



AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: Engineering (Track & Civil)

Category: Standard

Calibration of Track Inspection and Testing Equipment

ETE-00-01

Applicability

ARTC Network Wide	✓	Western Jurisdiction	
New South Wales		Victoria	

Primary Source

First issue

Document Status

Version	Date Reviewed	Prepared by	Reviewed by	Endorsed	Approved
2.2	16 Jan 09	Standards dept	Manager Standards	Chief Operating Officer	Risk & Safety Committee 07/10/2008 as part of ETE-01-03 approval

Amendment Record

Version	Date Reviewed	Clause	Description of Amendment
1.0	08 Aug 06		First issue
2.0	26 Apr 07	All	Major revision
2.1	15 Jun 07	10	Table 2 - spelling errors corrected and minor amendment to better define Suggested Method of Calibration for P1 Gauge
2.2	16 Jan 09	3; 9	Position title updated; Table 1 – reference to superseded NSW standard TEP 19 replaced with ETE-01-03

© ARTC 2009. This document is the confidential property of Australian Rail Track Corporation.

Disclaimer

This document is for internal use by the Australian Rail Track Corporation LTD (ARTC) only and may not be relied upon by any other party.
ARTC: 1. does not accept any liability or responsibility whatsoever for this document in respect to any use or reliance upon it by any other party;
and 2. does not provide any warranty as to the accuracy or reliability of this document.

This document is uncontrolled when printed. See ARTC Intranet for latest version.

Contents

1	Calibration Requirements	3
2	Responsibility	3
3	Calibration accuracy & frequency	3
4	Records of calibration	4
5	Determination of Safety Critical Equipment	4
6	Method of Calibration	5
7	Action to be taken when measured equipment is out of calibration.....	5
	7.1 Procedure identifying actions required.....	5
	7.2 Actions required by the procedure	5
8	Masters Gauges or Measuring Equipment	5
9	Table 1: Safety Critical Equipment Calibration Guide	6
10	Table 2: General Testing Equipment Calibration Guide	7
11	Appendix A : Suggested Calibration Records Form	8

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 4 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 Organisation involved in the inspection, testing or measuring of ARTC track shall 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.
- 3) Where equipment is not defined in either Table 1 or 2 and is considered to be *Safety Critical – Hand Held*, the ARTC Executive Manager Standards, Systems & Performance shall be advised. The advice shall include brief details of the equipment and the proposed frequency and accuracy of the calibration.

The proposed frequency and accuracy of the calibration shall 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
- 4) 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 Wheel Bearings
 - Impact Detectors
 - Angle of Attach Monitors
 - Tampers
 - Rail Grinders
 - VERSE
 - CAT
 - RailFrame
-

6 Method of Calibration

Suggested methods of calibration are listed in Tables 1 & 2. Alternative test methods are acceptable.

The following shall 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. <i>See section 8</i>	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	<u>Check in the Field Regularly</u> <u>Repair if readings are suspect</u> Place gauge on level track and record cant. Reverse (rotate through 180°) 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)	+/- 0.5mm Gauge	Measure gauge with good quality steel tape reserved for calibration. Set up master jig in depot.
Turnout measuring equipment: Calliper	6 monthly	+/- 0.5mm	<u>Check in the Field Regularly</u> <u>Repair if readings are suspect</u> Check for free play or looseness when open and closed.
Gauge face angle Go/ No go gauges	3 yearly 3 yearly	+/- 0.5° +/- 1%	Compare against master gauges reserved for calibration.
Rail Temperature Gauge	Annually	+/- 1 deg C	<u>Check in the Field Regularly</u> <u>Replace if readings are suspect</u> Compare with Master Gauge reserved for calibration or Assemble as many rail temperature gauges together and compare readings at 0°C, 35°C and 70°C
Survey Instruments (EDMs, Theodolites, Dumpy levels, Spirit levels, Tape measures etc)	Before Use	+/- 0.5mm	Manufacturers recommendation (3 peg tests, steel tapes, referenced makers)
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	Annually	+/- 1%	Measure out 10m and 30m with equipment. Check measurements with good quality or Check against 5mm Master steel tape reserved for calibration.
Hand Held Laser distance measurement device	Annually	+/- 3.2mm	
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	3 monthly	+/- 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 180°) 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.
Straight edge nibs	At purchase	+0 / -0.1mm	
Torque wrench	Manufacturer's recommendation	+/- 4%	<u>Check in the Field Regularly</u> <u>Repair if readings are suspect</u> 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	+/-0.05mm	Check calibration against a known rectangular calibration block
EZ2	Manufacturers recommendation	Manufacturers recommendation	Manufacturers recommendation
Railmate	Manufacturers recommendation	Manufacturers recommendation	Manufacturers recommendation
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				