1. ENGINES-HOW THEY WORK

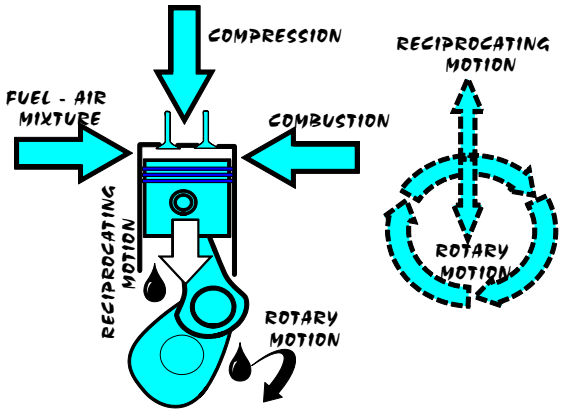


Fig. 1 - Basic Elements of An Engine

WHAT IS AN "INTERNAL COMBUSTION" ENGINE?

An internal combustion _____ is one that burns fuel internally.

Basically this engine is a container in which we put _____ and air and start them burning.

The mixture expands _____ while burning and pushes outward. This push can be used to move a part of the engine, and transmitted to drive the machine.

In summary, the engine is a _____ which ___ ____heat energy into mechanical energy to do work.

WHAT ELEMENTS ARE NEEDED FOR AN ENGINE?

These elements are needed to construct a simple engine:

- **Air_____ and Combustion**
- **Reciprocating and _____ Motion**
- **_____ of Fuel-Air Mixture**
- **Engine Cycles-Two-or _____ Stroke**

Key words: fuel, four, rotary, rapidly, device, engine, outward, convert, and compression.

WORD EXERCISE

aktion	.....
andning, andan	.....
arbetstakt	.....
betyda	.....
bränna, brinner	.....
bränsle	.....
cykel	.....
expandera	.....
flytta	.....
fram och tillbaka	.....
förbränning	.....
förändra	.....
grundelement	.....
inre sida, innersida, insida	.....
inre	.....
konstruera	.....
köra	.....
luft	.....
motor	.....
rörelse	.....
sammandrag	.....
sluten	.....
snabbt	.....
utåt	.....
värmeenergi	.....
	.....
act	.....
air	.....
aspiration	.....
basic element	.....
burn	.....
combustion	.....
construct	.....
convert	.....
cycle	.....
drive	.....
enclosed	.....
engine	.....
expand	.....
fuel	.....
heat energy	.....
inside	.....
internal	.....
mean	.....
motion	.....
move	.....
outward	.....
rapidly	.....

reciprocating .....
stroke .....
summary .....
.....
akti, toiminta .....
edestakainen .....
hengitys .....
ilma .....
isku tahti .....
kierto, tahti .....
käyttää, ajaa .....
laajeta paisua .....
liike .....
lämpöenergia .....
moottori kone .....
muuttaa .....
nopeasti .....
palaminen, poltto .....
peruselementti .....
polttaa palaa .....
polttoaine .....
rakentaa .....
siirtää, liikuttaa .....
sisäpuoli .....
sisäpuolinen .....
suljettu .....
tarkoittaa merkitä .....
tiivistelmä .....
ulospäin .....

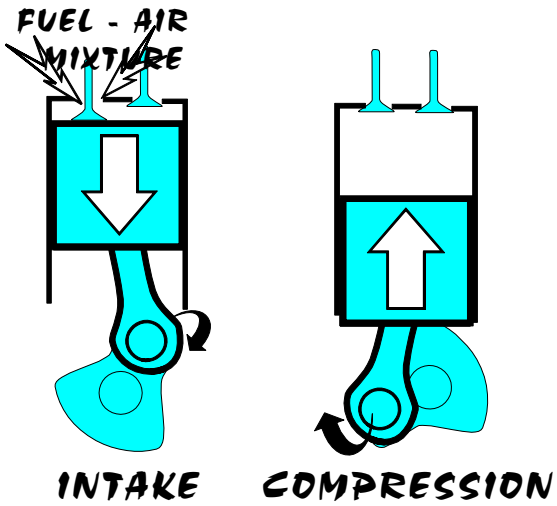
2. FOUR STROKE ENGINES HOW THEY WORK

FOUR-STROKE CYCLE ENGINE

In the four stroke cycle engine, the same four operations occur—intake, compression, power and exhaust. However, four _____ of the piston—two up and two down—are needed to complete the cycle. As a result, the _____ will rotate two complete turns before one cycle is completed.

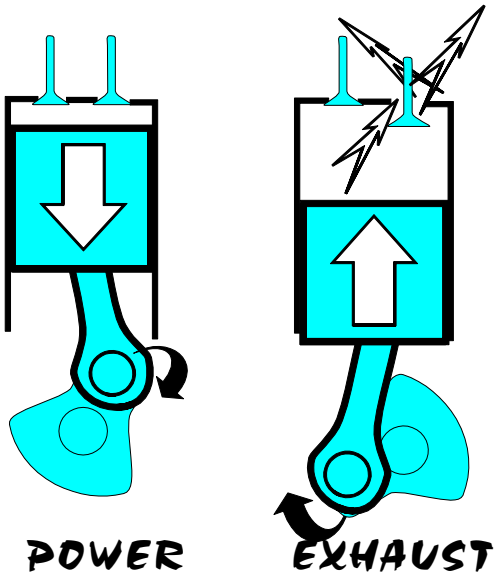
INTAKE

Fuel-air mixture is drawn into the cylinder from _____ through open intake valve by down stroke of piston.



COMPRESSION

Mixture is compressed by up-stroke of piston. Both _____ and exhaust valves are closed.



POWER

Compressed mixture is ignited by _____ ____ and expanding gases force piston to bottom of cylinder. Valves remain closed.

EXHAUST

Piston on up-stroke forces burned gases from _____ through open exhaust valves.

INTAKE STROKE

The intake stroke starts with the piston near the top and ends shortly after the bottom of its stroke. The intake valve is opened, _____the cylinder as the piston moves down to receive the fuel-air mixture. The valve is then closed, sealing the cylinder.

COMPRESSION STROKE

The compression stroke begins with the piston at bottom and rising up to compress the fuel-air mixture. Since the intake and _____valves are closed, there is no _____ for the fuel-air and it is compressed to a fraction of its original volume.

POWER STROKE

The power stroke begins when the piston almost _____ the top of its stroke and the fuel-air mixture is _____. As the mixture burns and expands, it forces the piston down on its power stroke. The valves _____ closed so that all the force is exerted on the piston.

EXHAUST STROKE

The exhaust stroke begins when the _____ nears the end of its power stroke. The exhaust valve is _____ and the piston rises, pushing out the burned gases. When the piston reaches the top, the exhaust valve is closed and the piston is ready for a new four stroke cycle, intake, compression, _____ and exhaust.

Key words: remain, ignited, reaches, piston, opened, power, escape, exhaust, strokes, crankshaft, intake, carburettor, sparking, cylinder, allowing, sealing.

WORD EXERCISE

använda	.....
avgasventil	.....
bråkdel	.....
effekt	.....
expanderande	.....
flyktväg	.....
förbi	.....
förbrända gaser	.....
gas	.....
insugsventil	.....
inträffa	.....
komplett	.....
kompression	.....
komprimerad;pressad	.....
nedåt/utför	.....
närma sig	.....
original	.....
påbörja/börja	.....
restera	.....
resultat	.....
röra sig neråt	.....
skjuta ut	.....
stiga upp	.....
syklon	.....
topp	.....
tända	.....
tändstift	.....
uppåtriktat slag	.....
urdragen, ; tom	.....
vevaxel	.....
volym	.....
öppen, öppna	.....
exert	.....
exhaust valve	.....
fraction	.....
power	.....
expanding	.....
escape	.....
through	.....
burned gases	.....
gas	.....
intake valve	.....
occur	.....
complete	.....
compression	.....
compressed	.....
down	.....
reach	.....
near	.....
original	.....
begin	.....

remain .....
result .....
move down .....
pushing out .....
rising up .....
cyclone .....
top .....
ignite .....
spark plug .....
up-stroke .....
drawn .....
crankshaft .....
volume .....
open .....

alas .....
alkaa .....
alkuperäinen .....
avoin, avata .....
huippu .....
imuventtiili .....
isku ylöspäin .....
jäädä/olla jäljellä .....
kaasu .....
kampiakseli .....
käyttää ponnistaa .....
liikkua alas .....
lähestyä .....
läpi, kautta .....
murto-osa .....
nousta ylös .....
paisuva .....
pakotie .....
pakoventtiili .....
palaneet kaasut .....
puristettu .....
puristus .....
puskea ulos .....
saavuttaa, tulla .....
sykloni .....
sytyttää, syttyä .....
sytytystulppa .....
tapahtua .....
teho-, työtahti .....
tilavuus .....
tulos .....
täydellinen .....
vedetty, imetty .....

3. AIR, FUEL AND COMBUSTION

Air is needed to _____ with fuel and give it oxygen for fast burning. Air also has two other _____ that affect the engine.

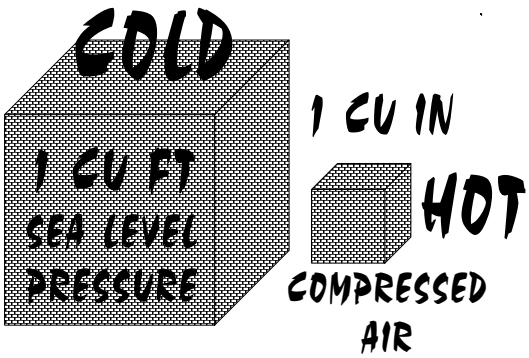


Fig. 1—Air can be compressed—air heats when compressed

1. Air will compress; one cubic foot of air can be packed into one cubic inch or less.

2. Air heats when it is _____. The molecules of air rub against each other and produce heat. FUEL must mix readily with air and _____ easily. The three we will cover are gasoline, LP-gas and diesel fuel.

These fuels ignite easily and are readily broken down or vaporized.

Why do we want to _____ the fuel? To help each particle of fuel contact enough air to burn fully.

COMBUSTION is the actual igniting and burning of the fuel-air mixture. It is the ___ ___ in the air that combines with the fuel for combustion. What is important here is how fast

the fuel burns, for this force must be "explosive" to get full power from the engine.

If a container of gasoline is ignited in calm outside air, it burns rather lazily (Fig. 4). This is because the air contacts only the surface of the fuel. To make the fuel burn faster, two things can be done: 1) Heat up the fuel and 2) Vaporize the fuel.

However, too powerful _____ would destroy an engine, since _____ take place in a closed container.

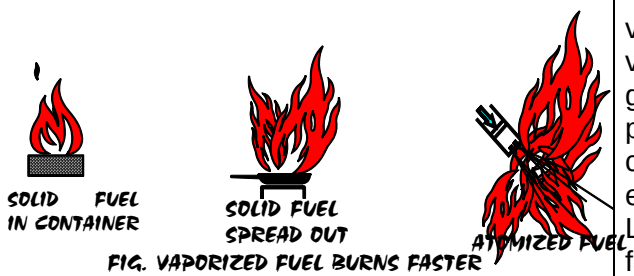


Fig. 2—Atomized and vaporized fuels burn faster

Key words: combine, ignite, properties, contact, vaporize, oxygen, combustion.

WORD EXERCISE

avdunsta .....
avdunstande .....
bensin .....
egenskap .....
elström .....
explosiv .....
flytgas .....
fortare; snabbare .....
fullständig förbränning .....
förbränningshastighet.....
förena .....
gnida .....
i motorn .....
inverka .....
justera; kontrollera .....
kan förstöra .....
kan göras .....
komprimera .....
kubik tum .....
luften blir hetare .....
lugn .....
med bränslet .....
med luft .....
mindre .....
molekyl .....
mot varandra .....
måste blandas .....
obesvärat; lätt .....
partikel .....
segt; sakta; långsamt .....
ske .....
stängd behållare; tillsluten cistern ....
syre .....
två saker .....
täcka .....
verklig .....

vaporize .....
volatile .....
gasoline .....
property .....
current .....
explosive .....
LP-gas, liquid pressurized- .....
faster .....
burn fully .....
rate of burning .....
combine .....
rub .....
in the engine .....
affect .....
control .....
would destroy .....
can be done .....
compress .....
cubic inch .....
air heats .....
calm .....
with fuel .....
with air .....
less .....
molecule .....
against each other .....
must mix .....
readily .....
particle .....
lazily .....
take place .....
closed container .....
oxygen .....
two things .....
cover .....

actual .....
are broken down .....
.....
höyrystyä .....
haihtuva .....
bensiini am. .....
ominaisuus .....
sähkövirta .....
räjähtävä .....
nestekaasu .....
nopeammin .....
palaa täydellisesti .....
palamisnopeus .....
yhdistyä .....
hangata .....
moottorissa .....
vaikuttaa .....
säädellä .....
voisi tuhota .....
voidaan tehdä .....
puristua kokoon .....
kuutiotuuma .....
ilma kuumenee .....
rauhallinen .....
polttoaineen kanssa .....
ilman kanssa .....
vähemmän .....
molekyyli .....
toisiaan vastaan .....
täytyy sekoittua .....
vaivatta, helposti .....
osanen .....
laiskasti .....
tapahtua .....
suljettu säiliö .....
happi .....
kaksi asiaa .....
kattaa, peittää .....
todellinen, tosiasiallinen .....
sumuuntuvia .....

4. DIESEL FUEL SYSTEM

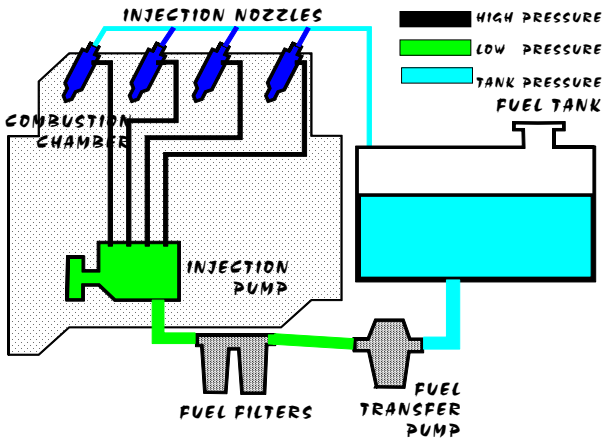
In the diesel fuel _____, fuel is sprayed directly into the engine combustion chamber where it _____ with hot compressed air and ignites. No electrical _____is used to ignite the mixture (as in gasoline engines).

Instead of carburetor, a fuel _____pump and spray _____are used.

The major parts of the diesel system are:

- **Fuel Tank—s_____**
- **Fuel Pump—_____ fuel to the injection pump**
- **Injection Pump—times, _____ and delivers fuel under pressure**
- **Injection Nozzles—_____ and spray fuel into cylinders**

Fig. Below shows these major parts of the diesel system.



In operation, the fuel pump _____ fuel from the tank and pushes it through the _____.

Clean fuel free of water is very vital to the precision parts of the diesel _____system. Extra filters are often used to _____clean fuel, but buying clean fuel and storing it properly are also prime needs.

The fuel is then pushed on to the injection pump where it is _____, put under high pressure and delivered to each injection _____ in turn.

The nozzles each serve one cylinder; they atomize the fuel and spray under controlled high pressure into the _____chamber at the proper moment.

High _____ fuel is needed at each nozzle to get a fine spray of fuel. This assures good mixing of fuel with the compressed air for full combustion.

Key words: combustion, pressure, nozzle, store, atomize, move, injection, measure, spark, system, mix, meter, assure, filter.

WORD EXERCISE, DIESEL FUEL SYSTEMS

blandas	.....
breda, sprida	.....
elektrisk; el-	.....
extra	.....
flytande bränsle	.....
från tanken	.....
fördela	.....
i funktion	.....
insprutning	.....
istället för	.....
kammare	.....
lagra	.....
mäta	.....
portionera	.....
precis	.....
rena, rengöra	.....
slätt	.....
spruta	.....
ställa in, tidsplanerna	.....
varje/envar	.....
vattenfri	.....
visa	.....

major parts	.....
mix	.....
spread	.....
electrical	.....
extra	.....
from the tank	.....
deliver	.....
in operation	.....
injection	.....
instead	.....
chamber	.....
store	.....
measure	.....
meter	.....
precision	.....
clean	.....
evenly	.....
spray	.....
time	.....
under pressure	.....
each	.....
free of water	.....
show	.....
	.....
pääosat	.....
sekoittua	.....
sähköinen	.....
lisä	.....
tankista	.....
jakaa	.....
toiminnassa	.....
ruiskutus	.....
jnk sijasta	.....
kammio, tila	.....
varastoida	.....
mitata	.....
mitata, annostella	.....
täsmällinen	.....
puhdistaa	.....
tasaisesti	.....
ruiskuttaa	.....
ajoittaa	.....
paineenalainen	.....
jokainen	.....
vedetön	.....
näyttää	.....

5. COOLING SYSTEMS

The cooling system prevents overheating of the engine. Some heat is necessary for combustion, but the working engine generates too much heat. The cooling system carries off this excess heat.

Cooling systems are designed to use parts that are matched in capacity. A matched cooling system will provide adequate heat rejection.

If one part is replaced that is under or over-capacity, the effectiveness of system will be decreased.

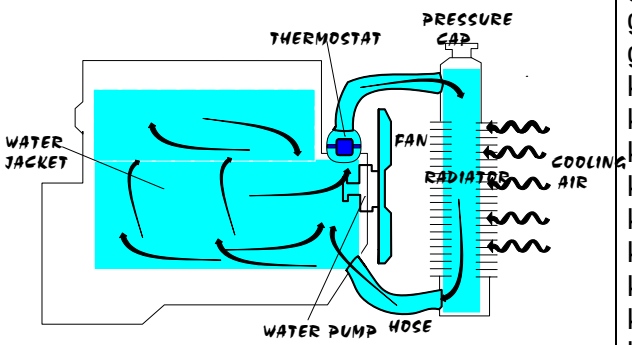
Parts include: water pump, radiator, coolant, piping, thermostat and fan.

TYPES OF COOLING SYSTEMS

Two types of cooling systems are used on modern engines:

Air Cooling—uses air passing around the engine to dissipate heat

Liquid Cooling—uses water around the engine to dissipate heat



AIR COOLING is used primarily on small engines or aircraft, as it is difficult to route air to all the heat points of large engines. Metal baffles, ducts, and blowers are used to aid in distributing air.

LIQUID COOLING normally uses water as a coolant. In cold weather, anti-freeze solutions are added to the water to prevent freezing.

The water circulates in a jacket around the cylinder and the cylinder head. As heat radiates, it is absorbed by the water, which then flows to the radiator.

Air flows through the radiator, cools the water and dissipates heat into the air. The water then recirculates into engine to pick up more heat.

WORD EXERCISE

avkylande luft (kylluft) .....
cirkulera/vara i omlopp .....
cirkulerar återigen .....
cylindervägg .....
distribuera .....
drivrem .....
dunsta .....
effektivitet .....
extra .....
fläkt .....
fläktrem .....
förhindra .....
generera .....
gå runt .....
göra bort .....
kallt väder; kall luft .....
kanal .....
kassering, underkännande .....
kylare .....
kylarvätska .....
kylarvätska ruot. glykol .....
kylning .....
kylsystem .....
ledare .....
luft farkost .....
minska .....
omfattar .....
passa .....
plocka .....
primärt .....
rördragning .....
stråla .....
system .....
termostat .....
tillfredsställande .....
trycklock .....
vattenmantel .....
vattenpump .....
vätska .....
vätskekylning .....
överhettning .....
.....
adequate .....
aicraft .....
antifreeze .....
baffle .....
blower .....

carry off .....
circulate .....
cold weather .....
coolant .....
cooling air .....
cooling system .....
cylinder wall .....
decrease .....
dissipate .....
distribute .....
drive belt .....
duct .....
effectiveness .....
excess .....
fan .....
fan belt .....
generate .....
include .....
liquid .....
liquid cooling .....
match .....
overheating .....
passing around .....
pick up .....
piping .....
pressure cap .....
prevent .....
primarily .....
radiate .....
radiator .....
recirculate .....
rejection .....
system .....
thermostat .....
water jacket .....
water pump .....
.....
ensisijaisesti .....
estää ehkäistä .....
haihduttaa .....
hoitaa pois .....
hylkääminen .....
ilma-alus .....
jakaa .....
johdin .....
järjestelmä .....
jäähd. järjestelmä .....
jäähdytin .....
jäähdyttävä ilma .....
jäähdytysneste .....
kanava .....
kehittää .....
kerätä poimia .....
kiertää .....
kiertää uudelleen .....
kulkea ympäri .....
kylmä ilma .....
käyttöhihna .....
laskea .....
neste .....
nestejäähdytys .....
painekorkki .....
pakkasneste .....
pitää sisällään .....
puhallin .....
putkitus .....
sopia yhteen .....
sylinterin seinämä .....
säteillä .....
tehokkuus .....
termostaatti .....
tuuletin, puhallin .....
tuulettimen hihna .....
tyydyttävä .....
vesipumppu .....
vesivaippa .....
ylikuumeneminen .....
ylimääräinen .....