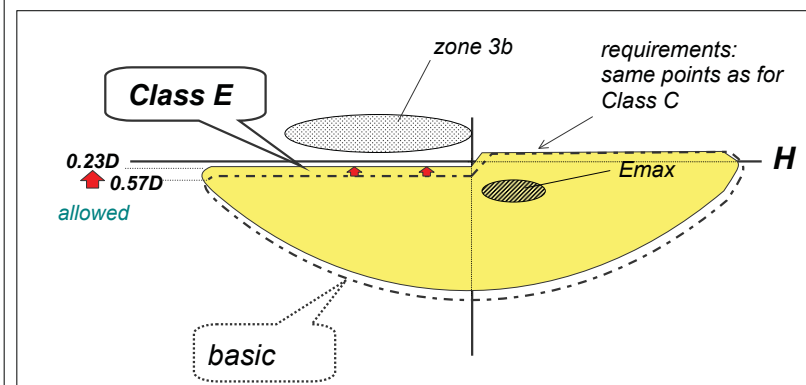
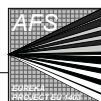
#### Definition of a Motorway:

- (j) "Motorway" means a road specially designed and built for motor traffic, which does not serve properties bordering on it, and which:
  - (i) Is provided, except at special points or temporarily, with separate carriageways for the two directions of traffic, separated from each other either by a dividing strip not intended for traffic or, exceptionally, by other means;
  - (ii) Does not cross at level with any road, railway or tramway track, or footpath; and
  - (iii) Is specially signposted as a motorway.

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## Class E (motorway) Passing Beam

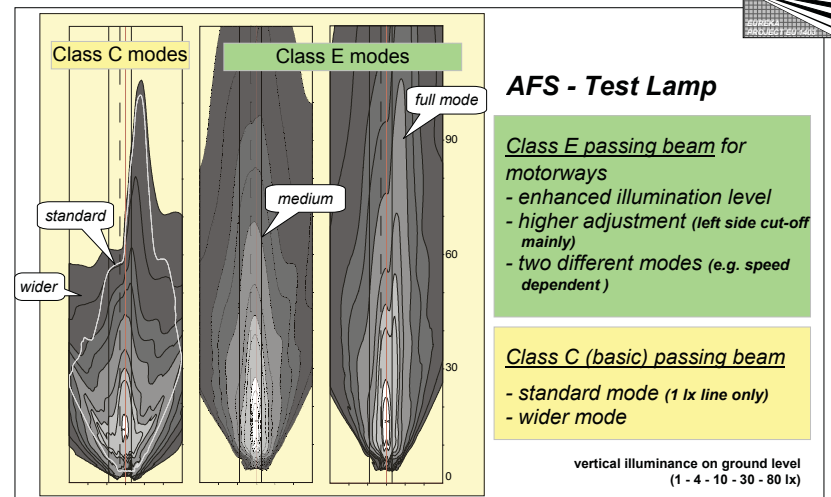
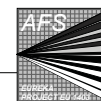
### The Beam Pattern, Schematically on Screen



w203041

## AFS Passing Beams (Examples)

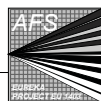
### Bird's Eye View Comparison



w203043

## Class E (motorway) Passing Beam

### The Automatic Activation



#### When the passing beam is switched on:

*The class E (motorway) passing beam may be emitted, if the vehicle generates the "E-signal".*

*This is allowed to be generated only:*

*if the road characteristics correspond to motorway conditions;*

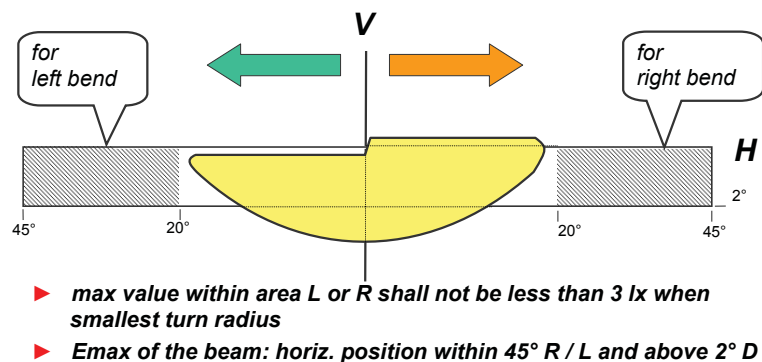
*it is not allowed to be generated if the vehicle speed is less than 60km/h*

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## 3.5 The Passing Beam Bending Modes

## Passing Beam Bending Modes Additional Photometric Provisions

### Bending Modes (on Screen, schematically)

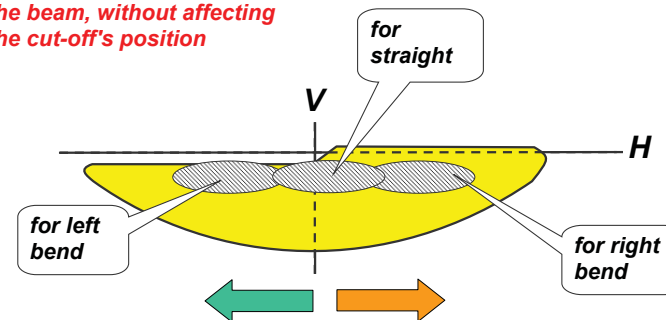


w203045

## Passing Beam Bending Modes Categories Definition

### Bending Modes <Category 2> (on Screen, schematically)

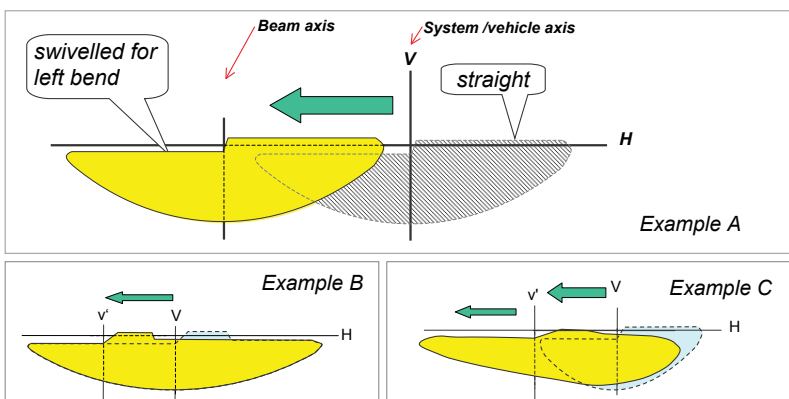
*moved or added parts of the beam, without affecting the cut-off's position*



w203047

## Passing Beam Bending Modes Categories Definition

### Bending Modes <Category 1> (on Screen, schematically)



w203046

## Passing Beam Bending Modes The Automatic Activation

### *When the passing beam is switched on:*

*The bending mode of a passing beam may be emitted if the vehicle generates the "T- signal".*

*This is allowed to be generated only:*

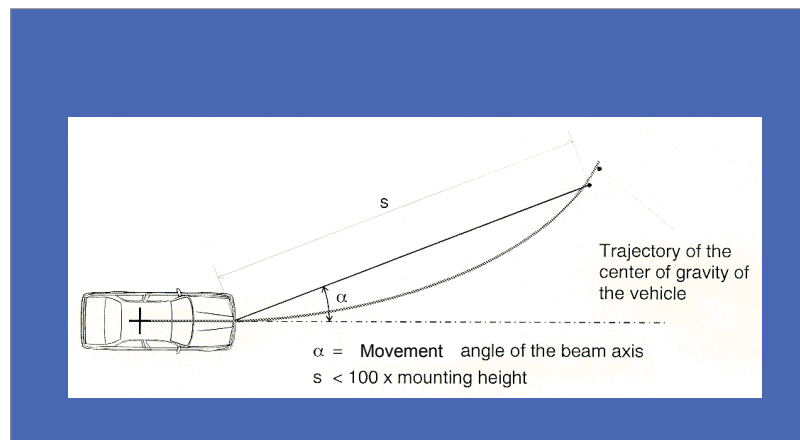
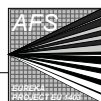
*in / for curves or during / for cornering at intersections.*

*In Addition:*

- the activation of additional unit(s) is only permitted if the turn radius is 500 m or less
- the activation of a category 1 bending mode is only permitted during forward motion of the vehicle except for turn to the side of traffic direction and S shall not exceed  $100 \times h$  (for the definitions see the following figure)

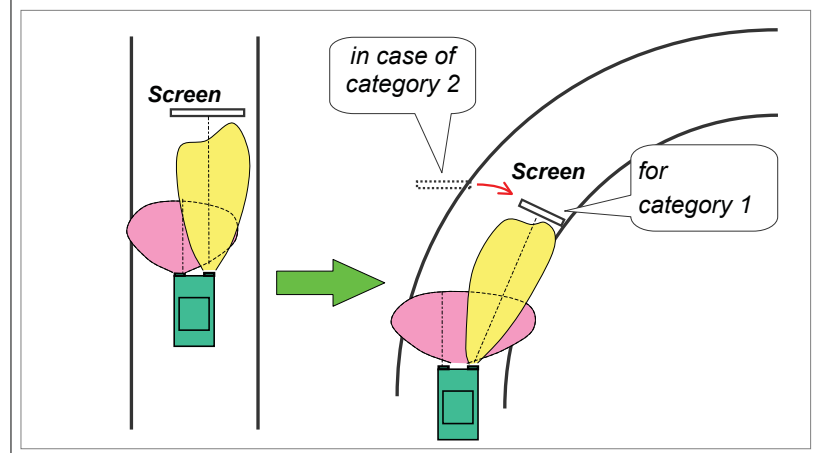
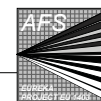
w203048

## Passing Beam Bending Modes The Automatic Activation



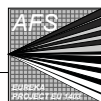
w203049

## Passing Beam Bending Modes Category Dependent Photometry

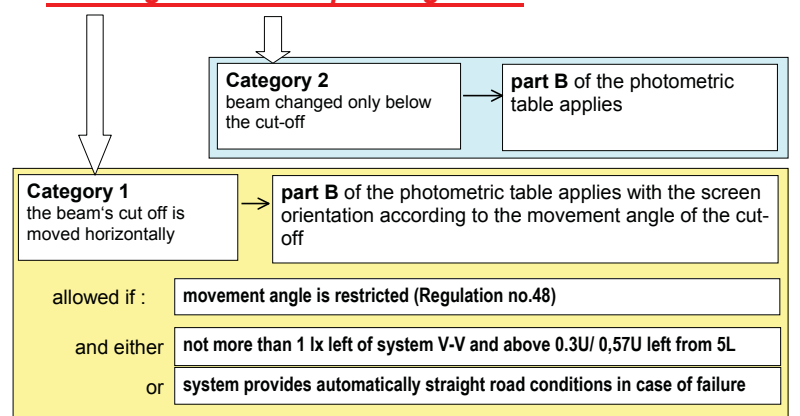


w203051

## Passing Beam Bending Modes Categories, Survey



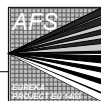
### Bending modes of a passing beam



w203050

## 3.6 The Main Beam and DRL Provisions

## Main Beam New / Changed Items



### New

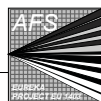
- ▶ *number of lighting units per side not restricted*
- ▶ *swivelling of any lighting unit allowed* (test provisions corresponding to those for passing beam categories)
- ▶ *automatic beam modifications allowed* (to specified/ tested)

### unchanged (compared with R.112 / R.98)

- *photometry provisions* (however system based instead for individual lamps)
- *reference figures system and relevant limitations*
- *time conditions* (as R.98)
- *activation of the main beam* (switching on /off)

w203053

## Daytime Running Light (DRL) New / Changed Items



### New

- ▶ *more than one lighting unit per side allowed* (each of them must comply)
- ▶ *photometry maximum requirements combined with that of a basic passing beam*
- ▶ *automatic beam modifications allowed, including swivelling*

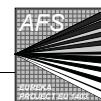
### unchanged (compared with R.87)

- *photometry minimum requirements*
- *the activation of the DRL* (switching on/off)

w203054

## 4 The Appearance

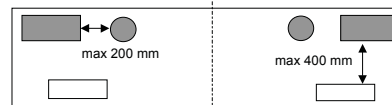
### The Appearance Installation Provisions (1)



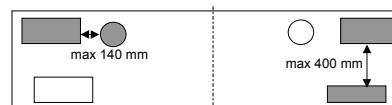
*Vehicle's front view, illuminating surfaces, schematically*



*two symmetrically placed lighting units*



*more than two symmetrically placed lighting units, if intended to be used symmetrically*

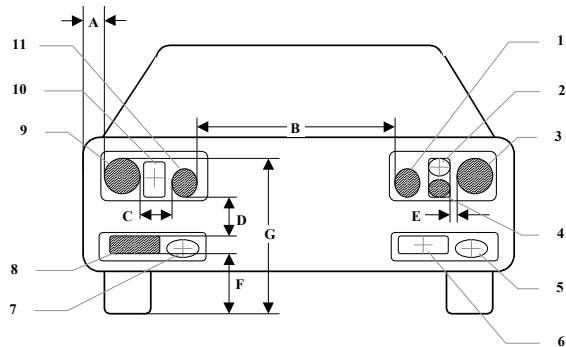
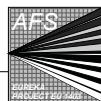


*more than two symmetrically placed lighting units, if intended to be lit in an asymmetrical configuration*

w203056



## The Appearance Installation Provisions (2)



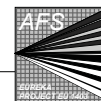
### Dimensions in mm:

**A = 400**  
**B = 600 (400)**  
**C = 200**  
**E = 140**  
**D = 400**  
**F = 250**  
**G = 1500**

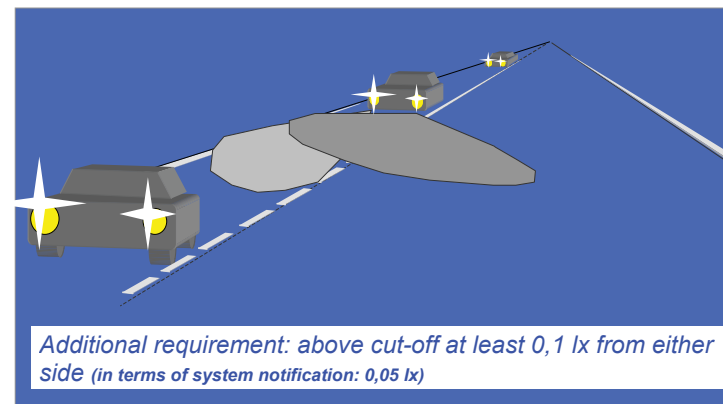
*Simultaneously energized for a given lighting function:*  
*two symmetrically placed lighting units No. 3 and 9*  
*two additional lighting units No. 4 and 8*  
*two additional symmetrically placed units No. 1 and 11*

w203057

## The Appearance The Right-Left Symmetry

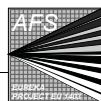


### *Oncoming vehicle, drivers view (schematically)*

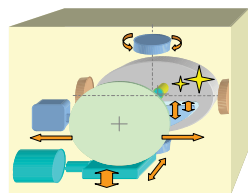


w203059

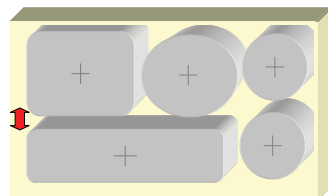
## The Appearance Adaptability – Necessary Means



### **A** *Variable Lighting Unit*



### **B** *Multiple Lighting Units*



**C**

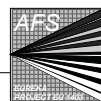
any combination  
of A and B

w203058

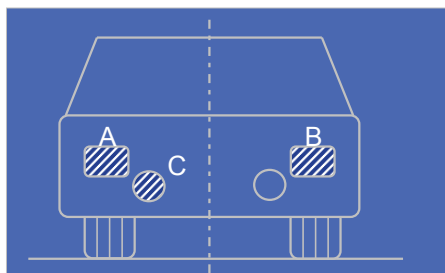
## 5 The Photometry

## Photometry

### Individual Contributions by the Lighting Units



#### Photometric requirements per vehicle



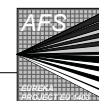
Lighting units may be differently "specialized" each to perform an individual lighting task producing in total one common illumination of the road

$\frac{1}{2}$  [ Measured illumination values A + B + C ]

w203061

## Photometry

### Different Light Sources



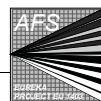
#### Measurements and conversion of results

Light source	Operation of the lighting unit	Factor
replaceable, accord. R37	with étalon light source at standard luminous flux	1
Any other	with its own light source and supply / operating device (if any) at vehicle voltage (13,5 V for 12 V system, e.g.)	0,7

w203063

## Photometry

### Light Sources Provisions



Light source	A Mechanical status		B Power control status		
	being exchangeable	being part of a 'light source module'	voltage from the vehicle's electrical system	specified separately	
			-directly-	-proportional-	-by a 'supply and operating device'-
R.37	Standard	<input checked="" type="checkbox"/>	Basis	<input checked="" type="checkbox"/> *	<input checked="" type="checkbox"/> *
R.99		<input checked="" type="checkbox"/>	--	--	<input checked="" type="checkbox"/> *
not being type approved**	not allowed	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> *	<input checked="" type="checkbox"/> *	<input checked="" type="checkbox"/> *

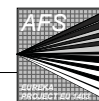
\*\* requirements corresponding to R.99 and relevant information, identification, marking, etc.

\* to be measured @13,5V (e.g., in the case of a 12 V system)

w203062

## Photometry

### Non-Approved Light Sources

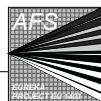


#### Supplementary Provisions

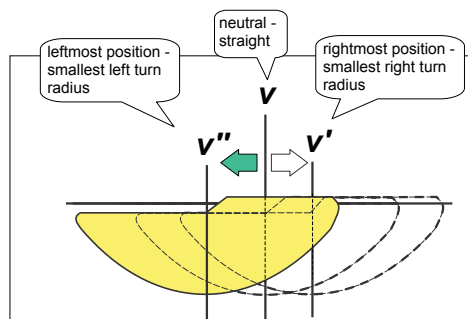
- ▶ Non-replaceable / as part of a light source module, only
- ▶ Annex 8: additional requirements and test specifications
  - ⇒ bulb and fixation performance
  - ⇒ dimensions and positioning compliance / data sheet
  - ⇒ starting, run-up and hot-restrike (from R.99)
  - ⇒ minimum red content (from R.99)
  - ⇒ UV-radiation Test etc. (from R.99)

w203064

## Photometry Bending Modes Testing



### Test positions

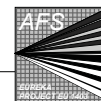


- ▶ extreme positions
- ▶ visual check and decision about tests in intermediate positions

- ▶ in case of category 1 or main beam: horizontal re-aim by means of the goniometer before testing

w203065

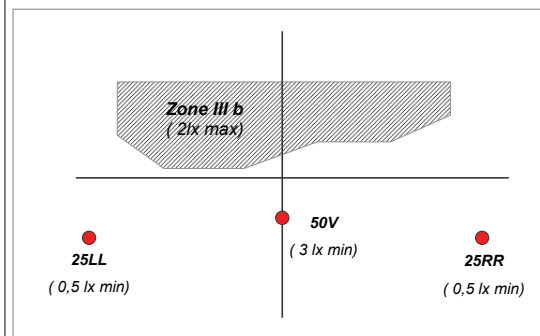
## Safety Provisions Fail Safe Requirements



In case of failure:

### (1) General provisions

- ▶ tell tale operation
- ▶ illumination values ..



..to be obtained automatically

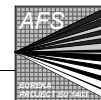
(a) by means within the AFS and/or

(b) by means of a substitute lighting function

w203067

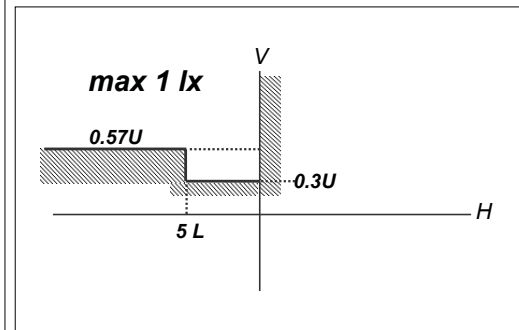
## 6 The Safety Provisions

## Safety Provisions Fail Safe Requirements



In case of failure:

### (2) Additional provisions for category 1 bending modes



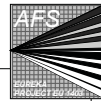
either  
(a) being so designed that in no case 1 lx is exceeded above the line 0,3°/ 0,57° (see graph)

or/ and  
(b) to obtain automatically a non-bending mode

w203068

## Safety Provisions

### Cleaning and Levelling (1)



#### Automatic levelling and cleaning requirements

**The use of lighting units providing a cut-off which projects into the area of 8 L to 8 R and above 0,9 D is confined to vehicles that provide headlamp cleaner and automatic headlamp levelling devices, if:**

from all such lighting units on a side of the vehicle

**(a) the combined objective luminous flux exceeds 2000 lm and**

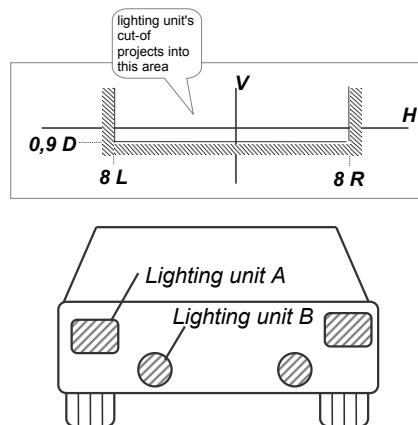
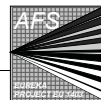
**(b) the combined light output in terms of luminous flux within its isolux of 0,5 lx exceeds 650 lm**

**To be indicated in the type approval documents**

w203069

## Safety Provisions

### Cleaning and Levelling (2)



#### Example

##### ► Design values [lighting units A + B]

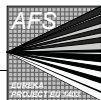
**if the sum exceeds 2000 lm light sources objective luminous flux and 650 lm units output**

**then devices for cleaning and automatic levelling for these lighting units required**

w203070

## 7 Documentation & Approval

### Application for Approval Documentation



#### Additional documentation

##### ► Description of the system

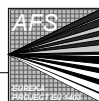
- lighting functions provided
  - modes of these lighting functions
  - the lighting units providing each of them
- control signals relevant to each mode
- the passing beam classes being provided
- cut-off characteristics
- adjustment means and specific procedures, if any

##### ► Safety concept

w203072

## Application for Approval

### Interrelation to Other Lighting Functions



## AFS requirements in case of..

***..lamps providing separate functions  
being grouped, combined or  
reciprocally incorporated to an AFS***

R.07 Front Position Lamp  
R.19 Front Fog Lamp\*\*\*  
R.87 Daytime Running Lamp  
R.98 Driving Beam  
R.112 Driving Beam

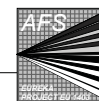
- ▶ **To be indicated in the Application, including details of intended use as functional substitution, if any**
- ▶ **AFS designed operation must not impair the lamp's compliance**
- ▶ **Contribution to AFS (to be specified) only if not used in its separate 'original' function**

\*\*\* Front fog lamp subjected to adjustment prescriptions in that case

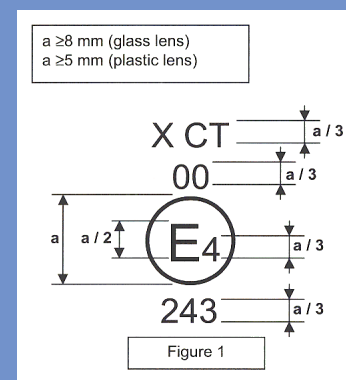
w203073

## Application for Approval

### Marking of the System and the Installation Units

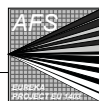


<i>Passing beam (class, mode)</i>	<i>Marking</i>
<b><i>AFS</i></b>	<b>X</b>
<b><i>Class C (basic)</i></b>	<b>C</b>
<b><i>Class V (town)</i></b>	<b>V</b>
<b><i>Class E (motorway)</i></b>	<b>E</b>
<b><i>Class W (wet road)</i></b>	<b>W</b>
<b><i>Bend modes</i></b>	<b>...«T</b>



w203075

## Application for Approval Specific Forms



**AFS Specification (5) Lighting functions, classes of passing beams / modes and the lighting units designed to provide it**

Front lighting functions	CLASS / MODE	FUNCTIONS TO BE PROVIDED BY THE LIGHTING UNIT (1)									
		DRIVING BEAM	DRIVING BEAM	DRIVING BEAM	DRIVING BEAM	DRIVING BEAM	DRIVING BEAM	DRIVING BEAM	DRIVING BEAM	DRIVING BEAM	DRIVING BEAM
1) Driving beam	1) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	2) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
3) Driving beam	3) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	4) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
4) Driving beam	4) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	5) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
5) Driving beam	5) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	6) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
6) Driving beam	6) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	7) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
7) Driving beam	7) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	8) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
8) Driving beam	8) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	9) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
9) Driving beam	9) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	10) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
10) Driving beam	10) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	11) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
11) Driving beam	11) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	12) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
12) Driving beam	12) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	13) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
13) Driving beam	13) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	14) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
14) Driving beam	14) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	15) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
15) Driving beam	15) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	16) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
16) Driving beam	16) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	17) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
17) Driving beam	17) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	18) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
18) Driving beam	18) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	19) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
19) Driving beam	19) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	20) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
20) Driving beam	20) (DRIVE)	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE	DRIVE
	21) (DRIVE)	DRIVE									

w203074