



**Title: PLASMA FACED PISTON RINGS FOR USE WITH NICKEL+CARBIDE™ PROCESS CYLINDER BORES**

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*Technical Portions are FAA DER Approved.*

**1.0 APPLICATION:** All aircraft piston engines using Nickel+Carbide™ process cylinder bores.

**2.0 INSTALLATION:** Top Compression Position only. Cast Iron rings below.

**3.0 BENEFITS:** Plasma faced rings (usually a molybdenum or molybdenum alloy material) provide the following benefits:

- Excellent wear characteristics
- Good break-in characteristics
- Significantly more scuff resistant than chrome faced piston rings
- Good sealing characteristics that influence performance and oil control

**4.0 PLASMA FACED RING GEOMETRY:** Plasma faced piston rings are produced by thermal spraying a metal or metal alloy into a groove cut in the outside periphery of piston rings and then machining the face of the ring to size and shape. The resulting geometry of a half wedge compression ring is shown in the illustration of a typical cross section.

**5.0 PLASMA FACED RING PRECAUTIONS:** Plasma rings are less susceptible to scuffing, but they are not as resistant to abrasives or debris as chrome faced or cast iron piston rings. Accordingly, it is especially necessary that cylinder bores be thoroughly cleaned and all debris and trash be eliminated during engine build-up and break-in.

During break-in, as with any engine, adequate cooling must be provided. Break-in using a test cell with auxiliary cooling or a break-in cooling shroud is optimum. Break-in on the airplane also can be achieved if carefully accomplished according to ECi's break-in instructions. The incidences of glazed cylinders with all types of cylinder bores continues to confirm that break-in parameters are not considered important by everyone, including many that have professional training and certification.

**6.0 OIL FILTRATION:** The cleanliness of break-in oil can also play a significant role in break-in success and continued operation. The oil film on cylinder walls can be as thin as one micron, and is rarely thicker than 10 microns (25 microns = one thousandth of an inch). Obviously, very small particles can be thicker than the oil film on a cylinder bore, and minimizing particles larger than 20 microns is very desirable. Use of an oil filter is very important, and ECi recommends the standard oil filter specified for the engine. The oil screens provided with many engines, and some lifetime type filters are not very efficient for particles even as large as 80 microns, so damaging bits of metal, sand, etc. can circulate almost freely in the engine. These particles can and do scratch wear surfaces.

**7.0 NICKEL+CARBIDE™ PROCESS CYLINDER BORE APPEARANCE:** Nickel+Carbide™ process cylinders are produced with an extremely smooth and relatively shiny surface. The surface finish as processed can be smooth as  $3 R_A$ , which is almost a mirror finish. The important thing to remember is that any tiny scratch in a smooth surface is readily visible, and even stands out. Some grinding and wear of the bore surface and piston ring faces is necessary for break-in. Accordingly, there will be some visible scratches and rub marks on the cylinder bore until break-in is completed; and even then, it may take as long as 200 hours to burnish out the marks. This is normal, and should not be construed as a problem unless there is excessive blow-by and low compression.

