陈文涛 邢正汉 刘 卫 主编

in Marine Electronic and Electrical Engineering

船舶电子电气专业英语

上海交通大學出版社
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内容提要

本书在编写过程中本着精简、实用和突出电子电气专业特点的原则，充分考虑船舶电子电气工程专业对学生的培养目标和未来工作岗位的职业需求，覆盖了750 kW及以上船舶电子电气员对“电子电气员英语”课程考试所要求的主要内容，涉及船舶概论、船舶电气、轮机自动控制技术、船舶计算机网络、船舶通信与导航系统、船舶管理等方面的知识。

本书可作为航海类院校“船舶电子电气专业英语”课程的教材，也可供船舶及航运相关行业电子电气技术人员作为提高专业英语水平的学习参考书。

图书在版编目(CIP)数据

船舶电子电气专业英语 / 陈文涛，邢正汉，刘卫主编. —上海：上海交通大学出版社，2014
ISBN 978-7-313-10795-4

Ⅰ. ①船… Ⅱ. ①陈… ②邢… ③刘… Ⅲ. ①船用电气设备—英语 Ⅳ. ①H31

中国版本图书馆CIP数据核字(2014)第013668号

船舶电子电气专业英语

主　　编：陈文涛　邢正汉　刘　卫
出版发行：上海交通大学出版社
邮政编码：200030
出 版 人：韩建民
印　　制：上海交大印务有限公司
开　　本：787 mm×1092 mm　1/16
字　　数：280千字
版　　次：2014年2月第1版
书　　号：ISBN 978-7-10795-4/H
定　　价：35.00元

地　　址：上海市番禺路951号
电　　话：021-64071208
经　　销：全国新华书店
印　　张：12.5
印　　次：2014年2月第1次印刷

前言

随着电气技术、计算机技术和信息技术的快速发展，船舶自动化水平不断提高，船舶电气系统和通信导航系统日趋复杂，维护维修难度越来越大，对专业技术人员的需求急剧增加。为适应这一形势，STCW公约马尼拉修正案中增加了“电子电气员”的职位，并于2012年1月1日正式生效实施。为培养适任的专业技术人员，经教育部批准，上海海事大学设立了船舶电子电气工程专业。《船舶电子电气专业英语》正是为船舶电子电气工程专业的教学需要而编写的。

本书在编写过程中本着精简、实用和突出电子电气专业特点的原则，充分考虑船舶电子电气工程专业对学生的培养目标和未来工作岗位的职业需求，覆盖了750 kW及以上船舶电子电气员对“电子电气员英语”课程考试所要求的主要内容，涉及船舶概论、船舶电气、轮机自动控制技术、船舶计算机网络、船舶通信与导航系统、船舶管理等方面的知识。

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本书电气部分由邢正汉编写，通信与导航部分由刘卫编写，全书由陈文涛负责统稿，并由林叶春负责全书的审校工作。本书的编写工作得到了上海海事大学教务处的鼎力资助，也得到了上海海事大学商船学院领导和轮机自动化教研

室全体老师的大力支持与帮助。在编写过程中岳虎、付军参与了全书词汇表以及课后练习的编写和校对工作，在此一并表示感谢。

由于编者水平所限，本书中不足之处和差错在所难免，竭诚希望广大同仁和读者批评指正！

编　者

2014 年 1 月

Contents

Lesson 1

Types of Ships

The term "ship" is used to denote a vehicle employed to transport goods and persons from one point to another over water. According to the nature of their cargo, and sometimes also the way the cargo is loaded/unloaded, ships can be divided into different categories, classes, and types, some of which are mentioned in Table 1.

The three largest categories of ships are container ships, bulk carriers (for bulk goods such as grain, coal, ores, etc.) and tankers, which again can be divided into more precisely defined classes and types. For example, tankers can be divided into oil tankers, gas tankers and chemical tankers, but there are also combinations, e.g. oil/chemical tankers.

Table 1 provides only a rough outline. In reality there are many other combinations, such as "Multipurpose bulk container carriers", to mention just one example.

Table 1 Ships' types

<table>
<tr><th colspan="2">Dry Cargo</th><th>Liquid Cargo</th><th>Passengers</th></tr>
<tr><td>Unit cargo
— Container ship
— Roll-on/Roll-off ship
— Reefer
— General cargo ship
— Cattle ship</td><td>Bulk cargo
— Bulk carrier
— Ore carrier</td><td>— Crude carrier (VLCC, ULCC)
— Product tanker
— Chemical tanker
— LPG/LNG carrier</td><td>— Passenger liner
— Car and Passenger ferry
— Cruise ship</td></tr>
<tr><th colspan="4">Multi-purpose ship</th></tr>
<tr><th>Navy</th><th>Fishing</th><th>Dredger</th><th>Work ship</th></tr>
<tr><td>— Aircraft carrier
— Cruiser
— Destroyer
— Submarine
— Frigate
— Mine sweeper</td><td>— Trawler
— Other types of fishing vessels</td><td>— Trailing hopper suction dredger
— Cutter suction dredger
— Dipper dredger
— Grab dredger
— Rock-dumper</td><td>— Crane vessel
— Cable layer
— Oil-recovery vessel
— Buoy layer
— Shearleg crane</td></tr>
</table>

(continued)

Service vessel	Pleasure craft	Various	Offshore construction
— Sea-going tug — Harbor tug — Icebreaker — Pilot vessel — Coast guard vessel — Research vessel	— Motor yachts — Sailing yachts	— Hydrofoil — Floating dock — Submersible platform — Pontoon — Barge	— Drilling rig/Jack-up — Drill ship — Pipe layer — Floating storage and offloading vessel

The following are examples of common cargo carriers:

1. Container ship

Container ships are cargo ships that carry all of their load in truck-size containers, in a technique called containerization. They are designed in such a manner that no space is wasted. Their capacity is measured in TEU or FEU depending upon the sizes of containers. TEU or FEU indicates the number of containers that the ship can carry.

TEU is short for "twenty-foot equivalent unit". The nominal length of these containers is: $20 * 0.305 = 6.10$ meters. The actual length is a little shorter, leaving some space between the containers. FEU means "forty-foot equivalent unit", the nominal length of which is: $40 * 0.305 = 12.20$ meters.

Informally known as "box boats", they carry the majority of the world's dry cargo. Most container ships are propelled by diesel engines and have crewmembers of 20 to 40 people. They generally have a large accommodation block at the stern, directly above the engine room. Container ships have grown from a capacity of 1,500 containers (1996) to 13798 (2011) on the oceans, right after crude oil carriers, or tankers.

2. Bulk carriers

Bulk carriers are ships especially designed to carry loose cargo in bulk. Possible cargos are coal, ore, grain and other agricultural products, fertilizer, cement, light minerals.

Bulk carriers have large upper and lower ballast tanks, i.e. topside and hopper tanks to facilitate automatic grain stowage (eliminate free surface) and to give the empty vessel sufficient draught and a better behavior whilst empty in transit. Ships transporting ore have a special design. Ore is very heavy (stowage factor is approximately $0.5\ m^3/t$) and thus ships only need small holds to be loaded completely. To prevent too large stability the holds must not be situated too low or too close to the sides of the ship. Some bulk carriers can also function as tankers. This combination carrier is called an Ore Bulk Oil (OBO) carrier.

3. LNG carrier

An LNG carrier is a tank ship designed for transporting liquefied natural gas (LNG). As the LNG market grows rapidly, the fleet of LNG carriers continues to

experience tremendous growth.

These cargoes are liquid when pressurized or brought under low temperature. When liquefied, the space that a gas takes is about 1/600 of the space needed under atmospheric conditions. Gasses are therefore transported in liquefied condition. Safety devices applicable to chemical tankers are also applicable on liquefied gas carriers. The cargo storage arrangement, however, is totally different. Cargo handling is somewhat different.

In all liquefied gas carriers the tanks are kept under at least a small positive pressure, to prevent air to enter the tank, which could create an explosive mixture. Loading and unloading is carried out in a completely closed system, no venting or vapors can escape to the atmosphere. During loading of LNG vapor return line is used, the vapor will be liquefied ashore and is not lost.

In order to facilitate transport, natural gas is cooled down to approximately −163 degrees Celsius at atmospheric pressure, at which point the gas condenses to a liquid. The tanks on-board an LNG carrier effectively function as giant thermoses to keep the liquid gas cold during storage. No insulation is perfect, however, and so the liquid is constantly boiling during the voyage. The boiloff is also allowed to keep the cargo cold.

New Words & Expressions

be divided into			分成,划分为
category	[ˈkætɪgərɪ]	*n.*	类别
ore	[ɔ:(r)]	*n.*	矿石
rough	[rʌf]	*adj.*	粗糙的;不平的
dry bulk carrier			干散货船
general cargo ship			杂货船
cutter suction dredger			绞吸挖泥船
hydrofoil	[ˈhaɪdrəʊˌfɔɪl]	*n.*	水翼
cruiser	[ˈkru:zə]	*n.*	巡洋舰,旅游船
pontoon	[pɒnˈtu:n]	*n.*	平底船,浮筒,浮舟
nominal	[ˈnɒmɪnl]	*adj.*	名义上的,有名无实的
propel	[prəˈpel]	*v.*	推进
diesel engine			柴油机
facilitate	[fəˈsɪlɪteɪt]	*v.*	使……便利,减轻……的困难
eliminate	[ɪˈlɪmɪneɪt]	*v.*	消除,排除
stowage factor			积载因数
LNG carrier (Liquefied Natural Gas carrier)			液化天然气(运输)船
tremendous	[trɪˈmendəs]	*adj.*	极大的,巨大的

condense [kən'dens] *v*. (使)变稠或变浓;浓缩

Exercises

1. Which of the following ships is NOT a liquid cargo carrier?
   A. LNG carrier. B. LPG carrier.
   C. Chemical tanker. D. Ore carrier.
2. A _____ bulk carrier is the largest bulk cargo ship.
   A. Panamax B. Handy-size C. Capsize D. Suezmax
3. TEU stands for _____.
   A. twenty-foot equivalent unit B. twenty-feet equivalent unit
   C. two-foot equivalent unit D. two-feet equivalent unit
4. VLCC stands for _____.
   A. very large car carrier B. very large cargo carrier
   C. very large crude carrier D. very large coal carrier
5. A ship designed for carrying goods requiring refrigeration is called _____.
   A. reefer B. ro/ro ship
   C. container D. tanker
6. A ship designed to carry trucks and cars which are driven on and off the ship on their own wheels is called a _____.
   A. reefer B. ro/ro ship C. container D. bulk carrier
7. The two basic types of cargo ships are _____.
   A. container ships and oil tankers
   B. bulk carriers and liquid carriers
   C. dry cargo carriers and oil tankers
   D. liquid cargo carriers and dry cargo carriers
8. _____ sail on regular routes and keep to a fixed timetable.
   A. Tramps B. Liners
   C. Specialized vessels D. Container ships
9. The capacity of container ship is measured in _____.
   A. UMS B. TDC C. TEU D. GT
10. ULCC stands for _____.
   A. ultra-large car carrier B. ultra-large cargo carrier
   C. ultra-large crude carrier D. ultra-large coal carrier

Lesson 2

Ship's Structure and Measurement

Ship's structure

A ship is something like a grand mansion floating on water and with a number of "floors" called decks. Among them is the upper deck or main deck that is upmost continuous deck from bow to stern, and often the deck exposed to sea and weather. That is why the main deck is also called the "weather deck". In fact, it provides a "shelter" for all the contents of the vessel. Another continuous deck under the upper deck is referred to as the lower deck. Above the upper deck there are also a few other decks. They are the compass deck on which one good magnetic compass is put as far as possible from the ship's magnetic field, the bridge deck where the wheelhouse is situated, the captain deck where the captain's cabin is located, the boat deck on which life-boats are fixed, and accommodation deck where the living quarters for passengers and crew are located.

The construction above the upper deck is usually called superstructure while that under the upper deck is defined as main hull. For the purpose of reasonable arrangement and full utilization of the inside space, the hull is divided into a number of watertight compartments by decks and bulkheads. Bulkheads are vertical steel walls going across the ship and along. Decks divide the hull horizontally. The hull contains the engine room, cargo space and a number of tanks. In dry cargo ships, the cargo space is divided into holds, in liquid cargo ships it is divided into tanks. At the fore end of the hull are the fore-peak tanks and at the after end the after peak tanks. They are used for fresh water and water ballast. The space between the holds and the bottom of the hull contains double bottom tanks. These are used for ballast water and fuel.

The space of a ship might reasonably be divided into three distinct areas: the cargo-carrying holds or tanks, the accommodation and the machinery space. Depending upon the type each ship will assume varying proportions and functions. An oil tanker, for instance, will have the cargo-carrying region divided into tanks by two longitudinal bulkheads and several transverse bulkheads. There will be

considerable quantities of cargo piping both above and below decks. The general cargo ship will have various cargo holds which are usually the full width of the vessel and formed by transverse bulkheads along the ship's length. Cargo handling equipment will be arranged on deck and there will be large hatch openings closed with steel hatch covers. The accommodation areas in each of these ship types will be sufficient to meet the requirements for the ship's crew, provide a navigating bridge area and a communications centre. The machinery space size will be decided by the particular machinery installed and the auxiliary equipment necessary. A passenger ship, however, would have a large accommodation area, since this might be considered the "cargo space". Machinery space requirements will probably be larger because of air conditioning equipment, stabilizers and other passenger related equipment.

Ship's measurement

Moulded Breadth is the horizontal distance between the insides of the moulds. In other words, it is the inside breadth of the vessel.

Moulded Depth is the vertical distance between the insides of the moulds. It indicates the inside height of the vessel.

Beam is the extreme breadth of the vessel. In restricted, narrow fairways, the vessel's beam is an important factor to obtain a clearance to proceed.

Length Over All is the distance between the extreme fore-end and the extreme aft-end of the vessel. Before a berth along an embankment is allocated, the port authorities will have to know the total length of the ship.

Draft is the distance from the bottom of the keel to the surface of the water. A distinction must be made between loaded draft and light draft, as well as salt-water draft and fresh-water draft.

Air Draft is the distance from the waterline to the highest point of the vessel. When proceeding through a channel that is spanned by a bridge, the air draft should of course be less than the vertical clearance of the bridge.

Freeboard is the distance between deckline and waterline.

Underkeel Clearance (UKC) is the distance between keel and seabed.

Displacement is the amount of water that is displaced by the body of the vessel as she is floating in the water. It is thus equal to the total weight, all told, of the relevant loaded ship, normally in seawater with a mass density of 1.025 t/m^3. Displacement comprises the ship's light weight and its deadweight, where the deadweight is equal to the ship's loaded capacity, including bunkers and other supplies necessary for the ship's propulsion.

New Words & Expressions

mansion	['mænʃən]	*n.*	宅第,公馆;大厦
bow	[baʊ]	*n.*	船头
stern	[stɜ:n]	*n.*	船尾
		adj.	苛刻的,严格的
wheelhouse	['hwi:l,haʊs, 'wi:l-]	*n.*	驾驶室
utilization	[,ju:tɪlaɪ'zeɪʃən]	*n.*	利用
ballast	['bæləst]	*n.*	(保持船身稳定的)压舱物
longitudinal	[lɒndʒɪ'tju:dɪnl]	*adj.*	经度的,纵向的
transverse	['trænzvɜ:s]	*adj.*	横向的;横断的;横切的
clearance	['klɪərəns]	*n.*	净空,余隙
embankment	[ɪm'bæŋkmənt]	*n.*	路堤;(河流的)岸堤
draft	[drɑ:ft]	*n.*	吃水;气流;草稿
under keel clearance			富余水位

Exercises

1. The abbreviation "GM" is used to represent the _____.
   A. height of the metacenter　　B. fighting arm
   C. righting moment　　D. metacentric height
2. If the buoyant force on a ship's hull is equal to or greater than the displacement tonnage, the ship will _____.
   A. require ballast added to only the port side tanks
   B. be down by the head
   C. sink
   D. float
3. The structural members of the hull extending in a fore and aft direction are called _____.
   A. frames　　B. joiners　　C. longitudinals　　D. knees
4. In dry docking repair, the hull of a ship will be descaled and repainted thoroughly from the _____ to deck.
   A. keel　　B. waterline　　C. boardside　　D. bridge
5. The ship of 70,000 DWT here means _____.
   A. its maximum discharging capacity
   B. its maximum weight
   C. its maximum discharging capacity deducting ship's own weight

D. its maximum cargo weight

6. Propeller pitch speed minus ship divided by the propeller pitch speed is termed _____.

A. apparent slip　　B. tree slip
C. pitch　　D. propulsive efficiency

7. If fuel is burned from only the starboard tanks, the ship will _____.

A. go down by the head　　B. list to starboard
C. trim by the stern　　D. list to port

8. For an upright vessel, draft is the vertical distance between the keel and the _____.

A. waterline　　B. freeboard deck
C. plimsoll mark　　D. amidships section

9. You may improve a vessel's stability by _____.

A. keeping the fuel tanks topped off
B. increasing the free surface effect
C. keeping the fuel tanks at least half full
D. keeping at least one fuel tank empty for slops

10. The trim of a vessel is the _____.

A. value of the mean draft　　B. degree of list
C. amount of roll　　D. difference in fore and aft drafts

Lesson 3

Engine Room Machinery

Main engine

The invention of the diesel engine in 1892 has been attributed to Rudolf Diesel, a German mechanical engineer and inventor. Since then diesel engines have played an important role in the shipping industry because of their improved engine efficiencies and designs compared to other forms of propulsion such as steam or gas turbines. Diesel engines are known by the name of compression ignition engines due to technical reasons. There are several ways of classification of diesel engines based on various parameters. According to their speeds, diesel engines may be divided into three types: slow speed, medium speed and high speed diesel engines.

Slow speed diesel engines are large, especially tall, and heavy and operate on the two-stroke cycle. These are the largest diesel engines ever built. Engine powers up to 100,000 kw are available from a single engine. They are tall to allow for long strokes which improve engine efficiency. The large physical size of the engine and components leads to slow rotational speed with speeds up to 300 rpm considered to be slow. For equivalent power output, the two-stroke diesel engine is significantly lighter than the four-stroke one. This is most apparent for large power requirements where the two-stroke engine produces much more power for the same weight.

Merchant ships driven by slow speed diesel engine will usually have a single large main engine directly coupled to a single fixed pitch propeller. The thrust forces from the propeller will be transferred to the hull of the ship through a thrust bearing.

Medium speed engines operate in speed ranges from 300 to 900 rpm. The majority of medium speed engines operate on the four-stroke cycle. They are most common as the propulsion engines in smaller ships, ro-ro and passenger ships. Most medium-speed diesel engines are non-reversible meaning that a controllable pitch propeller is usually employed to cater for astern thrust.

The most common diesel engine throughout the world is the high-speed engine. The majority of these engines operate on the four-stroke cycle but a significant proportion utilize the two-stroke cycle. These engines have running speeds over

1 000 rpm and are ideally suited to driving land-based vehicles such as buses and trucks. The application of high-speed diesel engines as propulsion engines at sea is limited to smaller vessels such as tugs, ferries and barges etc. They are regularly used for electrical power generation in support of a medium-speed propulsion engines and on large ships their use is limited to emergency power generation to small applications such as diesel driven emergency pumps and compressors.

Auxiliary machinery

Auxiliary machinery covers everything mechanical on board ship except the main engines and main boilers. It includes almost all the pipes and fittings and the equipment needed to carry out a number of functions. In details, they are the diesel generators, the power systems of the diesel engine, ship systems, pumps, centrifuges, deck machinery, auxiliary boilers, freshwater generators, refrigeration and air conditioning plants, anti-pollution equipment, etc.

Power systems of main engine

To guarantee proper operation of the main propulsion power plant, the diesel engine must be provided with a few auxiliary systems, called power systems. The power systems of the diesel engine consist of F. O. system, L. O. system, sea water and freshwater cooling system, compressed air system and exhaust gas system, etc. All kinds of pumps and centrifuges are absolutely necessary in the piping systems.

Oil separator

Both fuel oils and lubricating oils require treatment before passing to the engine. Then oil separators are used.

The centrifugal separator is used to separate two liquids, for example oil and water, or a liquid and solids as in contaminated oil. Where a centrifuge is arranged to separate two liquids, it is known as a "purifier". Where a centrifuge is arranged to separate impurities and small amounts of water from oil it is known as a "clarifier".

The separation of impurities and water from fuel oil is essential for good combustion. The removal of contaminating impurities from lubricating oil will reduce engine wear and possible breakdowns.

Steam system and auxiliary boilers

Different forms of boilers will be found on every type of ships. On a motor vessel, a small boiler will be fitted to provide steam for the auxiliary equipment. There are two distinct types of marine boilers in use on board ship, the fire-tube boiler and the water-tube boiler.

A boiler is used to heat feed water in order to produce steam. The task of this steam system is to provid heat energy for heating, hot water and galley as well as for the heating of fuel oil, lube oil and cargo oil.