

Guideline No.: S-01(201712)



S-01

NAVIGATION LIGHT

Issued date: December 7, 2017

© China Classification Society

Foreword

CCS Product Inspection and Testing Guideline (hereinafter referred to as this Guideline) contains the technical requirements, inspection and testing criteria related to classification and statutory survey of marine products to be applied for CCS approval/inspection.

This Guideline frees the users to adopt other test methods and requirements which are equivalent to or are stricter than this Guideline.

This Guideline is published and updated by CCS, and is released at <http://www.ccs.org.cn>. Your comments or suggestions are welcomed and may be sent to our email addressed mp@ccs.org.cn.

Historical version and release date: S-01(201712) December 7, 2017

Main change: New Release

Contents

1 Scope of application.....	4
2 Normative references	4
3 Terms and definitions	4
4 Drawings and documents	5
5 Technical requirements for design.....	5
6 Selection of typical samples.....	11
7 Type test.....	11
8 Unit/ batch inspection	16

NAVIGATION LIGHT

1 Scope of application

1.1 This guideline applies to the type approval and product inspection of navigation lights for international seagoing ships.

1.2 The type approval and product inspection of navigation light for domestic ships shall be carried out in accordance with Annex I of Convention on The International Regulations for Preventing Collision at Sea (COLREG) 1972 and its Amendments,

Chapter 8, Part Four of China MSA Regulation for Statutory Survey of Ships and Offshore Installations-Regulation for Statutory Survey of Sea-Going Ships Engaged in Domestic Voyages (2011) and its Amendments,

1.3 The type approval and product inspection of navigation light for inland ships shall be carried out in accordance with the requirements of Chapter 7, Part Five of China MSA Regulation for Statutory Survey of Ships and Offshore Installations-Regulation for Statutory Survey of Ships Engaged in Inland Voyages (2011) and its Amendments.

2 Normative references

2.1 Annex I of Convention on The International Regulations for Preventing Collision at Sea 1972 and its Amendments

2.2 International Maritime Organization Resolution A.694 (17) "*General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System (GMDSS) and for Electronic Navigational Aids*"

2.3 International Maritime Organization Resolution MSC.253 (83) "*Adoption of the Performance Standard for Navigation Lights, Navigation Light Controllers and Associated Equipment*"

2.4 The uniform interpretation of International Regulations for Preventing Collisions at Sea 1972 and its amendments in MSC.1-Circ.1427

2.5 IEC 60945:2002/COR1:2008 "*Maritime Navigation and Radio Communication Equipment and Systems—General Requirements—Methods of Testing and Required Test Results*"

2.6 Chapter 13, Part 2B of China MSA Regulation for Statutory Survey of Ships and Offshore Installations-Regulation for Statutory Survey of Sea-Going Ships Engaged in International Voyages (2014).

2.7 EN 14744 Inland Navigation Vessels and Sea-going Vessels – Navigation Light

3 Terms and definitions

3.1 COLREGs mean Convention on the International Regulations for Preventing Collisions at Sea, 1972, including their annexes.

3.2 Light sources include incandescent light sources, light emitting diodes (LED) and other non-incandescent light sources.

3.3 Navigation lights refer to the following lights:

3.3.1 Masthead light, sidelights, stern light, towing light, all-round light and flashing light as defined in Rule 21 of COLREGs;

3.3.2 All-round flashing yellow light required for hovercraft in Rule 23 of COLREGs; and

3.3.3 Maneuvering light signal required in Rule 34(b) of COLREGs.

The light includes a light source, its housing, placing and means for delimiting the angle of lighting.

Masthead light: a white light placed over the fore and aft centreline of the vessel showing an unbroken light over an arc of the horizon of 225 degrees and so fixed as to show the light from right ahead to 22.5 degrees abaft the beam on either side of the vessel.

3.5 Sidelights: a green light on the starboard side and a red light on the port side each showing an unbroken light over an arc of the horizon of 112.5 degrees and so fixed as to show the light from right ahead to 22.5 degrees abaft the beam on its respective side. In a vessel of less than 20 metres in length the sidelights may be combined in one lantern carried on the fore and aft center line of the vessel.

3.6

Sternlight: a white light placed as nearly as practicable at the stern showing an unbroken light over an arc of the horizon of 135 degrees and so fixed as to show the light 67.5 degrees from right aft on each side of the vessel.

3.7 Towing light: a yellow light having the same characteristics as the "stern light" described in Article 3.6.

3.8 All-round light: navigation lights showing an unbroken light over a horizontal sector of 360 degrees.

3.9 Flashing light: navigation lights flashing at a regular interval at a frequency of 120 flashes or more per minute.

4 Drawings and documents

4.1 The following drawings shall be submitted to CCS for approval:

- (1) Specification list of major performances of products;
- (2) General assembly drawing and overall installation drawing;
- (3) Parts diagram of Light body, the light head, lens and junction box;
- (4) Type test program.

4.2 The following drawings shall be submitted to CCS for reference:

- (1) Installation and maintenance manual;
- (2) Nameplate and qualified certificate in a factory (sample).

5 Technical requirements of design

5.1 Structural requirements

5.1.1 Navigation lights shall be able to work normally at ambient temperatures from -25°C to 55°C. The temperature rise at the terminal of the navigation light shall not exceed 40K. The glass parts of the navigation light shall be able to withstand sudden changes in temperature.

5.1.2 Unless otherwise expressly required, the navigation lights shall be flat light and shall not be flashed.

5.1.3 The lens of the navigation light shall be made of a solid, non-corrosive material and shall ensure the long-term durability of the optical quality of the lens.

5.1.4 Each of the specific navigation light shall only use the light source specified by the manufacturer so as not to degrade the performance of the navigation light due to unsuitable light sources. The adopted navigation light source shall be approved or verified by type test.

5.1.5 The navigation lamp can be provided with an automatic device of water leakage on its shell.

5.1.6 The interior of the navigation light's shell shall be painted with Berlin black.

5.1.7 Navigation lights shall adopt external connection mode.

5.1.8 Navigation lights shall have at least the degree of protection IP55 of the shell and the navigation light with LED light source shall have the degree of protection IP56 of the shell.

5.2 Optical performance

5.2.1 Chromaticity requirement

The chromaticity of all navigation lights shall conform to the standard, that is, it shall be within the illustrated area limits specified by the International Commission on illumination (CIE) for each color. See Figure 5.2.1 for further details.

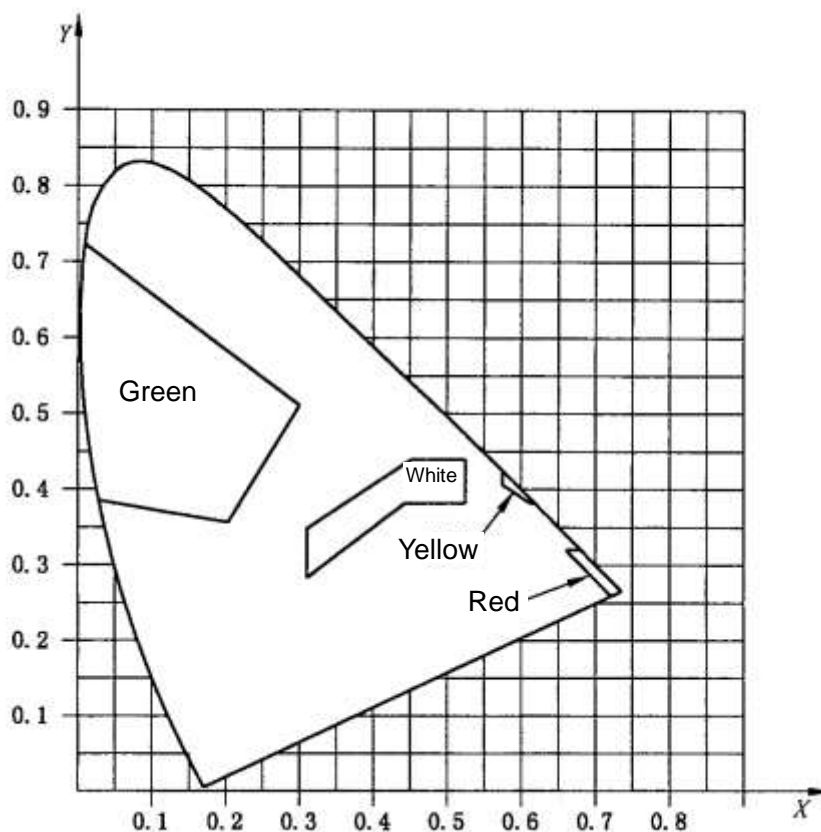


Figure 5.2.1 Chromaticity coordinates of navigation lights

The area boundary of each color is represented by the coordinates of knuckle points. These coordinates are shown in Table 5.2.2.

The knuckle points coordinate of area boundary of navigation lights 'color Table 5.2.2

Color of Navigation Lights	Coordinates	Knuckle Points					
		1	2	3	4	5	6
White	X	0.525	0.525	0.452	0.310	0.310	0.443
	Y	0.382	0.440	0.440	0.348	0.283	0.382
Green	X	0.028	0.009	0.300	0.203		

S-01(201712) NAVIGATION LIGHT

	Y	0.385	0.723	0.511	0.356		
Red	X	0.680	0.660	0.735	0.721		
	Y	0.320	0.320	0.265	0.259		
Yellow	X	0.612	0.618	0.575	0.575		
	Y	0.382	0.382	0.425	0.406		

5.2.2 Luminous intensity

(1)The minimum luminous intensity of the navigation light shall be calculated by using the following formula:

$$I=3.43 \times 10^6 \times T \times D^2 \times K^{-D}$$

Where: I - luminous intensity in candelas under service conditions
 T - the threshold factor of 2×10^{-7} Lux;

D - the range of visibility (luminous range) of the light in nautical miles,

K - the atmospheric transmissivity. For prescribed lights, the value of K shall be 0.8 corresponding to a meteorological visibility of approximately 13 nautical miles.

(2)

A selection of figures derived from the formula is given in the following table:

Table 5.2.2 (2)

Range of visibility (luminous range) of light in nautical miles D	Luminous intensity of light in candelas for K=0.8 I
1	0.9
2	4.3
3	12
4	27
5	52
6	94

Note:

The maximum luminous intensity of navigation lights should be limited to avoid undue glare. This shall not be achieved by a variable control of the luminous intensity.

If the navigation light source is LED, it is suggested that the minimum luminous intensity at the time of its initial use shall be the proportional multiple of the minimum luminous intensity after its normal attenuation.

(3)Distribution of luminous intensity

①

In the horizontal directions where decrease of luminous intensity to “practical cut-off” is required by section 9 of Annex I to COLREGs, the luminous intensity should be no more than 10% of the average luminous intensity within the prescribed sector for vessels not less than 12 m in length.

②

Within the prescribed sector in which the minimum luminous intensity is required by section 9 of Annex I to COLREGs, the horizontal intensity distribution of the light should be uniform in such a way that the measured minimum and maximum luminous intensity values (in candelas) do not differ by more than a factor of 1.5, to avoid luminous intensity changes which may result in the appearance of a flashing light for vessels not less than 12 m in length.

③ Within the prescribed sector in which the minimum luminous intensity is required by section 10 of Annex I to COLREGs, the vertical intensity distribution of the light should be uniform in such a way that the measured minimum and maximum luminous intensity values (in candelas) do not differ by more than a factor of 1.5, to avoid luminous intensity changes which may result in the appearance of a flashing light for vessels not less than 12 m in length.

5.2.3 Sector of light

See Table 5.2.3 for details.

Sector of light of navigation lights

Table 5.2.3

No.	Name of Navigation Lights	Light Color	Minimum Visibility Distance(n mile)			Total Angle	Horizontal sectors	Vertical sectors
			Ship Length $\geq 50\text{m}$	$50\text{m} \leq$ Ship Length $< 20\text{m}$	Ship Length $< 12\text{m}$			
1	Masthead light	White	6	5	2	225 °	From right ahead of the ship to 22.5 degrees abaft the beam on each side	From 5 degrees over the horizontal level to 5 degrees below the horizontal level
2	Port side light	Red	3	2	1	112.5 °	From right ahead of the ship to 22.5 degrees abaft the beam on port side	From 5 degrees over the horizontal level to 5 degrees below the horizontal level
3	Starboard light	Green	3	2	1	112.5 °	From right ahead of the ship to 22.5 degrees abaft the beam on starboard side	From 5 degrees over the horizontal level to 5 degrees below the horizontal level
4	Sternlight	White	3	2	2	135 °	From right aft of the ship to 67.5 degrees on each side	From 5 degrees over the horizontal level to 5 degrees below the horizontal level

S-01(201712) NAVIGATION LIGHT

5	Towing light	Yellow	3	2	2	135 °	From right aft of the ship to 67.5 degrees on each side	From 5 degrees over the horizontal level to 5 degrees below the horizontal level
6	Red all-round light	Red	3	2	2	360 °	All-round	From 5 degrees over the horizontal level to 5 degrees below the horizontal level
7	White all-round light	White	3	2	2	360 °	All-round	From 5 degrees over the horizontal level to 5 degrees below the horizontal level
8	Green all-round light	Green	3	2	2	360 °	All-round	From 5 degrees over the horizontal level to 5 degrees below the horizontal level
9	Yellow all-round light	Yellow	3	2	2	360 °	All-round	From 5 degrees over the horizontal level to 5 degrees below the horizontal level

Distribution of sector of light:

(1) In addition to meeting the requirements of Table 5.2.3.1, the vertical sector of light can be reduced to a specified minimum luminous intensity of 60 percent from the angles of 5 to 7.5 degrees over the horizontal line and 5 to 7.5 degrees below the horizontal line.

(2) In addition to meeting the requirements of Table 5.2.3.1, the horizontal sector of light shall meet the following requirements:

① The sidelights of port side and starboard side shall maintain at least the required luminous intensity from right ahead to 17.5 degrees abaft the beam on one side. It can be reduced to 50 percent of the minimum luminous intensity from 17.5 to 22.5 degrees abaft the beam and can be reduced to fully turning off the sector of light from 22.5 to 27.5 degrees. On the other side of the right ahead, the full luminous intensity shall be displayed within 1 degree and the luminous intensity shall be reduced to fully turning off the sector of light from 1 to 3 degrees.

② The horizontal sector of masthead light shall maintain at least the required luminous intensity from right ahead to 17.5 degrees abaft the beam on each side. It can be reduced to 50 percent of the minimum luminous intensity from 17.5 to 22.5 degrees abaft the beam on each side and can be reduced to fully turning off the sector of light from 22.5 to 27.5 degrees.

③ The horizontal sector of sternlight shall maintain at least the required luminous intensity from right aft to 62.5 degrees on each side. It can be reduced to 50 percent of the minimum luminous intensity from 62.5 to 67.5 degrees on each side and can be reduced to fully turning off the sector of light from 67.5 to 72.5 degrees.

5.3 Special requirements for navigation lights using LED as light source:

The luminous intensity of LEDs gradually decreases while the electricity consumption remains unchanged. The rate of decrease of luminous intensity depends on the output of LEDs and temperatures of LEDs. To prevent shortage of luminous intensity of LEDs:

5.3.1 An alarm function should be activated to notify the Officer of the Watch that the luminous intensity of the navigation lights reduces below the level required by COLREGs;

or

5.3.2 LEDs should only be used within the lifespan (practical term of validity) specified by the manufacturer to maintain the necessary luminous intensity of LEDs. The lifespan of LEDs should be determined and clearly notified by the manufacturer based on the appropriate test results on the decrease of luminous intensity of the LEDs under various temperature conditions and on the temperature condition of LEDs in the light during operation, taking the appropriate margin into account.

5.4 Requirements for flashing light

5.4.1 The main characteristics of the flashing light, such as its type, purpose, visibility distance and chromaticity, are shown in the following Table:

Table 5.4.1

S/N	Type	Purpose	Visibility Distance (n mile)	Chromaticity	Direction of the Emission
1	Masthead	For hovercrafts or wing-in-ground-effect vehicles	3	Yellow or red	All-round
			2		
2	Masthead	For operation	5	White	All-round

5.4.2 The all-round flashing yellow light used for hovercrafts shall flash at regular intervals at a frequency of 120 flashes or more per minute. 5.4.3 The operating lights shall be able to last about 1 s, each flash interval about 1 s. The interval between front and back signals shall be not less than 10 s.

5.4.4 The horizontal light intensity of the flashing light shall not be less than the value determined by the following formula:

$$I_f = \frac{0.2 + t}{t} I \quad cd$$

Where, I_f represents the horizontal light intensity of flashing light in cd

t represents duration of flash in s;

I represents luminous intensity as specified by 5.2.2 in cd.

5.5 Mark

5.5.1 Each of navigation lights shall be marked with:

(1)

the manufacturers name or symbol, and designation of type;

(2)

the type/category of the Navigation light in accordance with COLREGs;

(3) Serial number, survey mark and approval numbers of this Classification Society;

(4) head line directions; (except for the all-round light);

(5) range in nautical miles;; and

(6) nominal wattage of the light source in watts,

5.5.2 When the navigation lights are not permitted for geometric size, the manufacturer mark and survey mark can be used instead of the nameplate.

5.6 Related equipment

5.6.1 The manufacturer shall specify the size of the shutter according to the structural characteristics of the sidelights, and shall confirm that it is qualified by photometric test together with the sidelight screen.

5.6.2 The matching items such as the size and installation of sidelight screen shall be written to the specification of manufacturer. The shipyard shall manufacture and install the sidelight screen according to the specification.

5.6.3

Screens for sidelight may be a part of a ship's structure. All associated equipment should be produced in a robust, non-corroding material, which should ensure a long-term durability for the relevant operation.

5.7 Maintenance

5.7.1 Double sets or two lights of Masthead light, sidelights and sternlight shall be provided for the ship not less than 50m in length.

5.7.2 The navigation light with replaceable light source shall designed such that the light source specified by the manufacturer is easily and effectively replaced without careful recalibration or adjustment.

5.7.3 The navigation lights shall be constructed and installed for easy check and repair at any time, if necessary.

5.7.4 The structure of navigation lights shall be easy to disassemble, lift, replace the parts and handle, and prevent the light bulb from loosening and falling out.

6 Selection of typical samples

Samples shall be taken from qualified products provided by the manufacturer, including each type, every color and every rated voltage of navigation lights. The sealed samples shall be sent to test institute approved by this classification society.

7 Type test

7.1 The items, method and technical specifications of the type test shall meet the following requirements:

7.1.1 Annex I of Convention on The International Regulations for Preventing Collision at Sea (COLREG) 1972 and its Amendments,

7.1.2 International Maritime Organization Resolution MSC.253 (83) "*Adoption of the Performance Standard for Navigation Lights, Navigation Light Controllers and Associated Equipment*"

7.1.3 International Maritime Organization Resolution A.694 (17) "General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System (GMDSS) and for Electronic Navigational Aids"

7.1.4 The uniform interpretation of the International Regulations for Preventing Collisions at Sea 1972 and its amendments in MSC.1- Circ.1427

7.1.5 IEC 60945:2002/COR1:2008 "Maritime Navigation and Radio Communication Equipment and Systems – General Requirements–Methods of Testing and Required Test Results"

7.1.6 Chapter 13, Part 2B of China MSA Regulation for Statutory Survey of Ships and Offshore Installations-Regulation for Statutory Survey of Sea-Going Ships Engaged in International Voyages (2014).

7.1.7 EN 14744 Inland navigation vessels and sea-going vessels – Navigation light

7.1.8 China Classification Society, *Guidelines for Type Approval Test of Electric and Electronic Products* (currently valid)

7.2 Type test items

Table 7.2

S/N	Classification of Tests	Test Items	Standards	Test Method
1.	Appearance inspection	Structure	Article 4.1 of MSC.253(83) Resolution and Part 2B Title 4 Chapter 13 Article 2.1.7-2.1.11 of <i>Statutory Inspection Regulation of Ships and Marine Facilities–Technical Regulation for Statutory Inspection of International Seagoing Ships (2014)</i>	Article 4.1 of MSC.253(83) Resolution and Part 2B Title 4 Chapter 13 Article 2.1.7-2.1.11 of <i>Statutory Inspection Regulation of Ships and Marine Facilities–Technical Regulation for Statutory Inspection of International Seagoing Ships (2014)</i>
2.		Identification	Article 8 of MSC.253(83) Resolution and Part 2B Title 4 Chapter 13 Article 2.1.11 of <i>Statutory Inspection Regulation of Ships and Marine Facilities–Technical Regulation for Statutory Inspection of International Seagoing Ships (2014)</i>	Article 8 of MSC.253(83) Resolution and Part 2B Title 4 Chapter 13 Article 2.1.11 of <i>Statutory Inspection Regulation of Ships and Marine Facilities–Technical Regulation for Statutory Inspection of International Seagoing Ships (2014)</i>

Table 7.2(continued)

3.	Optical performance	Photometric test	Annex I Clause 8, 9, and 10 of the 1972 International Regulations for Preventing Collisions at Sea and MSC.1–Circ.1427	Article 5.2.2 in EN 14744 Regulation
4.		Distribution of luminous intensity	Article 4.2.1, 4.2.2 and 4.2.3 in MSC.253(83) Resolution	Article 5.2.2 in EN 14744
5.		Colorimetric Test	Annex I Clause 7 of International Regulations for Preventing Collisions at Sea 1972	Article 5.2.3 in EN 14744
6.		Measurement of luminous intensity and color locus under the influence of temperature (applicable to LED light source)	Article 4.10.2.1 in EN 14744	Article 5.2.4 in EN 14744

S-01(201712) NAVIGATION LIGHT

7.		Flashing light (applicable to flashing light)	Annex I Clause 8 of the 1972 International Regulations for Preventing Collisions at Sea, Part 2B Title 4 Chapter 13 Article 3.1 of <i>Statutory Inspection Regulation of Ships and Marine Facilities–Technical Regulation for Statutory Inspection of International Seagoing Ships (2014)</i> and Article 4.4 in EN 14744	Annex I Clause 8 of the 1972 International Regulations for Preventing Collisions at Sea, Part 2B Title 4 Chapter 13 Article 3.1 of <i>Statutory Inspection Regulation of Ships and Marine Facilities–Technical Regulation for Statutory Inspection of International Seagoing Ships (2014)</i> and Article 5.2.5 in EN 14744
8.		Mark of light source	Article 4.9 in EN 14744	Annex A of EN 14744
9.	Light source	Alarm or lifetime of LED light source	Article 4.3 in MSC.253(83) Resolution and Article 4.10 in EN14744	Article 4.3 in MSC.253(83) Resolution and Article 4.10 in EN14744

Table 7.2(continued)

10.	Power supply	Extreme power supply	Article 5.3.2 in EN14744	Chapter 5.2.2 and 7.1 in IEC 60945:2002
11.	Environmental conditions	Dry heat	Article 5.3.3 in EN14744	Chapter 8.2 in IEC 60945:2002
12.		Low temperature	Article 4.10.2.2 in EN14744	Chapter 8.4 in IEC 60945:2002
13.		Vibration	Article 5.3.5 in EN14744	Chapter 8.7 in IEC 60945:2002
14.		Rain and spray	Article 5.3.6 in EN14744(suitable for the degree of protection not lower than IP X6)	Chapter 8.8 in IEC 60945:2002
			Section 2.15 in GD 22-2015(suitable for the degree of protection IP55)	Section 2.15 in GD 22-2015
15.		Salt mist (corrosion)	Article 5.3.1 in En 14744	Section 8.12 in IEC 60945:2002
16.		Withstand voltage test	Article 2.14 in GD22-2015	Article 2.14 in GD22-2015
17.		Measurement of insulation resistance	Article 2.3 in GD22-2015	Article 2.3 in GD22-2015
18.	Solar radiation	Article 5.3.7 in En 14744	Chapter 8.10 in IEC 60945:2002	

19.	EMC (applicable to LED light source)	Conducted Emission	Article 5.3.8 in En 14744	Chapter 9.2 in IEC 60945:2002
20.		Radiation emission of shell port		Chapter 9.3 in IEC 60945:2002
21.		Conducted susceptibility induced by radio-frequency fields		Chapter 10.3 in IEC 60945:2002
22.		Immunity to Radio frequency Electromagnetic Field		Chapter 10.4 in IEC 60945:2002
23.		Electrical fast transient immunity		Chapter 10.5 in IEC 60945:2002
24.		Surge immunity		Chapter 10.6 in IEC 60945:2002
25.		Electrostatic discharge immunity		Chapter 10.9 in IEC 60945:2002
26.	Special	Compass safe distance (suitable for magnetic materials)	Article 4.8.8 in En 14744	Chapter 11.2 in IEC 60945:2002
27.		shock	Article 4.8.10 in En 14744	Article 5.4.1 in En 14744
28.		Housing temperature	Article 4.8.9 in En 14744	Article 5.4.2 in En 14744
29.		Tensile loading test (Applicable to pre-lifting navigation lights)	Article 4.5.2 in En 14744	Article 5.4.3 in En 14744
30.	Personal safety	Insulation of dangerous voltage	Article 4.5.3 in En 14744	Chapter 12.1 in IEC 60945:2002

7.3 Performance Test and Performance Check

7.3.1 A Performance Test means a complete photometric and colorimetric test as described.
 7.3.2 A Performance Check refers to the normal operation of the navigation light after the power is turned on.

7.3.3 Performance Check (PC for short) shall be carried out after each of the tests specified in IEC 60945.

7.3.4 After the corrosion test, the Performance Test (PT) is carried out according to the "test sequence", which means the test on the same navigation lights shall be conducted in sequence of vibration, shock dry heat, low temperature, solar radiation, rain and water spray test, then Performance Test (PT).

8 Unit/batch inspection

8.1 The unit/batch inspection of the navigation light can only be accepted after type approval.

8.2 For the unit/ batch inspection for the products of the manufacturer, which obtained the type approval (B) of CCS, the inspection items shall be carried out in accordance with the product inspection plan which has been approved at the time of approval. But at least, it shall include:

- (1) Inspection of structure, light bulb, wiring and identification;
- (2) Inspection of materials, dimensions and electrical gaps;
- (3) Luminous intensity test;
- (4) Test of light sectors
- (5) Chromaticity test;
- (6) Measurement of insulation resistance;
- (7) Withstand voltage test

8.3 The surveyor shall randomly select some of the products of each batch to carry out the test of the above items according to the principle of at least 5 percent and at least 2 sets of each type of each batch of navigation lights being sampled.