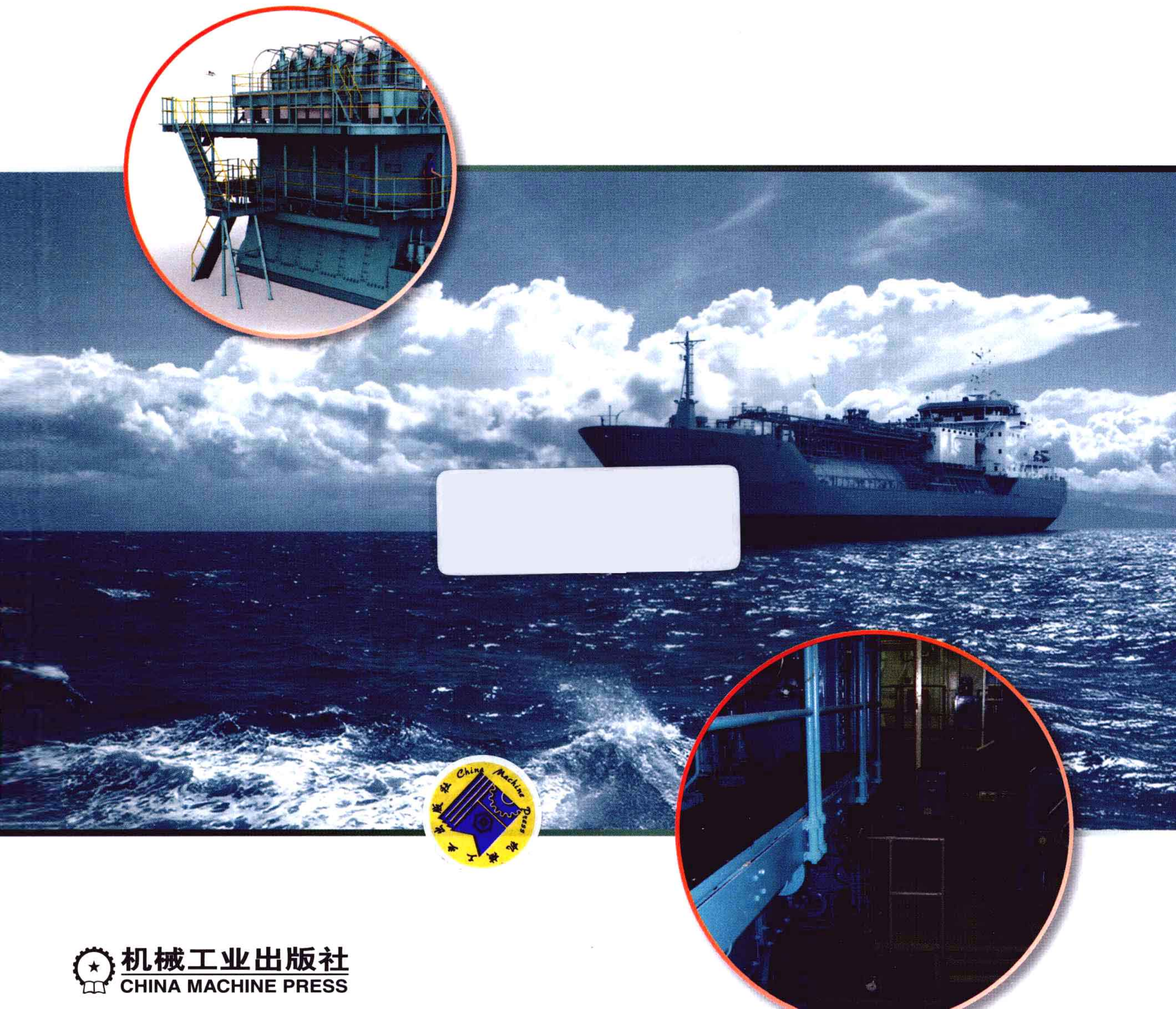
依据STCW公约马尼拉修正案和中华人民共和国海事局最新“轮机英语”考试大纲编写

轮机工程英语

赵在理　主编



机械工业出版社
CHINA MACHINE PRESS

轮机工程英语

English of Marine Engineering

赵在理　主编

机械工业出版社

本教材依据STCW公约马尼拉修正案和中华人民共和国海事局最新“轮机英语”考试大纲编写。全书内容包括船舶主推进装置，船舶辅机，船舶电气设备与自动控制，机舱管理及防污染，主要国际公约与法规和轮机业务写作等；书中每节后还有生词及短语解释和难句注释。本教材体现了轮机工程英语的系统性和完整性，内容新颖，实用性强。

本书可作为本/专科轮机专业“轮机英语”课程的教材，用于相关专业课的双语教学，用作“轮机英语”科目的全国海证统考培训教材；还可供船舶工程技术人员工作参考、船员英语强化训练及船上知识更新时使用。

图书在版编目（CIP）数据

轮机工程英语/赵在理主编. —北京：机械工业出版社，2012.4
ISBN 978-7-111-38043-6

Ⅰ. ①轮… Ⅱ. ①赵… Ⅲ. ①轮机—英语—高等学校—教材 Ⅳ. ①H31

中国版本图书馆CIP数据核字（2012）第069710号

机械工业出版社（北京市百万庄大街22号 邮政编码100037）
策划编辑：李万宇 责任编辑：李万宇
版式设计：霍永明 责任校对：于新华
封面设计：姚 毅 责任印制：乔 宇
三河市宏达印刷有限公司印刷
2012年6月第1版第1次印刷
184mm×260mm · 24.25印张 · 593千字
0 001—3 000册
标准书号：ISBN 978-7-111-38043-6
定价：49.00元

凡购本书，如有缺页、倒页、脱页，由本社发行部调换
策划编辑：（010）88379732
电话服务
社服务中心：（010）88361066
销售一部：（010）68326294
销售二部：（010）88379649
读者购书热线：（010）88379203

网络服务
门户网：http://www.cmpbook.com
教材网：http://www.cmpedu.com
封面无防伪标均为盗版

前言 Preface

STCW 公约马尼拉修正案的一个显著特征就是强制性地加强船员的有效沟通能力。在航海职业全球化和国际化的进程中，有效沟通的本质内涵和实现载体是航海英语交际能力。鉴于“轮机工程”职业高度涉外、国际海员的工作语言是英语的特点，本《轮机工程英语》教材虽涉及英语语言理论，但更注重航海轮机专业知识介绍，体现专业知识的系统性、全面性和完整性，强调英语应用能力的培养，使中国船员及轮机毕业生适应多国籍混合船员同船工作的特殊环境。

主编赵在理教授长期从事轮机工程的教学工作，在国内外轮机专业课程的授课中积累了丰富的教学经验和大量的英语教学资料，在多年的船舶轮机长管理实践中还收集了很多设备维护保养方面的英文技术资料，这些都为本教材的编写打下了良好的基础。编者十分关注国内外轮机发展新动态，在本书编写中参考了最新网上轮机英语资源和相关英语经典文献。

本书是“轮机工程”专业学生的“轮机英语”课程的教材，信息量大而新，内容紧扣 STCW 公约马尼拉修正案后的新“轮机英语”考试大纲。全书分为 6 章：第 1 章内容是船舶主推进装置，第 2 章是船舶辅机，第 3 章是船舶电气设备与自动控制，第 4 章是机舱管理，第 5 章是国际公约与法规，第 6 章是轮机业务写作。书中内容按新大纲的要求选材，编排按新考试大纲目录顺序。文中内容标记*部分为轮机长和大管轮考试要求，其他部分为轮机工程英语基本内容，任课教师可按教学时数酌情选用。每节后附有生词及短语，并对其中难句进行了注释，业务书写部分还有讲解和举例。

本书第 1 章 1.1、1.2、1.3、1.4、1.5、1.6 节，第 3 章 3.4 节，第 4 章 4.4 节和第 6 章 6.6 节由武汉理工大学赵在理教授编写；第 2 章 2.2、2.3 节和 2.6 节由向阳教授编写；第 2 章 2.4 和 2.5 节由尹奇志副教授编写；第 3 章 3.1、3.2、3.3、3.5、3.6 节由高岚教授编写；第 4 章 4.1、4.2、4.3、4.5、4.6 节和 4.7 节由杨志勇副教授编写；第 5 章 5.1、5.2、5.3、5.4、5.5、5.6 节由刘宏斌讲师编写；第 6 章 6.1、6.2、6.3、6.4、6.5 节由戴忠讲师编写；第 2 章 2.1 节和第 5 章 5.7 节由钦州学院张小军老师编写。武汉理工大学能源与动力工程学院的袁兆锋、康天钦、杨丹和龙景良也参加了本书的绘图、编校、生词注释与审定工作。本书由赵在理教授主编和统稿。

本书可作为本/专科轮机专业“轮机英语”课程的教材，用于相关专业课程的双语教学，用作“轮机英语”科目的全国海证统考培训教材；还可供船舶工程技术人员工作参考、船员英语强化训练及船上知识更新时使用。

本书在编写、出版工作中得到武汉理工大学、钦州学院、浙江海洋学院、中华人民共和国海事局、挪威斯考根海运集团公司和南京油运公司等单位的关心和大力支持，特致谢意。

编　者

2012 年 2 月

目录 Content

Chapter 1

Main Propulsion Plant

第 1 章　船舶主推进装置

A ship is a large vessel that floats on water. Ships are generally distinguished from boats based on size and cargo or passenger capacity. Ships may be found on lakes, seas, and rivers and they allow for a variety of activities, such as the transport of people or goods, fishing, entertainment, public safety, and warfare.

As a marine engineer, we might reasonably begin by taking an overall look at the ship. The various duties of a marine engineer are related to the operation of the ship in a safe, reliable, efficient and economic manner. The main propulsion machinery installed will influence the machinery layout and determine the equipment and auxiliaries installed. This will further determine the operational and maintenance requirements for the ship and thus the knowledge required and the duties to be performed by the marine engineer.[1]

1.1 Ships and Machinery 船舶及其机械设备

Ships 船舶概述

Ships are large, complicated vehicles which must be self-sustaining in their environment for long periods with a high degree of reliability. A ship is the product of two main areas of skill, those of the naval architect and the marine engineer. The naval architect is concerned with the hull, its construction, form, habitability and ability to endure its environment. The marine engineer is responsible for the various systems which propel and operate the ship. More specifically, this means the machinery required for propulsion, steering, anchoring and ship securing, cargo handling, air conditioning, power generation and its distribution.[2] Some overlap in responsibilities occurs between naval architects and marine engineers in areas such as propeller design, the reduction of noise and vibration in the ship's structure, and engineering services provided to considerable areas of the ship.

A ship reasonably is divided into three distinct areas: the cargo-carrying holds, the accommodation and the machinery space.[3] 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 sufficient space 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.

Ships have developed alongside mankind. They have become an integral part of modern commercial and military systems. Fishing boats are used by millions of fishermen throughout the world. Military forces operate highly sophisticated vessels to transport and support forces ashore. Commercial vessels, nearly 50,054 in number, carried 10.9 billion tons of cargo in 2010.

Machinery 船舶机械设备

Arrangement

Three principal types of machinery installation are to be found at sea nowadays. Their individual merits change with technological advances and improvements and economic factors such as the change in oil prices. It is intended therefore only to describe the layouts from an engineering point of view. The three layouts involve the use of direct-coupled slow-speed diesel engines, medium-speed diesels with a gearbox, and the steam turbine with a gearbox drive to the propeller. This book only talks about diesel engines instead of the steam turbine.

A propeller, in order to operate efficiently, must rotate at a relatively low speed. Thus, regardless of the rotational speed of the prime mover, the propeller shaft must rotate at about 80 to 100 rev/min. The slow-speed diesel engine rotates at this low speed and the crankshaft is thus directly coupled to the propeller shaft. The medium-speed diesel engine operates in the range 250-750 rev/min and cannot therefore be directly coupled to the propeller shaft. Thus, the drive from the diesel is provided to the propeller shaft via a gearbox.

Slow-speed diesel

Figure 1.1.1 shows the arrangement of machinery in the engine room of a slow speed diesel ship. The engine rooms is located near the bottom, and at the aft and end of the vessel. This design maximizes the cargo carrying capacity of the vessel and situates the prime mover close to the propeller, minimizing equipment cost and problems posed from long shaft lines.

A six-cylinder direct-drive diesel engine is shown in this machinery arrangement. A diesel generator is on the upper flat and an air compressor is below. Other auxiliaries within the machinery space would include additional generators, an oily-water separator, an evaporator, numerous pumps and heat exchangers. An auxiliary boiler and an exhaust gas heat exchanger would be located in the uptake region leading to the funnel.[4] Various workshops and stores and the machinery control room will also be found on the upper flat.

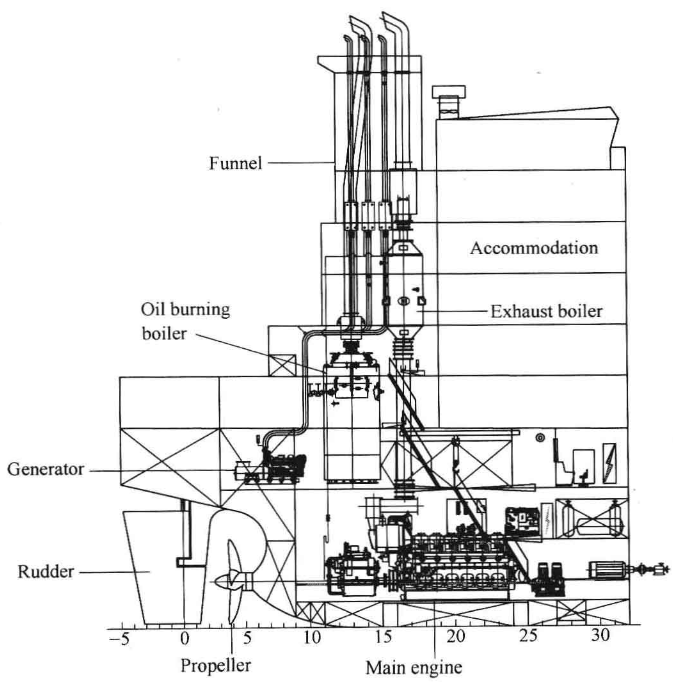


Figure 1.1.1 Cutaway drawing of a ship

Geared medium-speed diesel

Two medium-speed (500 rev/min) diesels are used in the machinery layout of a ship shown in Figure 1.1.2. The gear units provide a twin-screw drive at 170 rev/min to controllable-pitch propellers. The various pumps and other auxiliaries are arranged at floor plate level in this minimum-height machinery space. The exhaust gas boilers and uptakes are located port and starboard against the side shell plating.

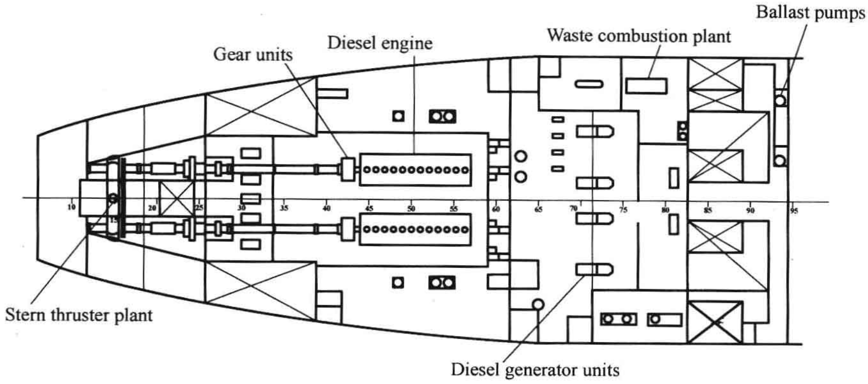


Figure 1.1.2 Medium-speed diesel machinery arrangement

A separate generator room houses four diesel generator units, a waste combustion plant and other auxiliaries. Engine control room is at the forward end of this room.

Operation and maintenance

Usually all shipboard machinery, with the exception of radio equipment, is maintained by the marine engineers. Electrical engineers may be carried on very large ships, but if not, the electrical equipment is also maintained by the marine engineer.

A broad-based theoretical and practical training is therefore necessary for a marine engineer. He must be a qualified mechanical, electrical, air conditioning, ventilation and refrigeration engineer. Unlike the people who work on shore in these occupations, he must also deal with the specialized requirements of a floating platform in a most corrosive environment. Furthermore he must be self sufficient and capable of getting the job done with the facilities at his disposal.[5]

A gas carrier 气体运输船介绍

Figure 1.1.3 shows a combined gas ship. The ship is built in accordance with the IMO's Gas and Chemicals Codes, and during construction of such ships the strictest of these codes must be observed.

Combined gas and chemical ships are usually built in sizes ranging from 5,000 to 10,000 m^3, with cylindrical tanks. The tanks are constructed for an excess pressure of 3 to 4 bar, and are built using acid-proof steel with regard to the transportation of chemicals.

The semi-pressurized ships are for the transport of LEG, LPG and ammonia. In addition to the direct cooling system (reliquefaction plant) for the cargo, they also have an indirect cooling and heating system, where there are coils fitted onto the outside of the tanks. In these coils a cooling/heating medium circulates.[6] The indirect cooling system is used for gases which will wish to avoid compression of the gas. Another advantage with indirect cooling is that the tanks can be pre-cooled before any cargo is taken on board, and tanks heated during gas freeing.

To achieve flexibility in the transportation of chemicals, each cargo tank has its own loading and discharging pipe lines, the ventilation systems are also segregated, and the ships can often carry up to six different cargoes at the same time. These cargoes can be a combination of gas and chemicals, or only chemicals. For the transportation of the same cargo in all the tanks, the pipe systems are connected with removable spool pieces.

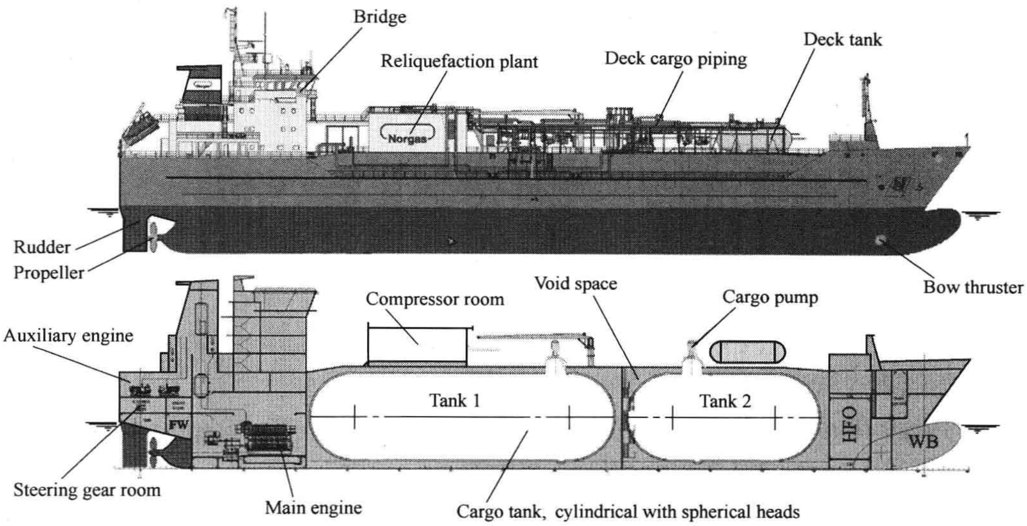


Figure 1.1.3 A semi-pressurized ship for Ethylene

New words and expressions 生词及短语

marine engineer			轮机工程师
propel	[prə'pel]	*v.*	推进，推动
naval architect			造船工程师
accommodation	[əˌkɔmə'deiʃən]	*n.*	房间，生活区
propeller	[prə'pelə]	*n.*	螺旋桨，推进器
cargo-carrying region			甲板装货区域
longitudinal bulkhead			纵舱壁
transverse bulkhead			横舱壁
stabilizer	['steibilaizə]	*n.*	减摇装置
layout	['leiˌaut]	*n.*	规划，设计
steam turbine			蒸汽轮机
refrigeration	[riˌfridʒə'reiʃən]	*n.*	制冷

arbitrary	[ˈɑːbitrəri]	*adj.*	随机选择的，主观的；
auxiliary boiler			辅助锅炉
pump	[pʌmp]	*n.*	泵
reliquefaction	[riːˌlikwiˈfækʃən]	*n.*	再液化
flexibility	[ˌfleksəˈbiliti]	*n.*	灵活性，弹性

Note 难句注释

1. The main propulsion machinery installed will influence the machinery layout and determine the equipment and auxiliaries installed. This will further determine the operational and maintenance requirements for the ship and thus the knowledge required and the duties to be performed by the marine engineer.
主推进装置的安装将会影响机舱的布局，并决定了其他设备和辅助装置的安装，进一步决定了船舶所需要的管理和维修。所以，船舶工程师必须具备一定的知识并且能履行各自的职责。

2. The marine engineer is responsible for the various systems which propel and operate the ship. More specifically, this means the machinery required for propulsion, steering, anchoring and ship securing, cargo handling, air conditioning, power generation and its distribution.
轮机工程师负责推进和操纵船舶的各种系统。更具体地讲,这些系统包括主机、舵机、锚机和绞缆机、起货机、空调、发电机和它的配电设备。

3. A ship might reasonably be divided into three distinct areas: the cargo-carrying holds, the accommodation and the machinery space.
船上可合理地分为三个不同的区域：货物区（货舱）、生活区和机舱。

4. An auxiliary boiler and an exhaust gas heat exchanger would be located in the uptake region leading to the funnel.
辅助锅炉和废气热交换器位于烟囱入口上升道处。

5. He must be a qualified mechanical, electrical, air conditioning, ventilation and refrigeration engineer. Unlike the people who work on shore in these occupations, he must also deal with the specialized requirements of a floating platform in a most corrosive environment. Furthermore he must be self sufficient and capable of getting the job done with the facilities at his disposal.
他一定是一个合格的机械、电气、空调、通风和制冷工程师。不同于岸上的这些对应的职业，他一定要具有在最腐蚀的环境中浮动的船所特别要求的能力。而且，他必须独立工作，管理和维护自己负责的设备。

6. In addition to the direct cooling system (reliquefaction plant) for the cargo, they also have an indirect cooling and heating system, where there are coils fitted onto the outside of the tanks. In these coils a cooling/heating medium circulates.
除了货物的直接冷却系统（再液化装置）以外，还有间接冷却和加热系统，它是把盘管安装在柜的外表面，使冷却/加热介质在盘管内循环。

1.2 Diesel Engine Cycle 柴油机循环

The diesel engine is a type of internal combustion engine which ignites the fuel by injecting it into hot, high-pressure air in a combustion chamber.[1] In common with all internal combustion engines the diesel engine operates with a fixed sequence of events, which may be achieved either in four strokes or two, a stroke being the movement of the piston between its extreme points. Each stroke is accomplished in half a revolution of the crankshaft.

Four-stroke cycle 四冲程柴油机工作循环

The four-stroke cycle is completed in four strokes of the piston, or two revolutions of the crankshaft. In order to operate this cycle the engine requires a mechanism to open and close the inlet and exhaust valves.

The cycle begins at Top Dead Centre (TDC), which is farthest away from the axis of the crankshaft. The inlet valve opens and fresh air is drawn in as the piston moves down (Figure 1.2.1 (a)). At the bottom of the stroke, i.e. bottom dead centre (BDC), the inlet valve closes and the air in the cylinder is compressed (and consequently raised in temperature) as the piston rises (Figure 1.2.1 (b)). Fuel is injected as the piston reaches top dead centre and combustion takes place, producing very high pressure in the gases (Figure 1.2.1 (c)). The piston is now forced down by these gases and at BDC the exhaust valve opens. The final stroke is the exhausting of the burnt gases as the piston rises to TDC to complete the cycle (Figure 1.2.1 (d)). The four distinct strokes are known as "suction", "compression", "power" and "exhaust".

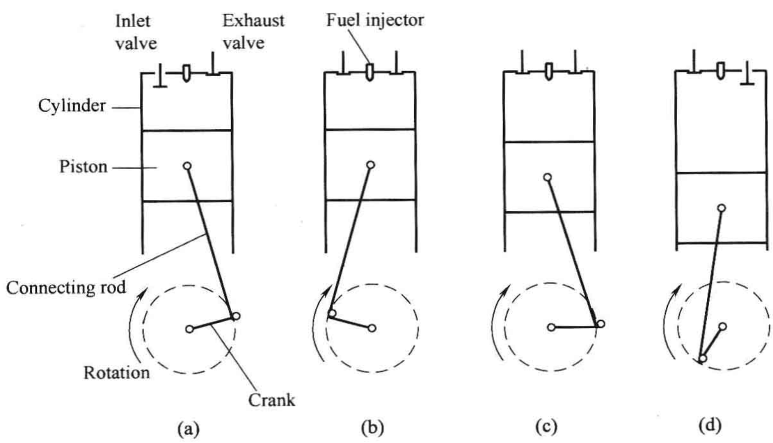


Figure 1.2.1 The four-stroke cycle
(a) Suction stroke, (b) Compression stroke, (c) Power stroke, (d) Exhaust stroke

These events are shown diagrammatically on a timing diagram (Figure 1.2.2). The angle of the crank at which each operation takes place is shown as well as the period of the operation in degrees. This diagram is more correctly representative of the actual cycle than the simplified explanation given in describing the four-stroke cycle. For different engine designs the different angles will vary, but the diagram is typical.

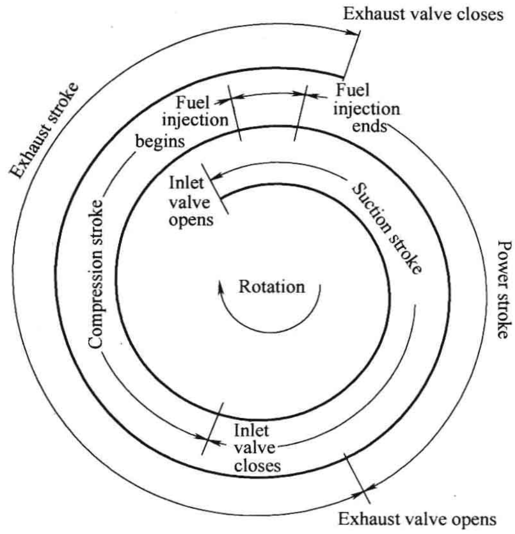


Figure 1.2.2 Four-stroke timing diagram

Two-stroke cycle 二冲程柴油机工作循环

The two-stroke cycle is completed in two strokes of the piston or one revolution of the crankshaft.[2] In order to operate this cycle where each event is accomplished in a very short time, the engine requires a number of special arrangements. First, the fresh air must be forced in under pressure. The incoming air is used to clean out or scavenge the exhaust gases and then fill or charge the space with fresh air. Instead of valves holes, known as "ports", are used which are opened and closed by the sides of the piston as it moves.

When the piston is at the top of its stroke, the fuel injection and combustion have just taken place (Figure 1.2.3 (a)). The piston is forced down on its working stroke until it uncovers the exhaust port (Figure 1.2.3 (b)). The burnt gases then begin to exhaust and the piston continues down until it opens the inlet or scavenge port (Figure 1.2.3 (c)). Pressurized air then enters and drives out the remaining exhaust gas. The piston, on its return stroke, closes the inlet and exhaust ports. The air is then compressed as the piston moves to the top of its stroke to complete the cycle (Figure 1.2.3 (d)).

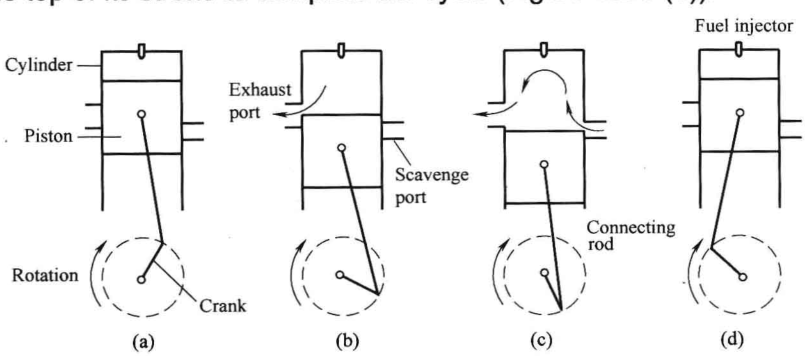


Figure 1.2.3 Two-stroke cycle
(a) Injection, (b) Exhaust, (c) Scavenge, (d) Compression

The four-stroke engine 四冲程柴油机构成

A cross-section of a four-stroke cycle engine is shown in Figure 1.2.4. The engine is made up of a piston which moves up and down in a cylinder which is covered at the top by a cylinder head. The fuel injector is located in the cylinder head. The inlet and exhaust valves are housed in the cylinder head and held shut by springs. The piston is joined to the connecting rod by a gudgeon pin. The big end of the connecting rod is joined to the crankpin which forms part of the crankshaft. With this assembly the linear up-and-down movement of the piston is converted into rotary movement of the crankshaft. The crankshaft is arranged to drive through gears the camshaft, which either directly or through pushrods operates rocker arms which open the inlet and exhaust valves. The camshaft is "timed" to open the valves at the correct point in the cycle. The crankshaft is surrounded by the crankcase and the engine framework which supports the cylinders and houses the crankshaft bearings. The cylinder and cylinder head are arranged with water-cooling passages around them.

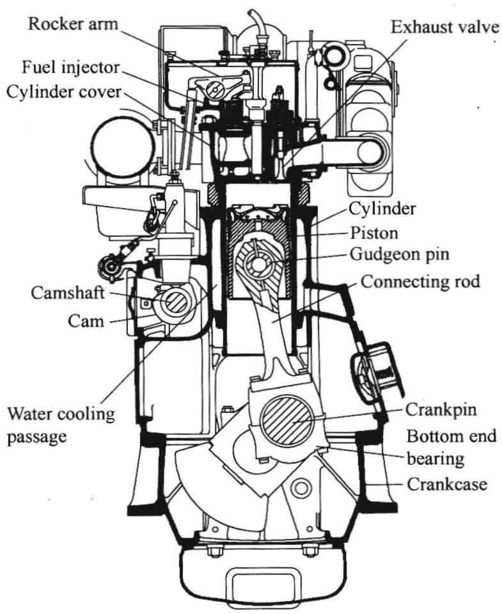


Figure 1.2.4 Cross-section of a four-stroke diesel engine

The two-stroke engine 二冲程柴油机构成

A cross-section of a two-stroke cycle engine is shown in Figure 1.2.5. The piston is solidly connected to a piston rod which is attached to a crosshead bearing at the other end. The top end of the connecting rod is also joined to the crosshead bearing. Ports are arranged in the cylinder liner for air inlet and a valve in the cylinder head enables the release of exhaust gases. The incoming air is pressurized by a turbo-blower which is driven by the outgoing exhaust gases. The crankshaft is supported on the bedplate and house guides in which the crosshead travels up and down. The entablature is mounted above the frames and is made up of the cylinders, cylinder heads and the scavenge trunking.

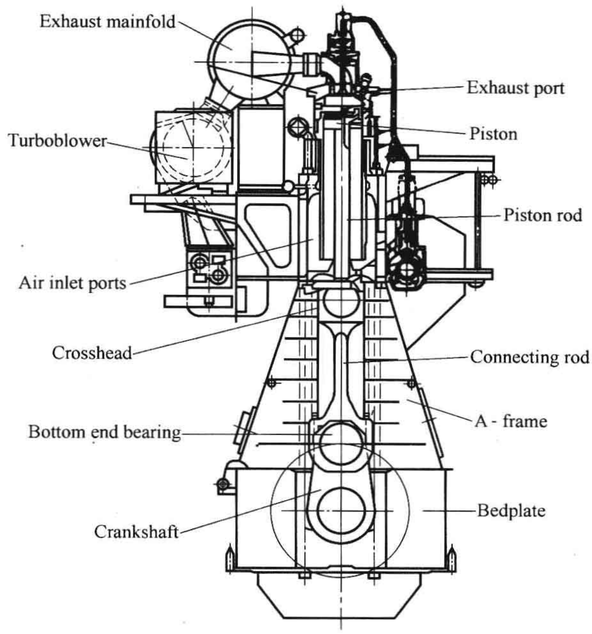


Figure 1.2.5 Cross-section of a two-stroke diesel engine

Comparison of two-stroke and four-stoke cycles
二冲程和四冲程工作循环比较

The main difference between the two cycles is the power developed. The two-stroke cycle engine, with one power stroke every revolution, will theoretically develop twice the power of a four-stroke engine of the same swept volume. Inefficient scavenging however and other losses, reduce the power advantage to about 1.8.[3] For a particular engine power the two-stroke engine will be considerably lighter. Nor does the two-stroke engine require the complicated valve operating mechanism. The four-stroke engine however can operate efficiently at high speeds which offset its power disadvantages.

Each type of engine has its applications on board ship. The two-stroke engine in slow speed is used for main propulsion. At this low speed the engine requires no reduction gearbox between it and the propeller. The four-stroke engine is used for auxiliaries such as alternators and sometimes for main propulsion with a gearbox to provide a propeller speed of between 80 and 100 rev/min.

Engine performance 柴油机主要性能指标

RPM

Revolutions per minute (RPM) is a measure of the frequency of a rotation. It annotates the number of full rotations completed in one minute around a fixed axis. It is used as a measure of rotational speed of a mechanical component, for example, the engine speed.

MCR

Diesel engines are typically furnished with a rating or a maximum continuous rating (MCR), i.e., a stated value of power output at a corresponding RPM. This is a description of the performance characteristics of the engine.

Indicator cards

Figure 1.2.6 represents the pressure in a four-stroke engine cylinder plotted against the piston position, which in turn is directly proportional to cylinder volume, and is therefore called a pressure-volume diagram. When the *P-V* diagram is obtained from the engine itself, using an engine indicator for low speed engines or electronic means for higher speed engines, it is called an indicator card.

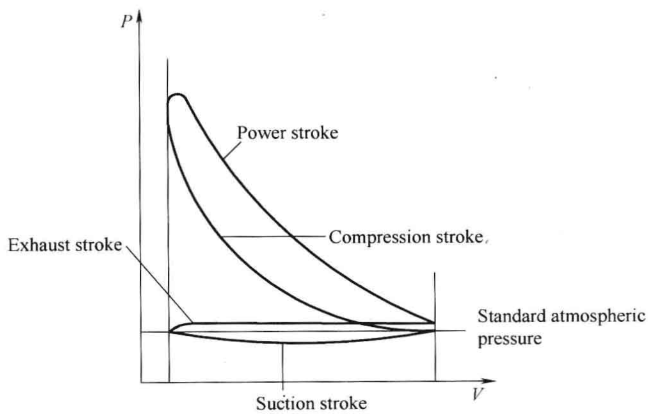


Figure 1.2.6 Pressure-volume diagram of a four-stroke engine

Indicated power

IHP (*Indicated power when expressed in horsepower*). In thermodynamic terms, the work done during a cycle is the product of the pressure at any point in the cycle times the volume displaced by the piston at that point. It is therefore proportional to the area enclosed by the curve on the *P-V* diagram. The area enclosed can be determined by measurement with a planimeter, or by graphical or mathematical integration. Once multiplied by the appropriate constants, this area is the net work (W_{net}) done by the piston during the cycle; i.e., it is all the work delivered by the piston to the crankshaft during the power stroke, plus or including the work to overcome friction and to drive engine accessories, less the