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Calibration of Track Inspection and Testing Equipment

ETP-00-04

Applicability

ARTC Network Wide SMS

Publication Requirement

Internal / External

Primary Source

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Document Status

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1.0	05 Apr 23	Standards	Stakeholders	Manager Track & Civil Standards	Head of Engineering Standards 11/04/2023

Amendment Record

Amendment Version #	Date Reviewed	Clause	Description of Amendment
1.0	05 Apr 23		Document Renumbered from ETE-00-01 and updated to cover testing frequencies.

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RELEVANT EXTRACT FROM AS 4292.1 Section 6.2 (e)

6.2 PROCESS CONTROL

Activities directly affecting railway safety shall be carried out under controlled conditions which shall be achieved as follows:

(e) By the control, calibration and maintenance of all equipment (which for the purposes of this Standard includes remote event detection equipment) used for the purposes of inspection and testing. The organization shall ensure that this equipment is used correctly with known measurement uncertainty and is consistent with the required measurement capability.

1 Calibration Requirements

AS 4292.1 Section 6.2 requires all equipment used for inspection and testing of safety critical aspects of the railway, to be calibrated.

This procedure covers calibration requirements for instruments and equipment used in inspection, testing and measurement during maintenance or construction of trackwork across the ARTC network.

ARTC has three categories of calibration requirements:

- Safety Critical Equipment - Hand Held
- General Testing Equipment
- Vehicle Mounted or Automated Wayside Equipment (see Section 5 for examples)

This procedure covers the specific requirements of Safety Critical Equipment and General Testing Equipment.

The specific requirements for calibration of *Vehicle Mounted or Automated Wayside Equipment* are to be addressed in their machine specific safety case following the principles set out in this Standard.

2 Responsibility

Each team involved in the inspection, testing or measuring of ARTC track should nominate the person responsible for calibration of the test equipment.

3 Calibration accuracy & frequency

1. The calibration accuracy and frequency of commonly used Safety Critical Equipment is suggested in table 1.
2. The calibration accuracy and frequency of commonly used General Testing Equipment is suggested in table 2.

   The proposed frequency and accuracy of the calibration sho take into account the factors listed in Section 6 and:

   - Required accuracy of equipment being calibrated
   - Normal scale of measurements taken
   - Reliability of equipment being calibrated
   - Likelihood of testing equipment to lose calibration
   - Any likely human error
   - Risk regime of end product to be measured or tested
3. In addition to the regular tests defined in 1) and 2) above, equipment shall be calibrated or replaced:
   - Where it has been damaged
   - Or where it is reasonable to suspect that it may have been damaged.

4 Records of calibration

Records of calibration should include:

- Date of calibration check
- Equipment ID
- Calibration Result (Pass or Fail)
- Date and signature of person authorising the calibration results
- Value of calibration tolerance (where applicable)

Records shall be retained by the person nominated in Section 2 for audit purposes for seven years.

A suggested form for calibration of equipment is shown in Appendix A

5 Determination of Safety Critical Equipment

1. Hand held equipment is deemed to be *Safety Critical Equipment* if it is used to define, test or measure:
    - Track Geometry
    - Track Clearances
    - Structural Clearances

    Note: This may include (but is not limited to) instruments used to check or define:

    - *horizontal track alignment, including curve radius, cant, transitions and cant gradients*
    - *track vertical alignment, including gradients and radii of vertical curves*
    - *track centres*
    - *whether any rails on curves are subject to sidewear or headwear*
    - *the lateral and vertical track fixity (rail stress and track fixings)*
    - *the permissible or enhanced permissible speed*
2. Other hand held equipment used for testing inspection or measuring of track work is deemed to be *General Testing Equipment*.
3. Rail mounted vehicles used for testing or inspection of track, or automated line-side equipment used to test rolling stock characteristic, is deemed to be *Vehicle Mounted or Automated Wayside Equipment*

    Note: This may include (but is not limited to) the following:

    - *AK Car or EM80*
    - *Rail Profile Car (Laser Rail)*
    - *Ultrasonic testing cars*
    - *Wayside Detection of Hot Wheel Bearings*
    - *Wheel Impact Load Detectors*
    - *Angle of Attack Monitors*
    - *Tampers*
    - *Rail Grinders*
    - *VERSE (Rail Stress Testing)*
    - *RailFrame*

6 Method of Calibration

Suggested methods of calibration are listed in Tables 1 & 2. Alternative test methods (including intervals) are acceptable if recorded in the appropriate asset management system.

The following should be considered when selecting an alternative Method of Calibration:

- Accuracy of the calibration test method
- Robustness/ repeatability of the calibration test method
- Safety of people using the calibration test method
- Required accuracy of equipment being calibrated
- Location and ease of access to the equipment being calibrated
- Reliability of equipment being calibrated
- Normal scale of measurements taken by equipment being calibrated
- Auditability of test method.
- Relevant Standards or manufacturer's recommendations for the equipment being calibrated

7 Action to be taken when measured equipment is out of calibration

7.1 Procedure identifying actions required

A procedure shall be in place that identifies the actions required when:

- the accuracy of the equipment differs from those recorded in table 1
- Site measurements vary significantly from previous recorded measurement

7.2 Actions required by the procedure

The actions required by the procedure shall take into account:

- Whether it is Safety Critical Equipment or not
- the amount by which the measurements differ from those shown in table 1

The procedure shall clearly state the timescale for action. It shall also state whether the equipment is to be recalibrated or destroyed. The actions required by the procedure shall be implemented.

8 Masters Gauges or Measuring Equipment

A procedure governing the use of the Master Gauges or Measuring Equipment shall be kept with the equipment. All equipment used as a 'Master' shall be kept in conditions which ensure it retains its accuracy and shall not be used for general site measurement.

Note: Master Gauges or Master Measuring Equipment are test equipment kept in perfect condition and are only used to check the accuracy of actual testing equipment.

9 Table 1: Safety Critical Equipment Calibration Guide

Equipment Description	Calibration Interval	Calibration Accuracy	Suggested Method of Calibration Check
Calibration Devices and Master Gauges. *See section 8*	3 Yearly	Half of calibration test accuracy	Independent 3rd party check or purchase new
Track Gauges *or* Combination Gauges *or* Cant Boards	Before use (Cross level)	+/- 2mm cross level	Check in the Field Regularly Repair if readings are suspect Place gauge on level track and record cant. Reverse (rotate through 180º) gauge. Check cant measurements are identical. If Track Gauge is adjustable split any minor discrepancy. Repeat on a range of cants (suggest: 30, 60, & 90mm).
Check Rail Gauges	6 monthly (Gauge) OR 12 monthly	+/- 0.5mm Gauge	Measure gauge with good quality steel tape reserved for calibration. Set up master jig in depot. Use of 3rd party calibration
Turnout measuring equipment:			Check in the Field Regularly Repair if readings are suspect
Calliper	6 monthly	+/- 0.5mm	Check for free play or looseness when open and closed.
Gauge face angle Go/ No go gauges	3 yearly 3 yearly	+/- 0.5º +/- 1%	Compare against master gauges reserved for calibration.
Rail Temperature Gauge	Annually	+/- 1 deg C	Check in the Field Regularly Replace if readings are suspect Compare with Master Gauge reserved for calibration or Assemble as many rail temperature gauges together and compare readings at 0ºC, 35ºC and 70ºC
Ultrasonic equipment (calibration blocks, probes, gain, linearity etc)	As per ETE-01-03 Non-Destructive Testing of Rail (for Internal & Surface Defects)	As per ETE-01-03 Non-Destructive Testing of Rail (for Internal & Surface Defects)	As per ETE-01-03 Non-Destructive Testing of Rail (for Internal & Surface Defects)

10 Table 2: General Testing Equipment Calibration Guide

Equipment Description	Calibration Interval	Calibration Accuracy	Suggested Method of Calibration Check
Measuring wheel Hand Held Laser distance measurement device	Annually Annually	+/- 1% +/- 3.2mm	Measure out 10m and 30m with equipment. Check measurements with good quality or Check against 5mm Master steel tape reserved for calibration.
Taper gauge	3 Yearly	+/- 1%	Vernier Gauge
Feeler gauge	5 Yearly or when illegible, damaged or broken	+/- 1%	Replace
Bar gauge	6 monthly	+/- 0.3mm	Check against Master profiles & feeler gauges
Straight edge Straight edge nibs	3 monthly At purchase	+/- 0.1mm +0 / -0.1mm	Locate a master piece of rail kept for calibration purposes or a piece of good condition smooth rail. Place straight edge on rail Reverse (rotate through 180º) straight edge. Check for snug fit in both directions. OR Check against A master straight edge (Master to be manufactured to accommodate the nibs of the field straight edge). To be certified by manufacturer.
Electronic Straight Edge	Before use, no more than weekly 5 Yearly	Manufacturers recommendation	Using calibration bar / kit supplied Return to 3rd party as per supplier advice
Torque wrench	Manufacturer's recommendation	+/- 4%	Check in the Field Regularly Repair if readings are suspect Use Manufacturer's specified calibration method. Field Test Use a Master torque wrench to tighten a bolt to the first value of its range (or until 'click' on basic wrenches.) Try the suspect wrench at the same setting, it should break away before turning that bolt. Then, loosen the bolt and tighten it to the same value with the suspect wrench. Check the bolt with the Master wrench. If the bolt does not turn, the suspect wrench is probably good for that torque value. Repeat for other torque values.
MiniProf (for rail profiles)	Annually OR Manufacturer's recommendation	+/-0.05mm Manufacturer's recommendation	Check calibration against a known rectangular calibration block Manufacturer's recommendation
Railmate	Manufacturers recommendation	Manufacturers recommendation	Manufacturers recommendation

Equipment Description	Calibration Interval	Calibration Accuracy	Suggested Method of Calibration Check
P1 gauge (Dipped weld gauge)	Before Use	+/- 10% of the acceptable zone	Run gauge over a flat, straight piece of rail and check deviation of the gauging pin from the zero position.
	Yearly	+/- 5% of the acceptable zone	Compare zero reading on flat rail or flat surface to reading with wheels on flat surface and gauging pin on 0.35 feeler gauge which is the NO GO condition.

11 Appendix A : Suggested Calibration Records Form

Equipment Description:	
Serial/I.D. No.:	
Date Issued:	
Nominal Calibration Interval:	

Date Calibrated	/ /	/ /	/ /	/ /
Location/Owner				
Accuracy Required	+/- mm	+/- mm	+/- mm	+/- mm
Calibration Accuracy	+/- mm	+/- mm	+/- mm	+/- mm
Calibration Status	PASS / FAIL	PASS / FAIL	PASS / FAIL	PASS / FAIL
Calibrated By				
Method of Calibration				
Action to be taken				
Date for next Test				
Date & Signature of Calibration Authoriser	/ /	/ /	/ /	/ /
Notes				