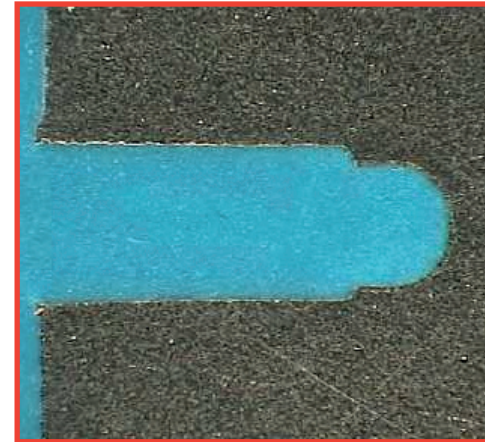


Extreme flank wear in the first piston groove



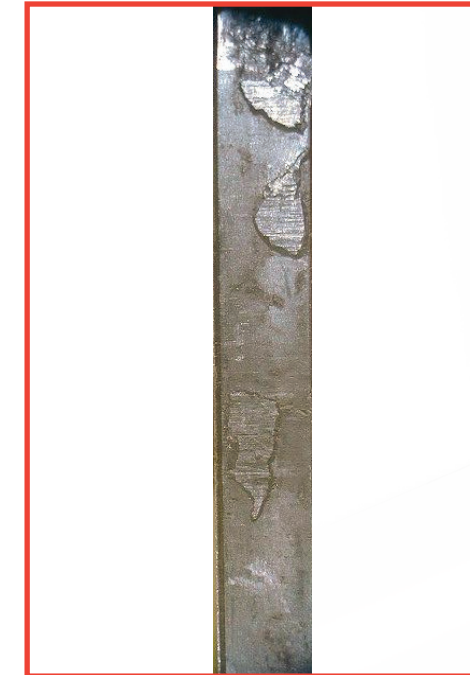
Cause: Lack of lubrication, overfueling. Dirt or debris in the engine oil or air intake. Defective catalytic converter.
Remedy: Replace defective parts. Change engine oil and ensure there is adequate lubrication. Clean the intake manifold and change the air filter. Check the functioning of the catalytic converter.

Scratches and surface cracks



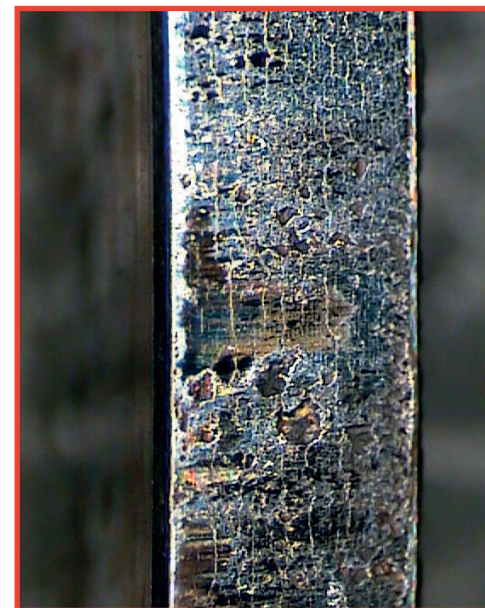
Cause: Dry start. Lack of lubrication, dirt and debris in lubricating oil.
Remedy: Replace defective parts. Thoroughly clean the engine, replace engine oil and filter and ensure rings are lubricated prior to initial start-up.

Molten areas on piston ring face



Cause: Overheating due to insufficient oil or coolant supply.
Remedy: Replace defective parts. Check that lubrication and cooling levels are correct, and that the correct grade or lubricating oil has been used.

Fretting on face of ring and initial stages of ring coating peeling away



Cause: Insufficient lubrication, overheating due to high frictional loads.
Remedy: Replace defective parts. Check that lubrication and cooling levels are correct, and that the correct grade of lubricating oil has been used.

Fretting on piston ring face



Cause: Overheating. Piston ring face and cylinder wall not compatible. Excessive pressure between piston ring and cylinder wall.
Remedy: Replace defective parts. Ensure that the piston rings and cylinder walls are compatible. Check if the piston rings are correct for the application.

Foreign bodies in engine, 'rolling traces'



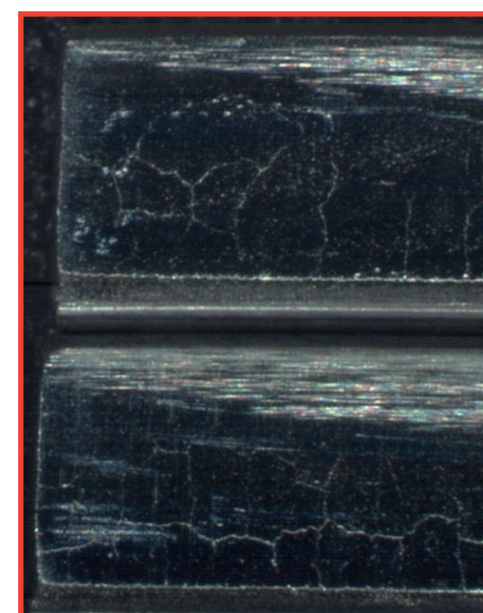
Cause: Dirt or debris in engine. Secondary damage due to overheating and seized piston(s).
Remedy: Replace defective parts. Thoroughly clean engine and replace oil and filter.

Ring in first groove broken



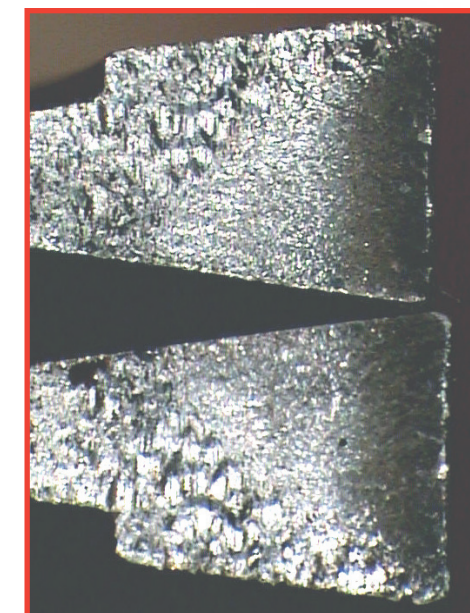
Cause: Overexpansion of ring when fitting the piston. Faulty fitting of piston or ring into engine block. Excessive pressure or worn piston grooves.
Remedy: Replace defective parts. Ensure piston and rings are correctly fitted. Use piston ring expander to prevent overstressing of ring during assembly. Check if the piston grooves are to specification.

Overheating (thermal overload)



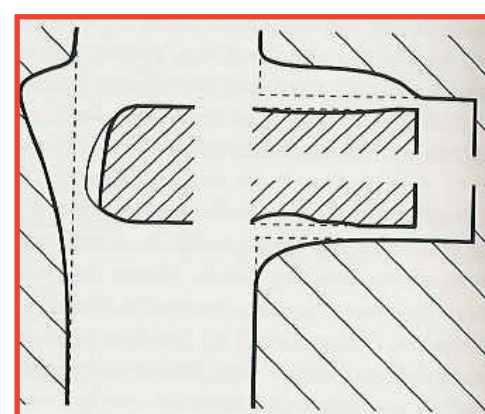
Cause: Overheating, insufficient lubrication, insufficient cooling and high friction levels.
Remedy: Replace defective parts. Check that lubrication and cooling levels are correct, and that the correct grade of lubricating oil has been used.

Failure of piston ring



Cause: Ring overexpanded when fitting to piston. Discolouration at ring edge and polishing at fracture face indicate long time in service prior to failure.
Remedy: Replace defective parts. Ensure piston and rings are fitted correctly. Use piston ring expanders during assembly to piston.

Wear at top dead center (TDC)



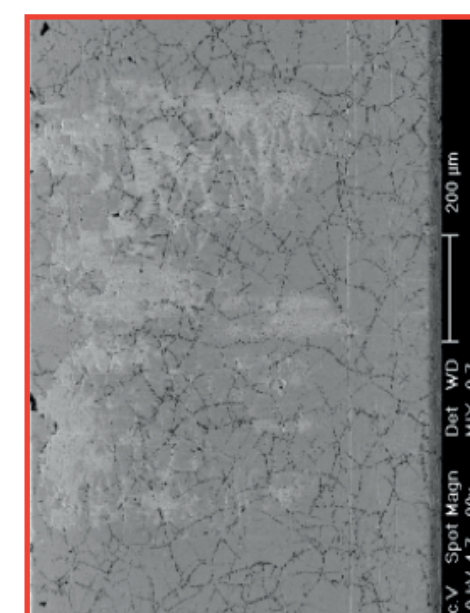
Cause: Shortage of lubrication. Incorrect choice of piston rings or cylinder liners. Cylinder distortion or inadequate cooling.
Remedy: Replace defective parts. Ensure correct selection of parts. Ensure that lubrication and cooling levels are correct. Check if tightening torques and sequences are followed.

Foreign bodies in engine



Cause: Dirt or debris in engine. Secondary damage due to overheating and seized piston(s).
Remedy: Replace defective parts, clean engine, change oil, oil filter and air filter.

Microwelding on piston ring face



Cause: Poor honing of cylinder wall. Dirt or debris in the lubricating oil.
Remedy: Replace defective parts. Thoroughly clean the engine, replace oil and filter. Ensure correct honing pattern is applied to the cylinder wall.

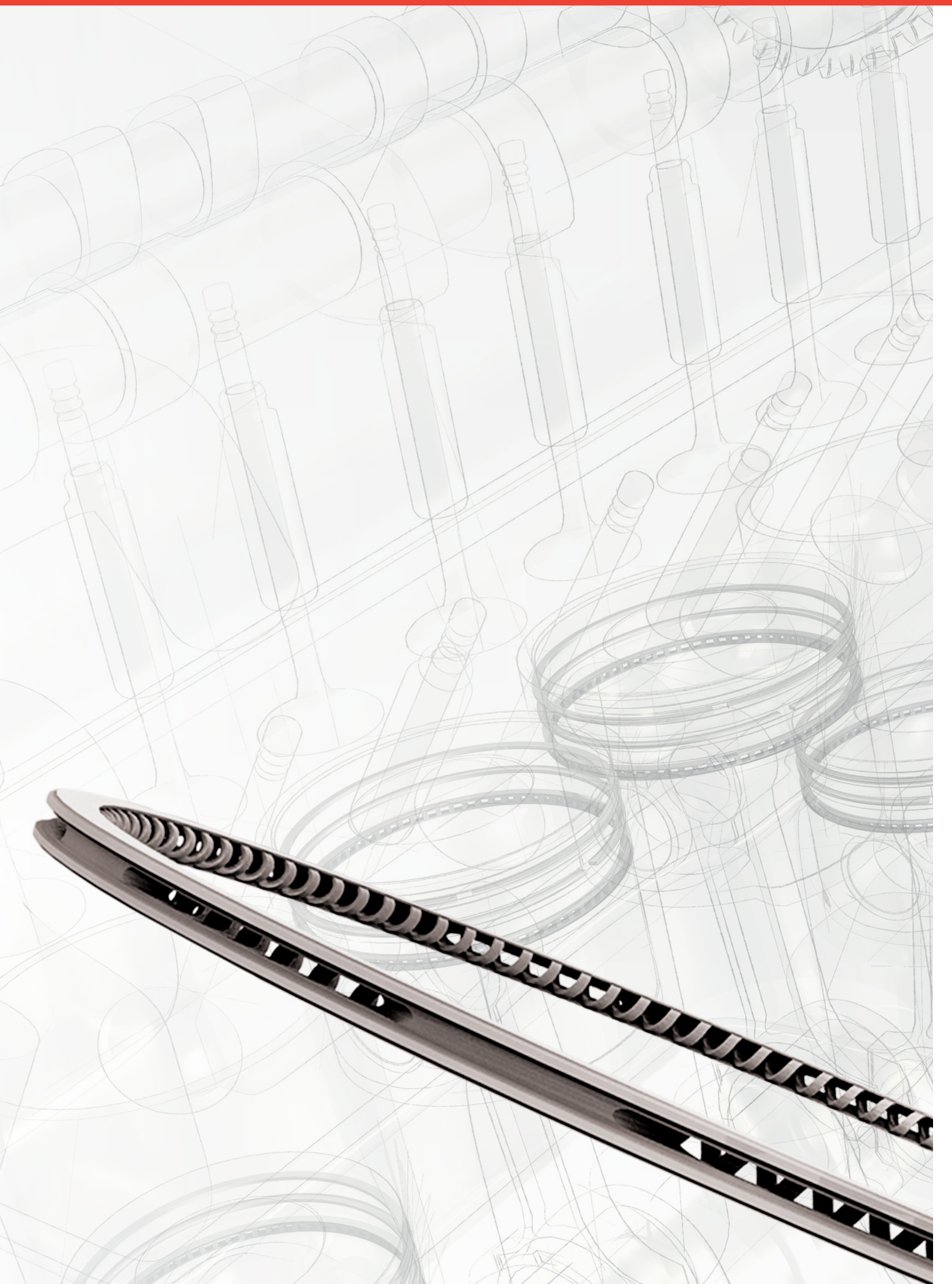


Illustration of a Tenneco/Goetze® patented Piston Ring