

**PART II RULES FOR THE CONSTRUCTION  
AND CLASSIFICATION OF SHIPS IDENTIFIED BY  
THEIR MISSIONS**

**TITLE 47 SUPPLY VESSELS**

**SECTION 7 ELECTRICITY**

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- B TECHNICAL DOCUMENTATION
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## CHAPTER A APPROACH

### CHAPTER CONTENTS

#### A1. APPLICATION

#### A2. STANDARDS AND UNITS

#### A3. DEFINITIONS

### A1. APPLICATION

#### 100. Types of installations

101. These Rules apply to electrical installations on vessels covered by this Part II, Title 47.

102. and 103. – See Title 11

### A2. STANDARDS AND UNITS

#### 100. Standards

– See Title 11

#### 200. Units

– See Title 11

#### 300. Statutory requirements

301. For purposes of this Section 7 of Title 47, apply the regulations of NORMAM 01 for ships with  $GT < 500$  and SOLAS Chapter II-1, Part D to vessels with  $GT \geq 500$ .

302. Additionally, vessels with  $GT < 500$  or  $\geq 500$  GT with additional class notation "Chemicals Carrier" or "Oil Carrier" meet the Resolution IMO A. 673(16) "Guidelines for the Transport and Handling of Limited Amounts of hazardous and Noxious Liquid Substances in Bulk in Offshore Support Vessels "(LHNS), as amended, as well as the IBC Code in the applicable parts.

304. The RBNA considers for all purposes the regulations of this Part II, Title 47, Section 7, sub-chapter A2., Items 301 and 302 above as class requirements.

### A3. DEFINITIONS

#### 100. Additional definitions

101. **Hazardous area:** area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of electrical apparatus;

- a. **Zone 0:** area in which an explosive gas atmosphere is present continuously or is present for long periods;
  - a.1. Interior of storage tanks of cargo;
  - a.2. Inside the cargo pumps and piping
- b. **Zone 1:** area in which an explosive gas atmosphere is likely to occur in normal operation;
  - b.1. Compartments enclosed or semi-closed containing cargo pumps, cargo piping or that are not of fully welded construction;
  - b.2. Zones or compartments on the open deck, or compartments partially closed on the open deck, within a range of 3 meters from the equipment to remove oil, scantlings or any other openings in the cargo tanks and of any pumps, valves, flanges for handling of removed oil which are not in the pump room;
  - b.3. Any enclosed compartments that have a direct opening to the zones and compartments mentioned above.
- c. **Zone 2:** area in which an explosive gas atmosphere is not likely to occur in normal operation and, if it does occur, is likely to do so only infrequently and will exist for a short period only;
  - c.1. Zones on open decks or semi-enclosed spaces on open decks on all cargo tanks, including ballast wing tanks, plus the areas situated 1.5 meters forward and aft, and 1.5 meters high from the deck.
  - c.2. Any compartments adjacent to cargo tanks, except in the cases for which:
    - i. The tank is made of welded steel construction;
    - ii. The compartment is equipped with forced ventilation capable of providing at least 20 changes per hour, and
    - iii. The ventilation system above has characteristics such that this ventilation can be maintained and ensure safe operation.
- d. **Extended hazardous area:** area in which an explosive atmosphere is not likely to occur in normal operation and, if it does occur, is likely to do so only infrequently and will exist for a short period only (and comparable with zone 2 as defined in IEC 60092-502).
  - d.1. that there is no formation of gas pockets.

## CHAPTER B TECHNICAL DOCUMENTATION

### CHAPTER CONTENTS

#### B1. DOCUMENTATION TO THE RBNA

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#### B1. DOCUMENTATION TO THE RBNA

##### 100. Documents for approval

101. and 102. - See Title 11

103. In the case of vessels with additional class notation "Chemical products" or "Oil Products", the following plans are included beyond those listed in Title 11:

- a. Plan of demarcation of "cargo zone" and "risk areas", with the location of machinery, appliances or electrical equipment installed in them;
- b. list of machinery, appliances or electrical equipment, mentioned above, indicating the following characteristics:
  - a.1. machine or appliance or equipment;
  - a.2. location;
  - a.3. type of protection;
  - a.4. type of explosion protection, and
  - a.5. tests that must be submitted.
- c. certificates of protection of the equipment installed in the "cargo zone" as prescribed in these Rules, numbered and stamped, with the approval of RBNA.

## CHAPTER C MATERIALS AND MANUFACTURE

### CHAPTER CONTENTS

#### C1. SELECTION

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#### C1. SELECTION

##### 100. Application

101. See Title 11

102. All electrical cables of the "cargo zone" are to be shielded with metallic frame.

103. The cables feeding the mobile navigation lights and runway lighting will be of the shielded type H 07 RN-F according to standard DIN 2451 CE 66 or equivalent, and conduit section at least 1.5 mm<sup>2</sup>.

**200. Type approval**  
– See Title 11

**300. Electrical components**  
- See Title 11

## CHAPTER D PRINCIPLES OF CONSTRUCTION

### CHAPTER CONTENTS

#### D1. CABLE INSTALLATION

#### D2. LOCATION OF SWITCHBOARDS

#### D3. INSTALLATION OF EQUIPMENT IN HAZARDOUS AREAS

#### D4. DEGREES OF PROTECTION

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#### D1. CABLE INSTALLATION

##### 100. Specific conditions

101. to 105. – See Title 11

106. Cables in spaces within and adjacent to the "cargo zone" of the closed or semi-closed type, are to have conduits and their shields connected to the hull, so that any insulation fault can be identified.

107. The intrinsically safe circuit cables, as defined in what follows, are to be separated and independent from those of any other electrical system and installed at a distance of at least 50 mm. The installation in mechanical path, common to cables of other circuits, will be permitted only if the cables can be set separately by different bands and respected the minimum distance.

108. In the "cargo zone" mechanical pathways and conduits, which are no longer automatically grounded by its contact with the metallic structure of the vessel are be grounded.

109. The requirements of paragraph 106. also apply to systems with voltage below 50 V.

110. The portable cables are prohibited in the cargo zone, except for intrinsically safe circuits and the connection of the navigation lights, lighting of walkways and immersion

pumps aboard oil recovery vessels (Part II, Title 35 of these Rules).

111. These cables are to meet the requirements of applicable standards and have minimal conduit section 1.5 mm<sup>2</sup> and are to be as short as possible, installed so that they are protected against damage.

112. When the ship is not granted to carry products that require explosion protection, the passage of cables is permitted through the bilge spaces.

## D2. LOCATION OF SWITCHBOARDS

### 100. Specific conditions

101. to 104. – See Title 11

105. The switchboards are not to be located in areas where there is the possibility of accumulation of explosive gas or vapor.

## D3. INSTALLATION OF EQUIPMENT IN HAZARDOUS AREAS

### Guidance

*This Subchapter D3 applies to supply vessels with the service notations “oil products”, “chemical products” and “DG (dangerous goods)”.*

### End of guidance

### 100. Electrical equipment in hazardous areas and areas where explosives are stored

101. **Selection with respect to ignition temperature of the gas or vapour:** The electrical apparatus shall be so selected that its maximum surface temperature will not reach the ignition temperature of any gas or vapour, or mixture of gases or vapours, which can be present. The surface temperature considered may be that of an internal or external part, according to the type of protection of the apparatus. Symbols for the temperature classes which may be marked on the electrical apparatus have the meaning indicated in table T.D3.101.1. (IEC 60092-506)

**TABLE T.D3.101.1 – RELATIONSHIP BETWEEN THE TEMPERATURE CLASSES AND IGNITION TEMPERATURE\***

Temperature class of electrical apparatus	Ignition temperature of gas or vapour
T1	>450 °C
T2	>300 °C
T3	>200 °C
T4	>135 °C
T5	>100 °C
T6	>85 °C

\*Derived from IEC 60079-14

<sup>1)</sup> Generally, the ignition temperature of a mixture is taken to be equal to that of the component having the lowest ignition temperature, or is determined by test. However, it is recognized that the properties of certain categories of cargo are sufficiently well established to allow section of equipment without individual analysis or test; for example equipment of temperature class T3 may be accepted for use in hazardous areas on crude oil or oil products tankers without analysis or test of particular cargoes.

<sup>2)</sup> For certain categories of chemical cargoes, equipment of temperature class T4, T5 or T6 may be required.

(IEC 60092-502, 6.2.3 and Table 3)

102. **Selection with respect to the classification of gas or vapour:** Flameproof enclosures and intrinsically-safe electrical apparatus, apparatus incorporating flameproof or intrinsically-safe components, or otherwise tested or certified for particular groups, shall be selected according to IEC 60079-12. Apparatus marked for particular gases shall be selected only where no other flammable gas can be present. Symbols for the groups which may be marked on the apparatus are listed against representative gases in Table T.D3.102.1.

NOTE 2 – For certain categories of chemical cargoes and liquefied gases, equipment of groups IIB and IIC may be required. (IEC 60092-502 and 60092-506)

**TABLE T.D3.102.1 – RELATIONSHIPS BETWEEN APPARATUS GROUP AND REPRESENTATIVE GASES\***

Apparatus group	Representative gas
IIA	Propane
IIB	Ethylene
IIC	Hydrogen
*Derived from IEC 60079-1	
NOTE - Gases generally are allocated to various groups upon determination of the maximum experimental safe gap or the minimum ignition current. These are related to the maximum gaps permissible in flameproof enclosures and the maximum currents permitted in intrinsically-safe circuits; both reduce progressively from group IIA to group IIC. See IEC 60079-12.	

**220. Installation of electrical equipment in hazardous areas**

201. Electrical equipment and wiring shall not be fitted in hazardous areas and in areas where explosives are stored unless it is essential for the safety and operation of the ship.

202. In areas which are classified as hazardous when dangerous goods are carried, electrical equipment which is not essential for the safety and operation of the ship and which is not of a type approved for use in the hazardous areas, shall be completely disconnected, and protected against unauthorized re-connection. Disconnection shall be made outside the hazardous areas and be effected with isolating links or lockable switches.

203. All cables and electrical equipment shall be protected against mechanical damage.

204. Cable penetrations of decks and bulkheads shall be sealed against passage of gas.

205. Cable joints in cargo spaces shall be avoided where possible. Where joints are unavoidable, they shall be enclosed in metal-clad or impact strength plastic junction boxes of certified-safety type (categorized per risk production specified in Clause 5 of IEC 60092-506) or heat-shrink or encapsulated-crimp sleeve cable joints.

206. Cables shall be either:

- a. enclosed in screwed heavy gauge steel drawn or seam-welded and galvanized conduit, or
- b. protected by electrically continuous metal sheathing or metallic wire armour braid or tape.

[IEC 60092-506]

**300. Protection by overpressure**

301. Where a space has an opening into an adjacent hazardous space or area, it may be made into a non-hazardous space in accordance with the following requirements as indicated in Table T.D3.301.1, item E (IEC 60092-506, Annex B, Item E).

302. A minimum overpressure of 25 Pa (0,25 mbar) with respect to the adjacent, hazardous space or area shall be maintained at all points inside the space and its associated ducts at which leaks are liable to occur, all doors and windows being closed.

303. During initial start-up or after shut-down, it is necessary, before energizing any electrical apparatus within the space which is not suitably protected for the classification of the space in the absence of pressurization, to:

- a. either ensure that the internal atmosphere is non-hazardous, or proceed with prior purging of sufficient duration that the internal atmosphere may be considered as non-hazardous, and
- b. pressurize the space.

NOTE The atmosphere is considered non-hazardous when, at all points in the space, the equipment enclosures and any associated ducts, the concentration of explosive gases or vapours is below 30 % of the lower explosive limit. The place of measurement should be judiciously chosen to determine the highest concentration of gas.

304. Monitoring shall be provided to ensure the satisfactory functioning of pressurization of spaces having an opening into a more hazardous zone.

305. Where a flow monitoring device (required by D3.302 above) is used to indicate failure of pressurization, it should be verified that either the pressurization level is maintained with any door or other opening open, or an alarm is given if any door or opening is not closed.

306. In the event of the loss of overpressure, the following protective measures shall apply to electrical equipment not protected for use in hazardous areas (for dangerous goods in packaged form, Class 1 – Explosives, except goods in division 1.4, compatibility group S of the IMDG Code as per IEC 60092-506, item 1.2a))

- a. suitable alarm (visible and audible);
- b. immediate action to restore pressurization;
- c. programmed disconnection of power supply if the pressurization cannot be restored for an extended



period or if the concentration of flammable gas is rising to a dangerous level.

[IEC 60092-506]

#### 400. Portable electrical equipment

401. Portable electrical equipment shall normally have its own self-contained electrical source of energy, except for intrinsically safe circuits, and shall be certified-safe type as specified in 4 D3.200 for the appropriate risk, unless specifically allowed by the appropriate authority (for example, portable bilge pumps).  
(IEC 60092-506)

**TABLE T.D3.301.1 – PROTECTION BY OVERPRESSURE IN SPACES ADJACENT TO HAZARDOUS SPACES OR AREA**

#### Symbols



Hazardous area  
(comparable with zone 1)



Extended hazardous area  
(comparable with zone 2)



Non-hazardous space



Substantially gas-tight self-closing door

NOTE Arrangements are to be to the satisfaction of the appropriate authority.

Item	Typical examples	Remarks
E		Pressurized space visual and acoustic alarm at a manned position in case of loss of pressure

#### D4. TYPES OF PROTECTION

##### 100. General conditions

101. to 103 See Part II, Title 11, Section 7, Subchapter E2.

##### 200. Degrees of protection

– See Part II, Title 11, Section 7, Subchapter E2

##### 300. Types and location of electrical equipment for the carriage of various classes of dangerous goods

301. The present requirements are additional to those of Part II, Title 11, Section 7, Subchapter E2. The requirements are based upon IEC Standard 60079-14, Section 5.

302. For electrical equipment installed in Zone 1 and Zone 2 hazardous areas, only the following types are permitted:



**TABLE T.D4.302.1 – TYPE AND LOCATION OF ELECTRICAL EQUIPMENT FOR THE CARRIAGE OF VARIOUS CLASSES OF DANGEROUS GOODS**

Zone	Equipment protection level (*)	Degree of protection	Code	Reference standard
1	-	Any type that may be considered for Zone 0		
		Through runs of cable		
	Ga	Intrinsically safe	Ex(ia)	IEC 60079-11
		Encapsulated	Ex(ma)	ABNT NBR 60079-18
	Gb	Flame proof	Ex(d)	ABNT NBR 60079-1
		Increased safety	Ex(e)	ABNT NBR 60079-7
		Intrinsically safe	Ex(ib)	IEC 60079-11
		Encapsulated	Ex(m) Ex(mb)	ABNT NBR 60079-18
		Pressurized	Ex(p)	ABNT NBR 60079-2
Sand filled		Ex(q)	ABNT NBR 60079-5	
2	-	Any type that may be considered for Zone 1		
	Gc	Intrinsically safe	Ex(ic)	IEC 60079-11
		Encapsulated	Ex(mc)	ABNT NBR 60079-18
		Not ignited	Ex(n) Ex (nA)	ABNT NBR 60079-15
		Restricted “breathing”	Ex(nR)	ABNT NBR 60079-15
		Energy restriction	Ex(nL)	ABNT NBR 60079-15
		Sparking apparatus in which the contacts are protected in a suitable way	Ex(nC)	ABNT NBR 60079-15
		Pressurized	Ex(pZ)	ABNT NBR 60079-2
FISCO – Fieldbus intrinsically safe concept		ABNT NBR 60079-27		

(\*) EPL – Equipment Protection Level

EPL a – with very high level of protection and thus a very high degree of safety

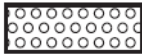





EPL b – with high level of protection and therefore a high degree of safety

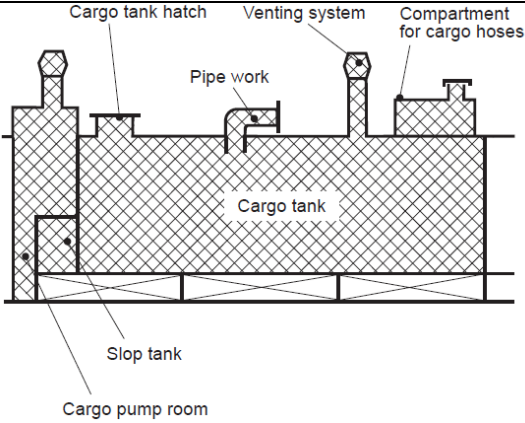
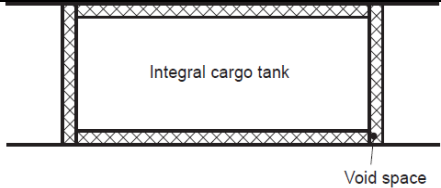
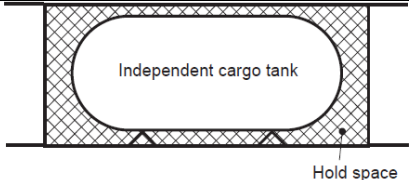
EPL c – with normal level of protection and therefore a conventional degree of safety

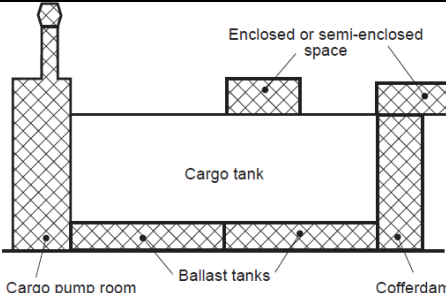
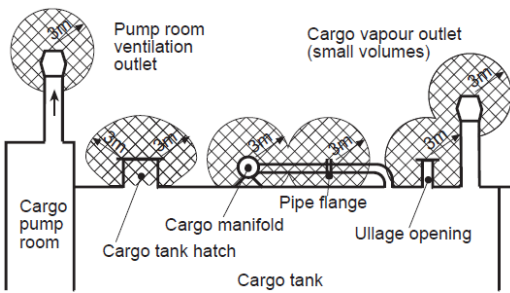
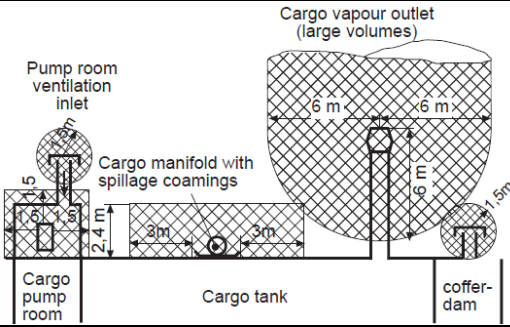
303. When apparatus incorporates a number of types of protection, it is to be ensured that all are suitable for use in the zone in which it is located.



**TABLE T.A3.101.1 – EXAMPLES OF HAZARDOUS AREA CLASSIFICATION – TANKERS OFFSHORE SUPPLY VESSELS CARRYING FLAMMABLE LIQUIDS OTHER THAN LIQUEFIED GASES HAVING A FLASHPOINT NOT EXCEEDING 60 °C, FOR EXAMPLE, CRUDE OIL, OIL PRODUCTS, CHEMICAL PRODUCTS**

<b>Symbols:</b>		Area classification as zone 0
		Area classification as zone 1
		Area classification as zone 2
		Self-closing door without holding back arrangements
		Audible and visual alarm in case of loss of pressure or failure of ventilation
		Source of release
	> p	Pressure above atmospheric pressure

Zon a de risco Haz ard Zone	Spaces		Example
	Item N°	Description	
	<b>Spaces in zone 0</b>		
<b>0</b>	1	The interiors of cargo tanks, slop tanks, any pipework of pressure-relief or other venting systems for cargo and slop tanks, pipes and equipment containing the cargo or developing flammable gases or vapours.	
	<b>Spaces in zone 1</b>		
<b>1</b>	2	Void spaces adjacent to, above or below integral cargo tanks	
<b>1</b>	3	Hold spaces containing independent cargo tanks	

Zona de risco Hazard Zone	Spaces		Example
	Item N°	Description	
1	4	Cofferdams and permanent (for example, segregated) ballast tanks adjacent to cargo tanks	
1	5	Cargo pump rooms	
1	6	Enclosed or semi-enclosed spaces, immediately above cargo tanks (for example, between decks) or having bulkheads above and in line with cargo tank bulkheads, unless protected by a diagonal plate acceptable to the appropriate authority.	
1	7	Spaces, other than cofferdam, adjacent to and below the top of a cargo tank (for example, trunks, passageways and hold)	
1	8	Areas on open deck, or semi-enclosed spaces on open deck, within 3 m of any cargo tank outlet, gas or vapour outlet (see note), cargo manifold valve, cargo valve, cargo pipe flange, cargo pump-room ventilation outlets and cargo tank openings for pressure release provided to permit the flow of small volumes of gas or vapour mixtures caused by thermal variation. NOTE – Such areas are, for example, all areas within 3 m of cargo tank hatches, sight ports, tank cleaning openings, ullage openings, sounding pipes, cargo vapour outlets.	
1	9	Areas on open deck, or semi-enclosed spaces on open deck above and in the vicinity of any cargo gas outlet intended for the passage of large volumes of gas or vapour mixture during cargo loading and ballasting or during discharging, within a vertical cylinder of unlimited height and 6 m radius centred upon the centre of the outlet, and within a hemisphere of 6 m radius below the outlet.	
1	10	Areas on open deck, or semi-enclosed spaces on open deck, within 1,5 m of cargo pump room entrances, cargo pump room ventilation inlet, openings into cofferdams or other zone 1 spaces.	
1	11	Areas on open deck within spillage coamings surrounding cargo manifold valves and 3 m beyond these, up to a height of 2,4 m above the deck.	

Zona de risco Hazard Zone	Spaces		Example
	Item N°	Description	
1	12	Areas on open deck over all cargo tanks (including all ballast tanks within the cargo tank area) where structures are restricting the natural ventilation and to the full breadth of the ship plus 3 m fore and aft of the forward-most and aft-most cargo tank bulkhead, up to a height of 2,4 m above the deck.	
1	13	Compartments for cargo hoses	
1	14	Enclosed or semi-enclosed spaces in which pipes containing cargoes are located.	
		<b>Spaces in zone 2</b>	
2	15	Areas of 1,5 m surrounding open or semi-enclosed spaces of zone 1 if not otherwise specified in this Chapter .	
2	16	Spaces 4 m beyond the cylinder and 4 m beyond the sphere defined in item 10 9	
2	17	Areas on open deck extending to the coamings fitted to keep any spills on deck and away from the accommodation and service areas and 3 m beyond these up to a height of 2,4 m above the deck	
2	18	Areas on open deck over all cargo tanks (including all ballast tanks within the cargo tank area) where unrestricted natural ventilation is guaranteed and to the full breadth of the ship plus 3 m fore and aft of the forward-most and aft-most cargo tank bulkhead, up to a height of 2,4 m above the deck surrounding open or semi-enclosed spaces of zone 1	

Zona de risco Hazard Zone	Spaces		Example
	Item N°	Description	
2	19	<p>Spaces forward of the open deck areas to which reference is made in 12 and 18, below the level of the main deck, and having an opening on to the main deck or at a level less than 0,5 m above the main deck, unless:</p> <ul style="list-style-type: none"> <li>– the entrances to such spaces do not face the cargo tank area and, together with all other openings to the spaces, including ventilating system inlets and exhausts, are situated at least 5 m from the foremost cargo tank and at least 10 m measured horizontally from any cargo tank outlet or gas or vapour outlet; and</li> <li>– the spaces are mechanically ventilated.</li> </ul>	

**TABLE T.A3.101.2 - EXAMPLES OF HAZARDOUS AREA CLASSIFICATION –OFFSHORE SUPPLY VESSELS CARRYING FLAMMABLE LIQUIDS HAVING A FLASHPOINT EXCEEDING 60 °C – UNHEATED CARGOES AND CARGOES HEATED TO TEMPERATURE ( $T_H$ ) BELOW, AND NOT WITHIN 15 °C, OF THEIR FLASHPOINT (FP):  $T_H < FP - 15\text{ °C}$**

Symbols: see Table T.A3.101.1

Zona de risco Hazard Zone	Spaces		Example
	Item N°	Description	
		<b>Spaces in zone 0</b>	
2	21 20	<p>The interiors of cargo tanks, slop tanks, any pipework of pressure-relief or other venting systems for cargo and slop tanks, pipes and equipment containing the cargo.</p>	
<p><i>Note: Cargoes heated to temperature (<math>T_H</math>) above their flashpoint (FP) and cargoes heated to temperature within 15 °C of their flashpoint: <math>T_H \geq FP - 15\text{ °C}</math> - The requirements of Table T.A3.101.1 are applicable.</i></p>			



## **CHAPTER T TESTING ELECTRICAL INSTALLATIONS ON BOARD**

### CHAPTER CONTENTS

- T1. TESTS DURING VESSEL CONSTRUCTION
  - T2. TESTS DURING THE VESSEL COMMISSIONING  
- See Title 11
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- See Title 11
- 

### **T1. TESTS DURING THE VESSEL CONSTRUCTION**

**100. Compliance**  
– See Title 11

**200. Tests of electrical equipments in manufacturers**  
– See Title 11

**300. Equipaments “explosion proof” and “intrincally safe”**

301. Electrical equipments “explosion proof” and equipments, instruments, circuits and devices “intrinsically safe”, for installation on board of ships classified by RBNA are to be tested and certified by independent and accredited laboratory.

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