PARTS SPECIFICATION

SPEC NO. ES-X43044

TITLE: LED EXTERIOR LAMPS

REV. SYM	REV. LET	DESCRIPTION OF CHANGE	TREV. PAGE	DATE	REV. BY
C	VC1092	ADD REQUIREMENTS&CLARIFICATION	P3,4,6,9,13,21	'17.12.06	R.TANIMOTO
B	TC0244	ADD REQUIREMENTS	P3,4,5,6,16.21	'16.03.07	T.YASUI
A	QC2605			'13.08.30	T.YASUI

REVISION

APPENDIX	APPROVED BY	CHECKED BY	PREPARED BY
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1. PURPOSE

This specification makes the required quality of car lamps which have LED light source clear and secures to manage the functional quality.

2. APPLICATION

This specification shall be applied to following lamps, except for the items shown in the SPEC “ES-X43009”.

- All exterior lamps which have LED light source (except for Headlamp)
- Interior High Mounted Stop Lamps which have LED light source.

Whenever the Drawings conflicts with this specification, the drawing shall be given priority.

3. DEFINITION OF TERMNOLOGY

B C

Term	Difinition
Tj temperature	Junction temperature of LED tips
Tj-max	Maximum permissible junction temperature of LED chip which can guarantee the practical functions.
LED module	Minimum component which makes LED light up (Example: LED light source and electrical circuit board, Lighting control device etc.)
Lamp Assy	Completed product which all component is assembled into the lamp
DRL	Daytime Running Lamp
VF	Forward Voltage of LED

4. CONDITION FOR USE

Item	Condition	Description
Minimum operating temperature	See clause 6.1	It corresponds “ES-X82113” $T_{op.min}$
Maximam operating temperature	See clause 6.1	It corresponds “ES-X82113” $T_{op.max}$
Minimum keeping temperature	See clause 6.1	It corresponds “ES-X82113” T_{min}
Maximum keeping temperature	See clause 6.1	It corresponds “ES-X82113” T_{max}
Minimum operating voltage (*)	See clause 6.1	It corresponds “ES-X82113” $U_{T.min}$
Maximum operating voltage (*)	See clause 6.1	It corresponds “ES-X82113” $U_{T.max}$
Performance warranty voltage(*)	8 ~ 16V	
Minimum lighting start voltage(*)	Less than 8V	
Minimum lighting keep up voltage (*)	Less than 6V	

*: Terminal voltage where the electric power is supplied from the vehicle

5. GENERAL PERFORMANCE REQUIREMENT

B C 5.1. Lighting life

5.1.1. Requirement

The following requirements shall be fulfilled after the test.
However, the surrogate data proved to fulfill the following requirements may be submitted to MMC instead of the actual test results.
[1] Legal requirements for each destination. (Chromaticity & Luminous intensity)
Except for degradation of transparency on the outer lens.
[2] Current value and Voltage value shall be within the range based on the design value.
Also, measuring condition of requirements shall be conducted in accordance with clause 6.3 in this specification.

5.1.2. Test

Shall perform “Test 1” in accordance with the following procedure.
In addition, also “Test 2” shall be performed for front position lamp and DRL which is using the same light source installed in upper side of headlamp. (When the lamps use the same light source, perform the test on the function that is higher at Tj temperature.)

<Test 1>

Procedure 1: Procedure 1: Shall measure maximum Tj temperature of lamp in accordance with the condition which is described in ES-X43009 Item 4.6 “Heat Resistance”. However, if Tj temperature is not saturate within 2 hours of test time, the test shall be continued until the saturation.

Procedure 2: Shall light continuously during test of Table 6.5-1 in maximum Tj temperature measured by Procedure 1.
In case of using the same light source for different functions, set to lighting ratio described in Section 6.4.. After turn on one function, switch the other and continuously turn on it.
In case a supplier use functions not described in this SPEC, shall adjust test time and lighting ratio with MMC design.

Procedure 3: Shall confirm that lamps satisfy requirement after continuously lighting.

<Test 2>

Procedure 1: Shall measure maximum Tj temperature of lamps in test condition of Table 5.1.2-1. Shall light for 1 hour in condition of Mode2 after lighting for 1 hour in condition of Mode1.

Procedure 2: If maximum Tj temperature measured by Procedure 1 in Test 2 is higher than maximum Tj temperature measured by Procedure 1 in Test 1, Shall light continuously for 3,000 hours on condition of maximum Tj temperature measured by procedure 1.

Procedure 3: Shall confirm that lamps satisfy requirement after continuously lighting

Table5.1.2-1: Test condition (lighting life)

Environmental temperature (℃)	Lighting mode				Test voltage (V)	Air flow condition (m/s)
	Mode 1		Mode 2			
Lens contour surface: 50 ± 3 Housing: 90 ± 3	Position lamp + Turn signal lamp(*1) + Other functions installed (*2)	continuously (*3)	DRL + Turn signal lamp(*1)	continuously (*3)	13.6	0.5(± 0.3)

(*1): Only if turn signal lamps are installed
(*2): The functions which are lit simultaneously may be arranged by the agreement with MMC design.
(*3): Turn signal lamp action is flashing (90 times/min)

5.1.3. Specimen condition

Procedure 1: Lamp Assy
Procedure 2: Lamp Assy or LED module

△B 5.2. Chromaticity

5.2.1. LED light source

X-axis width of the chromaticity of white LED shall be 0.015 or less within the chromaticity range shown in Figure 5.2-1

If X-axis is 0.33 or more, X-axis width can be 0.027 or less.

The chromaticity range shall be described in supplier's drawing.

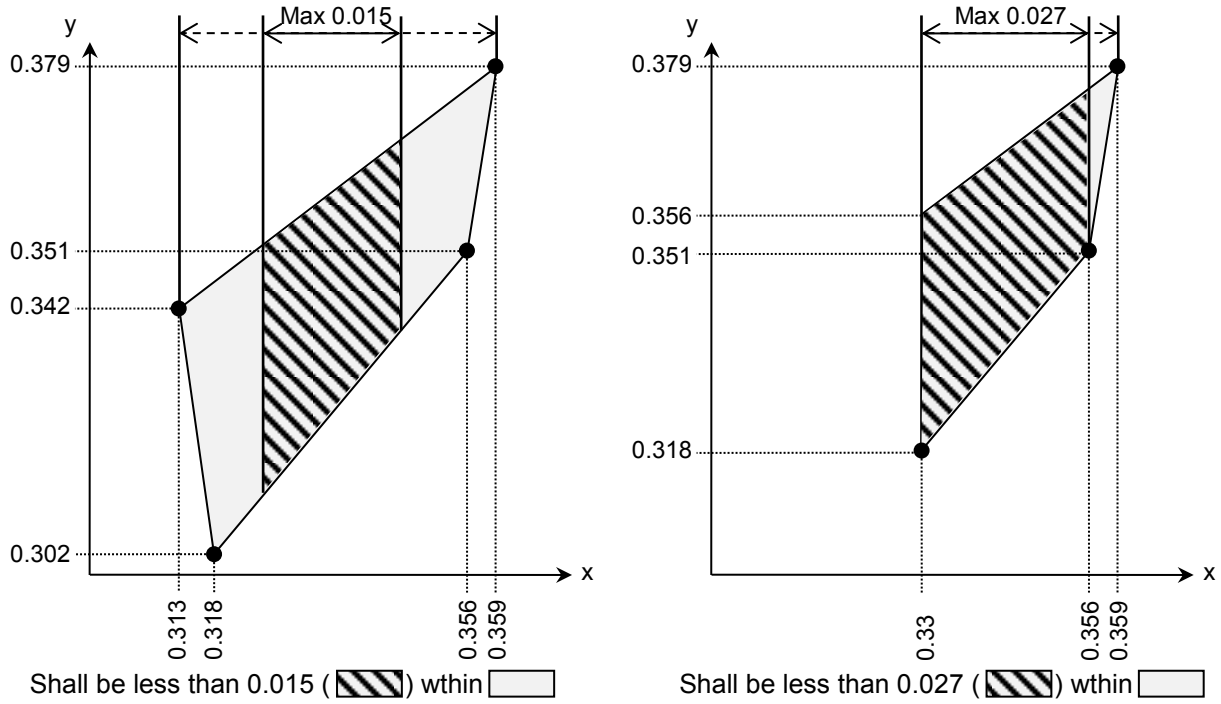

Figure 5.2-1 chromaticity range

5.2.2. Lamp assembly

Shall not be difference of emission color in visual evaluation.

The several samples that shows maximum chromaticity variant with measured data shall be submitted to MMC for evaluation. Then supplier shall get the approval from MMC.

The lamp assemble sample submitted for evaluation shall be evaluated by MMC.

△B 5.3. Tj temperature of LED

5.3.1. Requirement

The maximum of Tj temperature shall not exceed Tj-max.

5.3.2. Test

Shall measure maximum Tj temperature according to the test condition of ES-X43009 (after Revision AG) Section 4.6 “Heat Resistance”.

However, If Tj temperature is not saturated within 2 hour of test time, The test shall be continued until the being saturated.

C 5.4. Accelerated Moisture Resistance

5.4.1. Requirements

After the test, VF level shall not rise.
In addition, shall be measured VF at the time of 0h, 70h, 175h and 350h during the test.
And shall submit MMC the graph (ref. Figure 5.4-1) shows the change rate of VF.

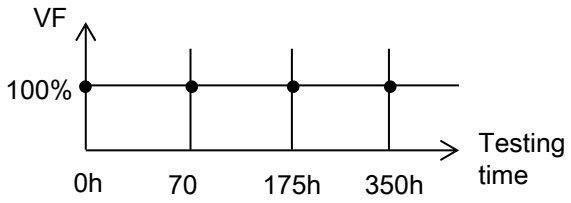

Figure 5.4-1 Change rate of VF

5.4.2. Test

Perform the test under the following test conditions.

Temperature	:121±2 ℃
Humidity	:100 %
Pressure	:205 kPa
Test time	:350 h
Test sample	:More than 60 LEDs(total)
Specimen condition	:Mounted on printed circuit board

6. ENVIRONMENT RESISTANCE REQUIREMENT

△B 6.1. Classification < temperature class, vibration class, IP code >

Each classification about this performance is as follows.

Item			Classification
Temperature class(*1)	Functions installed headlamp		II
	Functions without installed headlamp	With outdoor	I
		With indoor	II'
Vibration class			I
IP code (Dust protection)			5K
IP code (waterproof)			6K
Expected lifetime			10years

(*1): Detail of temperature classification is as follows.

Item	Temperature classificationI(℃)	Temperature ClassificationII(℃)	Temperature classificationII'(℃)
T_{min}	-40		
T_{max}	85	105	110
$T_{op.min}$	-40		
$T_{op.max}$	85	105	110
RT	20 ± 5		

6.2. Operating voltage range

Operating voltage range of lamp about this performance is as follows.

Item	Voltage(V)
$U_{T.min}$	8.0 ± 0.1
$U_{T.typ}$	13.0 ± 0.1
$U_{T.max}$	16.0 ± 0.1

6.3. Requirements (except for item 6.5.10 Ozone resistance test)

Shall satisfy the following content before and after the tests.

[1]. Item that are required by regulation (chromaticity & luminous intensity)

[2]. Current and voltage value: within the design value

[3]. LED module: Shall not be defect such as crack, deformation, rust and crack of solder on basal plate, electric parts and LED tip. The pictures by visual contact or microscope shall be submitted to prove the compliance.

In addition, measurements of requirement shall be performed under the following condition.
(Test items to request measurement at specified intervals during the test are also similar condition.)

[1]. Item that are required by regulation: By the measuring conditions described in the regulations.

[2]. Current and voltage value: Shall measure them under the following 4 cases. (*4)
The parameters without any particular instructions shall follow the measuring conditions that are described in ES-X43009.

(*4): The conditions that are not severe for LED and electronic parts may be skipped.

	Measuring condition	
	Temperature condition	Test voltage
Case 1	$T_{op.max}$	$U_{T.max}$
Case 2	$T_{op.max}$	$U_{T.min}$
Case 3	$T_{op.min}$	$U_{T.max}$
Case 4	$T_{op.min}$	$U_{T.min}$

6.4. Test time

Shall perform the test at test time that is described in reference specifications.
However, the test times of “Item 5.1”, “Item 6.5.3”, “Item 6.5.4” and “Item 6.5.8” are referred to Table 6.5-1.

In addition, when you perform test item to request operating during the test for lamps using same light source, operating time must be operated each functions at the following ratio.

If you use functions that are not described ratio in this specification at the same time, shall adjust ratio of test time with MMC design.

(Front position lamp: DRL) = (1:2)
(Tail lamp: Stop lamp) = (2:1)

6.5. Test method and condition

No.	Item	Application	Test condition	Analysis	Continuous monitoring	Specimen condition	
						Lamp Assy	LED module
6.5.1	Shipping/Storage Temperature Exposure	All components	See ES-X82113 Item 6.1.1 Test samples : 3pcs In addition, the time rate of temperature up and down shall be adjust in each process to match the test conditions of Fig.6.5-1.	○	○	○	
6.5.2	Low Temperature Operating Endurance	All components	See ES-X82113 Item 6.1.2 Test samples : 3pcs	○	○	○	
6.5.3 △C	High Temperature Operating Endurance (HTOE)	All components	See ES-X82113 Item 6.1.3 Test samples : 3pcs Test time: See Table6.5-1 In case of using the same light source for different functions, set to lighting ratio described in Section 6.4.. After turn on one function, switch the other and continuously turn on it. In case a supplier use functions not described in this SPEC, shall adjust test time and lighting ratio with MMC design. In addition, you shall be confirmed following item in 25%, 50%, and 75% of the test time. ・ Current value and voltage value ・ Lighting condition	○	○	○	
6.5.4	Powered Thermal Cycle Endurance (PTCE)	All components	See ES-X82113 Item 6.1.4 Test samples : 3pcs Test cycle : See Table 6.5-1 Soak time : See ES-X82113 ANNEX A.6 Intermittent operation 1: operation 1min → non-operation 9min Intermittent operation 2: operation 9min → non-operation 1min In addition, you shall be confirmed following item in 25%, 50%, and 75% of the test time. ・ Current value and voltage value ・ Lighting condition	○	○	○	

No.	Item	Application	Test condition	Analysis	Continuous monitoring	Specimen condition	
						Lamp Assy	LED module
6.5.5	Thermal Shock	All components	See ES-X82113 Item 6.1.5 Test samples : 3pcs Test cycle : built-in headlamp : 500 cycles outside built-in headlamp : 100 cycles Soak time : See ES-X82113 ANNEX A.6			○	
6.5.6	Thermal Shock Immersion	Not applicable	(Because the lamps are not components that operate in the liquid.)				
6.5.7	Thermal Humidity Cycle	All components	See ES-X82113 Item 6.1.7 Test samples : 3pcs Intermittent operation: operation 50min → non-operation 50min	○	○	○	
6.5.8	High Temperature and Humidity Endurance (HTHE)	All components	See ES-X82113 Item 6.1.8 Test samples : 3pcs Test time : See Table 6.5-1 In addition, you shall be confirmed following item in 25%, 50%, and 75% of the test time. ・ Current value and voltage value ・ Lighting condition	○	○	○	
6.5.9	Solar Radiation Soak	All components	Test: See ES-X43009 Item 4.12 But you shall be used light source of xenon arc. (without condition of water injection) Request: you shall be satisfied requirement of this spec item 6.3. Test samples : 3pcs In addition, you shall be confirmed following item when 1000 hours has elapsed. ・ Current value and voltage value ・ Lighting condition Requirements must be measured after assembling samples of before and after the test to Lamp Assy.			See ES-X43009 Item 4.12 (Inner part shall be tested with covering the outer part)	
6.5.10	Ozone Resistance Test	Component to be used rubber material	Test: See ES-X60115 Item 4.8 Request: C13 Test samples : 3pcs In addition, you shall be determined required specification after coordinating with MMC design to consider purpose and performance for use.				Elemental substance of rubber products

No.	Item	Application	Test condition	Analysis	Continuous monitoring	Specimen condition	
						Lamp Assy	LED module
6.5.11	Ice water shock test	Component installed inside	See ES-X82113 Item 6.1.11 However, you shall be carried out only water-discharge test. Test samples : 3pcs			○	
6.5.12	Vibration	All components	See ES-X82113 Item 6.2.1 Test samples : 3pcs But maximum frequency of random vibration profile shall be 1,000 Hz.	○	○	○	
6.5.13	Mechanical Shock	All components	See ES-X82113 Item 6.2.2 Test samples : 3pcs	○	○	○	
6.5.14	Mechanical Shock Endurance	All components	Lamps that is mounted on moving part: See ES-X82113 Item 6.2.3 Test samples : 3pcs Lamps that is not mounted on moving part: See ES-X43009 Item 4.5 In addition, shall satisfy the requirements of Item 6.3 that is described this specification. Test specimens: 3pcs			○	
6.5.15	Package Drop	All components	See ES-X82113 Item 6.2.4 Test samples : 3pcs This test item is not applicable if lamps won't be used when its lamps are fallen. However, in the case of inapplicable, shall submit process FMEA to MMC after reflecting it.			○	○
6.5.16	Handling Drop	All components	See ES-X82113 Item 6.2.5 Test samples : 3pcs This test item is not applicable if lamps won't be used when its lamps are fallen. However, in the case of inapplicable, shall submit process FMEA to MMC after reflecting it.			○	○
6.5.17	Switch Mechanical Operation / Abrasion Endurance	Not applicable	<Lamps are not a component that has a switch.>				

No.	Item	Application	Test condition	Analysis	Continuous monitoring	Specimen condition	
						Lamp Assy	LED module
6.5.18	Dust (and other solid intrusion)	Not applicable	<Because it is alternative in ES-X43009 Item 4.20.>				
6.5.19	Water Intrusion	Not applicable	<Because it is alternative in ES-X43009 Item 4.21.>				
6.5.20	High Pressure Steam Jet Exposure	Not applicable	<Because it is IP code(water proof) outside>				
6.5.21	Salt Water Immersion	Components that do not have breathing structure	See ES-X82113 Item 6.3.4 Test samples : 3pcs In addition, The salt concentration must be 5wt% and pH6.5-7.2.	○	○ (Only immersion)	○	○
6.5.22	Dew formation test	All components	See ES-X82113 Item 6.3.5 Test samples : 3pcs			○	
6.5.23	Mixed Flowing Gas	All components	See ES-X82113 clause 6.4.1 Test samples : 3pcs			○	
6.5.24	Salt Fog	Component installed outside	See ES-X82113 clause 6.4.2 Test samples : 3pcs Intermittent operation : 1hour with operating → 1hour none operation	○	○	○	
6.5.25	Chemical Exposure - Cabin Compartment	Component installed inside	See ES-X82113 clause 6.4.3 Test samples : 5pcs Test fluid : see Table 6.5-2 Fluid class / Type : see ES-X82113 clause 6.4.3			○	
6.5.26	Chemical Exposure - Outside Cabin Compartment	Component installed outside	See ES-X82113 clause 6.4.4 Test samples :see Table 6.5-3 (depend on each mounting location) Test fluid : see Table 6.5-3 Fluid class / Type : see ES-X82113 clause 6.4.4			○	

<About continuous monitoring >
You shall be monitored continuously the current value.

<About analysis>
Based on the results of continuous monitoring, you shall be carried out analysis whether there are behaviors that lead to fault occurrence.

< Intermittent operation of turn lamp>
Operating condition : Flashing (90times/minute)
Non-operating condition : Light off

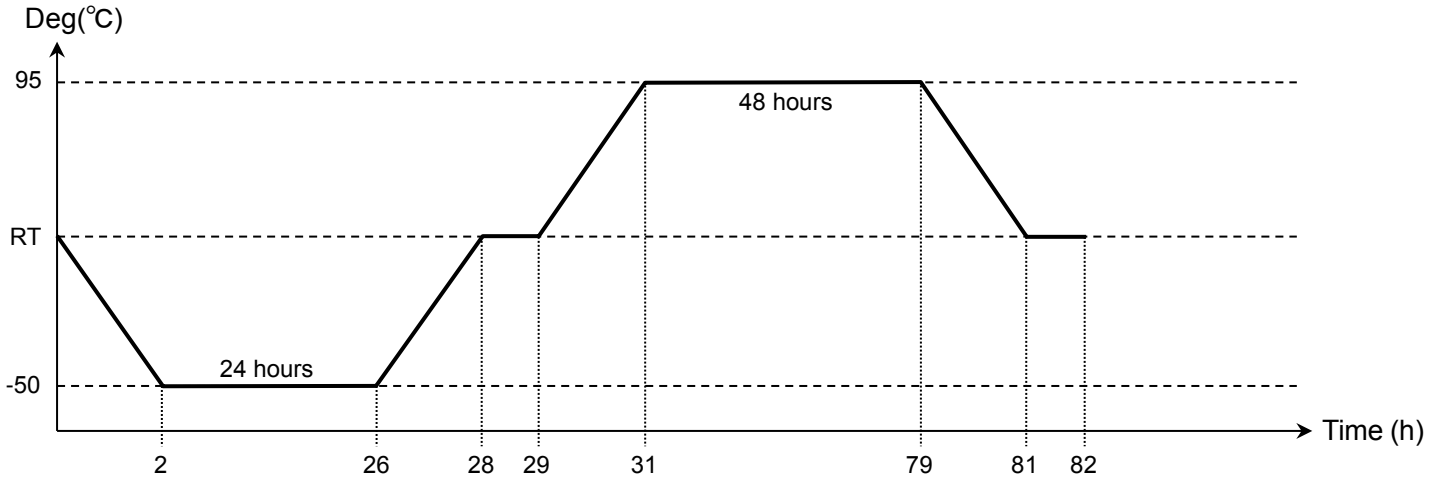

Fig 6.5-1: Test condition (ES-X82113 Item6.1.4) C

Table6.5-1: Test time

Function	Item 5.1 Lighting life test time (h)	ES-X82113 Item 6.1.3 HTOE test test time (h)			ES-X82113 Item 6.1.4 PTCE test test cycle (times)			ES-X82113 Item 6.1.8 HTHE test test time (h)		
		Mounting location			Mounting location			Mounting location		
		A	B	C	A	B	C	A	B	C
DRL	7000	1269	1208		556	540		1003	1003	
Front fog lamp	2000	363	345		556	540		1065	1065	
Cornering lamp	1500	272	259		556	540		1071	1071	
Front position lamp	3500	635	604		556	540		1046	1046	
Side maker lamp	3500	635	604		556	540		1046	1046	
Front position & DRL	10000	1813	1726		556	540		965	965	
Turn signal lamp	500	91	86		556	540		1083	1083	
Tail lamp	3500		604			540			1046	
License plate lamp	3500		604			540			1046	
Stop lamp	2000		345	306		540	519		1065	1065
Tail lamp & stop lamp	5000		863			540			1027	
Back up lamp	500		86			540			1083	
Rear fog lamp	500		86			540			1083	

Mounting location A: Built-in headlamp
Mounting location B: Outside built-in headlamp (outdoor)
Mounting location C: Outside built-in headlamp (indoor)

Table6.5-2: Applicable liquid (ES-X82113　Item 6.4.3)

Applied liquid	Specimen No.				
	No.1	No.2	No.3	No.4	No.5
Interior cleaning liquid / cockpit spray	○	○		○	
Detergent / stain remover	○				
Leather care goods	○		○	○	
Plastic and vinyl cleaner					○
Glass cleaner			○		
Warm drinking water		○			○
Cold drinking water				○	
Saline solution		○	○		○

Table6.5-3: Applicable liquid (ES-X82113 Item 6.4.4)

Mounting location / Applied liquid	・On front body of ehicle(Headlamp) ・On front bumper					・On side door ・On fender ・On rear body of vehicle (Rear combination lamp) ・On trunk lid (Trunk lid spoiler) /Tail gate/Back door/Rear gate			・On rear bumper			・On rear spoiler (Upper rear glass)	
	Specimen No.					Specimen No.			Specimen No.			Specimen No.	
	No.1	No.2	No.3	No.4	No.5	No.1	No.2	No.3	No.1	No.2	No.3	No.1	No.2
Automatic transmission fluid	○												
Manual transmission fluid	○												
Power steering fluid	○												
Differential gear lubricant		○							○				
Engine oil		○							○				
Engine wax protective agent		○											
Engine cooling water/Ethylene glycol			○										
Gasoline			○			○			○	○			
Diesel fuel			○			○				○			
Biodiesel / Methanol-based fuel			○				○			○			
Brake fluid				○							○		
Window washer fluid				○			○	○			○	○	○
Vehicle cleaner				○				○			○	○	○
Battery fluid : Dilute sulfuric acid					○								

7. EMC PERFORMANCE

7.1. Category

Each category on this performance is as follows.

Item		Category
Electronic module category	Passive electrical components or module (*5)	P
	Components having active electrical components (*6)	A
Electronic module subcategory		C (*7)
Electric motor category		N/A
Inductive device category		N/A
Functional group		C (*8)

(*5): Components or modules have a Circuit with resistors, capacitors, diodes, etc.
(*6): Components have a Circuit like PWM control and DC-DC convertor which consist to get changes of voltage and current with getting input of them
(*7): Regardless of the size, all parts having the circuit board shall apply subcategory C.
(*8): All components are group C.

7.2. Function performance condition

Level	Condition
Function performance condition I	Lamps shall be lit without luminosity change during and after the test or during and after giving the failure.
Function performance condition II	Lamps may occur turning off and flickering during giving failure.(including the operation of fail-safe mode) But lamps shall light normally after clearing failures or after the test

7.3. Test method and requirement

No.	Item	Application	Test method	Requirement	Specimen condition	
					Lamp Assy	LED module
7.3.1	Conducted RF emissions (voltage on supply lines)	The following omponents: Electronic module category A	See ES-X82114 Item 6.2 But about the test necessity of Table.9-11 is as follows. Table.9: Applicable Table.10: Common requirements of countries: Applicable Table.10: Requirements of each destination: Accepted on target destination only Table.11: Common requirements of countries: Applicable Table.11: Requirements of each destination: Accepted on target destination only Test samples : 3pcs	See ES-X82114 Item 6.2	○	

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Item</th><th rowspan="2">Application</th><th rowspan="2">Test method</th><th rowspan="2">Requirement</th><th colspan="2">Specimen condition</th></tr>
<tr><th>Lamp Assy</th><th>LED module</th></tr>
<tr><td>7.3.2</td><td>Conducted RF emissions (current on all lines in harness)</td><td>The following components:
Electronic module category A</td><td>See ES-X82114 Item 6.3
But about the test necessity of Table.12-14 is as follows.
<table><tr><td>Table.12</td><td></td><td>Applicable</td></tr><tr><td rowspan="2">Table.13</td><td>Common requirements of countries</td><td>Applicable</td></tr><tr><td>Requirements of each destination</td><td>Accepted on target destination only</td></tr><tr><td rowspan="2">Table14</td><td>Common requirements of countries</td><td>Applicable</td></tr><tr><td>Requirements of each destination</td><td>Accepted on target destination only</td></tr></table>Test samples : 3pcs</td><td>See ES-X82114 Item 6.3</td><td>○</td><td></td></tr>
<tr><td>7.3.3</td><td>Radiated emissions</td><td>The following components:
Electronic module category A</td><td>See ES-X82114 Item 6.4
But about the test necessity of Table.15-17 is as follows.
<table><tr><td>Table.15</td><td></td><td>Applicable</td></tr><tr><td rowspan="2">Table.16</td><td>Common requirements of countries</td><td>Applicable</td></tr><tr><td>Requirements of each destination</td><td>Accepted on target destination only</td></tr><tr><td rowspan="2">Table.17</td><td>Common requirements of countries</td><td>Applicable</td></tr><tr><td>Requirements of each destination</td><td>Accepted on target destination only</td></tr></table>Test samples : 3pcs</td><td>See ES-X82114 Item 6.4</td><td>○</td><td></td></tr>
<tr><td>7.3.4</td><td>Magnetic field emissions</td><td>Not applicable</td><td>(Because lamps are not components having motor.)</td><td></td><td></td><td></td></tr>
<tr><td>7.3.5</td><td>Conducted transient emissions</td><td>The following components:
Electronic module category A
or components having induction parts such as coil etc.</td><td>See ES-X82114 Item 6.6
Test samples : 3pcs</td><td>See ES-X82114 Item 6.6</td><td>○</td><td></td></tr>
</table>

No.	Item	Application	Test method	Requirement	Specimen condition	
					Lamp Assy	LED module
7.3.6	Bulk current injection(BCI) test	All components	See ES-X82114 Item 7.2 Test samples : 3pcs	See ES-X82114 Item 7.2 But requirements show as the following Table7.3-1 ~ 4.	○	
7.3.7	ALSE with a ground plane	All components	See ES-X82114 Item 7.3 Test samples : 3pcs	See ES-X82114 Item 7.3	○	
7.3.8	ALSE without a ground plane	Not applicable However, It is also possible to carry out this test in place of test 7.3.7.	See ES-X82114 Item 7.4 Test samples : 3pcs	See ES-X82114 Item 7.4	○	
7.3.9 △B	TEM cell test	All components	See ES-X82114 Item 7.5 The test shall be performed in both turn-on and turn-off condition. Test samples : 3pcs	See ES-X82114 Item 7.5 In condition, the lamp shall follow in function performance condition of 7.2 item. In condition, the lamp shall not turn on, while received transverse electromagnetic.	○	
7.3.10	Magnetic field immunity	Not applicable	(Because electronic module subcategory is not MS.)			
7.3.11	Transient disturbances conducted along supply lines	All components	See ES-X82114 Item 9.1 However, about test pulse 4 see ES-X82115 Fig.7-1、Table.7-2(Vmin = 6V) Test samples : 3pcs	See ES-X82114 Item 9.1 But lamps may have to turn off about requirement of pulse 4.	○	
7.3.12	Transient disturbances conducted along signal lines	Components having signal line	See ES-X82114 Item 9.2 In addition, test pulse is as follows by category applied. Pulse #2 (+ or -) : Applicable in Electronic module subcategory S Pulse a / Pulse b : Applicable in all categories Test samples : 3pcs	See ES-X82114 Item 9.2	○	
7.3.13	Electrostatic discharge (handling test)	All components	See ES-X82114 Item 10.1 Test samples : 3pcs	See ES-X82114 Item 10.1	○	
7.3.14	Electrostatic discharge (operating test)	All components	See ES-X82114 Item 10.2 Test samples : 3pcs	See ES-X82114 Item 10.2	○	

No.	Item	Application	Test method	Requirement	Specimen condition	
					Lamp Assy	LED module
7.3.15	Immunity to handheld transmitters	All components However, this test does not carry out if you test from No.7.3.6 to 7.3.9.	See ES-X82114 ANNEX F Test samples : 3pcs	See ES-X82114 ANNEX F	○	
7.3.16	Impulse noise test	All components	See ES-X82114 ANNEX G.1 Test samples : 3pcs	See ES-X82114 ANNEX G.1 However, "no malfunction" means "turning off of lamp".	○	
7.3.17	Fast transient noise test	All components	See ES-X82114 ANNEX G.2 Test samples : 3pcs	See ES-X82114 ANNEX G.2 However, “no malfunction" means "turning off lamp".	○	
7.3.18	Electromagnetic immunity test	All components	See ES-X82114 ANNEX H Test samples : 3pcs	See ES-X82114 ANNEX H But turning off lamp is RankII in classification of malfunction.	○	

Classification	Classification of malfunction
RankI	N/A
RankII	Turning off lamp
RankIII	N/A

Table.7.3-1 : 1 ~ 30MHz

Test level (mA)	Group C
500	Not test
375	II
250	
180	
107	

(Replace Table.24)

Table.7.3-2 : 30 ~ 100MHz

Test level (mA)	Group C	
	Basic level	HIRF level
400	Not test	Not test
300		II
200		
140	II	
107		

(Replace Table.25)

Table.7.3-3 : 100 ~ 220MHz

Test level (mA)	Group C	
	Basic level	HIRF level
300	Not test	Not test
225		II
150		
107	II	
50		

(Replace Table.26)

Table7.3-4 : 220 ~ 400MHz

Test level (mA)	Group C	
	Basic level	HIRF level
200	Not test	Not test
150		II
107		
70	II	
35		

(Replace Table.27)

8. ELECTRIC SYSTEM REQUIREMENT

8.1. Category

Each category on this performance is as follows.

Item		Category
Electronic module category	Passive electrical components or module (*9)	P
	Components having active electrical components (*10)	A
Electronic module subcategory		C (*11)
Function group		C (*12)

(*9): Circuit consisting of resistors, capacitors, diodes, etc.
(*10): Circuit like PWM control and DC-DC convertor that consist to get changes of voltage and current with getting input of them
(*11): Regardless of the size, all parts having the circuit board shall apply subcategory C.
(*12): All components are group C.

8.2. Test method and requirement

No.	Item	Application	Test method	Requirement	Specimen condition	
					Lamp Assy	LED module
8.2.1	Supply voltage range	All components	See ES-X82115 Item 6.1 Test voltage : 8 ~ 16V (applied 8V,12V,16V) Test procedure : -40℃→23℃→Tmax Soak time : See ES-X82113 ANNEX A.6 Lighting time : 10min Test samples : 3pcs	Electronic module category: A Lamp is lighting without luminosity change Electronic module category: P Lamp is lighting. But it does not matter luminosity change during lighting. In addition, you shall be satisfied requirement of Item6.3 in this spec.		○
8.2.2	Ignition off draw(IOD)	Not applicable	(Because lamps are not components having IOD.)			
8.2.3	Supply voltage ripple	All components	See ES-X82115 Item 6.3 Test samples : 3pcs	Electronic module category: A Lamp is lighting without luminosity change Electronic module category: P Lamp is lighting. But it does not matter luminosity change during lighting. In addition, you shall be satisfied requirement of Item6.3 in this spec.		○
8.2.4	Supply voltage drop out	All components	See ES-X82115 Item7.2 Test samples : 3pcs	See ES-X82115 Item7.2 However, if electronic module category is A, there shall not be luminosity change in less than 100 micro sec.		○

No.	Item	Application	Test method	Requirement	Specimen condition	
					Lamp Assy	LED module
				And if electronic module category is P, regardless of the dropout time, it may be function performance condition II of item7.2 in this spec.		
8.2.5	Supply voltage dips	All components	See ES-X82115 Item7.3 Test samples : 3pcs	See ES-X82115 Item7.3 In addition, you shall be satisfied requirement of Item6.3 in this spec.		○
8.2.6	Engine cranking low voltage	All components	See ES-X82115 Item7.4 Test samples : 3pcs All components are Group C.(Operation is necessary during engine cranking)	See ES-X82115 Item7.4 However, if the test voltage is above 6V, component may not be turned off.		○
8.2.7	Slow decrease and increase of supply voltage	All components	See ES-X82115 Item7.6 Test samples : 3pcs Within voltage range of normal operation: 8V ~ 16V Outside voltage range of normal operation: under 8V	See ES-X82115 Item7.6		○
8.2.8	Defective regulation (Full-fielded alternator)	All components	See ES-X82115 Item8.1 Test samples : 3pcs	See ES-X82115 Item8.1 In addition, you shall be satisfied requirement of Item6.3 in this spec.		○
8.2.9	Jump start	All components	See ES-X82115 Item8.2 Test samples : 3pcs	See ES-X82115 Item8.2 In addition, you shall be satisfied requirement of Item6.3 in this spec.		○
8.2.10	Load dump	All components	See ES-X82115 Item8.3 However, if lamps don't have a load dump protection, see ISO16750-2 4.6.4.2.1. At that time, Us = 86.5V+10%/-0V, tr = 10ms, td = 400ms±10%, Ri = 0.5Ω±10% Test pulse = 10times/min Test samples : 3pcs	See ES-X82115 Item8.3 In addition, you shall be satisfied requirement of Item6.3 in this spec.		○

No.	Item	Application	Test method	Requirement	Specimen condition	
					Lamp Assy	LED module
8.2.11	Reverse supply voltage	All components	See ES-X82115 Item8.4 Test samples : 3pcs	See ES-X82115 Item8.4 In addition, you shall be satisfied requirement of Item6.3 in this spec.		○
8.2.12	Immunity to short circuits in the supply voltage input and load output lines	All components	See ES-X82115 Item9.1 Test samples : 3pcs	See ES-X82115 Item9.1 In addition, you shall be satisfied requirement of Item6.3 in this spec.		○
8.2.13	Immunity to short circuits in I/O signal lines	Components having signal line	See ES-X82115 Item9.2 Test samples : 3pcs	See ES-X82115 Item9.2 In addition, you shall be satisfied requirement of Item6.3 in this spec.		○
8.2.14	Supply voltage offset	All components	See ES-X82115 Item9.4 Test samples : 3pcs	See ES-X82115 Item9.4		○
8.2.15	Ground reference offset	Not applicable	(Because lamps are not components having two grounds.)			
8.2.16	Operating and voltage stress	Not applicable	(Because lamps do not have motors or inductive devices.) △C			
8.2.17	Stall	Not applicable	(Because lamps do not have motors or inductive devices.) △C			

9. INDIVIDUAL REQUIREMENT OF EACH LAMP

△B 9.1. Stop lamp and CHMSL

If any LEDs are used for the stop lamp and CHMSL, The register of 820Ω(±5%) shall be installed in the circuit as shown in Figure 9.1-1.
In case of stop lamp, the register shall be installed in each right lamp and left lamp.
In addition, the resister shall be located upstream of the rectifier diode.

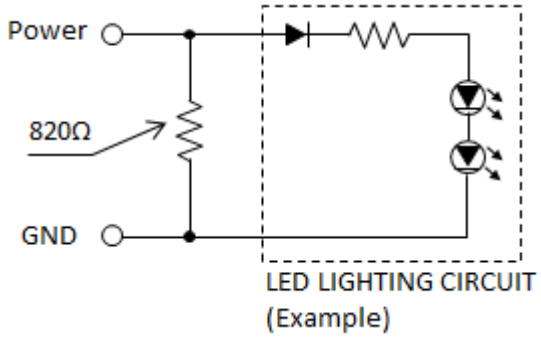

Fig 9.1-1: Example of circuit diagram

10. OTHERS

△B 1) Supplier shall conduct quality check in accordance with "Supplier Quality Guidebook"

2) If questions arise about this specification, shall consult MMC design in charge

Applying SPECs and standards list

NUMBER	CL	NAME
ES-X43009	AI	REQUIREMENTS IN SPEC CONTROL - PASSENGER CAR LAMPS
ES-X60115	-	SOFT VULCANIZED RUBBER
ES-X82113	F	E/E COMPONENT ENVIRONMENTAL TESTING SPECIFICATIONS
ES-X82114	E	EMC PERFORMANCE REQUIREMENT - COMPONENTS
ES-X82115	F	ELECTRICAL SYSTEM PERFORMANCE REQUIREMENT FOR E/E COMPONENTS
ISO16750-2	10	ROAD VEHICLES-ENVIRONMENTAL CONDITIONS AND TESTING FORELECTRICAL AND ELECTRONIC EQUIPMENT-PART 2ELECTRICAL LOADS