capricorn AUTOMOTIVE

Piston Installation Guide (MQAP SOP275-03)

Prior to installation please check part numbers on pistons and components to ensure you have the correct parts. It is recommended that the correct tools are used to install the pistons as damaged parts are non-returnable.
If you have any doubts or queries, please contact capricorn on +44 (0) 1256 365800 or sales@capricornauto.co.uk

Cleaning and lubrication

Pistons should be cleaned prior to assembly. If an aqueous solution is used, it is recommended to dry the parts promptly after cleaning.
Ensure all components are adequately lubricated during assembly and before starting. Pistons have been de-burred during manufacture; however check that no foreign matter is trapped in holes or grooves.
A mineral grade oil of similar viscosity to service lubricant is recommended for initial break-in and assembly fitting.

Ring Compatibility

Non-compatible

Chromium and WCC (tungsten carbon carbide) plated piston rings should not be used in conjunction with capricorn's nickel ceramic (silicon carbide) coating. Please refer to the factory in this case.

Compatible

Uncoated cast iron, titanium nitride coated steel, nitrided steel, and molybdenum inlayed are preferred ring face treatments.

Piston skirt to bore clearance

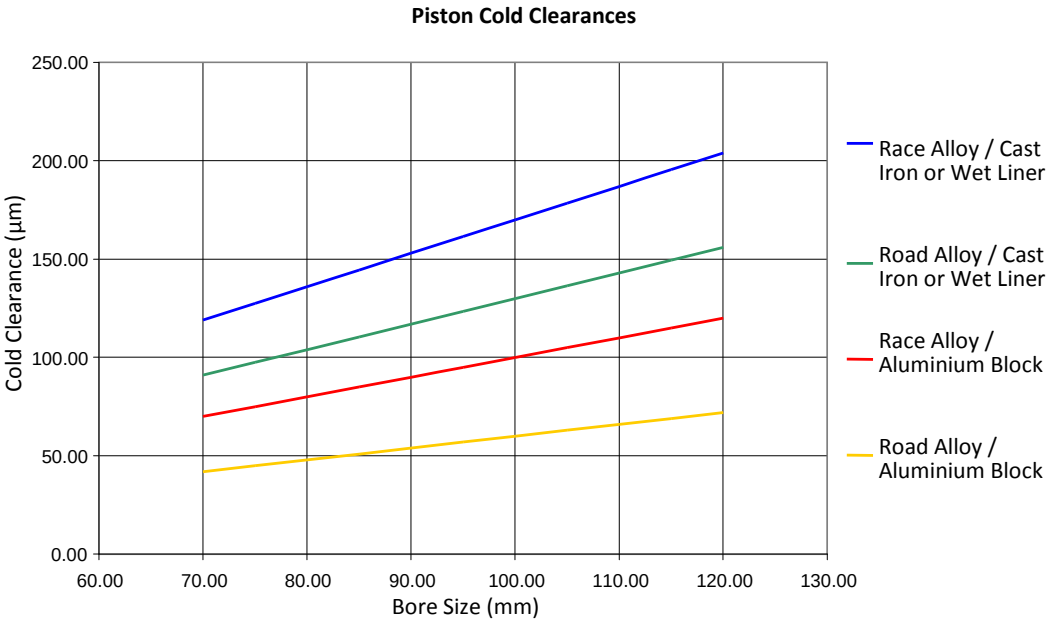
The correct clearance must be used to prevent piston slap at colder starting temperatures and seizing under heavy loading and high temperatures.
Piston diameter should be measured at right angles to the pin, this being the widest point of the piston. On most pistons the gauge point will be measured approximately 6.5 mm up from the bottom of the skirt.

Cold clearance is the diametrical piston skirt to bore clearance at 20°C. Cold clearance depends on several factors. Most importantly the type of piston alloy and the type of block construction. The manufactured piston takes into account this and other variables based on the mid-limit bore size given and engine block type. Skirt coatings are typically sacrificial which makes the measurement of cold

clearance difficult if such a coating is present. Please refer to supplied documentation for the actual manufactured size.

As a rule of thumb, the graph below lists typical cold clearances; however please refer to supplied part documentation for exact uncoated manufactured values.

Clearances will be slightly greater in high power per cylinder output application.



Piston crown to valve clearance

Recommended minimum clearances for alloy steel connecting rods are 2.0 mm on the intake valves and 2.5 mm on exhaust valves. For aluminium alloy connecting rods the minimum clearances should be 2.8 mm on the inlet and 3.3 mm on the exhaust valves. Piston to valve clearance can be checked using modelling clay and turning the engine over manually. If there is resistance, the process should be halted as the piston may have come into contact with the valve.

Piston crown to spark plug clearance

Recommended minimum clearances for alloy steel connecting rods are 1.2 mm and for aluminium alloy 1.5 mm. This can be checked with modelling clay and turning the engine manually until Top Dead Centre is met.

Pin pocket to connecting rod clearance

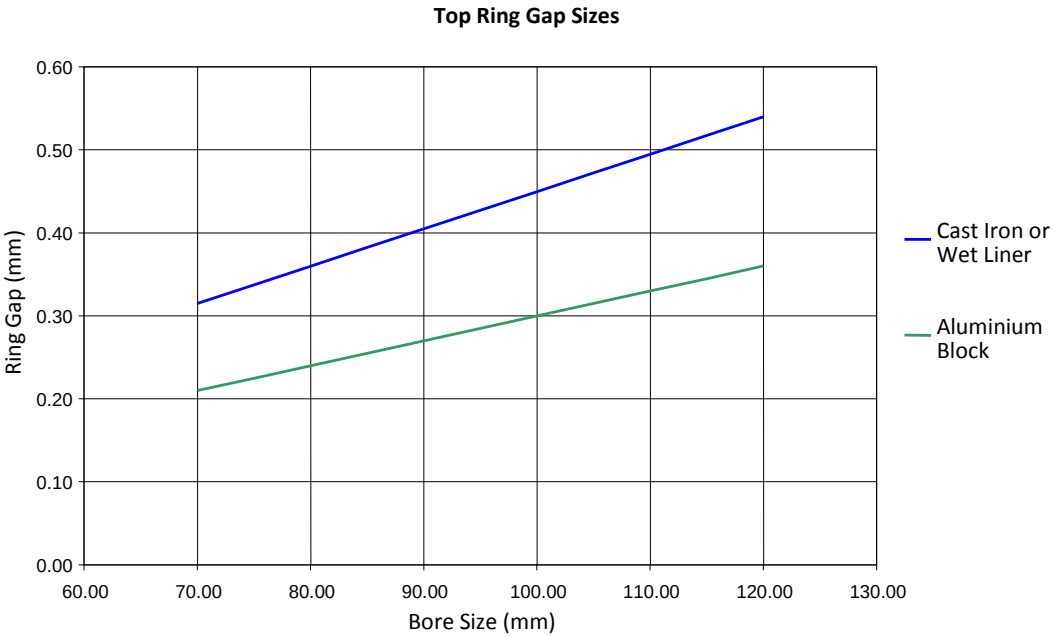
Most engines make use of crank guided rods and have the recommended minimum total clearances of 0.8 mm either side of the pin boss face and 1.5 mm on the under crown. Piston guided rods will have smaller clearances of approximately 0.05 mm (total float).

Piston ring side clearance

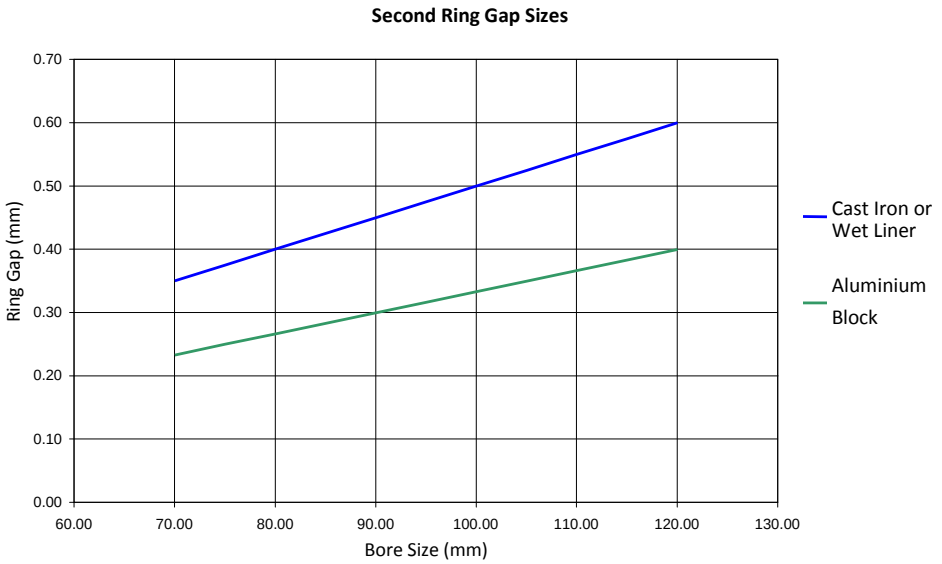
This is the vertical distance between the ring and the ring groove faces. It can be measured by rolling the outside of the ring around the ring groove and slipping a feeler gauge between them. Side clearances should be approximately 0.035-0.080 mm for compression rings and less than 0.080 mm for oil control rings.

Piston ring end gap

This is the distance of the gap in the ring when it is placed flat in the cylinder. It can be measured using a feeler gauge. Oversize rings may be used and file-fitted for a very precise end gap. **If file-fitting, ensure all sharp edges are removed to avoid damage to the piston or bore coating.**



For higher running temperatures such as supercharging, use an additional 0.005 mm per 10 mm of bore size, and for very high temperature operations such as drag racing an additional 0.007 mm per 10 mm of bore size.



For the oil retaining ring a minimum end gap of 0.38 mm is suitable for most 3 ring oil ring applications.

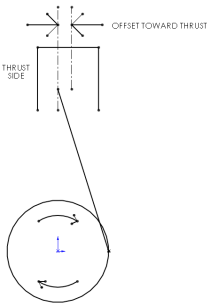
Pin installation

When installing the circlip you should hear a snap as it expands into the retaining groove. Visually check to ensure the circlip has installed correctly, otherwise catastrophic failure may occur. A total clearance of 0.2 – 0.5 mm should be used for the pin end float.

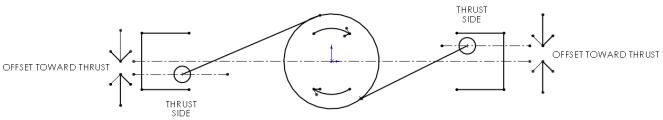
Pin Offset

In most cases a 0 offset (control) pin position provides best performance. In cases where cold clearance is fairly large, excess noise when cold may result. Pin offsetting is used in these cases to partially compensate. It is important that pin offset parts are correctly installed as below:

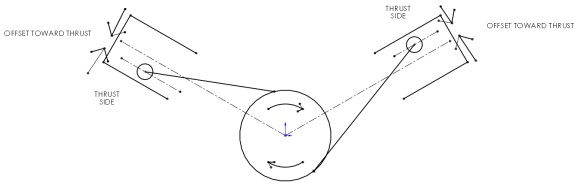
Inline Engines



Flat Engines



'V' Engines



Cylinder break-in:

Initial starting should be at a fast idle with some load, so as to warm the engine to operating temperature relatively quickly. Gentle low speed driving / riding is preferred.

Avoid idling with very little or no load when possible, as this will prevent ring-to-bore sealing.

Once the engine is warm, and in the absence of other running-in requirements (i.e. valve-train), run the engine normally (wildly cycling speed and load) whilst progressively increasing imposed maximum engine speed over a 40 minute period.

It is suggested to start cycling at half of peak power speed, incrementally increasing to maximum power speed (after 40 minutes).

It is suggested that the engine oil is now changed.

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