



Carbon Pistons for Internal Combustion Engines

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Schunk Kohlenstoff-technik – More than 90 Years of Expertise in Material Development

Based on extensive experience in the development of ceramic materials, Schunk Kohlenstofftechnik GmbH has developed special graphites for use as piston materials in internal combustion engines. They have performed successfully in various engine tests in different two-stroke and four-stroke engines, in both gasoline and Diesel powered versions.

Why Carbon Pistons?

Currently, pistons for two-stroke and four-stroke internal combustion engines are exclusively manufactured out of metallic materials; mostly aluminum alloys are used. Piston components or entire pistons for highly loaded engines are often made of steel.

Schunk Kohlenstofftechnik offers pistons made of special carbon materials with significant advantages compared to conventional piston materials. The most important characteristics of our piston materials are a low specific weight, a high temperature and thermal shock resistance, a low coefficient of thermal expansion as well as excellent wear resistance and low friction properties.



The Properties and Advantages of Schunk Carbon Pistons

Our carbon pistons have a density which is up to 30 % lower than that of conventional aluminum pistons. This advantage in weight results in a considerably reduced reciprocating mass in the engine which leads to higher performance and reduced vibration as well as to a reduction in fuel consumption by up to 5 %.

The mechanical strength of metals decreases greatly with rising temperature, whereas the strength of carbon materials increases. This enables the use of carbon pistons even in engines with very high thermal loads. A complicated piston-cooling scheme is not necessary.

The carbon pistons' excellent resistance to thermal shock avoids distortion under high thermal load and, therefore, improves the pistons' dimensional stability. This also implies a significant increase in operational reliability.

Schunk materials for carbon pistons exhibit a noticeably lower thermal expansion behaviour compared to that of metal alloys. This allows engine designs to incorporate lower cold clearances without risking piston seizure at operating temperature.



Lower cold clearances lead to a considerable decrease in hydrocarbon emissions during cold start (up to 50 %) as well as to reduced blow-by.

Even under extreme conditions and at high operating temperatures the low thermal expansion of the carbon pistons prevents piston seizure while increasing the operational reliability.

The self-lubricating properties of Schunk carbon materials result in both reduced lubricant (oil) consumption and decreased internal engine friction. Our carbon pistons exhibit excellent emergency running properties. This ensures smooth operation even when piston lubrication fails.

Carbon Pistons also for Two-Stroke Engines?

Metal pistons necessarily require a lubricant for their operation in the engine. Oil is supplied either by an engine lubricating system or it is, as for most two-stroke engines, directly added to the fuel.

Especially in the case of two-stroke engines, this oil content of the fuel leads to so called "blue smoke." These typical and unpleasant emissions are well known from chain saws, lawn mowers, scooters, etc.

Despite the definite advantages of two-stroke engines such as low weight, simple design and high specific output, they have been outstripped by technological development because of exhaust which does not meet today's emission standards.

The use of carbon pistons in two-stroke engines enables a significant reduction of the oil content in the fuel mixture and, thereby, a considerable decrease in emissions of unburned oil components.



Carbon pistons may help revive the popularity of two-stroke engines and re-energize the technological focus.





Further Applications of Carbon Pistons

Carbon pistons are not only well-suited for the application in conventional combustion engines. They have also proven their advantages in steam-powered cogeneration products, combined heat and power generators, compressors and other applications.

Please do not hesitate to contact us to learn more about how carbon pistons may help improve your engine design in many new ways.

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