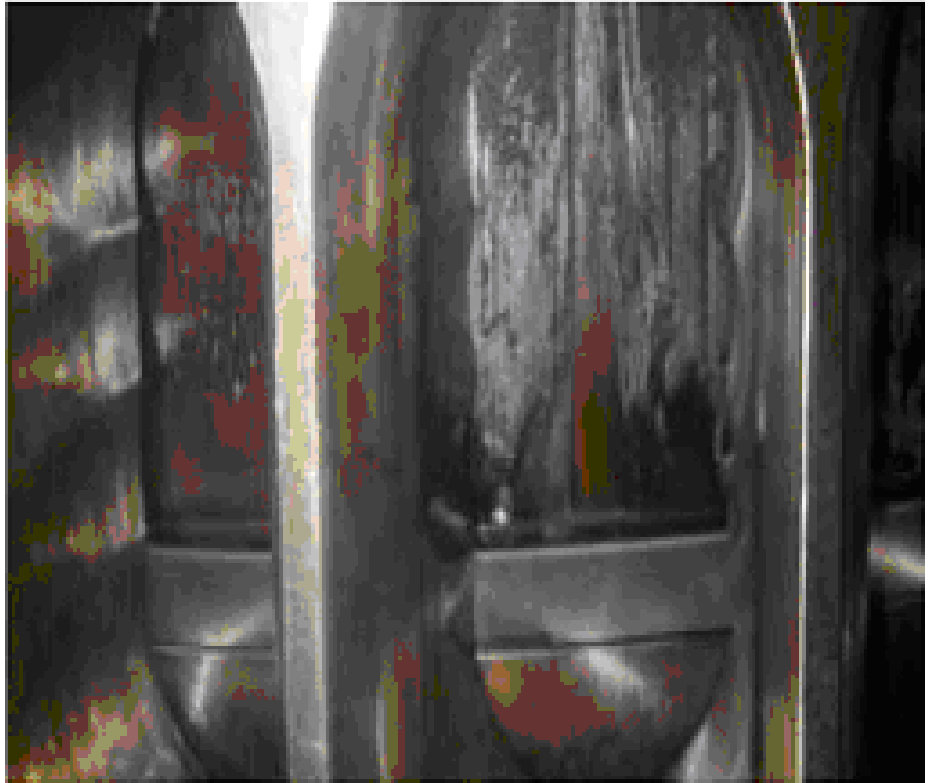


Liner Guardian



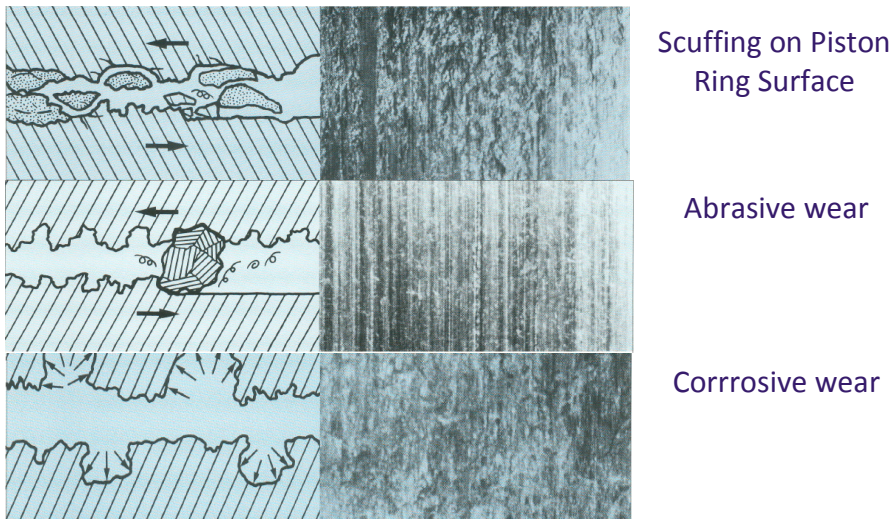
**Cylinder Liners Are
Too Expensive to be
Damaged in Few
Seconds!**

**THE ULTIMATE
PROTECTION OF
CYLINDER LINERS
AGAINST
CATASTROPHIC WEAR**

Liner Guardian and the Cylinder Liner Wear

Piston and piston ring lubrication and cylinder load are factors that strongly affect the wear of the reciprocating internal combustion engine liners and piston rings.

When the oil film thickness becomes smaller than a certain value, depending upon the roughness of the surfaces in contact, mixed lubrication modes are developed, and high wear rates can result into fast developing catastrophic failures of piston rings, skirts and liners.



Surface texture and mechanisms for the three main types of cylinder liner and piston ring wear (source DAROS Piston Ring Hand Book)

The rate of wear is an intermittent process. Periods of low wear or even no wear at all are followed by periods of more severe wear that sometimes fatal. Normal measurement taken by periodical overhauls only shows the average wear therefore a continuous cylinder liner wear monitoring system, such as **Liner Guardian** is a valuable tool for indication of piston ring and cylinder performance.

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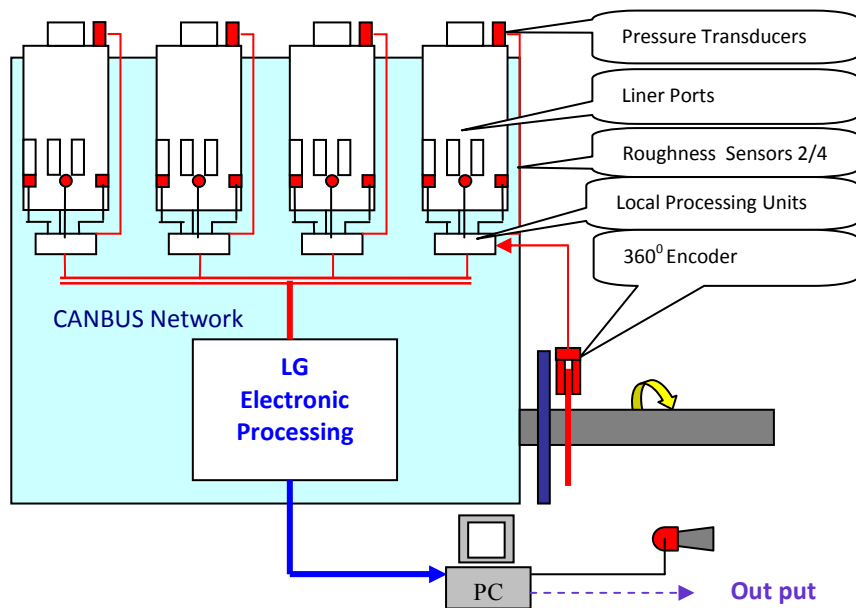
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Liner Guardian a patented system by TecnoVeritas (PCT/IB2008/053794) in 2008 which the objective is to protect two stroke engine cylinder liners against scuffing and other liner high wear rate causes.

Liner Guardian is a continuous monitoring system that collects piston and piston rings surface data, processes that data, compares it with a reference data, and activate warning signals in case a damage is being developed in a particular cylinder liner. **Liner Guardian** has two (PS-SB) or four (PS-SB-AFT-FW) high resolution roughness sensors installed diametrically opposed to each other around each cylinder liner. Each sensor with a resolution of 3 microns reads piston and piston rings surfaces. All the cylinder liner collected data is coordinated with crank angle of each cylinder and through a crankshaft mounted encoder. Simultaneously, a cylinder pressure trace is taken and fed into an engine cylinder model that calculates the existence of adverse operating conditions in a particular cylinder.



Wiring diagram of the Liner Guardian System

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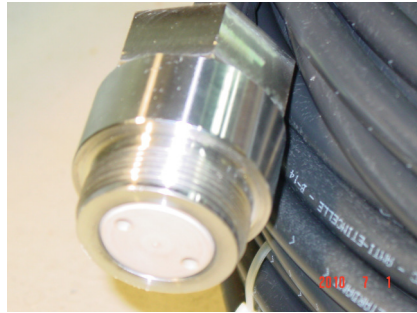
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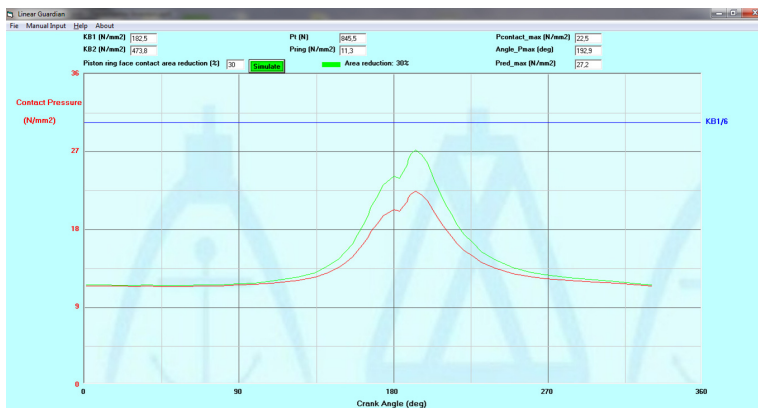
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Features of **Liner Guardian**

The figures below show the **Liner Guardian** shaft encoder, one of the cylinder liner roughness sensors and the computer graphic output. Optionally, **Liner Guardian** can provide also cylinder pressure indicator diagrams as any “on-line” engine performance system.



Cylinder liner Roughness Sensor



Piston ring contact pressure diagram and piston ring stress versus crank angle and alarm stress

Services of Engineering & Systems Technology Ltd



Europe (Portugal)
Phone: +351 261 819 819
Fax: +351 261 819 820



Asia (Singapore)
Phone: +65 62863622
Fax: +65 64873084

Email: info@tecnoveritas.net
www.tecnoveritas.eu

TecnoVeritas
Services of Engineering
&
Systems Technology Ltd.

www.tecnoveritas.eu

