BASIC KNOWLEDGE

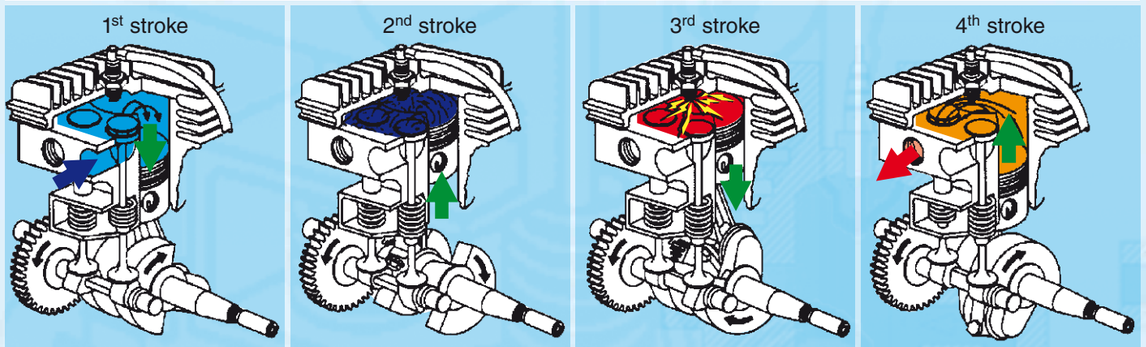
FUNCTIONING OF TYPICAL INTERNAL COMBUSTION ENGINES

Internal combustion engines belong to the group of combustion machines that plays a key role in training specialist staff and engineers. These engines are often used to power vehicles and are also used where drives that are independent of mains electricity are required (e. g. as emergency power units or in agriculture).

GUNT produces four different test stands for familiarisation with the most common internal combustion engines in a laboratory situation. The basic principles can be taught extremely effectively using small single cylinder engines, as used in lawnmowers for example (two-stroke and four-stroke engines). Meanwhile, genuine car engines are investigated on our CT 400 4-cylinder engine test stand. All test stands are equipped with a powerful PC data acquisition function, allowing characteristic curves to be plotted under full and partial load.

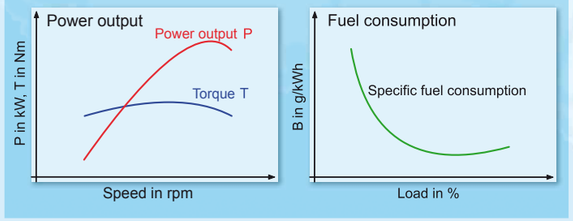
The basic knowledge gained by teaching and, particularly, through laboratory experiments, provides a high level of coverage of the requirements of most standard curricula. The knowledge acquired in this way provides a sound basis for moving onto more in-depth issues: In these days of climate change, reducing the greenhouse effect is becoming increasingly important. As a result, it is vital to cut CO_2 emissions, e.g. by using more efficient engines that consume as little carbon-rich fuel as possible.

OPERATING CYCLE OF A FOUR-STROKE PETROL ENGINE

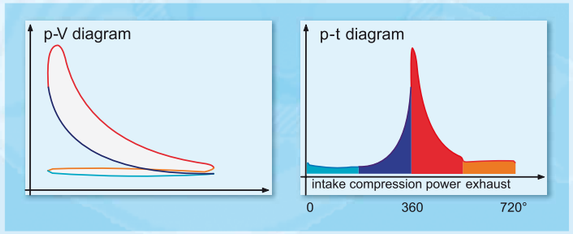


1st stroke	2nd stroke	3rd stroke	4th stroke
The piston moves from top dead centre to bottom dead centre. This takes in the fuel/air mixture.	*The piston moves from bottom dead centre to top dead centre. This compresses the fuel/air mixture.*	*The compressed fuel/air mixture is ignited shortly before it reaches top dead centre. The resulting pressure presses the piston downwards.*	*The piston moves from bottom dead centre to top dead centre. This expels the exhaust gases.*

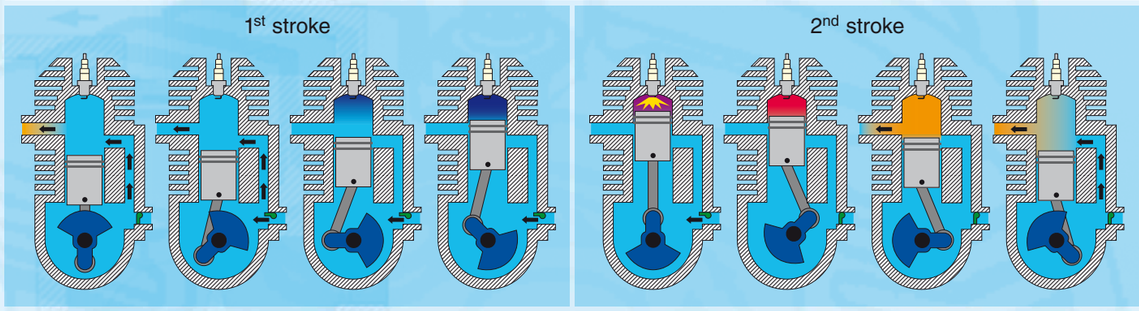
Four-stroke internal combustion engine curves



Indicating system diagrams for a four-stroke engine

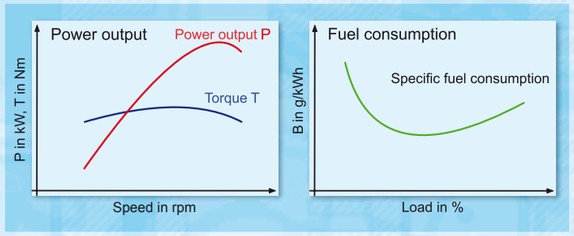


OPERATING CYCLE OF A TWO-STROKE ENGINE

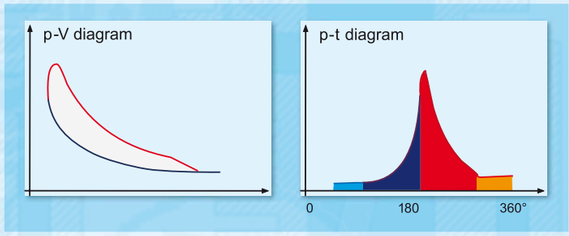


1st stroke	2nd stroke
In the first stroke, the piston moves from bottom dead centre to top dead centre. ***Processes below the piston:*** *The transfer port is sealed by the upward movement of the piston. Due to the resulting negative pressure, the inlet valve opens. This takes in the fuel/air mixture.* ***Processes above the piston:*** *The pre-compressed mixture is compressed above the piston.*	*During this stroke, the piston moves from top dead centre to bottom dead centre.* ***Processes above the piston:*** *The compressed mixture is ignited shortly before it reaches top dead centre. The resulting pressure presses the piston downwards and opens first the outlet port and then the transfer port. The pre-compressed mixture below the piston forces displaces the banked-up exhaust gases outwards.* ***Processes below the piston:*** *The mixture taken in is pre-compressed by the downward movement of the piston and is forced into the transfer port. The positive pressure seals the inlet port.*

Two-stroke internal combustion engine curves



Indicating system diagrams for a two-stroke engine



ENGINE COMPARISON: FOUR-STROKE DIESEL, FOUR-STROKE PETROL AND TWO-STROKE

	4-stroke diesel engine	4-stroke petrol engine	2-stroke petrol engine
Charge	Pure air	Air/fuel mixture	Air/fuel mixture
Fuel supply	Injector	Carburettor	Carburettor
Ignition	Compression	Ignition spark	Ignition spark
Compression ratio	14...21	5...12	5...8
Excess air factor	1,5...10	0,8...1,2	0,8...1,2
Fuel	Diesel	Petrol	Petrol