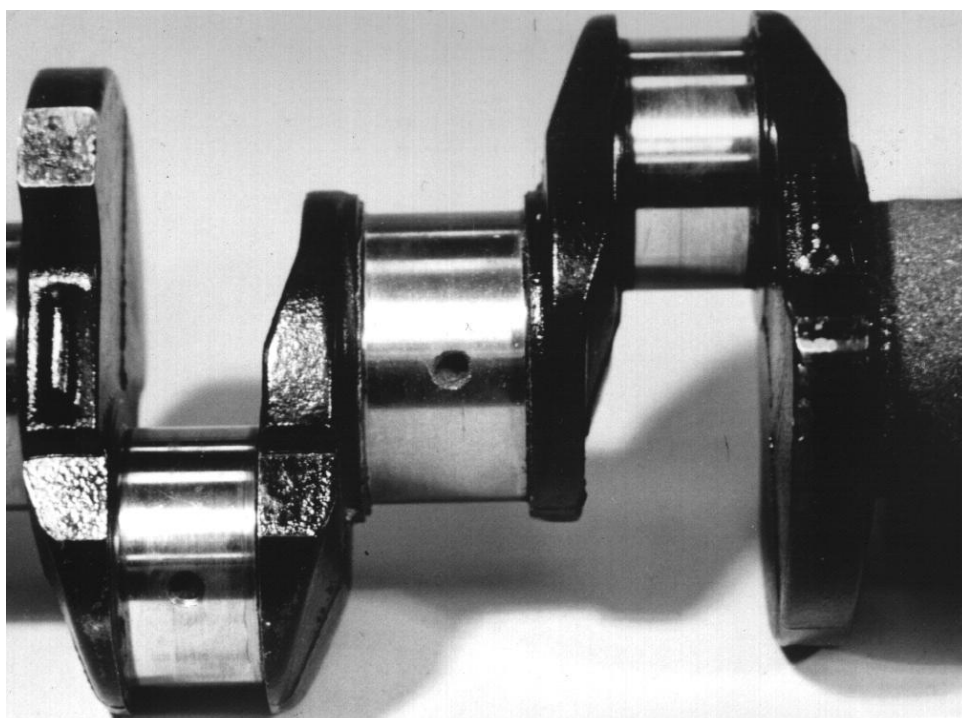


# The Reclamation Of Crankshafts By Plasma Spraying

Application Data Sheet AU-DR-008

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## Introduction

The reclamation of crankshafts (and many other components) by plasma spraying can produce considerable savings over the replacement cost. 50% savings are common and on large components, as much as 90% may be saved. The need for reclamation may be to correct manufacturing errors, to repair an obsolete part or a part that has worn excessively in service.

Wherever used, crankshafts can be reclaimed using Metallisation plasma spraying equipment and materials.

## Equipment

Metallisation PS50M Plasma Spray System

## Materials

### Bond Coat

Metallisation 99636 Nickel Aluminium Composite reacts exothermically during spraying, produces dense, self-bonding oxidation resistant coatings of high structural integrity.

### Main Deposit

Metallisation 99627 Molybdenum-Nickel-Aluminium Composite. A general purpose material giving tough wear and impact resistant coatings.

## Inspection

- a) Check for cracks by ultrasonic or magnetic crack detection method.
- b) Check for longitudinal distortion.
- c) Check dimensions accurately for wear, uniformity or wear and particularly depth of grooves.
- d) Check for signs of overheating.
- e) Check for signs of nitriding.
- f) Check technical data for the specific crankshaft with particular reference to the type of bearings in which it is to run.

**Note:** Crankshafts having the following defects are not recommended for treatment by plasma spray:

Cracks, distortion, wear below final re-grind tolerance. **All** traces of nitriding should be removed during pre-machining refer to a) and b).

It is reported that crankshafts running in aluminium tin bearings have exhibited 'pick up', therefore caution should be exercised when this type of bearing is being utilised.

## Cleaning

- a) Steam clean if equipment available.
- b) Degrease by solvent vapour if equipment available.
- c) Pay particular attention to oilways and ensure removal of all contaminants during a) and b).
- d) Carry out final inspection.

## Pre-Machining

- a) Grinding wheel type N° 46 Grit Blue V Grade.
- b) The grinding wheel corners should be dressed to a radius, which matches the radius of the crankshaft fillet.
- c) Dry grind to remove minimum amount of original metal ensuring that you maintain manufacturer's minimum recommended diameter.
- d) Shallow grooves not exceeding 0.1mm (0.004") in depth are acceptable in the pre-machined surface. Provided that the area can be properly gritblasted.
- e) Whilst bond coatings will adhere to carburised or induction hardened surfaces, they will not bond to nitrided layers. **All** nitriding must be removed before spraying.

## Cleaning

- a) Degrease by solvent vapour process if equipment available.
- b) All particles of abrasive and ground metal retained on ground surface should be removed by careful brushing or momentarily applying adhesive tape.
- c) Check that all oilways are free from contamination and debris.

## Preparation

- a) Mask all machined surfaces adjacent to the area requiring treatment with a heavy-duty masking tape.
- b) Plug oilways with tapered, heat resistant, rubber plugs. This plug should protrude equal to finished ground deposit thickness.
- c) Thoroughly inspect for contamination prior to blasting.
- d) Thoroughly blast with clean N° 30-36 grade aluminium oxide grit. The standard of surface cleanliness required is as Swedish Standard SA3.
- e) Ensure that radius at each end of bearing surfaces are thoroughly blasted.

## Application Of Sprayed Coating

### Masking

- a) Apply sprayshield-masking fluid using a small brush to all areas adjacent to the area being sprayed. Ensure fluid is not applied to the area being metalsprayed. Small amounts of masking fluid on the area to be sprayed can be removed with an emery cloth.
- b) Check thoroughly that the area to be sprayed is free from contamination.
- c) **Important:** The areas to be sprayed should not come into contact with oil, grease, hands or any other form of contamination. Delays between blasting and spraying must not exceed 20 minutes.

### Bonding

- a) The plasma spray equipment should be set up in accordance with the Metallisation manual for the spraying of 99636 Bonding Material.
- b) The area to be sprayed should be cleaned with a vacuum cleaner or clean air blast to remove any loose particles of grit.
- c) A deposit of Metallisation 99636 powder is applied to a deposit thickness of 0.05mm - 0.15mm (0.002"-0.006").
- d) Spraying Parameters - See Table 3 below.
- e) The tie bar should be rotated to give a minimum surface speed of 18 metres/minute (60 feet per minute).
- f) The plasma spray pistol should be set so that the spray stream is at 90° to the surface being coated and traversed at an even speed, giving a uniform coating.

### Main Deposit 99627

- a) The final deposit should be applied immediately after the bond coating.
- b) Thickness: The sprayed deposit thickness is the final deposit thickness, plus a machining allowance. An allowance of 0.4mm - 0.5mm (0.016" - 0.020") on the radius is normal.
- c) The crankshaft should be rotated to give a minimum surface speed of 18m/min (60 ft/min).
- d) The plasma spray pistol should be traversed by hand to give an even coverage ensuring that the radii are also evenly covered.
- e) The spray stream should be at 90° to the surface being coated. The deposit should be applied at not more than 0.002" (0.05mm) per pass. The base material should be cooled by an air jet whilst spraying.
- f) Using pre-set callipers, check final sprayed deposit thickness to ensure there are no areas below finished sprayed diameter

- g) Remove loose particles on surface with wire brush or clean air blast.
- h) Allow to cool thoroughly preferably whilst rotating.

**Spraying Parameters** - Table 3 (Refer to Manual)

**Note:** Particular attention should be paid to the edges of the sprayed deposit to ensure adequate coating thickness in these areas.

**Table 3**  
**Spraying Parameters**

	<b>99636 BOND COAT</b>	<b>99627 MAIN DEPOSIT</b>
Plasma Gas Ar/N2 (Lpm)	25 / 2.2	25 / 2.2
Current	500	600
Carrier Flow	30	30
Powder RPM	160	160
Nozzle	6 - Ext	6 - Ext
Spray Distance.	125 mm (5")	125 mm (5")

Metallisation Plasma Spraying Equipment PS 50m

**General**

There should be the minimum of interruption from commencement of preparation to completion of spraying. At all times, the prepared surface and the 99636 bond coating should be protected from dust, dirt, moisture etc.

**Sealing**

- a) Apply Sprayseal "M" in accordance with Metallisation Sprayseal "M" instructions. Keep surface wet by re-application for a period of approximately one hour.
- b) Allow to dry thoroughly.
- c) Remove uncured sealer from surface with clean, disposable cloths or paper towels.

## De-masking

- a) Remove all masking tape.
- b) Remove all overspray thoroughly, taking care to prevent coating damage.
- c) Remove all traces of sprayshield with solvent.

## Finish Grinding

It is recommended that crankshafts be finish ground. Wet grinding using a soluble cutting fluid and wheels of medium hardness with vitrified bond are normally recommended. Silicon carbide or bauxite grit with a grit size of 30-50 are also acceptable.

- a) A suggested grinding wheel would be A60-301J7-Vi5 or its nearest equivalent.
- b) Dress grinding wheel to match radius of crankshaft fillet.
- c) Wet grind to final diameter taking light cuts using feeds and speeds in accordance with grinding machine manufacturer's instructions.
- d) Remove rubber plug from oilway and chamfer hole by hand grinding with profiled stone or rotary file.

**Note:** Should a sprayed deposit fail to machine to final dimensions through lack of metal, the whole deposit must be removed and the complete operation repeated.

## Inspection

- a) Check dimensions.
- b) Check for cracks or defects in sprayed coating, i.e. large pores or protrusions and loose particles.
- c) Clean to remove all traces of grinding abrasive and loose particles.

## Polishing

- a) Set the crankshaft in a lathe to rotate in the same direction that it will rotate when assembled in an engine.
- b) Polish finished ground area until the shaft is highly polished.

## Finish Cleaning

- a) Clean the crankshaft thoroughly to remove all contamination, including any grinding debris retained on bearing surfaces.
- b) Check all oilways are clear.
- c) Wash with petroleum spirit/paraffin.
- d) Dry all bearing surfaces with clean, disposable cloths or paper towels.
- e) Final inspection prior to packing.
- f) Wrap in clean polythene sheet.
- g) Pack and despatch.

**Note:** Prior to installation in engine, repeat procedure – ‘Finish Cleaning’ a) - d). Immerse crankshaft in clean engine oil to fill any remaining porosity.

 Reference Technical Bulletins:

No. 2.9.3.11 Metallisation Nickel Aluminium Composite Bonding Powder 99636

No. 2.9.3.9 Metallisation Molybdenum Nickel Aluminium Composite Powder 99627

No. 5.2.2 Surface Preparation by Gritblasting

### **NOTE: SEE ALSO**

AU-DR-006 Reclamation of Crankshafts by Arcspraying

AU-DR-007 Reclamation of Crankshafts by Flamespraying

AU-DR-009 Reclamation of Crankshafts by Powder Flamespraying