Pistons of Internal Combustion Engines (reciprocating piston engine)

Today pistons for reciprocating piston engines are mainly made from aluminium alloys (as opposed to earlier cast-iron designs). Naturally, the areas where a lot of force is applied (high pressure and tensile load) and the areas of high thermal stress must be checked particularly carefully to prevent a subsequent breakdown of the component. This applies particularly to the pistons used in Diesel engines.

Areas of inspection:
1. Piston crown bowl/pinch-off edge
2. Grooves on the piston ring
   (in some cases with moulded piston ring carrier)
3. Bore hole for the piston pin

1st area of inspection:
Pinch-off edges of piston crown bowls
The pinch-off edges of piston crown grooves are often reinforced with fiber. Here the density of the distributed fiber, open and hidden pores, blowholes and cracks are of interest. The undercut inside the piston crown bowl presents a particular challenge.

Solution:
Probe head
Automated eddy current inspection of the pinch-off edge using probe levers that may also be guided into the area of the undercut.

Disk probe:
Automated eddy current inspection using rotating disk probes for pistons where the undercut does not have to be inspected.
Design: Depending on the application with up to 12 probe elements.

Probe types:
• MDK-1 in various designs
• KD-62 in various designs

Frequency:
Medium frequency range

Defect size (L x W x D):
• Groove:  1 mm x 0.1 mm x 0.3 mm
• Groove:  0.5 mm x 0.1 mm x 0.2 mm
• Bore hole:  ø 0.3 mm x 0.3 mm (D x D)

Cycle time:
Starting at 7 seconds
2nd area of inspection:
Grooves on the piston ring regular and reinforced
The grooves on piston rings are subject to great mechanical stress and must not have any deficiencies, inclusions or other irregularities. The tight geometric design presents a particular challenge.

Solution:
Automated eddy current inspection with geometrically customized probes that scan the ground and the flanks of the groove.

Probe type:
KDS in various designs

Frequency:
Medium to high frequency range

Defect size:
Bore holes of Ø 0.3 mm and greater

Cycle time:
< 100 mm/sec

3rd area of inspection:
Bore hole for the piston pin
The bore hole for the piston pin is subject to great mechanical stress and must therefore be free of defects and discontinuities. The bore hole of the piston pin is also the slide face for the piston pin.

Solution:
Automated eddy current inspection of the bore hole for the piston pin using rotating probes that simultaneously scan one or both slide faces.

Probe type:
MDK-1 with HDR-17 rotor

Frequency:
Medium frequency range

Defect size (L x W x D):
Groove: 1 mm x 0.1 mm x 0.3 mm

Cycle time:
Starting at 7 seconds