STANDARD OVERHAUL PRACTICES MANUAL

MAGNETIC PARTICLE INSPECTION

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STANDARD OVERHAUL PRACTICES MANUAL

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To: All holders of MAGNETIC PARTICLE INSPECTION 20-20-01.

Attached is the current revision to this STANDARD OVERHAUL PRACTICES MANUAL

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INTRODUCTION

1. General

A. The instructions in this manual tell how to do standard shop procedures during maintenance functions from simple checks and replacement to complete shop-type repair.

B. This manual is divided into separate sections:

(1) Title Page

(2) Transmittal Letter

(3) Highlights

(4) Effective Pages

(5) Contents

(6) Revision Record

(7) Record of Temporary Revisions

(8) Introduction

(9) Procedures

C. Refer to SOPM 20-00-00 for a definition of standard industry practices, vendor names and addresses, and an explanation of the True Position Dimensioning symbols used.

D. The data is general. It is not about all situations or specific installations. Use it as a guide to help you write minimum standards.

E. If the component overhaul instructions are different from the data in this subject, use the component overhaul instructions.

MAGNETIC PARTICLE INSPECTION

1. INTRODUCTION

A. The data in this subject comes from Boeing process specification BAC5424. The data about magnetic rubber comes from MIL-I-83387.

B. The data is general. It is not about all situations or specific installations. Use it as a guide to help you write minimum standards.

C. Refer to SOPM 20-00-00 for a list of all the vendor names and addresses.

2. DESCRIPTION

A. Magnetic particle examination can be done only on materials with ferromagnetic properties, usually low alloy steels and heat-treatable stainless steels. It is a sensitive nondestructive procedure to find surface and near-surface cracks and discontinuities.

B. Magnetic particle examinations are generally specified in overhaul instructions or service bulletins. In-service cracks can be caused by fatigue, stress corrosion, hydrogen embrittlement, or loads and can start at or near a surface. In good conditions, the procedure can find relatively small, tight cracks.

3. PRINCIPLES OF OPERATION

A. Magnetic particle examination uses the property of magnetic lines of force, or flux, of an applied field to go more easily through metal than through air. A defect at or near the metal surface changes the distribution of the magnetic flux and some must come out through the metal surface. The field strength is increased in the area of the defect and opposite magnetic poles occur on each side of the defect. Fine magnetic particles applied to the part are pulled to these regions and make a pattern around the defect.

B. To find a defect, the direction of magnetization must be adjusted to put the induced flux lines across the axes of possible defects. Two types of magnetization, circular (transverse) and longitudinal, are used to magnetize the part and cause perpendicular flux paths. On some configurations, local magnetization could be necessary to be sure the magnetic field direction is correct and the field strength is sufficient.

C. Examination of critical areas for defects could make necessary disassembly and complete removal of surface coatings, sealants and other such layers. Because the applied or residual magnetic fields could damage such delicate parts as instruments, bearings and mechanisms, removal of the parts could be necessary.

D. Some properties of the magnetic particle method could cause nonrelevant indications, because the magnetic field can be bent also by design features such as:

(1) Small fillet radii, such as smaller than 0.10-inch radius.

(2) Thread roots, keyways, drilled holes.

(3) Sudden changes in geometry or in magnetic properties within the part.

E. But the locations of these nonrelevant indications are also where many service induced defects can occur. Operators must know that nonrelevant indications can occur during examination. For correct analysis of indications in these areas, much skill and experience is necessary. Other procedures could be necessary before you can make a final evaluation. Special details are given below.

4. APPLICATIONS

A. You can use magnetic particle examination on any clean surface that has access for visual examination. Typical parts for magnetic particle examination are:

(1) Steel fasteners and pins

(2) Important structural elements

(3) Linkages

(4) Landing gear components

(5) Splice and attach fittings

(6) Actuating mechanisms

B. During field repair operations, disassembly is frequently not necessary, unless the parts have critical areas or easily damaged installed components.

C. During overhaul, a better examination is possible with stationary equipment in the shop on parts which are completely disassembled, cleaned and with all finishes removed.

D. Examinations with magnetic rubber can be used in fastener holes and when:

(1) The access is not easy.

(2) Particle suspensions could cause unwanted contamination.

(3) A permanent record is necessary.

(4) The area cannot be examined visually.

5. MATERIALS

NOTE: These materials can be used in different methods of magnetic particle examination. These items do not include all of the products available. Equivalent substitutes can be used. You must make the final selection.

A. Oil suspension liquid vehicle – Petroleum products per DOD-F-87935 or AMS 2641

B. Water suspension liquid vehicle – Water with rust inhibitor and wetting agent per AMS 3042 or AMS 3045

C. Magnetic particles

(1) Dry Powder Method

(a) AMS 3040, Magnetic Particle, Nonfluorescent, Dry Powder

(2) Visible Wet Method

(a) AMS 3041, Magnetic Particle Wet Method, Oil Vehicle, Ready to Use

(b) AMS 3042, Magnetic Particle Wet Method, Dry Powder

(c) AMS 3043, Magnetic Particle Wet Method, Oil Vehicle, Aerosol Packaged

(3) Fluorescent Wet Method

(a) AMS 3044, Magnetic Particle Fluorescent Wet Method, Dry Powder

(b) AMS 3045, Magnetic Particle Fluorescent Wet Method, Oil Vehicle, Ready to Use

(c) AMS 3046, Magnetic Particle Fluorescent Wet Method, Oil Vehicle, Aerosol Packaged

D. Magnetic Rubber Material – Dynachek, V30256

6. EQUIPMENT

A. Electrical Magnetizing Equipment

(1) General

(a) Stationary equipment that can supply 4000-6000 amps is typical in the aerospace industry for overhaul operations. Mobile equipment with equivalent current outputs is available for field examination of heavy structures such as landing gear cylinders and axles. Small parts and local areas of large components can be examined with small permanent magnets or electromagnetic yokes.

(b) The maximum rated output of the equipment must be greater than that necessary for the examinations, because the resistance load of the part could decrease the current through it by as much as 20% of the rated output.

(2) Current Types

(a) Three-Phase, Full-Wave Rectified Alternating Current – Large, stationary equipment of this type is preferred in major overhaul and repair facilities. This equipment sends a magnetic field deep into a part which is good for subsurface examination of repair welds, through plating or after shot peening.

(b) Half-Wave Rectified Alternating Current – Mobile and portable equipment of this type is generally good for subsurface examinations.

(c) Alternating Current equipment is satisfactory to find defects which occur during service. Fields made by AC stay near the external surface, where such defects usually occur. Also, fields that are not deep are more easily removed by AC demagnetization.

B. Permanent Magnets and Electromagnetic Yokes

(1) General

(a) Permanent magnets and electromagnetic yokes are used for magnetic particle examination of small parts and local areas of large parts. These items can be used to examine local areas of installed parts, or after you use the larger stationary bench type equipment on local critical areas on large parts. AC-DC electromagnetic yokes can demagnetize small parts or local areas after the examination.

(b) See Table 1 for dead weight lift requirements of magnetic yokes. Do dead weight lift tests of the yokes at intervals of 6 months maximum.

Table 1: Dead Weight Lift Requirements

Yoke Type	Leg Spacing	Dead Weight Lift
HWAC electromagnetic	2-4 inches (50-100 mm)	30 pounds (13.5 kg)
	4-6 inches (100-150 mm)	50 pounds (22.5 kg)
AC electromagnetic	2-4 inches (50-100 mm)	10 pounds (4.5 kg)
Permanent magnet	2-4 inches (50-100 mm)	10 pounds (4.5 kg)

(c) Typical examples:

1) Electromagnetic Yoke – Contour Probe Model DA-200, V26774

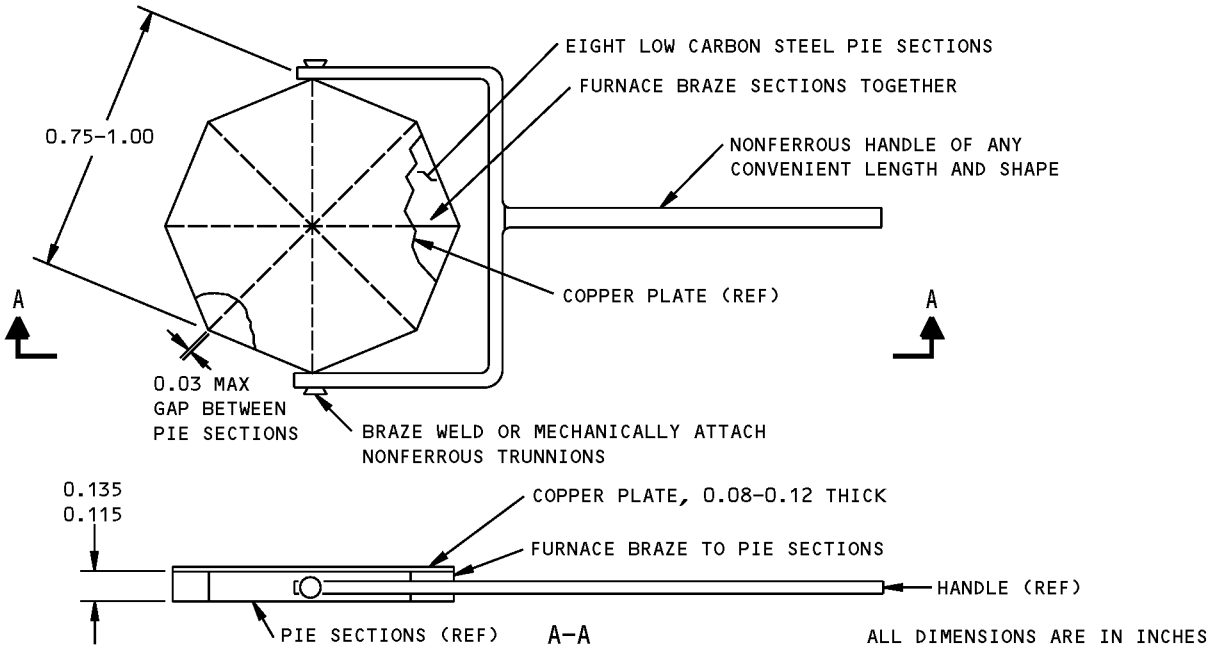
2) Permanent Magnets – Magnaflux Yoke YM-5, V37676

C. Magnetization Indicator

(1) Locally fabricated per Figure 1

(2) Penetrameter – Model 500386, V23373

(3) Pie Field Indicator 169799, V37676



Locally-Made Pie-Field Magnetization Indicator
Figure 1

7. PREPARATION OF PARTS FOR EXAMINATION

A. Be very careful to not let cleaning material or magnetic particles get where they cannot be removed. Removal of components such as bushings, bearings, or inserts from assemblies could be necessary before you clean and magnetic particle examine the unit.

B. Magnetic particle examination of assembled bearings is not recommended because the bearings are not easy to demagnetize. If a bearing cannot be removed it must be given protection from the magnetic particle examination materials and locally magnetized with a magnetic yoke to limit the magnetic field across the bearing.

C. Parts must have no grease, oil, rust, scale or other substances which could be a problem with the examination. If necessary, vapor degrease, or solvent, alkaline or abrasive clean per SOPM 20-30-03. Use abrasive cleaning only as necessary to completely remove scale or rust. Too much blasting of parts can change examination results.

D. A water-break-free surface is necessary for parts to be examined by water suspension methods. If the suspension completely wets the surface, the surface is satisfactory.

E. If necessary, remove protective coatings per SOPM 20-30-02. Unless otherwise specified, the magnetic particle examination must be before you shot peen, before you apply finishes such as primer and paint, and also before you apply metallic coatings such as electroplate, flame spray, or vacuum deposition of 0.002 inch or thicker. Unless specified by the overhaul instructions, magnetic particle examine parts with electroplate as shown in Table 2.

Table 2: Magnetic Particle Inspection of Electroplated Parts

	STEEL HEAT TREAT	
PLATING THICKNESS (inch)	**160 ksi or less**	**More than 160 ksi**
0.0008 or less	Before or after	After
0.0008-0.0050	Before	Before and after
More than 0.0050	Before	Before

F. For in-service inspection, removal of coatings and plating is not necessary before the magnetic particle examination unless the coating or plating is damaged, the thickness is more than 0.005 inch, or the coatings make inspection not easy.

8. METHODS OF EXAMINATION

A. Magnetic particle examination usually has these steps:

(1) Application of magnetic particles

(2) Magnetization, circular or longitudinal

(3) Measurement of field strength

(4) Examination for, and interpretation of indications

(5) Demagnetization and post-examination cleaning.

B. Magnetic Particles: The magnetic particles used can be nonfluorescent or fluorescent (as applicable to the examination specified) and are applied as a suspension in a vehicle. Fluorescent particles are preferred due to their higher sensitivity.

C. Wet Continuous Method: Unless shown differently, use only the wet continuous AC or DC fluorescent or nonfluorescent methods as follows:

(1) In the wet continuous method, the particle suspension is applied to wet all surfaces of the part. The magnetizing current is applied at the instant the suspension is diverted from the part. Apply a minimum of two shots of magnetizing current, each 1/2-second long.

(2) Wet suspensions of fluorescent particles, in water or oil, are recommended for most overhaul and in-service examinations unless not permitted by the material, size, or shape of the part.

(3) Water, with a suitable rust inhibitor and wetting agent, can be used as a liquid vehicle if the magnetic examination equipment can be used with water as the vehicle.

(4) It is acceptable to use the residual magnetization method (Paragraph 8.H.) as an alternative to the continuous method when you examine bores for cracks with a central conductor.

D. Dry Continuous Method: The dry continuous method is not recommended for airplane components because of its lower sensitivity level.

E. Circular Magnetization: Circular magnetization is put in the part by one of these methods:

(1) Central Conductor Method (Figure 2):

(a) Send the current through a central conductor that goes through the part. For examination of inside and outside surfaces of cylindrical and hollow parts, use a central conductor with as large a diameter as possible. for other shapes, use a central conductor for circular magnetization when you can.

(b) When the full circumference is not magnetized at one time, examine the circumference with a series of magnetizations and inspections, one after another, with the cylinder in one position after another as necessary to do a full circle magnetization.

1) Keep the control conductor adjacent to one side of the part. This will magnetize a distance (or arc) along the circumference approximately 3 times the diameter of the central conductor. (For cylindrical parts, the number of magnetizations necessary to go around the total circumference will be equal to the part diameter divided by the conductor diameter.)

2) The number of magnetizations (segments of the full circle) multiplied by the current per segment magnetization must be no less than the magnetization current necessary for a full circle magnetization of the outside diameter. Do not use too much current or you could get false indications.

(c) When a number of small parts are examined at one time, put sufficient space between each piece to permit satisfactory coverage (with particles), magnetization and examination.

(2) Direct Contact Method: Send current through the part mounted horizontally between contact plates. Be very careful not to burn the part at the electrode contact areas. Burns and arcs can be caused by:

(a) Too small a contact area

(b) Too low a contact pressure

(c) Dirty or coated contact areas

(d) Electrode removal during current flow

F. Longitudinal Magnetization

(1) To put longitudinal magnetization in a part, put the part inside a current carrying coil or between the poles of an electromagnetic yoke.

(2) When you use a coil, best results occur when:

(a) The part to be examined is two or more times as long as it is wide.

(b) The long axis of the part is parallel to the axis of the coil opening.

(c) The area of the coil opening is a minimum of 10 times the cross sectional areas of the part.

(d) The part is put near the side of the coil.

(e) Handheld coils, made of electrical cables wrapped around the part, have three to five turns.

(f) Long parts are magnetized and examined in increments of 12-18 inches, because approximately 6-9 inches on either side of the coil vertical centerline will be magnetized.

(g) The intensity of the longitudinal shots is kept just below the level that starts to make leakage fields across sharp changes of section, such as radii under bolt heads, threads, and other sharp angles in parts, unless this is to look for grinding cracks in chrome plate.

(3) When you use a yoke, the area of the part between the ends of the yoke completes the path of the magnetic lines of force. This gives a magnetic field between the points of contact.

G. Use of Permanent Magnets and Electromagnetic Yoke

(1) For a stable magnetic field from permanent magnets, you must shake the oxide particles within the field. The wet method is most satisfactory. Use a plastic squirt bottle for best results.

(2) When you do not know the direction of possible cracks in a suspect area or if the cracks could possibly be not perpendicular to the lines of force between the poles of the magnet, move the magnet and try again. The part must be demagnetized between each magnetization when the field direction is changed.

H. Residual Magnetization Method

(1) This method is generally used only for subsequent analysis of indications found by the wet continuous method. It can be used to help tell the difference between microsegregations (Paragraph 14.A.(3)) and other defects.

(2) In this method, the part is magnetized and the magnetizing current then cut off. Apply three shots of the magnetizing current, each 1/2-second long. Then apply the magnetic particles.

(3) Good results are a function of the strength of the applied field, the direction of magnetization, and the shape of the part.

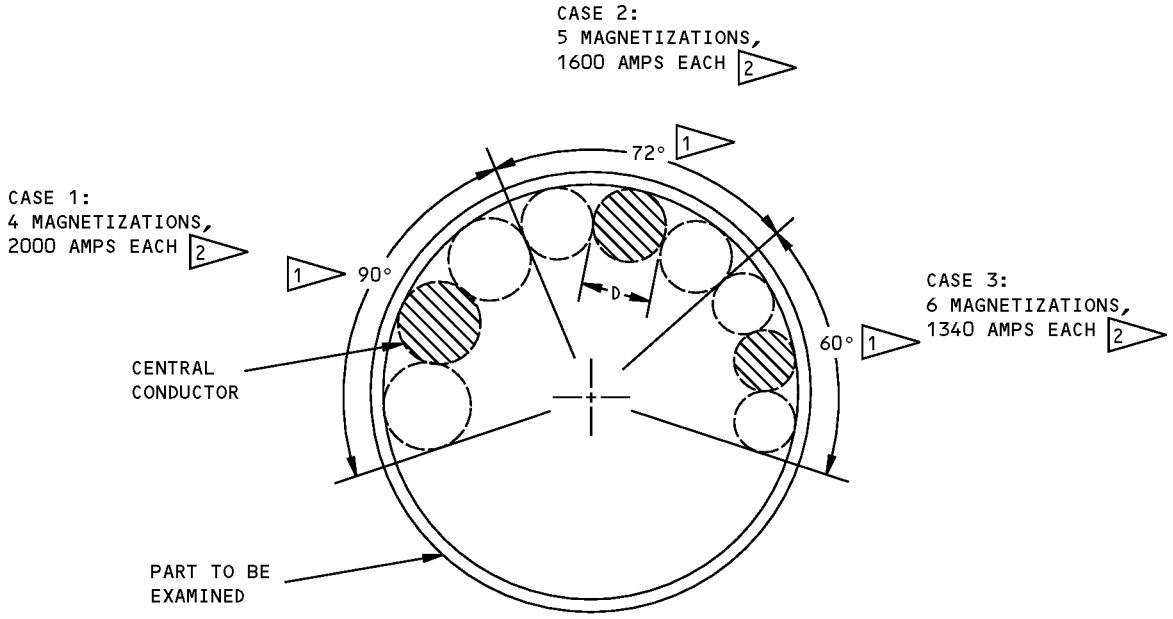
I. Field Strength Determination

(1) Factors such as part size, shape, magnetic properties of the material and the method of magnetization will affect the field strength made within a part by a given applied magnetizing force. The factors do not make it easy to give rules for magnetizing during examination. Technique requirements are best determined on actual parts having known defects.

(2) Use the magnetization indicator (Figure 1), or an equivalent method, to make sure the magnetic flux strength is sufficient. It shows you the internal field, the field direction, and the quality of the particle suspension during magnetization. Lay the indicator, copper side up, on the part in the area of interest as you apply the magnetizing force. An easy-to-see clear line of magnetic particles will occur across its face when sprayed with or put in the particle suspension.

(3) The level of magnetization necessary to find service related defects frequently can be lower than that necessary for material and manufacturing control. Where conditions are good, AC magnetizing currents of the order of 50% of the DC amperage recommended for overhaul will give good results for surface cracks. For example, 400-600 amps AC per inch of diameter will usually be sufficient for circular magnetization, but use the magnetization indicator (Figure 1) to make sure the field is sufficient.

(4) If you must do the examination with a decreased current because of part size or equipment limitations, you can adjust for lower field strength. Examine a smaller area for each magnetization, or use electromagnetic yokes. Examine only 4 inches on either side of a coil instead of 6 or apply more magnetizations along the wall of a hollow cylinder when you use an internal conductor.



1 ARC LENGTH MAGNETIZED BY THE CENTRAL CONDUCTOR (APPROXIMATELY 3 TIMES THE DIAMETER OF THE CENTRAL CONDUCTOR).

2 THE NUMBER OF MAGNETIZATIONS TIMES THE CURRENT IN EACH MAGNETIZATION MUST BE EQUAL TO OR GREATER THAN THE FULL CIRCLE MAGNETIZATION CURRENT.

EXAMPLE: FULL CIRCLE MAGNETIZATION CURRENT = 8000 AMPS

CASE 1: 4 X 2000 = 8000

CASE 2: 5 X 1600 = 8000

CASE 3: 6 X 1340 = 8040

Central Conductor Method Examples
Figure 2

9. SPECIAL EXAMINATION TECHNIQUES

A. Magnetic Rubber Method (Ref MIL-I-83387)

(1) Use this procedure as an alternative to the usual magnetic particle suspension when the access is not easy or if you must have a permanent record of the defect indication.

(2) The magnetic rubber material contains black magnetic particles in a room temperature vulcanizing (RTV) liquid rubber vehicle.

(3) General procedure:

(a) Fully clean the surfaces to be examined. Be sure to completely remove all magnetic particles from previous examinations.

(b) Prepare the area to get and contain the liquid rubber material. Use mylar or cellophane tape to close the lower opening of vertical holes. Make dams around flat surfaces with compatible plastic materials such as Duxseal putty. On horizontal holes, put tape over one opening and make a cup dam at the other. Make a hole in the tape at the upper edge to let caught air get out.

CAUTION: MANUFACTURER'S INSTRUCTIONS, SHELF LIFE AND POT LIFE TIMES MUST BE OBEYED.

(c) To prepare the magnetic base material, stir or shake the container to make sure the ferromagnetic particles are in good suspension. Add the specified amount of catalyst. Mix fully.

(d) Put the mixed liquid rubber into the examination area. You can use a plastic syringe with the needle removed to put the liquid rubber in tight areas or into small fastener holes. Do not apply more material than can be magnetized during its pot life.

(e) Apply a constant magnetic field for 30 seconds in the desired direction and of sufficient strength after you apply the rubber base material. Use a stronger field strength than that recommended for the oil or water suspension method, because the residual magnetism moves the particles through the rubber to collect as the indications as the rubber cures. Too strong a field could cause nonrelevant indications. You can apply the magnetic field with the usual procedures and equipment. The residual method is satisfactory for parts heat-treated above 180 ksi. You can use permanent magnets or DC electromagnetic yokes big enough to span the examination area. Because the residual magnetism must be strong, do not use alternating or swinging vector fields.

(f) If you know the load path or possible crack locations and directions, one magnetization in the correct direction is sufficient. When cracks are in different locations or angles, two or more examinations will be necessary with a new application of magnetic rubber. Demagnetize the area after each application. Fastener holes can be examined for radial cracks with one circumferential magnetization with DC current sent through a central conductor put through the hole.

(g) To get sensitivity equivalent to that of the wet continuous particle suspensions, mix in an amount of catalyst to the liquid rubber to make the rubber cure in 2 hours or more. Longer cure times up to 6 hours will make the indications easier to find because more particles can continue to move to their final locations.

(h) Let the rubber fully cure. Then remove the cast, and examine it under white light with 30-power magnification for indications of defects. These will stay permanently in position in the rubber and the casts can be identified and kept as a permanent record.

B. Critical Examinations

(1) A critical examination is necessary for defects at sudden changes in part shape or thickness, such as threaded parts, splines, gear teeth roots, because these sudden shape changes cause nonrelevant indications during usual examinations. This procedure is the most sensitive to find the start of in-service fatigue cracks in sharp, internal radii.

(2) You can use the usual magnetic particle examination equipment (Paragraph 6.) but alternating fields cannot always give the necessary high level of residual magnetism.

(3) Fluorescent particle suspensions are recommended for the critical examination procedure. Oil base suspensions are preferred rather than water base.

(4) Optical aids are necessary to get the maximum sensitivity possible by this magnetic particle procedure. Low-power (10X to 30X) binocular microscopes are recommended. As a minimum, pocket magnifiers of 7 to 10 power can be used.

(5) General procedures:

(a) Fully clean the part in the areas of the sharp radii and fillets where dirt can collect, and where they could be ignored during a too quick an examination.

(b) The residual method can help in some problem areas, although it is not always best in most other instances. Start with wet continuous methods for general examination, then use the residual method only for local examination of the sharp radii. Use it only where nonrelevant indications are a problem in the initial examination.

(c) Use the same methods of magnetization as in the standard procedures, but:

1) Do not use alternating fields.

2) Use a higher than usual level of magnetizing force to be sure of a higher residual field within the part.

(d) After magnetization, apply particles in a liquid suspension. Use a good amount, and apply them to cause maximum particle buildup. (A good method for small parts such as rod end fittings is to put them in a container of suspension that was stirred for approximately 30 seconds.)

(e) Look for collected particles in the sharp radii. Be sure you used a sufficient level of magnetization and amounts of the particle application to cause nonrelevant indications.

(f) Wash the parts in clean suspension vehicle only sufficiently to remove the weakly held particle accumulations that make the nonrelevant indications. Particles at actual defects will be more strongly held and will stay there if you are careful. To do this, apply a light flow or stream of liquid vehicle over the part, or, for a small component, lightly stir the part in a container of the vehicle. Carefully monitor the removal of the collected nonrelevant particles in the area to be examined. If not, you could also wash away the smaller defect indications. Try a few times to get the best method and time.

(g) Look for defect indications with optical magnification and good light. The smallest indications which are possible with this procedure cannot always be seen without such help.

10. POST-EXAMINATION REQUIREMENTS

A. Demagnetization

(1) Demagnetize between each magnetization of the same part to let you find defects in all directions, and whenever the residual magnetism becomes a problem with the interpretation of the indications. Also demagnetize all parts and materials after you are done with magnetic particle examination.

(2) Demagnetize to a level of three oersteds or less as read by a standard magnetic field indicator. Measure the field at different locations, on the part and at all important changes in geometry. Demagnetize again if you see the field indicator needle move.

(3) AC method

(a) Hold the part approximately 1 foot in front of the AC demagnetizing coils and then move the part slowly and smoothly through the coils and approximately 1 foot behind the coils.

(b) Do this until the residual magnetism is gone.

(c) Turn and tilt parts of complex configuration as they are passed through the coils.

(4) DC method

(a) Put the part in the same relative position as when you magnetized it, and apply reversing DC current.

(b) Gradually reduce the current to zero.

(c) Do this until the residual magnetic field is gone.

(5) When you use a magnetic yoke such as the Parker Research Contour Probe, you can remove the magnetized areas with the probe in the AC mode.

B. Cleaning

(1) When you used oil suspensions, solvent clean or vapor degrease the part until all magnetic particles are gone.

(2) When you used water suspensions, completely remove the water, such as with an air blast, to make sure that the parts are dried immediately when done. Fully rinse the part with a detergent base cleaner until the magnetic particles are all gone. Then rinse in a solution of water and rust inhibitor.

(3) On cadmium plated parts you can use an air-water vapor blast to remove remaining magnetic particles.

C. After magnetic particle examination, replace removed finishes as specified by overhaul instructions.

D. After the parts are clean and dry, use temporary protective coatings per SOPM 20-44-02 as necessary to prevent corrosion.

11. EQUIPMENT CONTROL

A. Regularly do tests of magnetic particle examination equipment as necessary to be sure of satisfactory operation.

B. When fluorescent magnetic particle suspension is used, the black light intensity must be a minimum of 1000 microwatts per square centimeter measured at the surface of the part. The ambient white light level must be no more than 2 foot candles (20 lux).

C. When nonfluorescent particles are used, the white light intensity must be a minimum of 100 foot candles (1000 lux) measured at the surface of the part.

D. Use special lighting equipment and optical devices, as necessary, when you examine the inside diameters of holes, tubing, cylinders, and other surfaces where the access is not easy.

12. MATERIAL CONTROL

A. Make tests of the magnetic substance concentration (wet method) regularly and control as shown in Table 3.

Table 3: Suspension Concentration Controls

Magnetic Particle Type	Concentration: ml Solids per 100 ml Suspension	
	Required	Preferred
Fluorescent	0.1 - 0.4	0.15 - 0.25
Nonfluorescent (visible)	1.0 - 2.4	———

B. When water suspension systems are used, do regular tests to make sure there is sufficient wetting agent and rust inhibitor.

C. If adjustment of water suspensions is necessary to get a water break-free surface, keep the pH in the 6.0-10.0 range. Use nonionic wetting agents when possible.

13. PROCESS CONTROL

A. When magnetic particle examination is specified, do it after all overhaul/repair operations but these:

(1) Before shot peening and protective finishing such as priming, painting and plating more than 0.002 inch thick.

(2) Both before and after nitriding and the application of 0.002-inch or more of chrome or nickel plate. This lets you find surface defects in the base metal under the plating.

B. If you think there are indications, start at the lowest current possible to let you find relevant indications. Then increase the current until you get the best amperage for the particular part.

C. Do the magnetic particle check with sufficient magnetization and number of examinations to be sure that you can find discontinuities with axes in any direction.

D. On tubular parts, use a central conductor and turn the part on the conductor with a separate magnetization and examination at each position. Use one turn for approximately 7 inches of part circumference.

14. ACCEPTANCE CRITERIA

A. General (All Classes)

(1) The following are not acceptable:

(a) Defects caused during service, such as cracks or corrosion.

(b) Indications of material defects caused by or shown during any processing step, unless permitted by Paragraph 14.A.(2), Paragraph 14.A.(3) below. Examples of defects are cracks, laps, coldshuts, laminations, seams, tears, blowholes, flakes, forging bursts, embedded scale, linear porosity, pipes, corrosion pits, crazing, galling. Examples of processing steps include grinding, plating, welding, machining.

NOTE: Some service bulletins, maintenance manuals, or overhaul instructions specify an acceptance class, such as Class A critical. Acceptance classification is not necessary for overhaul inspections. It is used for newly-made parts to specify permitted discontinuities such as material inclusions or phase segregation. If you inspect a newly-made part or must evaluate material inclusions or phase segregation, refer to BAC5424 for the acceptance criteria.

(c) Indications of any length that extend over or into an edge, chamfer, corner, radius, fillet, or hole. But do not reject the part if the indications are because of microsegregation (alloy segregation). Refer to Paragraph 14.A.(3) below.

(d) Parts with arc burns.

(2) Indications of metallic phase segregations in precipitation hardened corrosion resistant steel:

(a) are not acceptable in springs and material used for springs.

(b) are acceptable in parts other than springs, made from sheet no thicker than 0.125 inch.

(c) must not be more than the limits of the material procurement document in parts made from materials thicker than 0.125 inch. If the procurement document does not contain limits, use the criteria for linear inclusions contained in BAC5424.

(3) Indications of microsegregation (alloy segregation) are acceptable. Microsegregation is a condition in which small changes in material chemistry could cause a banded microstructure in wrought items. When magnetic particle examined, microsegregation could be seen as very narrow lines, usually long and straight, on the surfaces of parts.

(a) Indications are microsegregation if these two conditions occur:

1) Indications do not reappear when the part is examined by the residual method, in BSS7040, and

2) Indications do not reappear when the part is demagnetized, cleaned, and then magnetic particle examined again at one-half the recommended current levels.

(b) If the indications reappear, reject the part.

B. For Classes A, B, and C, see BAC5424.

15. IN-PROCESS CORRECTION

A. If Class A examination was specified, parts which are not satisfactory are not acceptable for in-process correction.

(1) If you made the part but the Class A examination found defects in it, you must stop the process and reject the part.

(2) If this is a part that was in service and the Class A inspection found defects in it, get help from Boeing.

B. For all other cases (Classes B, C, and when no class is specified), removal of indications from cracks or nonmetallic inclusions is permitted within limits given by overhaul procedures.

C. When permitted, repair all parts in the final heat-treated condition as follows:

(1) Remove surface indications by procedures and equipment that will not change the metallurgical structure of the adjacent material. Examples are hand filing, rotary filing, etc.

(2) Blend out the repaired areas into the adjacent material with as large a radius as possible. A minimum of 1 inch radius is recommended.

(3) Make the surface finish of the repaired areas equal to or smoother than that specified by overhaul instructions.

(4) Do not grind.

(5) Examine the repaired areas by this procedure and the overhaul instructions.

(6) Refinish the required areas as specified by the overhaul instructions.