



CAN-MT-14P001 REVISION 07

MAGNETIC PARTICLE EXAMINATION – YOKE



ASME V, ARTICLE 7 AND 25; ASME SE-709 (ASTM E709)

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Notes:	This document was renamed from AGI MT 01 to CANMT-14P001 and may also be used when AGI MT 01 is referenced.
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Approval & Authority

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QUALITY "EVERY CLIENT, EVERYWHERE, EVERY DAY"

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Revision Summary		
Revision No.	Date	Description
00	---	First revision.
01	December 01, 2011	Inspection - replaced with examination throughout. References - Added ASME Section V 2010 w 2011a. 8.1- modified statement.
02	February 01, 2012	5.2 - Modified statement. 7.8 - Nonmagnetic Surface Contrast Enhancement. 10.0 - Procedure Qualification added.
03	---	Document and references renamed.
04	November 01, 2012	Corrected table of contents.
05	June 10, 2013	Updated document format. Modified 5.1, 5.2.2, 5.2.2d), 7.5, 10.0.
06	July 24, 2013	Replaced missing text from Appendix B.
07	November 15, 2013	Updated for ASME V 2013 edition. Revised 2.0, 3.0, 3.1, 4.0 and 9.0.



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APPENDIX A: QUALIFICATION OF WHITE LIGHT SOURCE

APPENDIX B: QUALIFICATION OF WHITE LIGHT SOURCE (100 WATT BULB)

1.0 SCOPE

This procedure provides instruction to technicians performing magnetic particle examination in accordance with ASME Section V, Article 7 and 25 (ASME SE-709 / ASTM E709) utilizing a yoke. It is to be applied when those standards are referenced and may also be used when no protocol is specified.

2.0 REFERENCES

- 2.1 Acuren Safety Management System
- 2.2 ASME Section V, Article 7 and 25 (2013)
- 2.3 ASTM E709
- 2.4 CAN-CP-02P001 Acuren Canada SNT-TC-1A Written Practice

3.0 PERSONNEL

- 3.1 Examination shall be carried out by technicians certified to the requirements of the Acuren procedure CAN-CP-02P001. Note: Certain codes or standards may require the use of additional or alternate certification schemes (e.g. CAN/CGSB-48.9712).
- 3.2 A Level I technician may perform examination when under the direct supervision of a Level II or Level III technician.
- 3.3 A Level II or III technician shall carry out final interpretation and sign the report.
- 3.4 A Level III technician shall approve this procedure.

4.0 SAFETY

- 4.1 Personnel shall;
 - 4.1.1 Comply with the requirements of the Acuren Safety Management System.
 - 4.1.2 Follow all Client and project specific safety requirements.
- 4.2 Aerosols must be stored away from heat sources.

5.0 EQUIPMENT AND MATERIALS

- 5.1 Equipment shall be calibrated as required by the applicable Acuren calibration procedure (CAN-CAL). Calibration shall also be conducted following equipment damage and repair.
 - 5.1.1 Applicators: powder spray bulb, sprayer bottle
 - 5.1.2 Centrifuge Tube 100 ml – 1 ml stem (0.05 ml divisions) for fluorescent particles
 - 5.1.3 Centrifuge Tube 100 ml – 1.5 ml stem (0.1 ml divisions) for non-fluorescent particles

- 5.1.4 Documentation – must be available at the worksite: Code acceptance extracts, and this procedure
- 5.1.5 Inspection materials e.g. powder, contrast paint etc. as required
- 5.1.6 Lift Test Bar 10 lb for AC, 40 lb for DC with weight verification certificate
- 5.1.7 Light Meter – ultraviolet, calibrated within previous 12 months
- 5.1.8 Light Meter – white Light, calibrated within previous 12 months
- 5.1.9 Ultraviolet (Black Light) Source – with output verified per 7.4 c)
- 5.1.10 Yoke – AC, DC or combination AC/DC with lift test verification within previous 12 months
- 5.1.11 Yoke – Permanent Magnet. A performance check (lift 40 lb test bar) must be completed prior to, and after each examination
- 5.1.12 White Light Source –verified with a white light meter at the time of examination or with output verified per 7.5. A 100 watt bulb used at 30 cm or less is qualified (see APPENDIX B).
- 5.2 Particles
 - 5.2.1 Finely divided ferromagnetic particles used for examination shall be purchased that meet the requirements of ASME Section V, Article 7, T-731 (ASTM E709). They shall be treated to provide colour sufficient to make them visible against the background of the surface being examined.
 - 5.2.2 Aerosol cans that are purchased per 5.2.1 meet the concentration requirements. Non-aerosol wet particles shall be mixed in light oil or conditioned water as per the manufacturer's directions. Concentration checks shall be performed and the mixture stored in a sealed container for transfer to spray applicators. The bath is not reused after contact with examination parts therefore; contamination checks are not required. Instructions for concentration confirmation follow (refer also to CAN-CAL-02P006).
 - a) Agitate the mixture sufficiently to distribute the particles throughout.
 - b) Fill the appropriate centrifuge tube with 100 ml of the mixture:
 - 0.05 ml divisions for fluorescent particles
 - 0.1 ml divisions for non-fluorescent particles
 - c) Demagnetize
 - d) Let settle for 60 minutes for oil and 30 minutes for water based suspensions.
 - e) Concentration shall be:
 - 0.1 ml to 0.4 ml for fluorescent

- 1.2 ml to 2.4 ml for non-fluorescent

6.0 TECHNICAL LIMITATIONS

- 6.1 This procedure limits examination to indications that are open to the surface on non-coated items unless as addressed per 7.2.3. Non-magnetic surface contrast enhancement may be used per 7.8.
- 6.2 This procedure limits examination within the following temperature ranges:
- 6.2.1 Wet particles (oil based) -20°C to 50°C, Wet particles (water based) above freezing to 50°C
- 6.2.2 Dry particles -40° C to 260°C (without the use of contrast paint)
- Temperature ranges specified are based upon standard products. They may be exceeded if the manufacturer rates the product beyond these ranges.

7.0 EXAMINATION

Client information and specific examination requirements including acceptance criteria shall be provided to the technician in the form of a Work Order (Call Sheet) prior to the start of examination. On projects where work orders are not issued, the supervisor shall provide detailed instructions, preferably written, to the technician.

- 7.1 There are no restrictions to the size and shapes of the items to be examined. Geometry or access may limit examination. Such limitations shall be recorded in the examination report.
- 7.2 Surface Preparation
- Satisfactory results may be obtained when the surface of the part is in the as-welded, as-rolled, as cast, or as-forged condition. Grinding or machining may be necessary to eliminate surface irregularities which could mask discontinuity indications.
- 7.2.1 Prior to Examination
- The surface to be examined and the adjacent areas within 25 mm shall be dry and free from all matter that could interfere with the interpretation.
- Perform a visual examination of the surface in order to locate any open to the surface discontinuities that may not attract and hold magnetic particles due to their width. Document any such discontinuities in the examination report.
- 7.2.2 Cleaning may be accomplished using detergents, organic solvents, descaling solutions, paint removers, vapour degreasing, sand or grit blasting.
- 7.2.3 When nonmagnetic coatings are left on the part it must be demonstrated that indications can be detected as per Mandatory Appendix 1 of ASME V, Article 7.
- 7.3 Examination shall be done using the continuous method, that is, particles are applied while the magnetizing force is present. Each area to be inspected requires the yoke to be placed in two (2) directions at 90° to each other with sufficient overlap (75 to 150

mm) to ensure complete coverage. Position yoke, switch on current. Apply particles to form a light, uniform coating on the examination surface. In order to aid evaluation, dry particles may be removed with a light air stream while current is on. Switch current off, remove yoke, evaluate. Reposition the yoke at 90° from the original position and repeat the examination.

7.4 Fluorescent Examination

- 7.4.1 Shall be performed in a darkened area.
- 7.4.2 Prior to use inspect the blacklight bulb, reflector, lenses or glass for damage and cleanliness. Clean and replace as necessary.
- 7.4.3 Black light intensity shall be a minimum of 1000 $\mu\text{W}/\text{cm}^2$ at the examination surface. Intensity is required to be measured; prior to use, whenever the power source is interrupted and at the completion of the examination. If intensity has decreased below 1000 $\mu\text{W}/\text{cm}^2$ replace the light and reinspect.
- 7.4.4 Inspectors shall allow five (5) minutes of eye adaptation in the darkened area prior to examination.
- 7.4.5 Photosensitive or permanently tinted lenses shall not be worn.

7.5 Visible (Colour Contrast) Examination

White light intensity at the examination surface must be a minimum of 100 foot candles or 1076 lux. Light intensity must be measured prior to examination or a light source as verified per APPENDIX A shall be used. A 100 watt bulb is qualified. Refer to APPENDIX B.

7.6 Wet Particle Application

- 7.6.1 Visible or fluorescent particles may be applied by aerosol container as supplied by the manufacturer or by manually operated spray pump. Agitate prior to each application and provide a uniform consistent spray on the part.
- 7.6.2 Apply during the application of the magnetizing current at a low velocity that will not remove accumulated particles. Stop the application of particles prior to or simultaneously with the current.

7.7 Dry Particles

The colour of the particles used shall be sufficiently different to contrast with the colour of the examination surface.

- 7.7.1 Apply with a hand operated puffer bulb placed approximately 150 mm from the examination surface.
- 7.7.2 Continue to energize the yoke while the particles are being applied, and while excess particle medium is being removed.
- 7.7.3 Accumulations of excess dry particles may be removed with a light stream of air from a bulb, or other source of dry low pressure air.

7.8 Nonmagnetic Surface Contrast Enhancement

Nonmagnetic surface contrasts may be applied by the examiner to uncoated surfaces, only in amounts sufficient to enhance particle contrast. When nonmagnetic surface contrast enhancement is used, it shall be demonstrated that indication can be detected through the enhancement. Thickness measurement of this nonmagnetic surface contrast enhancement is not required.

7.9 Interpretation

7.9.1 Interpretation shall be performed during and immediately after the current application.

7.9.2 Indications shall be assessed as to whether they are false, non-relevant or relevant. False or non-relevant indications shall be re-examined to confirm their type.

7.9.3 Evaluate the discontinuity based on the size of the indication. Report all relevant indications.

7.9 Demagnetization

Demagnetize when requested by client. Alternating current yokes may be used for local demagnetization by placing the poles on the surface, then moving them around the area, and slowly withdrawing the yoke while it is energized.

7.10 Post Examination Cleaning

Post cleaning shall be carried out at the request of the client and be performed soon as practical after examination. It may be accomplished by:

7.10.1 Using compressed air to blow off the particles

7.10.2 Drying of wet particles and subsequent removal by brushing

7.10.3 Removal of wet particles by flushing with solvent

8.0 EVALUATION

8.1 Indications shall be evaluated as acceptable or rejectable as per the client specified acceptance standard. Technicians are provided with, or have access to, the applicable acceptance requirements of the relevant standards in the Acuren Code Extract Manual.

8.2 The client shall designate the acceptance criteria. Indications shall be evaluated in terms of the applicable acceptance criteria.

8.3 Non-rejectable indications shall be recorded as per the relevant standard.

8.4 Rejectable indications shall be recorded. At a minimum record linear or rounded, location and extent, e.g., length, diameter or aligned.

8.5 Broad areas of particle accumulation which may mask discontinuity indications shall be cleaned and re-examined.

- 8.6 In absence of a designated code or specification, all indications are to be characterized and noted on the report with no acceptance or rejection.

9.0 REPORTS

- 9.1 Complete all fields of the Acuren supplied report form in either the electronic or hard copy format.
- 9.2 For each examination the following information shall be recorded as a minimum. Where the item is not applicable to the examination the field shall be completed as N/A:
1. Client Information
 2. Description of items tested
 3. Date
 4. Acuren Job Number
 5. Work Location
 6. Acceptance Standard including revision status
 7. Acuren Procedure Number including revision status
 8. Material
 9. Thickness
 10. Scope of Examination
 11. Type of Examination, e.g., Visible or Fluorescent
 12. Yoke type and current
 13. Material identification:
 - i) Particle Brand, colour and product number
 - ii) Suspension
 - iii) Contrast Paint Brand and product number
 14. Blacklight output verification
 15. White light type and output verification
 16. Light meter serial number and calibration due date
 17. Surface condition
 18. Surface temperature
 19. Results including map, detailed description or photographs of indications
 20. Technician name, signature and certification level
 21. Client Signature (when possible)

10.0 PROCEDURE QUALIFICATION

When procedure qualification is specified by the referencing Code Section a change of a requirement of **ASME Section V, Article 7, Table T-721** (see below) identified as an essential variable shall require requalification of the written procedure by demonstration. A change of a requirement identified as a nonessential variable does not require requalification of the written procedure. All changes of essential or nonessential variable from those specified within the written procedure shall require revision of, or an addendum to, the written procedure.

Table T-721
Requirements of a Magnetic Particle Examination Procedure

REQUIREMENT	Essential Variable	Nonessential Variable
Magnetizing technique	X	
Magnetizing current type or amperage outside range specified by this Article or as previously qualified	X	
Surface preparation	X	
Magnetic particles (fluorescent/visible, color, particle size, wet/dry)	X	
Method of particle application	X	
Method of excess particle removal	X	
Minimum light intensity	X	
Existing coatings, greater than the thickness demonstrated	X	
Nonmagnetic surface contrast enhancement, when utilized	X	
Performance demonstration, when required	X	
Examination part surface temperature outside of the temperature range recommended by the manufacturer of the particles or as previously qualified	X	
Shape or size of the examination object		X
Equipment of the same type		X
Temperature (within those specified by manufacturer or as previously qualified)		X
Demagnetizing technique		X
Post-examination cleaning technique		X
Personnel qualification requirements		X



APPENDIX A: QUALIFICATION OF WHITE LIGHT SOURCE

Examination of visible (colour contrast) indications must be carried out where light at the examination surface is at a minimum intensity of 100 foot-candles. The light may be measured with a white light meter at the time of examination. Alternatively, a source may be qualified as per the following method:

EQUIPMENT

White Light: Light Source (describe): _____

Light Meter: Serial Number: _____ Calibration Due Date: _____

1. Set the meter in a stationary location.
2. Place the light in front of the light meter sensor and retract while observing the light output on the meter.
3. Stop retraction when the meter reads 100 foot candles. Record the distance. The light is qualified examination use at a maximum distance as noted.

White Light Source is qualified for use at a maximum distance of _____ cm.

Technician (Signature)

Date

Technician (Print Name)

The Regional Quality Representative is responsible for retaining this document on file per local practice.



APPENDIX B: QUALIFICATION OF WHITE LIGHT SOURCE (100 WATT BULB)

Examination of visible (colour contrast) penetrant or magnetic particle indications must be carried out where light at the examination surface is at a minimum intensity of 100 foot-candles. This document qualifies a 100 watt bulb at 30 cm.

EQUIPMENT

White Light: Light Source (describe): Trouble Light with 100 watt bulb and 100 foot extension cord

Light Meter: Serial Number: 0500305 Calibration Due Date: June 20, 2012

1. Set the meter in a stationary location.
2. Place the light in front of the light meter sensor and retract while observing the light output on the meter.
3. Stop retraction when the meter reads 100 foot candles. Record the distance. The light is qualified examination use at a maximum distance as noted.

White Light Source is qualified for use at a maximum distance of 30 cm.

A handwritten signature in black ink, appearing to read "Gary Isaac".

Technician (Signature)

January 26, 2012

Date

Gary Isaac

Technician (Print Name)