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AERONAUTICAL MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.

29 West 39th Street
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M A G N E T I C I N S P E C T I O N

1. **PURPOSE:** To detect the presence of small grinding or quenching cracks, seams, non-metallic inclusions, and other defects on and immediately below the surface, in magnetizable materials by the magnetic flux method.
2. **APPLICATION:** (a) To steel parts as may be designated by the manufacturer's engineering department and which are covered by one of the three following general classifications:
 - (1) Highly-stressed and complex parts which contribute basically to the reliability of engine performance.
 - (2) Parts for which Service Records indicate the need for magnetic inspection.
 - (3) Parts which in the judgment of the manufacturer's engineering department should be magnetically inspected on the contract in question.(b) The magnetic inspection must be performed on parts which have been fully heat treated and whose surfaces have been completely finish machined and, when specified, cadmium plated. Preliminary magnetic inspection may be performed at any intermediate manufacturing stage.
 - (c) Magnetic inspection shall be performed on each individual part in such a manner as to insure satisfactory detection of defects having axes in any direction relative to the axes of the part. A complete magnetic inspection test shall consist of one or more distinct magnetizing, inspection, and demagnetizing operations so conducted that the lines of force are transverse to the defects in the part.
 - (d) All bolts and small shafts, whenever magnafluxed, must be magnetized to show transverse cracks. Gears shall be magnetized in two directions.
 - (e) If this specification number appears on a drawing, every part shall be inspected to this specification.
3. **PROCESSES:** (a) Wet:-
 - (1) All material shall be inspected by the wet process, unless otherwise specified, using either the simultaneous or the residual method as warranted by the particular material or part undergoing inspection.
 - (2) This process utilizes an approved liquid hydrocarbon vehicle of low volatility holding in suspension a magnetic substance in such quantity that the concentration of the mixture as applied is not less than one ounce by weight of the solid to one gallon of liquid. Stronger concentrations may be used if the indications are not obscured. Suitable means shall be provided for agitating the solution to maintain the magnetic substance thoroughly in suspension.

(3) The solution shall be applied to the magnetized part by flowing from a hose, pouring or immersion, either while the magnetic current is flowing (the simultaneous method), or after the part has been magnetized and the current turned off (the residual method).

(b) Dry:- This process utilizes a dry, magnetic powder, dusted directly onto the magnetized part using whichever magnetizing method proves most effective. (The powder must be extremely finely divided so that its action is more nearly that of polishing rather than cutting or scratching).

4. PROCEDURE: (a) The surfaces of all materials and parts shall be properly cleaned to free them from oil, grease, dirt, or other contamination which might interfere with the proper distribution and concentration, or with the intensity, character, or definition of the deposit of the magnetic substance. Cadmium plated surfaces are excellent for inspection.

(b) Oil holes and other openings which lead to areas from which the magnaflux solution cannot be easily removed should be plugged with grease or otherwise covered before the part is magnafluxed.

(c) The magnetic field is created by placing the piece to be tested between the poles of electro-magnets or within a solenoid coil carrying direct current (Bi-Polar or Longitudinal Method); or by passing a high-ampereage low-voltage direct current through the part or through an adjacent conductor (Circular Method). The magnetic flux shall be of suitable intensity and direction to reveal all indications which might be cause for rejection. The magnetic substance is applied to the magnetized piece preferably by the wet process but the dry process may be used under special conditions when approved by the Inspection and Engineering Departments.

(d) Over-magnetization may obscure defects and must be guarded against. Size of parts under test must be considered. Over-magnetization may be recognized by indications showing, for example, grain-flow and/or metallic segregations inherent in parts under test.

(e) It may be feasible to magnetize several parts simultaneously in the same magnetic field but if the field is induced by the Circular Method the pieces, when parallel, shall be 1/2 inch or more apart.

(f) Direct current must be used as the source for magnetizing.

(g) All pieces shall be satisfactorily demagnetized between successive magnetizing operations as well as after the final inspection.

(h) The inspected parts shall be cleaned at this or some subsequent stage to remove the retained magnetic substance, and grease which was introduced in (b), from oil holes.

5. MARKING: The letter "M" shall be legibly marked on all parts which have satisfactorily passed the magnetic inspection.