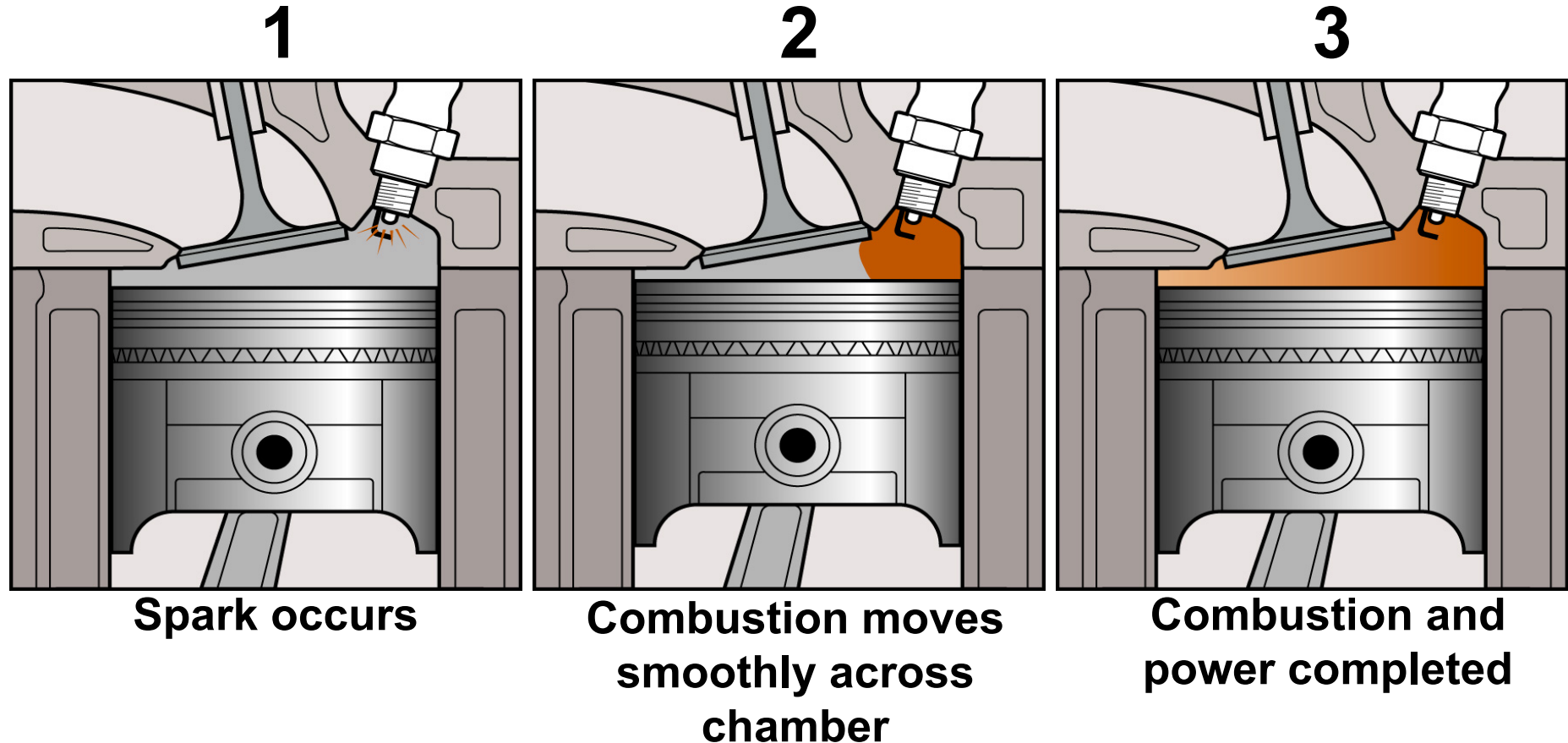
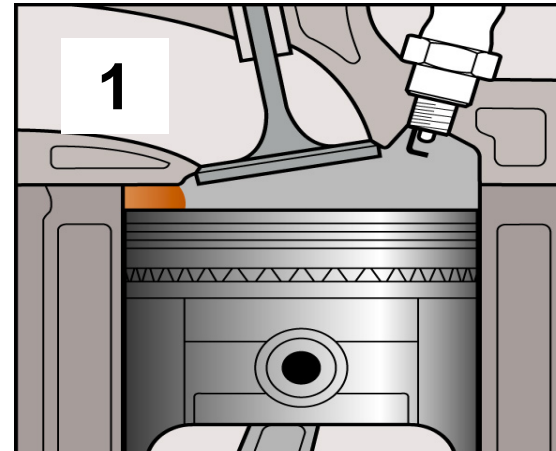


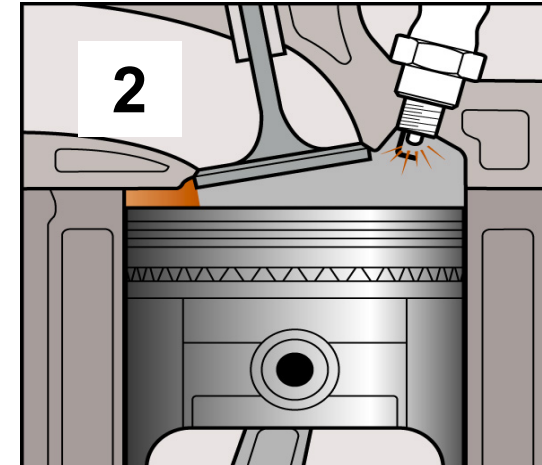
Normal combustion: is smooth and even from the spark plug through the top of the chamber.



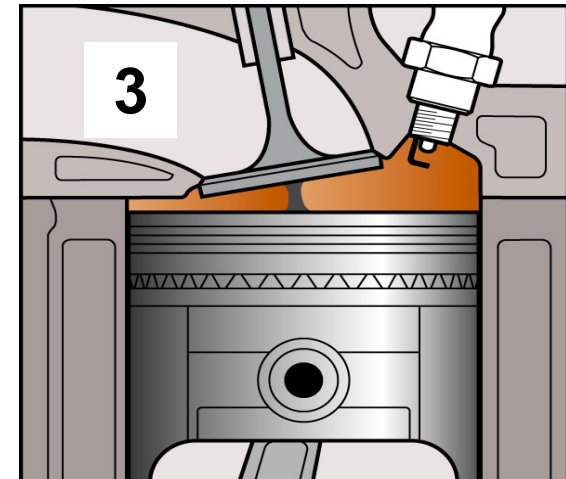
Pre-Ignition: occurs when the fuel/air mixture is ignited early by hot carbon deposits. Advanced ignition timing is also a cause of pre-ignition and will result engine component damage.



Ignition occurs from hot deposit.

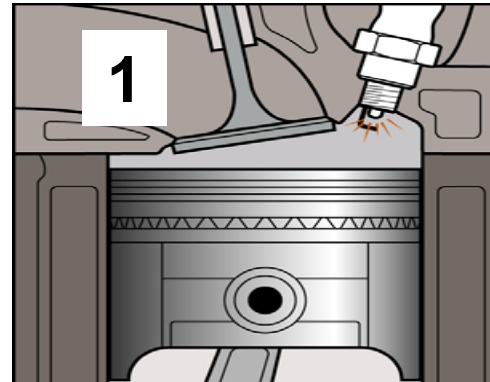


Spark plug ignites

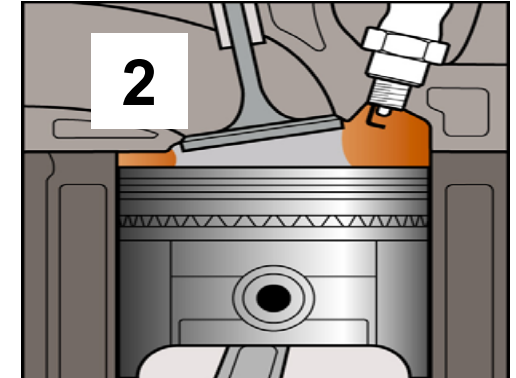


Flame fronts collide

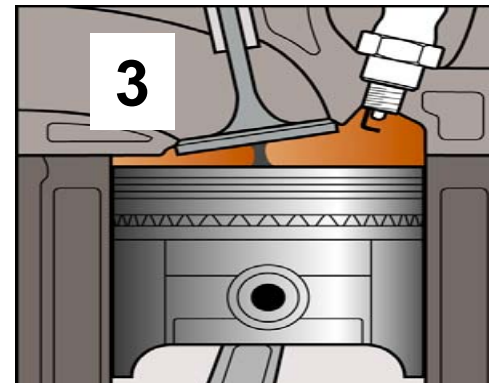
Detonation- occurs when a second flame front moves across the cylinder. This generally occurs after the spark plug fires and when the piston is not in the correct position for maximum power.



Spark occurs



Combustion begins at spark plug, spontaneous combustion begins elsewhere.



Flame fronts collide



Diagonal Skirt Contact:

Appearance:

Non-symmetric contact/wear pattern on piston skirt.

Cause:

Bent connecting rod.

Misaligned small end bush.

Excessive crankshaft end float.

Symptom:

Oil consumption/noise.

Remedy:

Check connecting rod and small end for misalignment & rectify fault.

Check crankshaft end float & rectify.

Gudgeon Pin Seizure:



Appearance:

Seized gudgeon pin.

Surface of pin and pin hole surface

Cause:

Lack of lubrication, possibly during initial start-up (after re-build).

Tight small end bush

Symptom:

Engine noise

Remedy:

Replace damaged components. Ensure gudgeon pin has correct clearance in the small end bush, or if the pin is anchored in the connecting rod, ensure that the piston is free to articulate about the gudgeon pin. Ensure adequate lubrication of piston and pin. Avoid lengthy periods of low engine speed in the running in period.

Hole burned through crown:



Findings:

Hole in piston crown. Crown edge locally burnt or molten.

Cause:

Detonation. Pre-ignition. Incorrect combustion

Symptom:

Engine noise. „Pinking“. Loss of power

Remedy:

Check spark plugs and ignition setting.

Ensure correct carburation or fuel injection.

Ensure that no air leaks exist in the induction system. Use only correct fuel as specified by the engine manufacturer

Indentations on piston crown

**Appearance:**

Indentations on piston crown. Possible fracture and/or distorted and seized top land.

Cause:

Foreign matter entering combustion chamber and becoming trapped between piston and cylinder head

Symptom:

Engine noise.

Remedy:

Ensure no other matter trapped in induction system. Check and correct any damage to cylinder head, valves, connecting rod and bearings. Check induction and air filtration system for leaks and correct any damage. Replace damaged components.

Abrasive Particle Damage:



Appearance:

Vertical scratching or scuffing of piston skirt.

Piston rings and cylinder bore may also be damaged by vertical scratching.

Cause:

Abrasive matter in engine

Symptom:

Oil consumption

Remedy:

Clean and inspect all engine components.

Clean all oil-ways. Ensure that air and oil filters are clean and fitted with correct filter elements.

Check integrity of all connection between air filter and engine. All damaged components should be replaced.

Piston - Ring Land Fracture:



Cause - petrol engines: excessive combustion chamber pressure, Over-advanced ignition setting, Increased compression ratio, Detonation.

Cause - diesel engines: Irregular combustion pressure due to: Start of delivery too early, Injector nozzle defective / broken, fuel Cetane value too low, causing extreme delay of start of ignition, Compression ratio too high, excessive use of aerosol starting aid.

Symptoms:

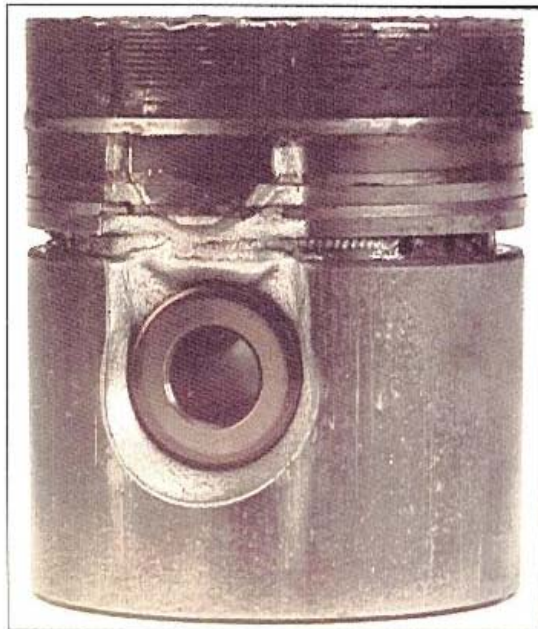
Oil consumption, loss of power, engine noise, excessive blow-by

Remedy:

Establish cause and correct.
Replace damaged components.



Skirt Erosion at Gudgeon Pin Hole:



Appearance:

Erosion of piston skirt adjacent to piston pin hole. The material sometimes appears to have melted. Damage to cylinder bore.

Cause:

Foreign matter assembled with piston in pin bore. Used circlips refitted. Incorrect fitting of circlips. End thrust transmitted via the piston pin from misaligned connecting rod or crankshaft end float.

Symptom:

Engine noise. Oil consumption

Remedy:

Correct any cylinder bore damage. Check for and correct any connecting rod misalignment or excessive crankshaft end float. Replace piston assembly ensuring that all circlips are correctly located.

Skirt Cracked or Broken



Appearance:

Cracks / break-outs on piston skirt.

Cause:

Mechanic impact prior to installation.

Contact to crankshaft balancer.

Cylinder bore distortion.

Foreign object in crank drive.

Symptom:

Engine noise.

Remedy:

Check functional length of connecting rod.

Check dimensions of crankshaft.

Check piston skirt length.

Check cylinder bore.

Inspect engine for foreign objects.

Replace all damaged components.

Overheated Piston Crown:



Appearance:

Top land seized. Consequential seizure down to skirt possible.

Piston rings damaged, trapped in ring grooves

Cause:

Overheating of piston crown due to:

Exceptionally high combustion temperatures,
Malfunction of piston cooling system.

Symptom:

Oil consumption, Engine noise, Loss of power

Remedy:

Check adjustment of fuel injection equipment and correct as necessary.

Check piston cooling system.

Rectify or replace all damaged cylinder components.

Skirt Seizure on Thrust - Side:



Appearance:

Seizure or scuffing on piston skirt thrust face. Non-thrust face remains relatively undamaged.

Cause:

Oil starvation, possibly during initial use.
Oil dilution by fuel or water. Oil spray nozzle on connecting rod clocked or misaligned.
BE bearing shell without oil hole installed.

Symptom:

Engine noise. Some power loss.

Remedy:

Check lubrication system and cylinder bore and correct as necessary. Replace damaged components. Check function and alignment of spray nozzles on connecting rods.
Check engine for internal coolant leakage.
Check injection and timing.
Ensure all components of the engine lubrication system are fully primed before starting the engine.



Skirt Seizure on Thrust & Non-Thrust Sides:



Appearance: seizure or scuffing on thrust side and anti-thrust side of piston skirt.

Cause: progression of damage caused by lack of lubrication.

Insufficient piston to cylinder clearance.

Cylinder bore distortion.

In cases where all pistons in the engine are affected the cause is usually: General engine overheating.

Symptoms: engine noise. Loss of power.

Fumes from engine breather.

Remedy: check cylinder bore and coolant circulation and correct as necessary.

Replace damaged cylinder components.

Erosion of Piston Material from Crown:



Appearance: crown or bowl edges locally burnt/eroded.

Extreme: Hole in piston crown.

Cause: irregular „knocking“ combustion due to:

Start of delivery too early / too late.

Injector nozzle defective / broken.

Fuel Cetane value too low.

Compression ratio too low.

Symptom: engine noise. „Knocking“ under load.

Loss of power.

Remedy: check setting of injection system.

Inspect injector nozzles.

Replace all damaged components.

Use only correct fuel as specified by the engine manufacturer

Piston Rings Trapped in their Grooves:



Appearance:

Piston rings trapped in their grooves by carbon build-up.

Scuffing/wear of piston ring outer surface.

Symptoms:

Oil consumption, Loss of power, piston & ring seizure.

Cause:

Excessive combustion temperatures.

Oil in combustion chamber.

Remedy:

Ensure valves, valve guides and valve stem oil seals (where fitted) are in good order and free from wear. Check engine oil quality & quantity and replace damaged components.

Burnt Piston Ring Surfaces:



Appearance: running surfaces of piston rings scuffed or burnt.

Scuffing or seizure marks on ring lands.

Cause: lack of lubrication on liner surface.

Oil level in engine too low..

Oil spray nozzles not aligned, blocked or missing.

Oil controlling of ring set too aggressive.

Injector nozzle defective or broken.

Fuel delivery too early or too late.

Symptom: loss of power. Oil consumption.

Remedy: check lubrication of liner.

Ensure correct oil volume in the engine.

Check correctness of ring set type and correct positioning of the individual piston rings.

Check injector nozzles/setting of injection system. Replace damaged components.