

2022327-QUA/LTL 02-147/a

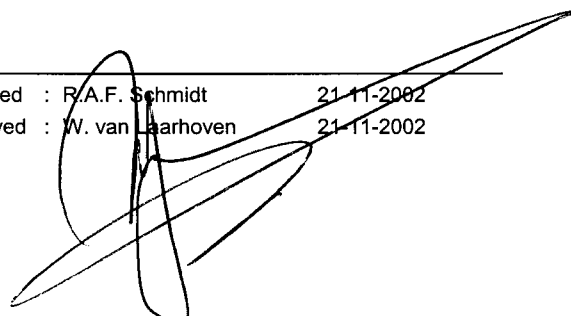
**Testing of traffic lights with LED's
GELcore types DR4-RTFB-51C,
DR4-YTFB-51C and DR4-GTFB-51C
according to EN12368**

Arnhem, 21 November 2002

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By order of GELcore Company Lachine, Canada

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SUMMARY

A three aspect traffic signal light with LED light sources and a lens diameter of 200 mm was tested and evaluated according to EN 12368 (January 2000).

The traffic light passed all the constructional, environmental and photometric tests of EN12368 with the following results:

- Impact test class IR3
- Random vibration test
- Ingress class IP55
- Temperature range tests class B
- Luminous intensity performance level A1/1, A1/2, A2/1 and A 2/2
- Luminous intensity distributions types "W", "M" and "N"
- Luminance uniformity
- Phantom signal class 3
- Signal and combined colour

A detailed overview of the results can be found in annex 2 of this report.

This report replaces report 2022327-QUA/LTL 02-147 d.d. 27-09-2002, that hereby has been withdrawn. A correction has been made in the number of the standard for electrical safety and EMC requirements as referenced on page 5 of this report.

1 Application for EN12368 testing

On 22 July 2002, GELcore Company in Canada sent in a 200 mm three aspect traffic signal light, consisting of three LED signal lights and a three aspect housing. The three aspect housing is marked Vialis type FD 214.

The three tested signal lights were marked:

GELcore DR4-RTFB-51C, ser. no. 462683, 8.0 Watts and 230.0 Volts

GELcore DR4-YTFB-51C, ser. no. 462685, 11.0 Watts and 230.0 Volts.

GELcore DR4-GTFB-51C, ser. no. 462687, 7.0 Watts and 230.0 Volts

The applicant desired an examination to check whether this type of traffic light is in compliance with the requirements of EN 12368 (January 2000).

The signal lights are constructed with LED-light sources combined with coloured lenses. The technical description and drawings of the LED signal lights are shown in annex 1.

2 Examination

All constructional and environmental tests of section 7 of EN12368 were performed on the Vialis three aspect housing with the three signal lights built in. According to section 11.2 of EN12368 these tests were performed prior to all optical tests. The following constructional and environmental tests were performed:

- Impact resistance test (EN12368 table 9, Class IR3)
- Constructional integrity test or vibration test (EN12368 table 10)
- Ingress test consisting of a water penetration and dust test (EN12368 table 11, IP55)
- Temperature range test (Table 12, Class B) consisting of:
 - Change of temperature test
 - Damp heat, cyclic test
 - Solar radiation test

During the environmental tests the traffic light cycled through each of the optical units at one minute intervals, except for the temperature range test where the red unit was permanently on during the hot period and during the cold period all units were extinguished as is required by section 11.1 of EN12368. Also during the impact test all units were extinguished.

The vibration test was subcontracted to Thales Nederland BV at Hengelo, the Netherlands. The solar radiation test was subcontracted to Atlas SFTS BV at Lochem, the Netherlands.

Section 5.2 of EN12368 concerning the electrical safety and EMC requirements was considered as “not applicable”, because this section refers to standard prEN 50278:1997 and no specific requirements on electrical safety (section 6.5 of prEN 50278:1997) and EMC (section 6.8 of prEN 50278:1997) are mentioned in this standard.

For the photometric measurements the traffic lights are positioned on an Optronik goniometer, which is a “type 1” goniometer as required by EN 12368.

In order to measure the luminous intensities, a photocurrentmeter was used (trademark LMT, type I500, nr.0379081), with a detector (nr. 087909) which is very fine corrected for the eye sensitivity curve $v(\lambda)$. This instrument has a sufficiently long integration time in order to measure the light intensities of pulse shaped LED light sources. The detector was aligned to the reference axis of the signal light and positioned at a distance of 10 m to the lens of the traffic light.

The signal lights were measured as single units without housing; the power supply was adjusted to the nominal voltage of 230 Volt AC.

All examinations were started after a certain stabilization time (app. 1 hour) of the LED light sources, large enough to obtain a decrease of the luminous intensity during the examination less than 1%.

To determine the luminance uniformity, the minimum and maximum luminances of the lenses were measured with a luminancemeter trademark LMT, type L1003, nr. 029220.

The distance from luminancemeter to the traffic light was adjusted to get a measured area with a diameter of 25 mm on the lens of the traffic light.

In order to measure the phantom luminous intensities a projector was used with an incandescent lamp of 900 W, which was tuned as a “CIE light source A”. The geometry of the projector set-up was according to EN 12368 section 8.4.

The required phantom illuminance of 40000 lux on the lens of the signal light is not feasible. The achieved illuminance with the mentioned projector was approximately 46 lux. The measured phantom luminous intensity can be converted to the value at 40000 lux, as prescribed in EN 12368. During the measurement of the phantom luminous intensities the signal light was turned off.

The colour of the emitted (signal) light and the colour of the phantom light was measured with a spectroradiometer trademark Instrument Systems, type Spectro 320. The colour of the combined signal/phantom light was calculated as prescribed in EN 12368 section 8.6.

3 Results of examination

An overview of the test results is given in the table of annex 2.

Impact test: Pass Class IR3

No cracks or broken parts were visible after the impact test at a height of 1300 mm at roomtemperature and at $-5\text{ }^{\circ}\text{C}$. The signal lights still functioned properly after this test.

Vibration test: Pass

There was no evidence of loose or broken parts, except from some small plastic parts of the plastic housing which do not affect the functioning of the signal lights. The signal lights still functioned properly after this test. Also see the graphics with the test conditions in annex 3.

Water penetration and dust test: Pass IP55

No water or dust penetrated into the signal lights during these tests and the signal lights still functioned properly after this test.

Temperature range test: Pass Class B

The signal lights were visual inspected and no physical problems were detected, the signal lights continued functioning properly during and after these tests. The test conditions of the solar radiation test are shown in annex 4.

The luminous intensity distributions are measured with stabilized light sources.

The results are shown in annex 5:

page 1: luminous intensities of signal lights with 200 mm lenses

page 2: the same luminous intensities converted to a percentage of the luminous intensity measured in the reference axis.

The stabilization behavior of the light sources is shown in annex 6.

For the check of the yellow signal light whether the luminous intensity is in compliance with the requirements of EN 12368 section 6.3, it is not realistic to measure the luminous intensity after a long stabilization period. During operation in practice the yellow light will only be "on" for a short period or during a long period with a certain on/off cycle. For this examination was chosen for a cycle of 1 second on followed by 1 second off. The luminous intensity of the yellow light stabilized at 214 candela. The table of annex 6 also shows the luminous intensities direct after putting the signal lights on. None of the signal lights exceeded the maximal luminous intensity of 400 candela of performance level 1.

Conclusive: The measured luminous intensities in the reference axis are examined and comply with the requirements of EN 12368, table 1: all signal lights comply to the requirements of luminous intensity performance level class 1/1, 1/2, 2/1 and 2/2.

In annex 7, page 1 – 3, the luminous intensity distributions are compared with the requirements of NEN-EN 12368 table 3 – 5. All signal lights comply with the requirements for type “M” , type “W” and type “N” traffic lights.

The luminance uniformity is calculated from the measured minimum and maximum luminances of the lenses. The requirements according to EN 12368 section 6.5 are:
 $L_{min} : L_{max} \geq 1 : 10$ for distributions of luminance intensities of the types E, W and M.
 $L_{min} : L_{max} \geq 1 : 15$ for distributions of luminance intensities of the type N.

The results are:

		L_{min} (cd/m ²)	L_{max} (cd/m ²)	$L_{min} : L_{max}$
200 mm	Red	0.550×10^4	0.235×10^5	1 : 4.3
	Yellow	0.290×10^4	0.115×10^5	1 : 4.0
	Green	0.380×10^4	0.215×10^5	1 : 5.7

From these results it was found that all signal lights comply with the uniformity requirements of the luminous intensity distributions of the types M, W and N.

The phantom luminous intensities of the lenses were measured for all signal lights. Only the lenses of the signal lights were illuminated by the incident light. The front reflection of the phantom light projector on the lenses was not covered with a mask because this reflection was not in the direction of the detector. The luminous intensities, measured with an illuminance of 46 lux, are converted to an illuminance of 40000 lux according to EN 12368.

The results are:

		$I_{measured}$ (cd) at 46 lux	$I_{phantom}$ (cd) at 40000 lux
200 mm	Red	0.045	39.5
	Yellow	0.060	52.7
	Green	0.040	34.8

The ratio $I_{\text{signal}} / I_{\text{phantom}}$ was calculated from the measured, stabilized signal luminous intensities in the reference axis of the signal lights. These values are shown in the table of annex 6. For the yellow signal light the stabilized luminous intensity was measured after a stabilization period with a 1 sec. "on" / 1 sec. "off" cycle.

200 mm red : $I_s = 297$ cd and $I_s / I_{ph} = 7.5$

200 mm yellow : $I_s = 214$ cd and $I_s / I_{ph} = 4.1$

200 mm green : $I_s = 278$ cd and $I_s / I_{ph} = 8.0$

From these calculated ratios it can be concluded that all signal lights comply with class 3 according to EN 12368.

The colorimetry was performed according to EN 12368 section 8.5 and 8.6.

These colours of the phantom light from the signal lights were measured with an incident illuminance of 46 lux instead of 40000 lux. The chromaticity coordinates of the combined light (signal + phantom light at 40000 lux) were therefore calculated with the formula according to EN 12368 section 8.6.

The chromaticity coordinates of the signal lights; phantom light from the signal lights and combined colours are listed below:

Colour	Signal colour coordinates		Phantom colour coordinates		Combined colour coordinates	
	x	y	x	y	x	y
Red	0.703	0.296	0.619	0.351	0.695	0.302
Yellow	0.579	0.418	0.606	0.372	0.585	0.408
Green	0.095	0.570	0.323	0.449	0.127	0.553

These chromaticity coordinates are also drawn in the CIE chromaticity diagrams of annex 8, and all of them comply with EN 12368, table 7.



NOUVEAU FEUX DE CIRCULATION À DIODES 200 MM ET 300 MM – 230 V

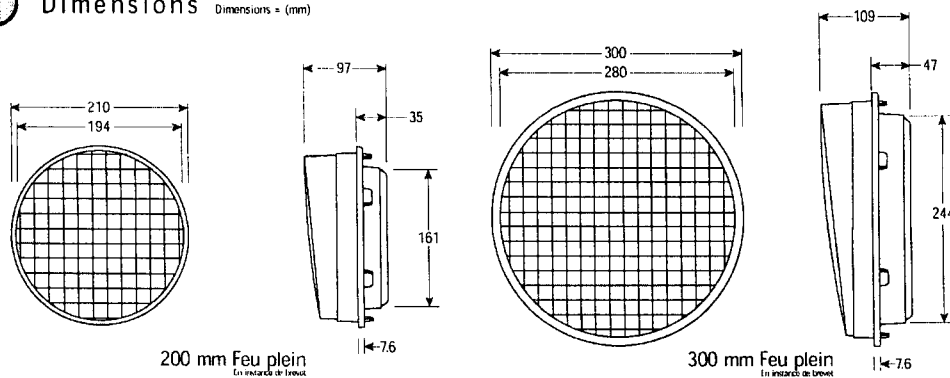
Caractéristiques :

- Faible consommation d'énergie
- Conforme aux normes EN 12368
- Source lumineuse uniforme
- Température de fonctionnement de : -40 °C à +74 °C
- Étanches à la poussière et à l'humidité (IP65)
- Perte de flux lumineux inférieure à 1 % après la défaillance d'une diode
- Module de diodes autonome avec anneau de fixation

Avantages :

- Réduction des coûts d'entretien et de fonctionnement
- Jusqu'à 90 % d'économies d'énergie
 - Durée de vie 10 fois plus longue que celle des systèmes classiques
 - Garantie de 5 ans, pièces et main-d'oeuvre
- Fiabilité et sécurité accrues :
- Visibilité supérieure tout au long de la durée de vie du produit
 - Diminue le remplacement d'urgence des lampes
 - Conception qui réduit au minimum les effets fantômes
- Compatible avec la plupart des boîtiers et contrôleurs

1 Dimensions Dimensions = (mm)



2 Caractéristiques des produits

N° de modèle	Profil	Format	Couleur	Tension	Puissance		Intensité lumineuse		Classe d'effets fantômes
					(W)	Facteur de puissance	liv. de perf.	Classe	
					(maximale)	(minimal)			(minimal)
DR4-RTFB-51C	Feu plein	200 mm	Rouge	230 V	9	.9	2	1	3
DR4-GTFB-51C	Feu plein	200 mm	Jaune	230 V	12	.9	2	1	3
DR4-GTFB-51C	Feu plein	200 mm	Vert	230 V	7	.9	2	1	3
DR6-RTFB-48C	Feu plein	300 mm	Rouge	230 V	15	.9	3	1	3
DR6-GTFB-48C	Feu plein	300 mm	Jaune	230 V	15	.9	3	1	3
DR6-GTFB-48C	Feu plein	300 mm	Vert	230 V	15	.9	3	1	3

* tel que spécifié dans EN12368

Aussi disponible avec des lentilles claires

Condition d'essai : T_a = 25 °C

Les renseignements indiqués peuvent être modifiés sans préavis. Toutes les valeurs sont des valeurs de calcul ou caractéristiques qui ont été mesurées dans des conditions de laboratoire.

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NOUVEAU FEUX DE CIRCULATION À DIODES 200 MM ET 300 MM

3 Normes de performance

Critères	Résultats
Visibilité	EN 12368
CEM	EN 50278
Intempéries	EN 60529 (13, 14) / IP65
Vibration	IEC 60068-2-64
Environnement	Class C

4 Caractéristiques de fonctionnement

Critères	Résultats
Température	-40 °C (-40 °F) à +74 °C (165 °F)
Tension	185 V à 250 V (50-60 Hz c. a.)
Facteur de puissance	>90 %
Distorsion harmonique totale (D.H.T.)	<20 %
Uniformité lumineuse	1:10

5 Limites de chromaticité

	Coordonnée 1		Coordonnée 2		Coordonnée 3		Coordonnée 4	
	CCX	CCY	CCX	CCY	CCX	CCY	CCX	CCY
Rouge	0,660	0,320	0,680	0,320	0,710	0,290	0,690	0,290
Jaune	0,536	0,444	0,547	0,452	0,613	0,387	0,593	0,387
Vert	0,009	0,720	0,284	0,520	0,209	0,400	0,028	0,400

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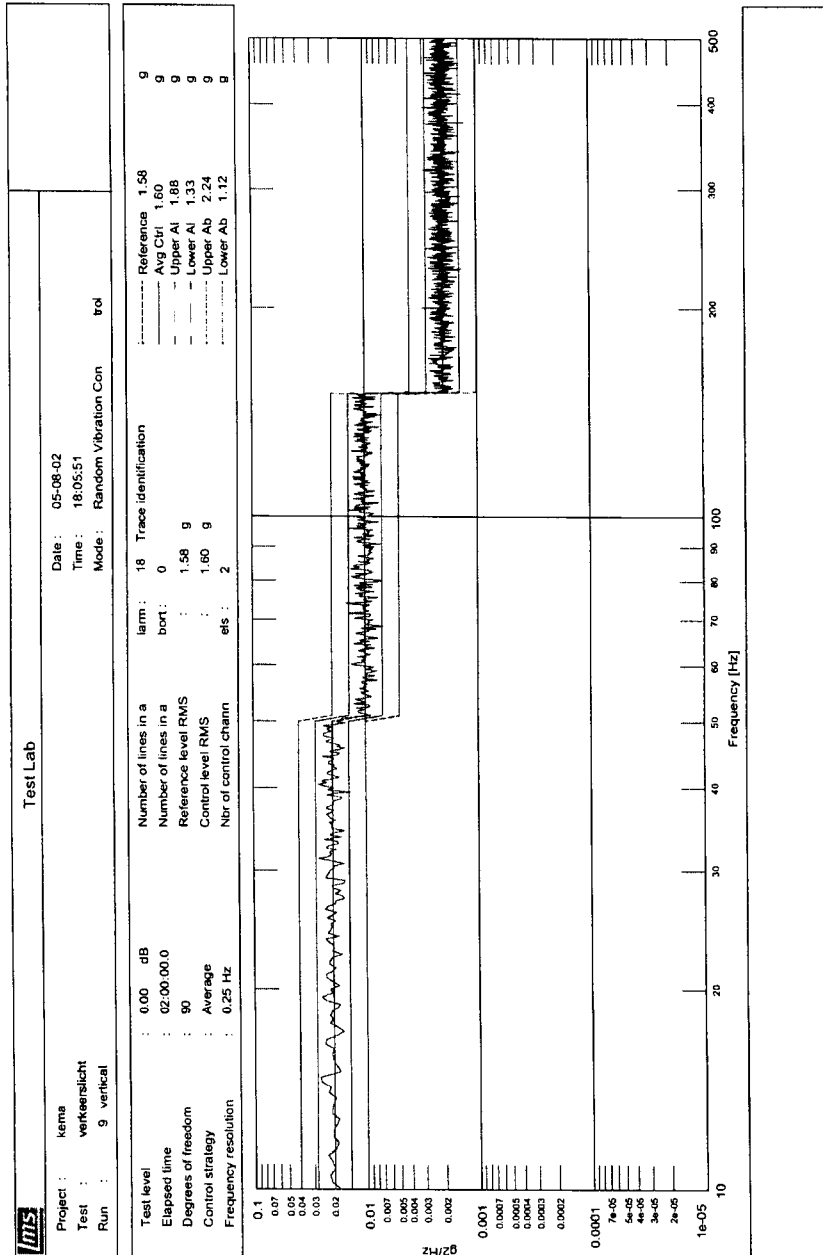
N° de publication : 70874 • R:2/15/02 • GELcore est une entreprise formée par GE Lighting et EMCORE Corporation

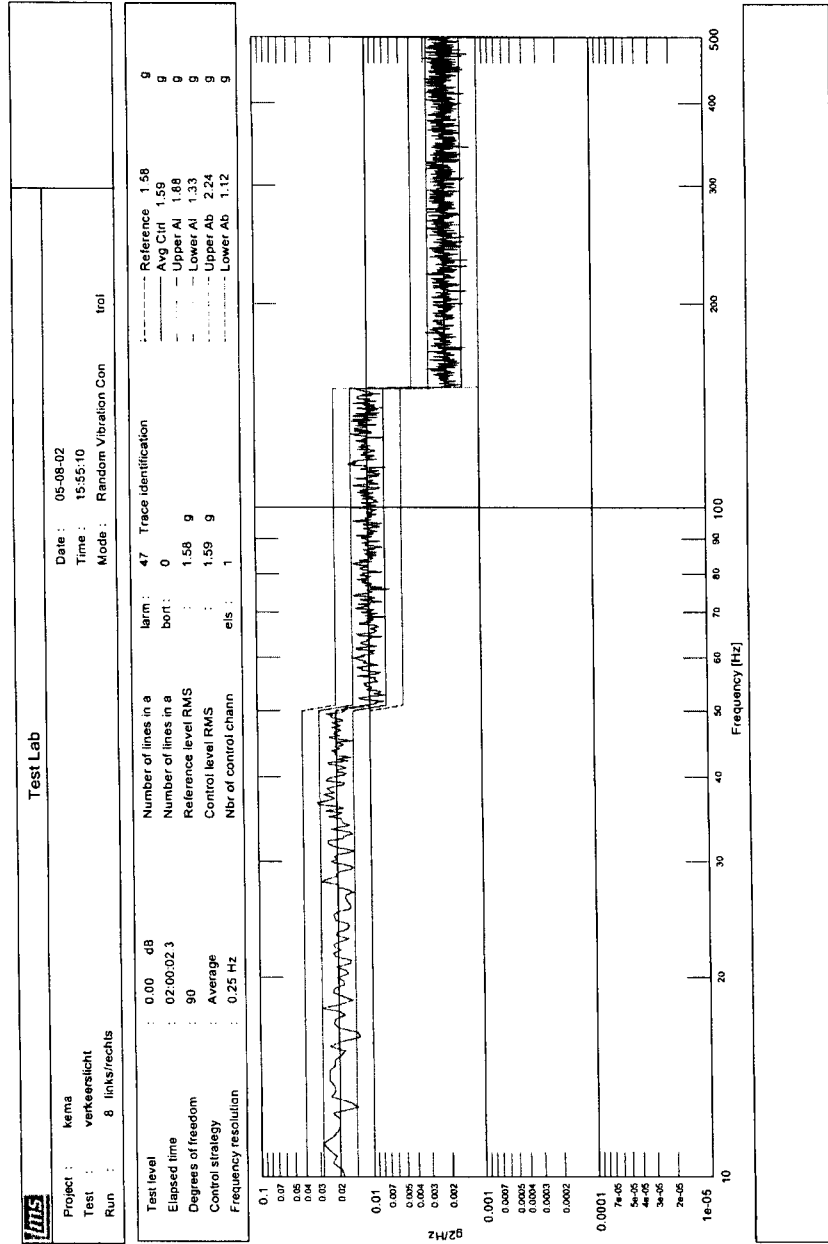
**EN12368 test results of GELcore traffic lights
types DR4-RTFB-51C, DR4-YTFB-51C and DR4-GTFB-51C**

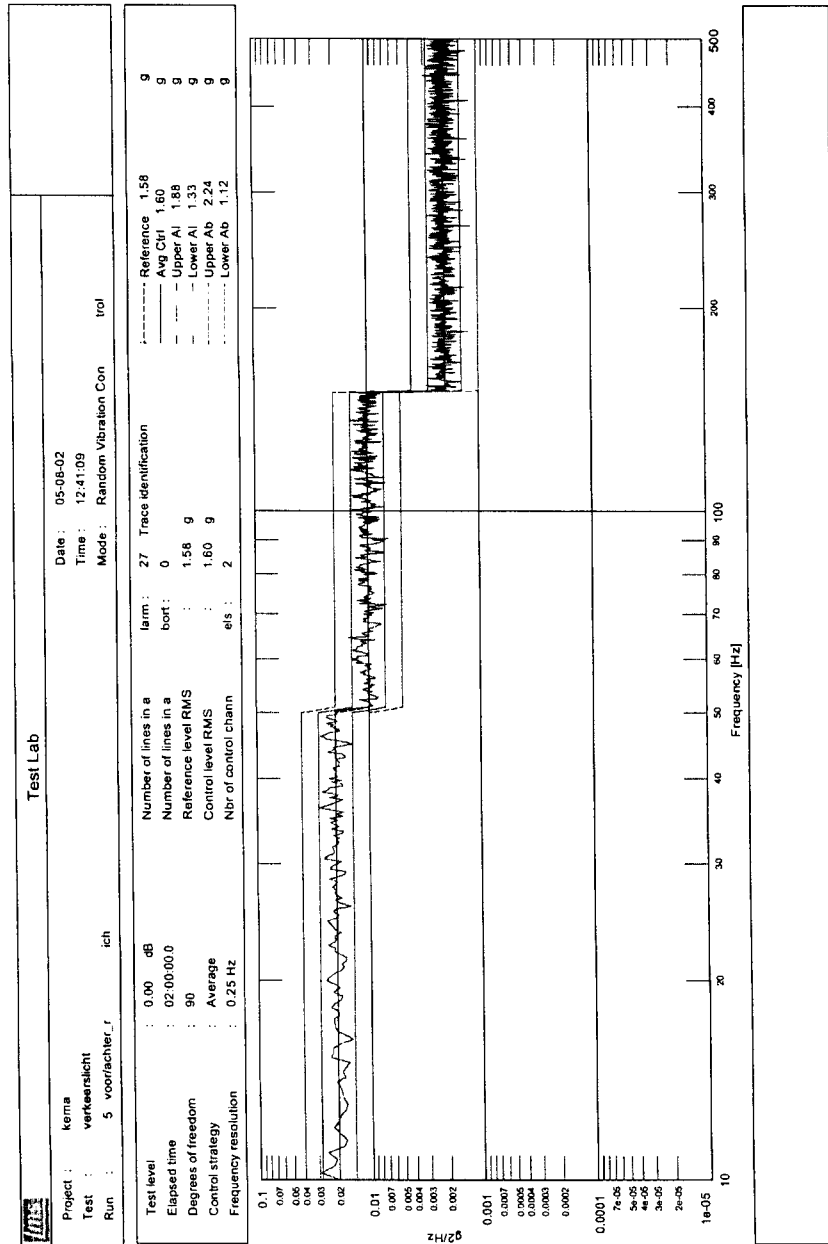
Performance parameter	Tested or declared	Clause	Result
Size: 200 mm 300 mm	tested	6.2	Pass (200 mm)
Impact resistance: Class IR1 Class IR2 Class IR3	tested	table 9	Pass (Class IR3)
Random vibration	tested	table 10	Pass
Ingress: IP55 IP54 IP44 IP34	tested	table 11	Pass (IP55)
Structural (displacement): temporary permanent	not applicable	4.4	--
Temperature range: Class A Class B Class C	tested	table 12	Pass (Class B)
Electrical safety and EMC	not applicable	5.2	--
Luminous Intensity: Performance level 1/1; 1/2 Performance level 2/1; 2/2 Performance level 3/1; 3/2	tested	8.2	Pass (1/1; 1/2; 2/1; 2/2)
Distrib. luminous intensity Type E class B Type W class A/B Type M class A Type N class A/B	tested	8.2	Pass (Types W, M and N class A)
Luminance uniformity: Types E; W and M Type N	tested	8.3	Pass (Types W, M and N)

**EN12368 test results of GELcore traffic lights
types DR4-RTFB-51C, DR4-YTFB-51C and DR4-GTFB-51C (continued)**

Performance parameter	Tested or declared	Clause	Result
Maximum phantom signal ratio: Class 1 Class 2 Class 3 Class 4 Class 5	tested	8.4	Pass (Class 3)
Colour of signal lights: Red Yellow Green	tested	8.5	Pass Pass Pass
Combined colours: Red Yellow Green	tested	8.6	Pass Pass Pass
Signal lights with symbols: Class S1 Class S2	not applicable	6.8	--
Background screens: Class C1: 200 mm / 300 mm Class C2: 200 mm / 300 mm Class C3: 200 mm / 300 mm Class C4: 200 mm / 300 mm	not applicable	6.9	--









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KRQ Afdeling LTL Gebouw H40
Attn.: Mr. G.C. Muda
Utrechtseweg 310
6812 AR Arnhem

Lochem, 19-08-2002

TEST REPORT**Reference:**

Order No. : Your visit of 16-08-2002
Description samples : 1 sample: traffic light
Receipt : sample received 16-18-2002 in good condition
Test method : IEC 68-2-5 Procedure B (1975): Basic environmental testing procedures Part 2: Tests – Test Sa: Simulated solar radiation at ground level.

ATLAS Case No. : 4688
ATLAS Test No. : KEM-49-DIV-193
Test time : 1 cycle (24 hours) (Start 16-08-02; End 17-08-02)

Testconditions:

Test instrument : Solar Climatic 1600
Light source : Metal Halide
Filter system : Outdoor filter
Irradiance : 700 till 1310 W/m² at 300-3000 nm. (see enclosed figure)
Cycle : 20 hours light; 4 hours dark
Dry Bulb Temperature : light: 40 ± 2 °C; dark: 25 ± 2 °C
Relative humidity : light: 20 ± 10 %; dark: 40 ± 10 %



MATERIAL TESTING TECHNOLOGY B.V. / AWSG B.V.

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BTW-nr. NL006298631B01

Lochem, 19-08-2002

ATLAS Case No. : 4688
ATLAS Test No. : KEM-49-DIV-193

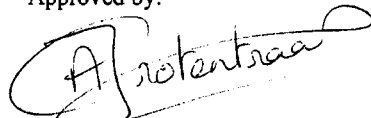
In case of correspondence refer to the above AWSG BV Case number.
Elaborate information concerning this test is available, charges in accordance with the current price-list.
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Weathering Services and so certified by the client.

Yours faithfully,
ATLAS Material Testing Technology BV
AWSG BV Division

Handled by:


Mariska Gosselink
Laboratory Technician

Approved by:


Betsje Grotentraast
Laboratory Manager

Measured luminous intensities in [cd]

Light colour: red

Vertical angle (°)	Horizontal angle (°)						
	0	±2.5	±5	±10	±15	±20	±30
0	297	299	285	204	112	54	17
-1.5	308	307	-	-	-	-	-
-3	309	-	269	-	-	-	-
-5	310	-	-	180	-	-	-
-10	158	-	-	-	70	46	-
-20	58	-	-	-	-	-	15

Light colour: yellow

Vertical angle (°)	Horizontal angle (°)						
	0	±2.5	±5	±10	±15	±20	±30
0	149	147	142	99	55	26	9
-1.5	150	145	-	-	-	-	-
-3	151	-	126	-	-	-	-
-5	140	-	-	82	-	-	-
-10	70	-	-	-	32	21	-
-20	28	-	-	-	-	-	7

Light colour: green

Vertical angle (°)	Horizontal angle (°)						
	0	±2.5	±5	±10	±15	±20	±30
0	278	278	270	199	119	56	13
-1.5	265	257	-	-	-	-	-
-3	257	-	222	-	-	-	-
-5	265	-	-	158	-	-	-
-10	140	-	-	-	64	42	-
-20	54	-	-	-	-	-	12

Measured luminous intensities as percentage of measured value in the reference axis

Light colour: red

Vertical angle (°)	Horizontal angle (°)						
	0	±2.5	±5	±10	±15	±20	±30
0	100	101	96	68	38	18	6
-1.5	104	103	-	-	-	-	-
-3	104	-	91	-	-	-	-
-5	104	-	-	61	-	-	-
-10	53	-	-	-	24	15	-
-20	20	-	-	-	-	-	5

Light colour: yellow

Vertical angle (°)	Horizontal angle (°)						
	0	±2.5	±5	±10	±15	±20	±30
0	100	99	95	66	37	18	6
-1.5	100	98	-	-	-	-	-
-3	101	-	85	-	-	-	-
-5	94	-	-	55	-	-	-
-10	47	-	-	-	22	14	-
-20	19	-	-	-	-	-	5

Light colour: green

Vertical angle (°)	Horizontal angle (°)						
	0	±2.5	±5	±10	±15	±20	±30
0	100	100	97	71	43	20	5
-1.5	95	92	-	-	-	-	-
-3	92	-	80	-	-	-	-
-5	95	-	-	57	-	-	-
-10	50	-	-	-	23	15	-
-20	19	-	-	-	-	-	4

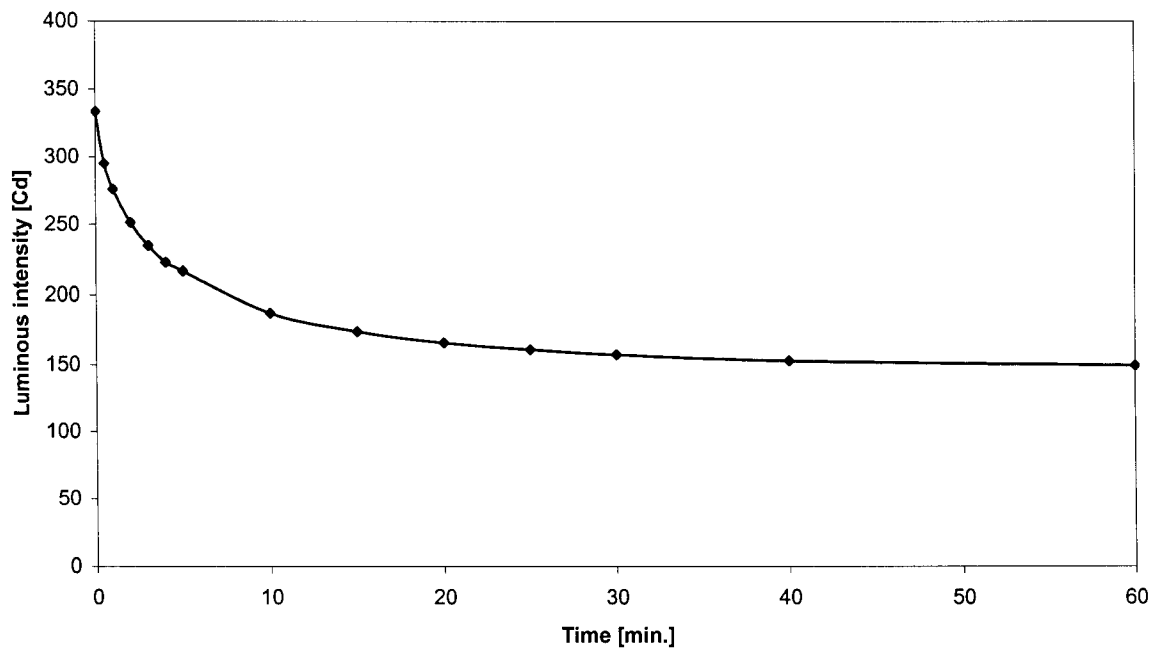
Stabilization behavior LED signal lights

Colour		Luminous intensities in reference axis (candela)			
		At switch on	Start of measurements	End of measurements	Cycle *)
200 mm	Red	380	298	297	-
	Yellow	333	149	149	214
	Green	285	278	278	-

*) cycle 1 sec. "on" / 1 sec. "off".

Luminous intensity of yellow signal light as a function of time.

Luminous intensity versus time



Luminous intensities as a percentage of the measured value in the reference axis, compared to the requirements of EN 12368 table 3 "Wide beam signal (W)". (The requirements are printed between brackets)

Light colour: red

Vertical angle (°)	Horizontal angle (°)				
	0	±5	±10	±20	±30
0	100	96 (85)	68 (55)	18 (3)	6 (1)
-3	104 (80)	91 (75)	-	-	-
-5	104 (60)	-	61 (35)	-	-
-10	53 (30)	-	-	15 (8)	-
-20	20 (2)	-	-	-	5 (2)

Light colour: yellow

Vertical angle (°)	Horizontal angle (°)				
	0	±5	±10	±20	±30
0	100	95 (85)	66 (55)	18 (3)	6 (1)
-3	101 (60)	85 (75)	-	-	-
-5	94 (60)	-	55 (35)	-	-
-10	47 (30)	-	-	14 (8)	-
-20	19 (2)	-	-	-	5 (2)

Light colour: green

Vertical angle (°)	Horizontal angle (°)				
	0	±5	±10	±20	±30
0	100	97 (85)	71 (55)	20 (3)	5 (1)
-3	92 (60)	80 (75)	-	-	-
-5	95 (60)	-	57 (35)	-	-
-10	50 (30)	-	-	15 (8)	-
-20	19 (2)	-	-	-	4 (2)

Conclusion:

All three luminous intensity distributions comply with the requirements of type "W"

Luminous intensities as a percentage of the measured value in the reference axis, compared to the requirements of EN 12368 table 4 "Medium wide beam signal (M)". (The requirements are printed between brackets)

Light colour: red

Vertical angle (°)	Horizontal angle (°)					
	0	±5	±10	±15	±20	±30
0	100	96 (75)	68 (40)	38 (10)	18 (1)	-
-3	104 (75)	91 (60)	-	-	-	-
-5	104 (50)	-	61 (20)	-	-	-
-10	53 (12,5)	-	-	-	15 (6)	-
-20	20 (1,5)	-	-	-	-	5 (1)

Light colour: yellow

Vertical angle (°)	Horizontal angle (°)					
	0	±5	±10	±15	±20	±30
0	100	95 (75)	66 (40)	37 (10)	18 (1)	-
-3	101 (75)	85 (60)	-	-	-	-
-5	94 (50)	-	55 (20)	-	-	-
-10	47 (12,5)	-	-	-	14 (6)	-
-20	19 (1,5)	-	-	-	-	5 (1)

Light colour: green

Vertical angle (°)	Horizontal angle (°)					
	0	±5	±10	±15	±20	±30
0	100	97 (75)	71 (40)	43 (10)	20 (1)	-
-3	92 (75)	80 (60)	-	-	-	-
-5	95 (50)	-	57 (20)	-	-	-
-10	50 (12,5)	-	-	-	15 (6)	-
-20	19 (1,5)	-	-	-	-	4 (1)

Conclusion:

All three luminous intensity distributions comply with the requirements of type "M"

Luminous intensities as a percentage of the measured value in the reference axis, compared to the requirements of EN 12368 table 5 "Narrow beam signal (N)". (The requirements are printed between brackets)

Light colour: red

Vertical angle (°)	Horizontal angle (°)				
	0	±2.5	±5	±10	±15
0	100	101 (75)	96 (65)	68 (15)	38 (1,5)
-1.5	104 (95)	103 (90)	-	-	-
-3	104 (70)	-	91 (45)	-	-
-5	104 (40)	-	-	61 (10)	-
-10	53 (6)	-	-	-	24 (5)

Light colour: yellow

Vertical angle (°)	Horizontal angle (°)				
	0	±2.5	±5	±10	±15
0	100	99 (75)	95 (65)	66 (15)	37 (1,5)
-1.5	100 (95)	98 (90)	-	-	-
-3	101 (70)	-	85 (45)	-	-
-5	94 (40)	-	-	55 (10)	-
-10	47 (6)	-	-	-	22 (5)

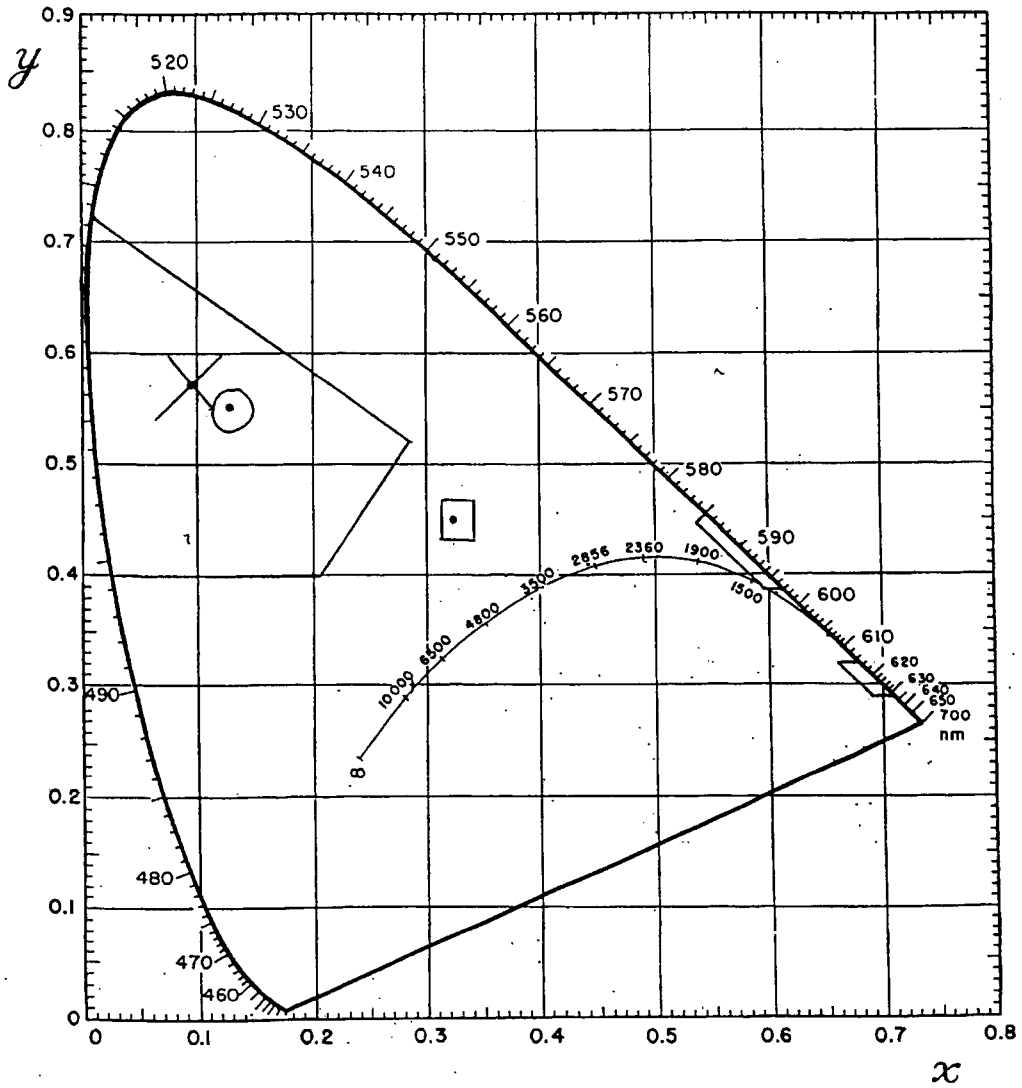
Light colour: green

Vertical angle (°)	Horizontal angle (°)				
	0	±2.5	±5	±10	±15
0	100	100 (75)	97 (65)	71 (15)	43 (1,5)
-1.5	95 (95)	92 (90)	-	-	-
-3	92 (70)	-	80 (45)	-	-
-5	95 (40)	-	-	57 (10)	-
-10	50 (6)	-	-	-	23 (5)

Conclusion:

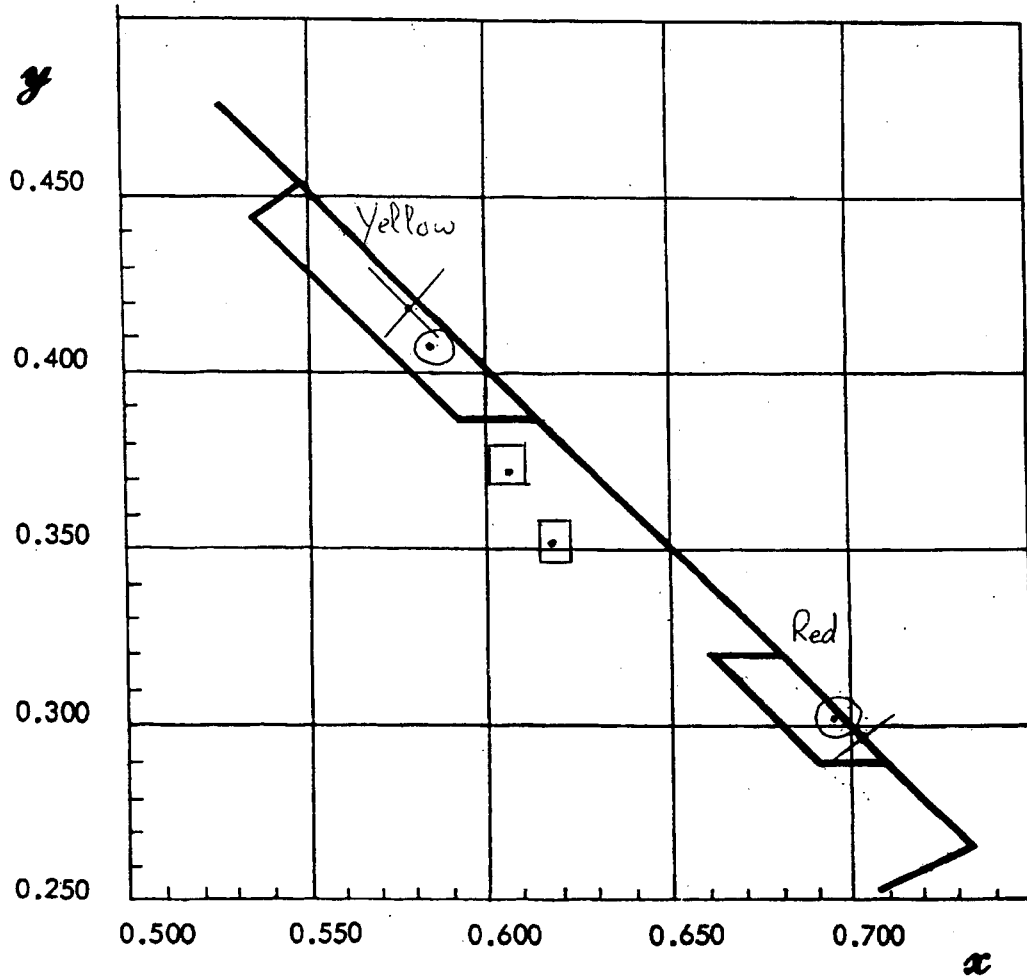
All three luminous intensity distributions comply with the requirements of type "N"

Measured colours of GELcore DR4-GTFB-51C



- X = signal light
- = phantom light
- = combined signal/phantom light

Measured colours of GELcore DR4-RTFB-51C and DR4-YTFB-51C



- X = signal light
- = phantom light
- = combined signal/phantom light