PURPOSE:

This procedure will be used to perform Magnetic Particle Testing when required by contract, specification, or customer information.

REFERENCE SPECIFICATIONS

API 620, Latest Edition
API 650, Latest Edition
ASME Section V, Article 7, Latest Edition
ASME Section VIII, Div. 1 and 2, Latest Edition
ASME B31.1, Latest Edition
ASME B31.3, Latest Edition
AWS D 1.1, Latest Edition
AWWA D-100, Latest Edition

PROCEDURE:

1.0 SCOPE

1.1 This procedure specifies the technique, requirements, and acceptance standards and documentation requirements which apply to magnetic particle examination with an electromagnetic yoke technique on steel and other ferromagnetic alloys.

1.2 The magnetic particle examination method is an effective means for detecting discontinuities which are on or near the surface of ferromagnetic metals. Typical discontinuities detectable by this method are cracks, seams, laps, cold shuts, laminations, and porosity.

2.0 PERSONNEL

2.1 Magnetic particle examination personnel shall have vision, with correction if necessary, to enable them to read a Jaeger Type No 2 Standard Chart (or equivalent), at a distance of not less than 12 inches (304mm), and shall be capable of distinguishing and differentiating contrast between colors used. Inspection personnel shall be checked annually to ensure that they meet this requirement.
2.2 Magnetic particle examination personnel shall be proven competent in the technique of magnetic particle examination, including performing the examination and interpreting and evaluating the results.

3.0 SURFACE PREPARATION

3.1 In general, satisfactory results may be obtained when the surface of the part is in the as-welded, as-rolled, as-cast, or as-forged condition. Surface preparation by grinding, machining, or other means may be necessary where surface irregularities could mask indications of unacceptable discontinuities.

3.2 All welds shall be visually examined and found to be visually acceptable prior to magnetic particle examination.

4.0 CLEANING

4.1 Prior to each magnetic particle examination, the surface to be examined and all adjacent areas within 1 inch (25mm) shall be dry and free of all dirt, grease, lint, scale, welding flux, weld spatter, paint, oil and other extraneous matter that could obscure surface openings or otherwise interfere with the examination.

5.0 MATERIALS

5.1 Magnetic particles will contrast with part being inspected. All dry particles used shall meet the requirements of AMS 3040.

6.0 TECHNIQUE

6.1 Using the yoke technique either circular or longitudinal magnetism may be generated using various techniques. Alternating current (AC), and/or half wave direct current (HWDC) may be used in this procedure to obtain different results based on the parts being inspected. AC magnetism is used to detect surface indications only. HWDC magnetism may be used to detect surface and near surface indications.

6.2 Unless otherwise indicated, parts to be examined shall be examined a minimum of two times at approximately right angles to each other to insure that any discontinuity present may be detected.
6.3 The yoke will be placed on the part to be inspected and energized in an orientation that is first perpendicular to the direction of the weld or area of interest. Powder will be applied while the yoke is energized and on the part being inspected. While the magnetizing current is on, dust the powder in a light cloud onto the magnetized area of the part so that a light uniform dust like coating settles on the surface of the area to be examined. Remove the excess powder by gently blowing with a stream of dry air while the current is still applied.

6.4 Sufficient overlap will be used to ensure all areas are examined. The yoke will be placed perpendicular to the last position to be aligned longitudinally with the weld or area of interest. The powder will be repeatedly applied as described in Sec. 6.3. This process will be repeated for the entire length of the part. Each time the yoke is energized the Inspector will examine the area for indications.

6.5 A minimum light intensity of 100 fc (1000 lux) is required to ensure adequate sensitivity during the examination and evaluation of indications. (This light intensity can be achieved by use of a head lamp at a distance of approximately 2’ or a 1000 watt halogen light at a distance of approximately 6’).

6.6 The electromagnetic yoke shall be capable of lifting 10 lbs with a 2 to 4 inch spacing when set on AC and at least 30 lbs with 2 to 4 inch spacing, or 50 lbs with 4 to 6 inch spacing, when set on DC.

7.0 INTERPRETATION

7.1 Indications will be generally found in an orientation perpendicular to the axis of the yoke. Indications may vary form case to case. Indications are

8.0 EVALUATION OF INDICATIONS

8.1 Discontinuities at the surface will be indicated by magnetic particle examination; however, localized surface irregularities due to machining marks or other surface conditions may produce false indications.

8.2 An indication is the evidence of a mechanical imperfection. The following will be considered when evaluating indications:

8.2.1 Only indications with major dimensions greater than a 1/16” inch (1.6 mm) shall be considered relevant.
8.2.2 A liner indication is one having a length greater than three times the width.

8.2.3 A rounded indication is one of circular or elliptical shape with the length equal or less than three times the width.

8.2.4 Any questionable or doubtful indications shall be reexamined to determine whether or not they are relevant.

8.2.5 An indication of an imperfection may be larger than the imperfection that causes it; however, the size of the indication is the basis for acceptance evaluation.

8.2.6 Any indication of an imperfection which is believed to be non-relevant shall be regarded as a defect unless and until it is shown by reexamination by the same method or by the use of other nondestructive methods and/or by surface conditioning that no unacceptable imperfection is present.

9.0 ACCEPTANCE STANDARDS

9.1 All surfaces to be examined shall be free of the following:

9.1.1 Relevant liner indications. No crack or linear indication is acceptable.

9.1.2 Relevant rounded indications greater than 3/16” inch (4.8 mm) will not be acceptable.

9.1.3 Four or more relevant rounded indications in a line separated by 1/16” inch (1.6 mm) or less, edge-to-edge.

10.0 REPAIR REQUIREMENTS

10.1 Sections of welds that do not meet the acceptance standards in Section 9.0 shall be repaired and reexamined in accordance with the requirements specified herein. Unacceptable imperfections shall be repaired and reexamined made to
assure removal or reduction to an acceptable size. Whenever an imperfection is removed by chipping or grinding and subsequent repair is by welding is not required, the excavated area shall be blended into the surrounding surface so as to avoid sharp notches, crevices, or corners and welding performed by a qualified welder or welding operator in accordance with a qualified welding procedure.

10.2 After an imperfection is thought to have been removed and prior to making weld repairs, the area shall be examined by suitable methods to assure the imperfection has been removed or reduced to an acceptable size.

10.3 After repairs have been made, the repaired area shall be blended into the surrounding surface so as to avoid sharp notches, crevices, or corners and reexamined by the liquid penetrant method and by all other methods that were originally required for the affected area.

10.4 Surfaces shall be cleaned to remove residual magnetic particles…

11.0 RECORDS AND REPORTS

11.1 The examining operator shall report the results on the inspection form and complete it in its entirety.
# Magnetic Particle Examination Record

**Contract/Job No.**: ________________  **Drawing No.**: ________________

**Assembly**: ______________________  **Piece Mark**: ______________________

**Type of Material**: ________________  **Material Thickness**: ________________

**Magnetic Particle Type**: ________________  **Magnetic Particle Method**: ______

**Magnetic Particle Batch No.**: ________________  **Expiration Date**: ________________

**Light @ Point of Inspection**: ________________  **Light Gage**: ________________

**Temperature**: ________________  **Before / After PWHT**: ________________

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**Comments**: ________________

**Inspection Operator**  **Date**: ________________

**Third Party Inspector**  **Date**: ________________

**Owners Representative**  **Date**: ________________

**Code Inspector**  **Date**: ________________