**Appendix T Proposed Changes – NDT LIII**

Current 1.2

* 1. Scope This appendix contains requirements and methods for nondestructive testing and personnel requirements when and to the extent they are specifically referenced and required by this specification, in a tank specification, or by other referencing documents. The most commonly used nondestructive testing methods are listed in Table T.1. Additional or alternative techniques or methods shall be approved by the Tank Car Committee. For the purpose of this document, the terms NDT (testing), NDE (examination or evaluation), or NDI (inspection) shall be considered equivalent terms. When not directly covered by this specification, the ASTM Standards, Volume 03.03, Nondestructive Testing and/or ASME Section V may be used to develop nondestructive test procedures.

Proposed 1.2

## Scope

This appendix contains requirements and methods for nondestructive testing and personnel requirements when and to the extent they are specifically referenced and required by this specification, in a tank specification, or by other referencing documents. Those nondestructive methods and associated techniques covered by this appendix are listed in Table T.1. Additional or alternative techniques or methods shall be approved by the Tank Car Committee. For the purpose of this document, the terms NDT (testing), NDE (examination or evaluation), or NDI (inspection) shall be considered equivalent terms. When not directly covered by this specification, the ASTM Standards, Volume 03.03, Nondestructive Testing and/or ASME Section V may be used to develop nondestructive test procedures.

Current 1.4.1

**1.4.1 Level III:** A Level III shall have the skills and knowledge to establish techniques; interpret codes, standards, and specifications; designate the particular technique to be used; and verify the adequacy of procedures. The Level III shall ensure that the procedures cover the particular type of work to be performed to meet the end product requirements. The individual also shall have general familiarity with the NDT methods. The Level III shall be capable of conducting or directing the training and examining of NDT personnel in the methods for which the Level III is qualified. An NDT Level III shall be responsible for the administration of the NDT program as described in this paragraph. An AWS CWI, SCWI, or CSA 178.2 can function as a Level III for visual weld inspection. An AWS CWI, SCWI, or CSA 178.2 can function as a Level III for remote visual inspection if they have received documented training in the set-up, operation, and use of remote visual equipment. The level of training shall be defined in the company’s written practice. The individual shall ensure that the visual procedures cover the particular type of work to be performed to meet the end product requirements.

Proposed 1.4.1

**1.4.1 Level III:** An NDT Level III shall be responsible for the administration of the NDT program as described in this paragraph. An NDT LIII shall be an ASNT LIII or CGSB LIII valid certificate holder in the method employed. The LIII shall be responsible for approval of the written practice, NDT procedures, NDT training material, NDT Instructors, the requirements of 1.8.3.3 for vision examinations, and the requirements of 1.10 for technical performance. An AWS SCWI, or CSA 178.2 LIII can approve visual weld inspection procedures.

Current 1.4.2

**1.4.2 Level II:** A Level II shall have the skills and knowledge to set up and calibrate equipment; conduct tests; and interpret, evaluate, and document results in accordance with procedures approved by an NDT Level III. The Level II shall be thoroughly familiar with the scope and limitations of the method to which certified. The Level II shall be capable of directing the work of trainees and Level I personnel and shall be able to organize and report nondestructive testing results.

Proposed 1.4.2

**1.4.2 Level II:** A Level II shall have the skills and knowledge to set up and calibrate equipment; conduct tests; and interpret, evaluate, and document results in accordance with procedure s approved by an NDT Level III. The Level II shall be thoroughly familiar with the scope and limitations of the method to which certified . The Level II shall be capable of directing the work of trainees and Level I personnel and shall be able to organize and report nondestructive testing results. An AWS CWI, SCWI, or CSA 178.2 LII or LIII can function as an NDT LII for visual weld inspection. A VT Level II, AWS CWI, SCWI, or CSA 178.2 LII or LIII can perform visual inspection using remote visual equipment if they have received documented training in the set-up, operation, and use of remote visual equipment.

Current 1.4.3

**1.4.3 Level I:** A Level I shall have the skills and knowledge to properly perform specific calibrations and tests, and with a prior written approval of the NDT Level III, to perform specific interpretations and evaluations for acceptance or rejection and document the results in accordance with specific approved procedures. The Level I shall be able to follow approved nondestructive testing procedures and shall receive the necessary guidance or supervision from a certified NDT Level II or NDT Level III individual.

Proposed 1.4.3

**1.4.3 Level I:**  A Level I shall have the skills and knowledge to properly perform specific calibrations and tests, and with a prior written approval of the NDT Level III, to perform specific interpretations and evaluations for acceptance or rejection and document the results in accordance with specific approved procedures. The Level I shall be able to follow approved nondestructive testing procedures and shall receive the necessary guidance or supervision from a certified NDT Level II or NDT Level III individual. In addition, for VT, the LI may receive guidance or supervision from a CWI, SCWI, or CSA 178.2 LII or LIII.

Current 1.4.4

**1.4.4 Trainee:** A person who is not yet certified to any level shall be considered a trainee. Trainees shall work with a certified person under the direction of an NDT Level II or NDT Level III and shall not independently conduct any tests or complete a report of test results.

Proposed 1.4.4

**1.4.4 Trainee:** A person who is not yet certified to any level shall be considered a trainee. Trainees shall work with a certified person under the direction of an NDT Level II or NDT Level III and shall not independently conduct any tests or complete a report of test results. In addition, for VT, the trainee may receive guidance or supervision from a CWI, SCWI, or CSA 178.2 LII or LIII.

Current 1.5

* 1. **Written Practice for Qualifying and Certifying NDT Personnel**

All nondestructive testing shall be performed by personnel qualified and certified in accord with a written practice. The written practice shall describe the program for the control and administration of NDT personnel training, examination, and certification modeled on this appendix and on ASNT SNT-TC-1A. The written practice shall be reviewed and approved by the NDT Level III and shall include, as a minimum, the following:

Proposed 1.5

* 1. **Written Practice for Qualifying and Certifying NDT Personnel**

All nondestructive testing covered by this appendix shall be performed by personnel qualified and certified in accord with a written practice. The written practice shall describe the program for the control and administration of NDT personnel training, examination, and certification and shall be modeled on this appendix. The written practice shall be reviewed and approved by the NDT Level III and shall include, as a minimum, the following:

(bullet points remain unchanged)

Delete entire paragraph 1.8.4.

Delete entire paragraph 1.9.3.

Current 1.18

**1.18 NDT Procedure Requirements**

All nondestructive testing shall be performed in accord with a written procedure. NDT Procedures shall be approved by an NDT Level III certified in the method and qualified in accordance with paragraph 1.19. The procedure shall include, as a minimum , all of the requirements of this appendix, including the requirements of this paragraph and the applicable method section. The parameters for essential and nonessential variables shall be stated in the procedure. Paragraph 1.19 describes the requirement s for the qualification of NDT procedures. In addition to the method section, the procedure shall, as a minimum, contain the following:

Proposed 1.18

**1.18 NDT Procedure Requirements**

All nondestructive testing shall be performed in accord with a written procedure. NDT Procedures shall be approved by an NDT Level III certified in the method and qualified in accordance with paragraph 1.19. An SCWI or CSA 178.2 LIII may approve visual weld inspection procedures. The procedure shall include, as a minimum, all of the requirements of this appendix, including the requirements of this paragraph and the applicable method section. The parameters for essential and nonessential variables shall be stated in the procedure. Paragraph 1.19 describes the requirement s for the qualification of NDT procedures. In addition to the method section, the procedure shall, as a minimum, contain the following:

(no change to table in 1.18)

Current 1.19.1

**1.19.1** The NDT Level III shall be responsible for the qualification and the technical approval of all NDT procedures, repairs, and service-related testing.

Proposed 1.19.1

**1.19.1** The NDT Level III shall be responsible for the qualification and the technical approval of all NDT procedures~~.~~

# Current 1.19.4.4

# 1.19.4.4 Results of the procedure demonstration shall be documented using an NDT Procedure Qualification Record having spaces to record the procedure identification, signatures, and date. In addition, the applicable NDT report form referenced in the procedure being qualified shall be completed and shall describe the demonstration specimen and results.

# Proposed 19.4.4

# 1.19.4.4 The NDT procedure is considered qualified when the results of the demonstration indicate the ability to detect discontinuities to the satisfaction of the NDT Level III. Results of the procedure demonstration shall be documented using an NDT Procedure Qualification Record Fig T.1 or equivalent form.

# Current 19.4.5

# 1.19.4.5 The NDT procedure is considered qualified when the results of the demonstration indicate the ability to detect discontinuities to the satisfaction of the NDT Level III. An NDT Level III witness and the individual(s) who performed the demonstration examination shall sign the Procedure Qualification Record form.

# Proposed

# Delete 19.4.5, see proposed paragraph 19.4.4.

# Current 1.19.4.7

# 1.19.4.7 If a documented probability of detection study (POD) has been performed for the NDT method, the results will satisfy the procedure demonstration requirements of paragraph 1.19 A procedure qualification record (PQR) must still be completed (See Fig T.1 on page C-III-449).

# Proposed 19.4.7

# 1.19.4.7 If a documented probability of detection study (POD) has been performed for the NDT method, the results will satisfy the procedure demonstration requirements of paragraph 1.19 A procedure qualification record (PQR) must still be completed.

# Appendix T Proposed Changes – Hydrostatic Testing / Electromagnetic Testing

# Add items 17 through 21 to table T1.

**Table T.1 General examination**

|  |  |  |  |
| --- | --- | --- | --- |
| **METHOD** | | **Minimum Number of Questions** | |
| Level I | Level II |
| 1 | Acoustic Emission | 40 | 40 |
| 2 | Leak Testing: |  |  |
| 3 | Bubble | 10 | 10 |
| 4 | Pressure Change | 20 | 20 |
| 5 | Halogen Diode | 20 | 20 |
| 6 | Mass Spectrometer | 20 | 20 |
| 7 | Chemical Reactivity | 10 | 10 |
| 8 | Liquid Penetrant | 30 | 30 |
| 9 | Magnetic Particle | 30 | 30 |
| 10 | Radiography | 40 | 40 |
| 10A | Radiographic Film Interpreter | N/A | 40 |
| 11 | Ultrasonic | 40 | 40 |
| 12 | Ultrasonic Thickness | 10 | 10 |
| 13 | Visual Inspection: |  | |
| 15 | Weld Inspection | 30 | 70 |
| 16 | Thermal/Infrared | 20 | 20 |
| 17 | Hydrostatic Leak Testing | 5 | 5 |
| 18 | Electromagnetic Testing |  |  |
| 19 | AC Field Measurement | 40 | 40 |

# Add items 17 through 21 to table T.2.

**Table T.2 Specific examination**

|  |  |  |  |
| --- | --- | --- | --- |
| **Method** | | **Minimum Number of Questions** | |
| Level I | Level II |
| 1 | Acoustic Emission | 20 | 20 |
| 2 | Leak Testing: |  |  |
| 3 | Bubble | 10 | 10 |
| 4 | Pressure Change | 15 | 15 |
| 5 | Halogen Diode | 15 | 15 |
| 6 | Mass Spectrometer | 20 | 15 |
| 7 | Chemical Reactivity | 10 | 10 |
| 8 | Liquid Penetrant | 20 | 15 |
| 9 | Magnetic Particle | 20 | 15 |
| 10 | Radiography | 20 | 20 |
| 10A | Radiographic Film Interpreter |  |  |
| 11 | Ultrasonic | 20 | 20 |
| 12 | Ultrasonic Thickness | 10 | 10 |
| 13 | Visual Inspection: |  | |
| 15 | Weld Inspection | 20 | 20 |
| 16 | Thermal/Infrared | 20 | 20 |
| 17 | Hydrostatic Leak testing | 5 | 5 |
| 18 | Electromagnetic Testing |  |  |
| 19 | AC Field Measurement | 20 | 20 |

# Current Table T.3

**Table T.3 Minimum initial training and experience requirements**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Examination**  **Method** | **Technique** | **Level** | **Training Hours Requirements** | **Experience Required (Months / Hours)** |
| Acoustic Emission |  | I | 40 | 4 / 280 |
| II | 16 | 8 / 560 |
| Leak Testing | BT | I | 2 | 2 hours |
| II | 4 | .5 / 35 |
| Leak Testing | PCT | I | 8 | 1.5 / 105 |
| II | 4 | 4 / 280 |
| Leak Testing | HDLT | I | 12 | 1.5 / 105 |
| II | 8 | 4 / 280 |
| Leak Testing | MSLT | I | 40 | 4 / 280 |
| II | 24 | 6 / 420 |
| Leak Testing | CRLT | I | 2 | 2 hours |
| II | 4 | .5 / 35 |
| Liquid Penetrant |  | I | 4 | 1 / 70 |
| II | 8 | 2 / 140 |
| Magnetic Particle |  | I | 12 | 1 / 70 |
| II | 8 | 3 / 210 |
| Radiography |  | I | 39 | 3 / 210 |
| II | 40 | 9 / 630 |
| Radiographic Film Interpretera/ |  | II | 18 | 22 hours |
| Ultrasonic |  | I | 40 | 3 / 210 |
| II | 40 | 9 / 630 |
| Ultrasonic  Thickness | UTT | I | 4 | 40 hours |
| II | 8 | 80 hours |
| Visual | Welding Inspection | I | 16 | 1 / 70 |
| II | 16 | 2 / 140 |
| Visual | RVIb/ | I | 8 | 1 / 70 |
| II | 16 | 3 / 210 |
| Thermal/ Infrared |  | I | 8 | 40 hours |
| II | 8 | 80 hours |

# Proposed Table T.3. Add HLT and ET, and remove the months criteria from the Experience Required column.

**Table T.3 Minimum initial training and experience requirements**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Examination**  **Method** | **Technique** | **Level** | **Training Hours Requirements** | **Experience Required (Hours)** | |
| Acoustic Emission |  | I | 40 | 280 | |
| II | 16 | 560 | |
| Leak Testing | BT | I | 2 | 2 | |
| II | 4 | 35 | |
| Leak Testing | PCT | I | 8 | 105 | |
| II | 4 | 280 | |
| Leak Testing | HDLT | I | 12 | 105 | |
| II | 8 | 280 | |
| Leak Testing | MSLT | I | 40 | 280 | |
| II | 24 | 420 | |
| Leak Testing | CRLT | I | 2 | 2 | |
| II | 4 | 35 | |
| Liquid Penetrant |  | I | 4 | 70 | |
| II | 8 | 140 | |
| Magnetic Particle |  | I | 12 | 70 | |
| II | 8 | 210 | |
| Radiography |  | I | 39 | 210 | |
| II | 40 | 630 | |
| Radiographic Film Interpretera/ |  | II | 18 | 22 | |
| Ultrasonic |  | I | 40 | 210 | |
| II | 40 | 630 | |
| Ultrasonic  Thickness | UTT | I | 4 | 40 | |
| II | 8 | 80 | |
| Visual | Welding Inspection | I | 16 | 70 | |
| II | 16 | 140 | |
| Thermal/ Infrared |  | I | 8 | 40 | |
| II | 8 | 80 | |
| Hydrostatic Leak Testing |  | I | 2 | 2 | |
| II | 2 | 2 | |
| Electromagnetic Testing | | ACFM | I | 40 | 210 hours |
| II | 40 | 630 hours |

Current table T.3 Note 2:

Initial experience may be gained simultaneously in two or more methods if the candidate spends a minimum of 25% of work time on each method for which certification is sought. The remainder of the work time claimed as experience is spent in NDT-Related activities as defined in the employers written practice.

Proposed table T.3 Note 2:

(vacant)

Create paragraph 13.0 to address hydrostatic leak testing requirements.

**13.0 Hydrostatic Leak Testing (HLT)**

**13.1 Procedures**

Written procedures for hydrostatic leak testing (HLT) shall include as a minimum the following:

|  |  |  |
| --- | --- | --- |
| **Requirements** | **Essential Variable** | **Nonessential Variable** |
| All provisions of paragraph 1.18 above (NDT Procedure Requirements) |  |  |
| Test Liquid and Test Pressure | X |  |
| Hold times | X |  |

# 13.2 Personnel

# NDT personnel shall be in accord with paragraphs 1.4 through 1.17 above (NDT Personnel).

# 13.3 Calibration

# Equipment calibration shall be in accord with paragraph 1.22 above (Equipment Calibration).

# 13.4 Examination

# 13.4.1 The surface condition of the area of examination shall be in a suitable condition to prevent interference that may block or mask leakage.

# 13.4.2 Test pressures, temperatures, and hold times shall be per the referencing specification or procedure.

# 13.4.2.1 For tank car tanks and interior heater systems refer to 49 CFR 179.

# 13.4.3 Continuous fluid flow, wetting, or dampness from the area of examination shall be evaluated for leakage per the acceptance criteria.

# 13.5 Evaluation

All examinations shall be evaluated in terms of acceptance standards of the referencing specification.

# 13.6 Reports

# 13.6.1 Hydrostatic Leak test reports shall meet the requirements of paragraph 1.20. In addition, the following shall be either contained on the report or specifically identified in the test procedure:

* Test conditions and test pressure.
* Test Liquid type.
* Test Liquid temperature.
* Temperature range requirements.
* Gauge(s) identification.
* Temperature measuring device(s) identification numbers(s).

# 13.7 Records

Records shall be maintained as required by the referencing specification.

Create paragraph 3.4.3 for the BT visible leak technique. Renumber the current 3.4.3 to 3.4.4 and renumber the subsequent paragraphs accordingly.

**3.4.3 Bubble Leak Test (BT) (Visible Leak Technique)**

# 3.4.3.1 This section applies to bottom outlet valves (BOV) and bottom appurtenances applied to tank cars.

# 3.4.3.2 Water, or other liquid with similar viscosity shall be used as the test liquid.

# 3.4.3.3 Sufficient test liquid shall be applied to cover the area of interest.

# 3.4.3.4 Continuous fluid flow, wetting, or dampness from the area of examination shall be evaluated for leakage per the acceptance criteria.

**Add new definition to Chapter 1.**

**Hydrostatic Leak Testing** - A nondestructive hydro or hydro-pneumatic test method in which the component, system, or tank car tank being tested is filled (partially or completely) with water or another liquid of similar viscosity. Internal pressure is then applied to the required value and the area of examination inspected for evidence of leakage.

For the purposes of Appendix T, Hydrostatic Leak Testing is not considered a Hydrostatic Proof Test or any other part of a potentially destructive test.

Create paragraph 14.0 for Electromagnetic Testing

**14.0 Electromagnetic Testing**

**14.1 Alternating Current Field Measurement (ACFM)**

**14.1.1** As a minimum, written procedures shall include the following:

|  |  |  |
| --- | --- | --- |
| **Requirements** | **Essential Variable** | **Nonessential Variable** |
| All provisions of paragraph 1.18 above (NDT Procedure Requirements) |  |  |
| Instrument (Model and Serial Number)1 | X |  |
| Probes (Model and Serial Number)2 | X |  |
| Directions and extent of scanning | X |  |
| Method for sizing (length and depth) indications, when required | X |  |
| Coating | X |  |
| Coating thickness (increase only) | X |  |
| Personnel performance qualification requirements, when required | X |  |
| Surface preparation technique |  | X |
| Personnel qualification requirements |  | X |
| Base material P number (except P1 and P10C can be considered the same) | X |  |

**Notes:**

1. **Serial number is only essential when the instrument is used in conjunction with a laptop or PC.**
2. **Serial number is only essential when the probe configuration must be loaded manually.**

**14.1.2 Personnel**

NDT personnel shall be in accord with paragraphs 1.4 through 1.17 above (NDT Personnel).

**14.1.3 Calibration**

Equipment calibration shall be in accord with paragraph 1.22, “Equipment Calibration,” and the following:

* The material from which the block is fabricated shall be of the same product form and material specification, or equivalent P-number grouping, of the materials being examined. P10C and P1 materials may be considered equivalent P-number grouping.
* Known depth and length notches shall be used to verify that the system is functioning properly.
* The calibration block configuration and notches shall be as shown in ASME Section V – Article 15 – T-1533
* Calibrations shall include the complete ACFM system (e.g. instrument, software, computer, probe, and cable) and shall be performed as prescribed by the manufacturer.
* The same probe to be used during the examination shall be used for the function check.
* Any instrument setting which affects the response from the reference notches shall be at the same setting for calibration, function checks, and the examination.
* The instrument shall be turned on and allowed to warm up for the minimum time specified by the instrument manufacturer prior to performing the function check.
* The selected probe, and cable extensions if utilized, shall be connected to the instrument and the manufacturer’s standard probe file loaded, if applicable.
* The function check shall be performed by passing the probe over the notches in the calibration block and noting the responses. The nose of the probe shall be orientated parallel to the notch length and shall maintain contact with the surface being examined. The probe scan rate shall not exceed 2” per second. A successful function check displays a butterfly loop from notch #1 of 50% (+/-10%) of full scale height and 175% (+/-20%) of full scale width and that also can readily detect a signal response from the smaller notch. If this is unachievable, the probe sensitivity shall be adjusted, a different probe file loaded, or another probe selected and the notches again scanned per this section. It may be necessary to contact the manufacturer if equipment is unable to adjust probe sensitivity.
* A function check shall be made at the start and finish of each examination or series of similar examinations, and when examination personnel are changed.

**14.1.4 Equipment**

ACFM Equipment and software shall be capable of operating over a range of frequencies from 1 to 50 kHz. The display shall contain individual time or distance-based plots of the x compound of the magnetic field *Bx*, parallel to the probe travel, *z* component of the magnetic field *Bz*, perpendicular to the examination surface, and a combined *Bx* and *Bz* plot (i.e., butterfly display).

**14.1.5 Probes**

The nominal frequency shall be 5 kHz unless variables, such as materials, surface condition, or coatings require the use of other frequencies.

**14.1.6 Examination**

The maximum instrument scan speed and probe scanning rate shall not exceed 2” per second. The probe shall be kept in contact with the examination surface during scanning. Probe positioning and scanning shall ensure full coverage of the weld and heat affected zones.

**14.1.7 Evaluation**

All examinations shall be evaluated in terms of acceptance standards of the referencing specification.

**14.1.8 Reports**

Reports shall be made for each examination. As a minimum reports shall contain the following:

* All the requirements of 1.20 above
* Software identification and revision
* Probe frequency
* Probe and/or file identification and revision
* Identification and location of weld or surface examined
* Map or record of rejected indications detected or areas cleared
* Areas of restricted access or inaccessible welds

**14.1.9 Records Retention**

Records shall be maintained as required by the referencing specification.

**Appendix T Proposed Changes – Automated Ultrasonic Testing**

Current 12.1.1

**12.1.1** As a minimum, written procedures shall include the following:

* All the provisions of paragraph 1.18, “NDT Procedure Requirements”
* Weld and/or material types and configurations to be examined, including dimensions and product form
* The surface or surfaces from which the examination shall be performed
* Ultrasonic techniques [pulsed-echo, phased array, or time of flight diffraction (TOFD)]
* Angles and mode(s) of wave propagation in the material
* Search unit type, frequency(ies), and transducer size(s)
* Special search unit, wedges, shoes, or saddles
* Type of couplant and application
* Directions, extent, and method of scanning
* Data to be recorded and method of recording
* Recording equipment, as applicable
* Rotating, revolving, or scanning mechanisms
* Detailed scan plan
* Calibration procedure
* Evaluation of screen height linearity and amplitude control linearity, as in accord with ASME Section V, Article 4

Proposed 12.1.1 (information from current 12.1.1 tabled)

**12.1.1** As a minimum, written procedures shall include the following:

|  |  |  |
| --- | --- | --- |
| **Requirements** | **Essential Variable** | **Nonessential Variable** |
| All the provisions of paragraph 1.18 above (NDT Procedure Requirements) |  |  |
| Weld and/or material types and configurations to be examined, including dimensions and product form | X |  |
| The surface or surfaces from which the examination shall be performed | X |  |
| Ultrasonic techniques [pulsed-echo, phased array, or time of flight diffraction (TOFD)] | X |  |
| Angles and mode(s) of wave propagation in the material | X |  |
| Search unit type, frequency(ies), and transducer size(s) | X |  |
| Special search units, wedges, shoes, or saddles | X |  |
| Type of couplant and application |  | X |
| Directions, extent, and method of scanning | X |  |
| Recording equipment, as applicable |  | X |
| Rotating, revolving, or scanning mechanisms | X |  |
| Detailed scan plan | X |  |
| Calibration procedure | X |  |
| Evaluation of screen height linearity and amplitude control linearity, as in accord with ASME Section V, Article 4 | X |  |

Create paragraph 12.2.1

**12.2.1** AUT personnel certification falls under UT requirements.

Current:

**12.3.3**    Reference standards of the same configuration of the test material shall be scanned dynamically at the same speed at which the examination will be performed.

**12.3.4** Overall dimensions and shape of the reference standard shall be determined by the size of the search unit array and scanning device.

**12.3.5**   Reference standards shall be of the same product form, P-number grouping, nominal thickness, and radius (±10%).

Proposed:

**12.3.3**   Calibration and calibration blocks shall be in accordance with ASME Section V, Article 4, except that  calibration block material of P10C may be considered equivalent to P1 material.

**~~12.3.4~~** ~~Overall dimensions and shape of the reference standard shall be determined by the size of the search unit array and scanning device.~~

**~~12.3.5~~**~~Reference standards shall be of the same product form, P-number grouping, nominal thickness, and radius (±10%).~~

Current 12.4.3

**12.4.3** Phased array or multi-channel pulsed-echo focused search units utilizing zone discrimination shall be utilized. Time of flight diffraction (TOFD) may be used in addition to the above.

Proposed 12.4.3

**12.4.3** Phased array or multi-channel pulsed-echo focused search units utilizing zone discrimination shall be utilized. Time of flight diffraction (TOFD) may be used in addition to the above for newly applied welds. TOFD may be used as a “stand-alone” technique for structural integrity inspection when qualifying groove welds in the bottom 4’ of the tank car tank.

Current 9.4

9.4 Examination

9.4.1 Weld Inspection

Weld inspection should be made when access is sufficient to place the eye within 24 in. of the

surface to be examined at an angle of not less than 30° to the surface to be examined. Mirrors may

be used to improve the angle of vision, and aids such as a magnifying lens may be used to assist

examinations. The specific part, component, tank, or section thereof, under immediate

examination shall be illuminated with sufficient lighting as defined by the procedure.

9.4.2 Remote Visual Inspection

9.4.2.1 Remote visual inspection shall be performed with suitable remote equipment.

9.4.2.2 If remote inspection will include weld inspection, the remote technician shall be weld

inspection certified.

Proposed 9.4.3

9.4 Examination

9.4.1 Weld Inspection

Weld inspection should be made when access is sufficient to place the eye within 24 in. of the

surface to be examined at an angle of not less than 30° to the surface to be examined. Mirrors may

be used to improve the angle of vision, and aids such as a magnifying lens may be used to assist

examinations. The specific part, component, tank, or section thereof, under immediate

examination shall be illuminated with sufficient lighting as defined by the procedure.

9.4.2 Remote Visual Inspection

9.4.2.1 Remote visual inspection shall be performed with suitable remote equipment.

~~9.4.2.2 If remote inspection will include weld inspection, the remote technician shall be weld~~

~~inspection certified.~~

**9.4.3 Visual Inspection – Other Than Welds**

**9.4.3.1  Visual inspection of components other than welds such as tank shells and heads; service equipment including gaskets; fasteners, closures, protective housings, excess flow valves, markings or any other component on a tank car tank (not including welds covered by App W or AWS D15.1), shall be conducted by personnel who have received function specific training in accordance with a facility’s training program as detailed in their quality assurance manual.**