avoid the removal of metal from the bottom and sides of the grooves. When grit-blasting housings, plug all drilled oil passages with rubber plugs or other suitable material to prevent the entrance of foreign matter.

The decarbonizing solution will generally remove most of the enamel on exterior surfaces. All remaining enamel should be removed by grit-blasting, particularly in the crevices between cylinder cooling fins.

At the conclusion of cleaning operations, rinse the part in petroleum solvent, dry and remove any loose particles of carbon or other foreign matter by air-blasting, and apply a liberal coating of preservative oil to all surfaces.

Magnesium parts should be cleaned thoroughly with a dichromate treatment prior to painting. This treatment consists of cleaning all traces of grease and oil from the part by using a neutral, noncorrosive degreasing medium followed by a rinse, after which the part is immersed for at least 45 minutes in a hot dichromate solution (three-fourths of a pound of sodium dichromate to 1 gallon of water at 180 °F to 200 °F). Then the part should be washed thoroughly in cold running water, dipped in hot water, and dried in an air blast. Immediately thereafter, the part should be painted with a prime coat and engine enamel in the same manner as that suggested for aluminum parts.

Some older engines used sludge chambers in the crankshafts, which were manufactured with hollow crankpins that serve as sludge removers. The sludge chambers require inspection and cleaning at overhaul. Sludge chambers are formed by means of spool-shaped tubes pressed into the hollow crankpins, or by plugs pressed into each end of the crankpin. If an engine has a sludge chamber or tubes, they must be removed for cleaning at overhaul. If these are not removed, accumulated sludge loosened during cleaning may clog the crankshaft oil passages and cause subsequent bearing failures. If the sludge chambers are formed by means of tubes pressed into the hollow crankpins, make certain they are re-installed correctly to avoid covering the ends of the oil passages. Due to improved oils, sludge chambers are no longer used with modern engines.

Structural Inspection

One of the best methods to double check your visual inspection findings is to supplement them with one of the forms of nondestructive testing, such as magnetic particle inspect, dye penetrate inspection, eddy current, ultrasound, and x-ray. Defects in nonmagnetic parts (aluminum parts) can be found by all these methods except for magnetic particle inspect, which is used for magnetic or ferrous materials (steel).

Dye Penetrant Inspection

Dye penetrant inspection is a nondestructive test for defects open to the surface in parts made of any nonporous material. It is used with equal success on such metals as aluminum, magnesium, brass, copper, cast iron, stainless steel, and titanium. Dye penetrant inspection uses a penetrating liquid that enters a surface opening and remains there, making it clearly visible to the inspector. It calls for visual examination of the part after it has been processed, increasing the visibility of the defect so that it can be detected. Visibility of the penetrating material is increased by the addition of one of two types of dye: visible or fluorescent. When using a fluorescent dye, the inspection is accomplished using an ultraviolet (UV) light source (black light).

The steps for performing a dye penetrant inspection are:

1. Thorough cleaning of the metal surface.
2. Applying penetrant.
3. Removing penetrant with remover emulsifier or cleaner.
4. Drying the part.
5. Applying the developer.
6. Inspecting and interpreting results.

Eddy Current Inspection

Eddy currents are composed of free electrons under the influence of an induced electromagnetic field, that are made to drift through metal. Different meter readings are seen when the same metal is in different hardness states. Readings in the affected area are compared with identical materials in known unaffected areas for comparison. A difference in readings indicates a difference in the hardness state of the affected area. Eddy current inspection can frequently be performed without removing the surface coatings, such as primer, paint, and anodized films. It can be effective in detecting surface and subsurface corrosion, pots, and heat treat condition.

Ultrasonic Inspection

Ultrasonic detection equipment makes it possible to locate defects in all types of materials. There are three basic ultrasonic inspection methods:

1. Pulse-echo
2. Through transmission
3. Resonance

Pulse-Echo

Flaws are detected by measuring the amplitude of signals reflected and the time required for these signals to travel between specific surfaces and the discontinuity.