

Service Bulletin

Engines | General

**Subject | Processes in the combustion chamber- restarting
after downtimes of more than one day**

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This bulletin explains the processes in the combustion chamber with regard to silicon compounds in the fuel gas. It also contains instructions for the correct restarting following downtimes of more than one day.

♦ Explanation of the processes in the combustion chamber

As you know, especially biogases and sewage gases carry with them various silicon compounds in gaseous condition, called siloxanes and silanes. If these compounds are burnt in the combustion chamber, they are turned into water and silicon dioxide, resulting in “silica deposits”.

The characteristics of these **deposits in the combustion chamber** are largely determined by the amount of **oil ash**, therefore from the type of oil used and the given oil consumption.

- The more oil an engine needs due to advanced wear, the more oil ash arises, what leads to an increased bonding of the silicon particles.
- When an engine needs **little oil** (for example at the beginning of its running time) and the fuel gas contains **relative little siloxanes and silanes**, the resulting deposits will mainly consist of silicon dioxide and will tend to **flake off very easily**.

All deposits containing silicon have one property in common: depending on the content of silicon they are more or less hygroscopical (*Hygroscopical* means, that the deposits suck up water and steam (air humidity) like a “dry sponge”). As soon as deposits have sucked up humidity they experience a kind of volume- increase and tend to flake off.

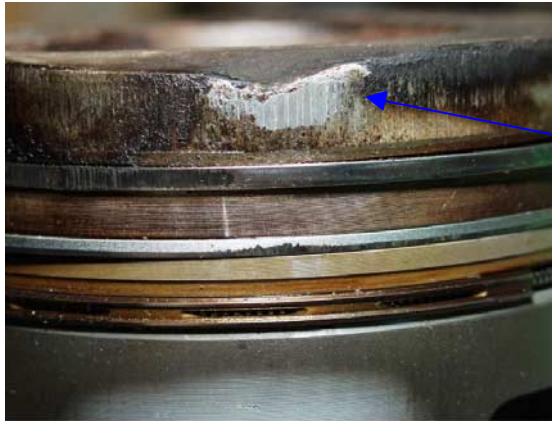
At increased oil consumption the above mentioned deposits are bonded better because of the existing oil ash and therefore at less risk to flake off!

If this flaking off occurs with the engine stationary, the particles collect especially on pistons that happen to be situated in the lower half and mainly in the 6 o'clock position of the respective piston crown because of their inclination.

As soon as the piston starts moving in the direction of the cylinder head the next time, there is a risk that these deposits will no longer have space between piston edge and lower edge of the cylinder head and that the piston is upset in the area of the firing land. This causes the cast-in ring carriers and the first ring slot to be squashed together vertically, the piston ring will no longer be able to slide into the slot unhindered.

→ Conclusion: **Ring seizure!!**

In the following example the piston crown was upset that much that not only the slot of the first piston ring but also the one of the second were deformed. This caused the taper face ring to jam in the slot, automatically resulting in ring seizure.



*Piston with upset piston crown
→ seizure of the firing land and all 3 piston rings on the scrape ring!*

Remark: On this example you also can see the difference between buckling and knocking:
A piston, damaged by knocking only shows damaging marks at the piston crown, where the missing material is vaporised.
Buckling additionally leads to a bump at the side of the piston, what causes the firing land to seize at the scrape ring.

In order to prevent such damages, a so-called “silicon recess” was introduced in all pistons of series 3 about three years ago. This bevel on the piston serves to prevent that collected deposits upset the piston when turning next.

This bevel is normally sufficient to prevent damage since all deposits come loose at once very seldom. Under special circumstances (e.g. restarting after a prolonged downtime) it can happen that almost all deposits in the combustion chamber come loose at once. To avoid, that various pistons will be upset on the firing land on restarting the engine, the following advises have to be observed:

◆ Please note and observe!

Should the engine be shut down for more than one day (= reference value!!) for whatever reason, adhere to the following:

- **Leave preheater switched on**, as far as this is possible. Preheater switched on means operating mode selector switch must be left on “MANUAL“ and never on “OFF”. When doing so it must be ensured that the engine cooling water pressure is above the minimum pressure, otherwise the preheater will be switched off automatically. If the pressure can’t be held, because there may be a cooling-water leakage into the oilroom, the oil level has to be checked immediately!
- It is imperative to **reinstall the spark plugs** after a possible inspection of the combustion chambers to prevent moisture being introduced in the combustion chambers which favours the flaking off of deposits.

- Before cranking the engine after prolonged disuse for the first time, be it manually or with the starter motor, **all cylinders have to be inspected by endoscope** for the presence of flaked-off deposits. Special attention must be paid to the 6 o'clock position! Possible deposits have to be removed by a vacuum cleaner.
- If no endoscope is available, **all combustion chambers** must be vacuumed with a **vacuum cleaner** to be on the safe side before cranking the engine. To this end, a suitable small hose has to be attached to the vacuum cleaner hose.

Note: This descriptions refer not only to biogas and sewage gas engines, where experience has shown silicon concentrations to be highest, but also to engines, the gas of which would colloquially be considered “harmless” (i.e.: low silicon content).