职业教育汽车类专业“互联网+”新生态创新示范教材

汽车专业英语

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出版说明

面对新时代中国特色社会主义建设的宏伟蓝图，我国社会主要矛盾已经转化为人们日益增长的美好生活需要与发展不平衡、不充分之间的矛盾，这就需要我们有更高水平、更高质量、更高效益的发展，实现更加平衡、更加充分的发展，才能全面建成社会主义现代化强国。职业教育的发展必须服从服务于国家发展战略，以不断满足人们对美好生活需要为追求目标，全面贯彻党的教育方针，全面深化教育改革，全面实施素质教育，全面落实立德树人根本任务，充分发挥职业教育的优势，建立和完善职业教育课程体系，健全德能并修、工学结合的育人机制，着力培养学生的工匠精神、职业道德、职业技能和就业创业能力，创新教育教学方法和人才培养模式，完善人才培养质量监控评价制度，不断提升人才培养质量和水平，为实现中华民族伟大复兴的中国梦贡献力量。

教材建设是人才培养工作的重要载体，也是深化教育教学改革、提高教学质量的重要基础。教材编写应遵循教材建设规律和职业教育教学规律、技术技能人才成长规律，紧扣产业升级和数字化改造，满足技术技能人才需求变化，依据职业教育国家教学标准体系，对接职业标准和岗位（群）能力要求。目前，职业教育教材建设规划性不足、系统性不强、特色不明显等问题一直制约着内涵发展、创新发展和特色发展的空间。因此，我们紧密结合职业教育发展新形势，主动适应职业教育改革创新的需要，组织了一批具有先进教学思想和学术造诣较高的专业骨干教师，编写了本套教材。

本套教材在编写过程中，注重教材内容安排，符合学生认知特点，逻辑严谨，梯度明晰，严格对接职业标准和岗位能力要求；以典型工作任务为载体，反映人才培养模式改革方向，将知识、能力和正确价值观的培养

有机结合，有效激发学生学习兴趣和创新潜能。本套教材具有以下特点：

（1）坚持立德树人。本套教材以习近平新时代中国特色社会主义思想为指导，弘扬工匠精神，将工匠精神、爱国情怀等融入到教学全过程，力求培养更多高素质技能人才、能工巧匠、大国工匠，为全面建设社会主义现代化国家、实现中华民族伟大复兴的中国梦提供强有力的人才支撑。

（2）将课程内容与职业标准对接。本套教材将职业标准融入到了教材内容中，根据职业资格考试和岗位要求，选择了与行业和职业需求接轨的教学内容。

（3）将教学过程与生产过程对接。本套教材理论上遵循适度、必需、够用的原则，将工作情境搬进课堂，强化工学结合。

（4）多样的呈现形式。根据目前职业院校学生特点，本套教材采用了全彩印刷，版式设计灵活，形式新颖，便于教师教学和学生使用。

（5）超强的编写团队。校园名师与行业专家强强联合，校企结合的编写模式保证了本套教材的前沿性和适用性。

（6）丰富的课程资源。本套教材配备了二维码、PPT、电子教案等多种资源，构建 O2O 立体化课程资源。

总的来说，本套教材较好地吸收了职业教育最新理论和实践研究成果，符合职业教育人才培养目标定位要求。教材内容深入浅出，难易适中，突出专业实践技能经验积累培养，重视启发学生思维和培养学生运用知识的能力。教材条理清楚，层次分明，结构严谨，图表美观、文字规范，是一套专门针对职业教育人才培养的教材。

编委会

前言 preface

随着我国经济快速发展，汽车已经逐步走入家庭，汽车行业处于快速发展时期。国内的汽车产品逐渐走向世界，同时世界著名的汽车品牌也纷纷加盟中国市场。这种技术大融合的时代背景和产业全球化的趋势必然要求培养大量既掌握汽车专业知识又具备良好英语沟通能力的高级人才。汽车专业英语是汽车服务技术人员尤其高级技术人才不可或缺的必备知识。在这样的背景下，我们编写了这本《汽车专业英语》教材。

在编写过程中，我们紧紧联系当前汽车技术发展的实际状况，按照职业技术教育的特点和培养方案，本着“适用、管用、够用”的原则，将知识与实践紧密结合。以学习者为中心，根据职业院校学生及其职业特点，设定课程学习目标，按照学习者获取职业英语技能的需求，用灵活多样的任务形式组织教学内容，便于教师实施各种高效的教学方法，实现预期的教学目标。

本书一共 6 个单元。第一～四单元以汽车构造为主，涵盖了发动机、底盘、车身及电子设备等内容，素材选自英文原文，体例编排图文并茂，便于识读、理解、记忆和灵活运用；第五单元为新技术应用，介绍了目前应用在现代汽车上的新技术，如防抱死制动系统（ABS）、安全气囊、巡航控制系统等；第六单元介绍了新能源汽车，如 EV 电动汽车、FCEV 燃料电池电动汽车和 HEV 混合动力电动汽车。本书参考了国外的专业书刊和大专院校教科书的部分章节，语言简明流畅，难易适中，实用性较强，不仅可以使读者提高英语水平，而且可以使读者熟悉汽车方面的专业知识。在编写本书的过程中，考虑到我国读者的英文水平，我们尽可能地使每篇课文的篇幅长短适量，难度适中；为帮助读者克服阅读障碍，我们在每篇课文后均设有注释和词汇表，便于学生复习、巩固和提高。书后附有专业词汇

表和常用缩略语表，便于学生自学和实际工作中查阅。同时，本书尽可能与汽车构造等汽车类教材介绍的内容与顺序保持基本一致，这也有助于广大读者阅读与理解。

本书由卢锦、郑军武担任主编，王盈盈、胡北京、刘刚担任副主编。参加编写的还有高文卓，为编写该书给予了大力支持和帮助。本书最后由张长江主审，并提出宝贵建议。

在编写本书的过程中，编者参阅了大量的书籍和文献资料，受益匪浅，在此向有关作者表示衷心的感谢！

由于编者水平所限，加上时间紧迫，书中难免存在一些缺点和错误，恳请广大读者批评指正。

编　者

目录

Unit1 Engine

Engine is the source of power that makes the wheels go around and the car move. The automobile engine is a machine that turns heat energy of fuel into mechanical energy for moving the vehicle. Because fuel is burned within the engine, it is also called internal combustion engine. The burning of gasoline inside the engine produces high pressure in the engine combustion chamber. This high pressure forces piston to move, the movement is carried by connecting rods to the engine crankshaft. The crankshaft is thus made to rotate, then, the rotary motion is carried through the power train to the car wheels so that they rotate and the car moves. (see Figure 1.1)

Figure 1.1 Engine in a car

1.1 Engine Overall Mechanism

The component of engine

Engine has hundreds of parts. The major parts of engine are engine block, engine heads, pistons, connecting rods, crankshaft and valves. The other parts are joined to make systems. These systems are the fuel system, valve system, ignition system, cooling system, lubrication system. Each of these systems has a definite function. (see Figure 1.1.1)

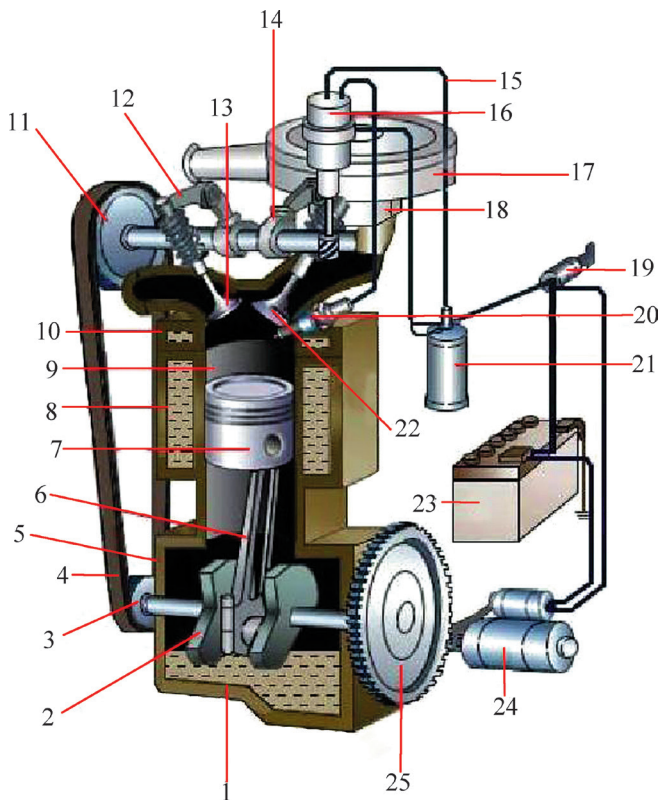


Figure 1.1.1 Engine overall mechanics

1. oil pan 2. crank 3. crank pulley 4. belt 5. crankcase 6. connecting rod 7. piston 8. the water jacket 9. cylinder 10. cylinder head 11. camshaft pulley 12. rocker 13. exhaust valve 14. camshaft 15. high voltage 16. distributor 17. air filter 18. carburetor 19. ignition switch 20. spark 21. ignition coil 22. intake valve 23. battery 24. starter 25. flywheel

Engine Classification

Engines can be classified in several methods. In general, engines can be divided into electric motors, steam engines and internal combustion engines. We can also follow other methods to divide engines.

Cylinder Arrangement

Generally, the cylinder arrangements are cylinder-in-line; V-arrangement; Flat and radial. (see Figure 1.1.2)

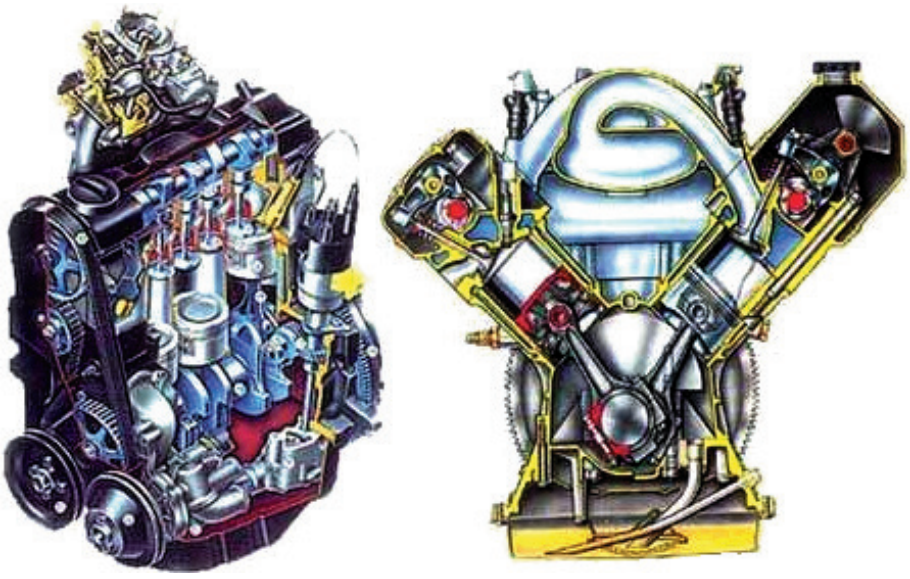


Figure 1.1.2 Inline and V type arrangement

Engine Terms

Engine terms are (see Figure 1.1.3):

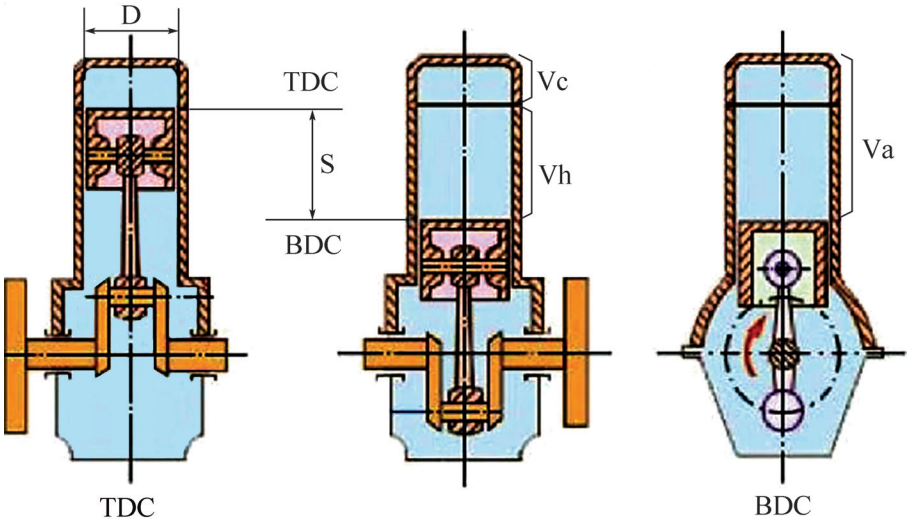


Figure 1.1.3 Engine terms

TDC（Top Dead Center）: the position of the crank and piston when the piston is farther away from the crankshaft.

BDC（Bottom Dead Center）: the position of the crank and piston when the piston is nearest to the crankshaft.

Stroke: the distance between BDC and TDC; stroke is controlled by the crankshaft.

Bore: the internal diameter of the cylinder.

Swept volume: the volume between TDC and BDC.

Engine capacity: this is the swept volume of all the cylinders, e. g. a four-cylinder engine having a capacity of two liters（2000 cm）has a cylinder swept volume of 500 cm.

Clearance volume: the volume of the space above the piston when it is at TDC.

Compression ratio=（swept vol + clearance vol）/（clearance vol）

Two-stroke: a power stroke every revolution of the crank.

Four stroke: a power stroke every other revolution of the crank.

Four Strokes Operation (See Figure 1.1.4)

Almost all cars currently use a four-stroke combustion cycle to convert gasoline into motion. That is to say that the Intake stroke, Compression stroke, Power stroke and Exhaust stroke are one engine cycle. When the fourth stroke is completed, the cycle begins again.

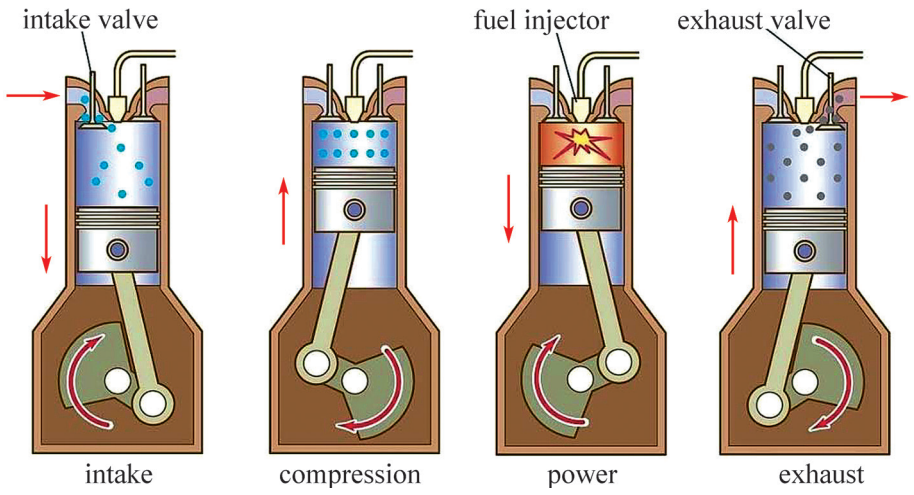


Figure 1.1.4　Four strokes operation

Intake Stroke

The first stroke is the intake stroke. As the piston starts down, the intake valve opens and the air-fuel mixture enters into the cylinder. When the piston reaches the

bottom of the intake stroke, the intake valve closes, trapping the air fuel mixture in the cylinder. During this stroke, the exhaust valve stays closed.

Compression Stroke

The second stroke is the compression stroke. The piston moves up in the cylinder with both valves closed and compresses the trapped air-fuel mixture. When the piston reaches the top of the cylinder, the pressure rises.

Power Stroke

The third stroke is the power stroke. Near the end of the compression stroke, the spark plug fires, igniting the compressed air fuel mixture that produces a powerful explosion. The combustion process pushes the piston down the cylinder with great force turning the crankshaft to provide the power to drive the car.

Exhaust Stroke

The fourth stroke is the exhaust stroke. With the piston at the bottom of the cylinder, the exhaust valve opens, and the piston moves up again and forces the burned gases out of the cylinder. The piston travels up to the top of the cylinder pushing all the exhaust out before closing the exhaust valve in preparation for starting the four-stroke process over again.

New Words

engine	['endʒɪn]	*n.* 发动机，引擎
automobile	['ɔ:təməbi:l]	*n.*（主美）汽车 =（英）motor car, car
gasoline	['gæsəli:n]	*n.* 汽油
piston	['pɪstən]	*n.* 活塞
crankshaft	['kræŋkʃɑ:ft]	*n.* 曲轴
major	['meɪdʒə(r)]	*adj.* 主要的；重要的
valves	[vælvz]	*n.* 阀气门
cylinder	['sɪlɪndə(r)]	*n.* 圆筒，气缸
camshaft	['kæmʃɑ:ft]	*n.* 凸轮轴
flywheel	['flaɪwi:l]	*n.* 飞轮
assembly	[ə'sembli]	*n.* 集合，装配，组件
classification	[ˌklæsɪfɪ'keɪʃn]	*n.* 分类

arrangement	[əˈreɪndʒmənt]	*n.* 排列
gasoline	[ˈgæsəliːn]	*n.* 汽油
diesel	[ˈdiːzl]	*n.* 柴油
stroke	[strəʊk]	*n.* 行程，冲程
expel	[ɪkˈspel]	*v.* 驱逐
recharge	[ˌriːˈtʃɑːdʒ]	*vt.* 再充电
exhaust	[ɪgˈzɔːst]	*vt.* 用尽，耗尽 *n.* 排气，排气装置
diameter	[daɪˈæmɪtə(r)]	*n.* 直径
volume	[ˈvɒljuːm]	*n.* 卷，册，体积
revolution	[ˌrevəˈluːʃn]	*n.* 革命，旋转
intake	[ˈɪnteɪk]	*n.* 口，进口
explosion	[ɪkˈspləʊʒn]	*n.* 爆发，发出，爆炸

Phrases and Expressions

mechanical energy	机械能
internal combustion engine	内燃机
engine combustion chamber	发动机燃烧室
connecting rods	连杆
rotary motion	旋转运动
power train	传动系
engine block	汽缸体
cylinder head	汽缸盖
spark plug	火花塞
piston ring	活塞环
oil pan	油底壳
valve train	配气机构
fuel supply system	燃油供给系统
lubricating system	润滑系统
cooling system	冷却系统
ignition system	点火系统

starting system	启动系统
electric motor	电动机
steam engine	蒸汽机
gasoline engine	汽油机
diesel engine	柴油机
power stroke	工作行程
compression ratio	压缩比
intake stroke	进气冲程
compression stroke	压缩行程
exhaust stroke	排气行程
air-fuel mixture	可燃混合气

Translate the following phrases into Chinese or English.

1. cylinder block
2. air-fuel mixture
3. 冷却系统
4. connecting rod
5. 工作行程
6. 点火系统
7. valve train
8. intake stroke
9. 进气冲程
10. piston ring

1.2 Connecting Rods and Crankshaft

The connecting rods

The connecting rods link the pistons with the crankshaft and transmit force and motion from the piston to the crankpin on the crankshaft. In operation, the connecting rod is subjected to both gas pressure and inertia loads, and therefore, it must be adequately strong and rigid. At the same time, the rod is in eccentric motion. To minimize vibration and bearing loads, the rod must be light in weight. So, many connecting rods are steel-forged, tapered I-beam design. Connecting rods have ring-shaped heads at its ends, the heads being known as the connecting rod big end and small end. The connecting rod big end fits over the crankshaft journal, and the connecting rod small end fits over the piston pin (see Figure 1.2.1).

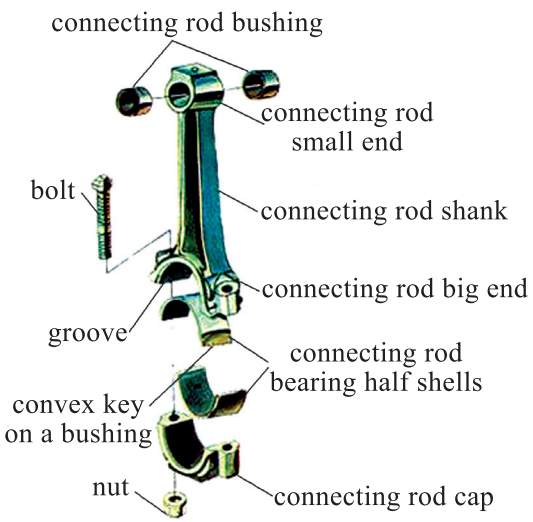


Figure 1.2.1 Connecting rods

The connecting rods are composed of connecting rod small end, connecting rod shank, connecting rod big end, connecting rod cap and connecting rod bearing half shells. The connecting big end and the connecting rod cap are joined by means of special high-strength bolts and nuts. The nuts on the connecting rod bolts are tightened with a torque indicating wrench and then pattered. The big end of the connecting rod houses a sliding contact bearing and features a hole through which oil is squirted onto the cylinder walls.

The parting line between the connecting rod and its cap is generally arranged at right angle to the axis of the connecting rod shank, but in some engines, the parting line is necessarily arranged diagonally, because the proportions of the big end of the connecting rod are such that the lower part of the rod could not otherwise be passed through the cylinder for assembly purpose. With such an angled big end, the cap is secured to the connecting rod by setscrew instead of bolts and nuts. To resist the greater tendency for the inertia forces to displace the cap sideways relative to the connecting rod, either a serrated or a stepped joint is generally preferred for their

abutting faces. Hence, the retaining setscrew in their clearance holes are completely relieved of shear loads. Tab washers are used under the heads of setscrew in order to prevent the latter from working loose.

The crankshaft

The crankshaft (see Figure 1.2.2) takes the downward thrusts of the pistons and connecting rods when the air fuel mixture is burned in the cylinders and changes these thrusts into torque which is transferred to the drive line of the automobile. The crankshaft is usually made from carbon steel which is alloyed with a small proportion of nickel. The main bearing journals fit into the cylinder block and the big end journals align with the connecting rods. The crankshaft also drives various engine mechanisms and components. At the rear end of the crank-shaft is attached the flywheel, and at the front end are the driving wheels for the timing gears, fan, cooling water and alternator.

Figure 1.2.2 Crankshaft

All the main bearing and connecting rod bearing journals are machined to a highly polished finish. Bearing inserts are located between the main bearing bores and the main bearing journals on the crankshaft. The main bearing journals must be perfectly aligned with each other. The crankshaft journals must be properly spaced so the pistons reach TDC in the correct order.

New Words

squirt	[skwɜːt]	*v.* 喷出
crankpin	[ˈkræŋkˈpɪn]	*n.* 曲轴销
diagonally	[daɪˈægənli]	*adv.* 倾斜地
inertia	[ɪˈnɜːʃə]	*n.* 惯性，惯量，惰性
setscrew	[setˈskruː]	*n.* 固定螺钉
adequately	[ˈædɪkwətli]	*adv.* 足够地，充分地，相当地
tendency	[ˈtendənsi]	*n.* 倾向，趋势
serrated	[səˈreɪtɪd]	*adj.* 有锯齿的，锯齿状的

thrust	[θrʌst]	*n.* 插，挤进，强迫
proportion	[prəˈpɔːʃn]	*n.* 比例
nickel	[ˈnɪkl]	*n.* 镍
bearing	[ˈbeərɪŋ]	*n.* 轴承
torque	[tɔːk]	*n.* 力矩
finish	[ˈfɪnɪʃ]	*v.* 精加工

Phrases and Expressions

the connecting rod big end	连杆大头
the connecting rod small end	连杆小头
crankshaft journal	曲轴轴颈
piston pin	活塞销
drive line	传动系
connecting rod shank	杆身
connecting rod cap	连杆盖
connecting rod bearing half shell	轴瓦

1. The big end of the connecting rod houses a sliding contact bearing and features a hole through which oil is squirted onto the cylinder walls.

译文：连杆大头装有滑动轴承，并钻有油孔，可使机油喷到气缸壁。

2. The parting line between the connecting rod and its cap is generally arranged at right angle to the axis of the connecting rod shank, but in some engines,the parting line is necessarily arranged diagonally, because the proportions of the big end of the connecting rod are such that the lower part of the rod could not otherwise be passed through the cylinder for assembly purpose.

译文：连杆与连杆盖之间的剖分线与连杆杆身轴线垂直，但是在有些发动机中剖分线呈倾斜布置，否则在装配时连杆大头就不能通过气缸。

Exercises

1. What is the function of the connecting rods?
2. Why must the connecting rod be light in weight?
3. What are the main parts of the connecting rod?
4. What is the function of the crankshaft?

1.3 Valve Gear

The valve gear provides timely admission of the fresh charge into the cylinders and exhaust of spent gases from them. The valves at definite moments open and close the intake and exhaust ports in the cylinder head, through which the cylinders communicate with the intake and exhaust manifold.

The opening of each valve is controlled by a camshaft.

Overhead Camshaft (OHC) Valve Train

The cam is an egg-shaped piece of metal on a shaft that rotates in coordination with the crankshaft. The metal shaft, called the camshaft, typically has individual cams for each valve in the engine. As the camshaft rotates, the lobe, or high spot of the cam, pushes against parts connected to the stem of the valve. This action forces the valve to move downward. This action could open an inlet valve for an intake stroke, or open an exhaust valve for an exhaust stroke.

As the camshaft continues to rotate, the high spot moves away from the valve mechanism. As this occurs, valve springs pull the valve tightly closed against its opening, called the valve seat.

Valves in modern car engines are located in the cylinder head at the top of the engine. This is known as an overhead valve (OHV) configuration. In addition, when the camshaft is located over the cylinder head, the arrangement is known as an overhead camshaft (OHC) design (see Figure 1.3.1). Some high-performance engines have two separate camshafts, one for each set of inlet and exhaust valves. These engines are known as dual overhead camshaft (DHOC) engines (see Figure 1.3.2).

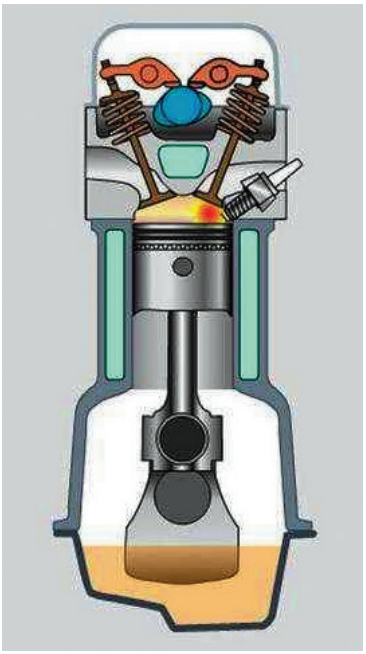
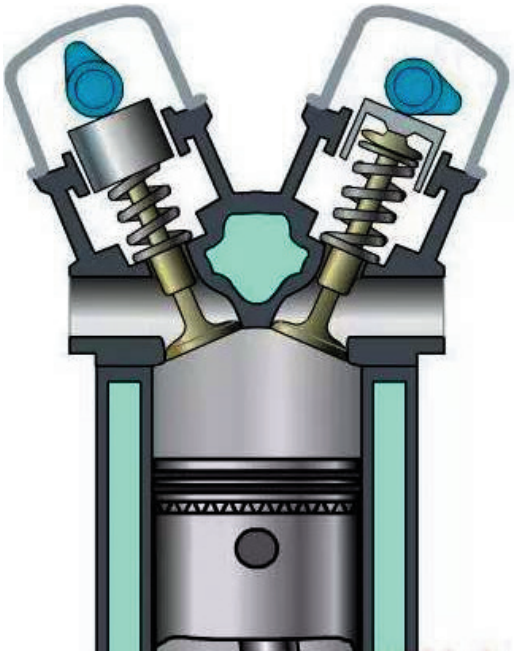


Figure 1.3.1 OHC Figure



1.3.2 DHOC

Push-rod Valve Train

The camshaft also can be located in the lower part of the engine, within the engine block. To transfer the motion of the cam upward to the valve, additional parts are needed.

In this arrangement, the cam lobes push against round metal cylinders called cam follower. As the lobe of the cam comes up under the cam follower, it pushes the cam follower upward (away from the camshaft). The cam follower rides against a push rod, which pushes against a rocker arm. The rocker arm pivots on a shaft through its center. As one side of the rocker arm moves up, the other side moves down, just like a seesaw. The downward-moving side of the rocker arm pushes on the valve stem to open the valve.

Because a push-rod valve train has additional parts, it is more difficult to run at high speeds. Push-rod engines typically run at slower speeds consequently, produce less horsepower than overhead camshaft designs of equal size. (Remember, power is the rate at which work is done.)

The camshaft must revolve at exactly half the speed of the crankshaft. This is accomplished with a 2∶1 great ratio. The gears are linked in one of three ways:

(1) Belt drive

Such belts are made of synthetic rubber and reinforced with internal steel or fiberglass strands. The belts have teeth, or slotted spaces to engage and drive teeth on gear wheels. A belt typically is used on engines with overhead-cam valve trains.

（2） Chain drive

On some engines, a metal chain is used to connect the crankshaft and camshaft gears. Most push-rod engines and some OHC engines use this driving.

（3） Gear drive

The camshaft and crankshaft gears can be connected directly, or meshed. This type of operating linkage commonly is used on older six cylinder inline engines.

Electronic Valve Control System

An electronic valve control（EVC）system replaces the mechanical camshaft, controlling each valve with actuators for independent valve timing. The EVC system controls the opening and closing time and lift amount of each intake and exhaust valve with independent actuators on each valve. Changing from a mechanical camshaft driven valve into independently controlled actuator valves, provides a huge amount of flexibility in engine control strategy. Vehicles utilizing EVC can realize several benefits including: increases engine power and fuel economy; allows centralized and distributed EVC systems to perform at their full potential; adapts to engines of varied cylinder counts.

With all of the improved efficiencies and consumer benefits, auto manufacturers are eager to get their first EVC systems on the road. The EVC system is targeted to operate in temperatures up to 125℃, while the actuator is targeted to run up to 6 000 r/ min. The actuator can be controlled in a centralized system with a high-speed multiplex bus（up to 10 Mbps）or in a distributed system with a nominal speed bus.

EVC systems must be compact in size, specifically the actuators that must be small enough to fit in the engine space. A vehicle that uses a 42V system is ideal for EVC because it requires high voltage to control the valve actuators, and EVC is targeted for V8 and V12 engines. The EVC system is also highly flexible, allowing adaptability for a number of cylinder engines.

New Words

charge	[tʃɑːdʒ]	*n.* 气体
definite	[ˈdefɪnət]	*adj.* 肯定的；确定的
port	[pɔːt]	*n.* 口
manifold	[ˈmænɪfəʊld]	*n.* 歧管
lobe	[ləʊb]	*n.* 凸角
downward	[ˈdaʊnwəd]	*adj.* 下降的；向下的

spring	[sprɪŋ]	*n.* 弹簧
pivots	[ˈpɪvət]	*n.* 枢轴；支点；枢轴；中心点
seesaw	[ˈsi: sɔ:]	*n.* 跷跷板
consequently	[ˈkɒnsɪkwəntli]	*adv.* 因此；所以
horsepower	[ˈhɔ:rspaʊər]	*n.* 马力（功率单位）
revolve	[rɪˈvɒlv]	*v.* 旋转；环绕；转动
actuator	[ˈæktjʊeɪtə]	*n.* 传动（装置，机构）；拖动装置
manufacturer	[ˌmænjuˈfæktʃərər]	*n.* 生产者；制造者；生产商

Phrases and Expression

Valve Gear	配气机构
spent gases	废弃
Overhead Camshaft （OHC） Valve Train	顶置凸轮轴气门机构
in coordination with	与……协作
dual overhead camshaft	双顶置凸轮轴
Push-rod Valve Train	推杆配气机构
cam lobes	凸轮凸角
cam follower	凸轮从动件
rocker arm	摇臂
great ratio	齿轮比
belt drive	带传动
synthetic rubber	合成橡胶
reinforced with	加固
fiberglass strands	玻璃钢绞线
chain drive	链传动
gear drive	齿轮传动
Electronic Valve Control System	电子阀门控制系统
mechanical camshaft	机械凸轮轴
high voltage	高（电）压