RAIL WHEEL INSPECTION

QA Procedure: ISP-QA-04

Infrastructure Services

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1.0 PURPOSE and SCOPE

This procedure covers the routine inspection and examination of rolling stock wheels fitted onto axles and bogies as well as individual loose wheels not yet installed onto rolling stock. It applies to the Infrastructure Services branch.

2.0 REFERENCES

a) ROA – Manual of Engineering Standards and Practice, Section 24.2 Bogies – Wheel Condition
b) COP DIRN Vol 5 – RCP 2303, Section 2, Inspection and Limits
c) Rail-Plant-2-100-12 John Holland P/L Rail Division Procedure – Rail Wheel Inspection

3.0 TERMINOLOGY

![Diagram of wheel terminology]

Fig 3.1  Fig 3.2

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4.0 IDENTIFICATION OF WHEELS, WHEELSETS and BOGIES

The diagram below illustrates the method to be used for numbering of wheels, wheelsets and bogies.

NOTES:

1. The A end of the rollingstock is always the end closest to where the handbrake wheel is mounted. For track machines it is designated as the direction of travel in normal work mode.
2. If a wagon is fitted with brake wheels on the side of the wagon, the A end of the wagon is the end nearest to the brake wheels.
3. The prefix L and R identifies the Left and Right side of the rollingstock respectively when viewed from the B end of the wagon.
4. Wheelset components are to be located by assigning the prefix L1, R1, L2, R2, etc to the component description.
5. Axle numbers are described using the identical method as above. Eg, axle number 2 is a part of wheelset number 2, and likewise axle number 4 is a part of wheelset number 4.
6. Bogie numbers are shown as above with bogie no.1 being closest to the A end of the rollingstock.
7. Couplers and drawbars are identified as being at either the A end or B end of the rollingstock.
8. Note that if the rollingstock has only two axles then the terminology used to describe the axle location shall be wheel set 1 and wheel set 2.
5.0 PROCEDURE

5.1 Daily Pre Travel and Pre Work Inspection

Wheels shall be visually inspected for profile, flange, rim and general physical condition whenever a brake block is replaced and prior to leaving any siding and traveling on any running track.

Where a visual inspection indicates that the condition of the wheel may be approaching or exceeding any of the limiting parameters or conditions specified hereafter, wheels should be checked for contour, flange condition and rim thickness using either the standard wheel condemning gauge (see fig. 7.3) or the steel wheel gauge (see figs 8.1 and 8.2 ref Drawing A2-P5-528) and results noted on the Operator Daily Inspection Checklist and a Plant Fault Report raised.

Particular attention should be given to the form and condition of the wheel flange because of the potential for rail climb and derailment caused by either worn, irregular or deformed flanges, such as arrises, wear grooves, machining marks, steps, sharp flange angle etc. This is just as important for the crest and back of the flange as it is for the running surface of the rail side.

The flange and tread should be inspected for thermal cracks, spalling, skid flats, scaling and tread wear. In determining the severity of any defects found, reference can be made to ROA Wheel Defects Manual in which example defects and their classification are provided. This manual also gives advice on speed restrictions that apply to defective wheels or if the wheel is not to be used until the defect is rectified.

Wheel inspections performed as daily inspections or part of normal train inspections may not generally cover the full wheel because of practical limitation on the access to all parts of the wheel. However if any defects are identified during this inspection the whole wheel shall be closely examined.

5.2 Periodical Inspection and Maintenance

Wheels shall be inspected for profile, flange, rim and general physical condition at scheduled inspections.

The inspection shall include measurements of Rim Thickness, Flange Width, Flange Height, Flange Angle and Tread Hollowing. The wheels, or wheel sets, will require repair or replacement if limits referred to in item 6 below are exceeded. These measurements shall be recorded on the rail wheel inspection record ISF-QA-07 and retained on the asset file suitable register for the life of the vehicle.

Wheels are also to be inspected for any visible indication of lateral displacement or rotation on the axle wheel seat. A back to back measurement and inspection of the wheel axle contact area should identify if the wheel is out of position.

Note: Scheduled Inspections must also include check of Wheel Set Back to Back Gauge.

For explanation of the wheel or wheel set numbering system see section 4.
6.0 LIMITING PARAMETERS OF RAIL WHEELS

Reference: ROA – Sect 24.2.1 Wheel Condition
COP DIRN Vol % - RCP 2303, Section 2, Inspection and Limits

Minimum permissible flange height above tread running surface 35 mm
Maximum permissible tread wear below flange as indicated on measuring gauge 7 mm

Maximum permissible tread hollowing
  Vehicles with speeds not exceeding 115 km/hr 3 mm

Minimum permissible flange thickness 19 mm
Minimum permissible flange angle 1:6

Minimum permissible rim thickness
  Up to 25 tonnes axle load 20 mm

Maximum permissible variation in wheel tread diameter between wheels
  On the same axle (when new or re-turned) 0.5 mm
  In the same bogie 25 mm
  In the same vehicle 60 mm
7.0 APPLICATION OF STANDARD WHEEL CONDEMN GAUGE

The gauge should be inspected for calibration and any obvious sign of damage prior to use. If found to be out of calibration or damaged, return to the relevant functional manager.

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**Figures 7.1 & 7.2**

GAUGING THICKNESS: CONDEMN THICKNESS 19mm

“E" FLANGE ANGLE – IF THE FLANGE TOUCHES THE GAUGE ABOVE THE SLOT ON FACE "E" THE WHEEL IS CONDEMNED

**Figure 7.4**

GAUGING "G" FLANGE HEIGHT (ALTERNATIVE POSITION)

GAUGING "A" FROM INNER RIM CONDEMN THICKNESS 20mm

"G" FLANGE CONDEMN HEIGHT 35mm

**Figure 7.3**

GAUGING FROM CONDEMN GROOVE
8.0 APPLICATION OF THE STEEL WHEEL MEASURING GAUGE

The gauge should be inspected for calibration and any obvious sign of damage prior to use. If found to be out of calibration or damaged, return to the relevant functional manager. Record all measurements taken on form ISF-QA-07 Rail Wheel Profile Inspection Record.

8.1 Rim Thickness

Position steel wheel gauge against back of flange, at right angle to tread face, with base of gauge pointing towards centre of wheel. Whilst ensuring gauge point ‘A’ is again tread face, take measurement at point ‘D’, indicated on 8.1. (Condemn limit < 20m for axle loads up to 25 tonne).
8.2 Flange Width

Without moving stock of gauge from above position, rotate swing arm until point ‘B’ is against inner face of flange. The measurement point is at a junction of zero mark on stock of gauge and scale on swing arm.

Condemn limit < 19mm.

Figure 8.2 Use of Steel Wheel Measuring Gauge - Flange Thickness

8.3 Flange Height

Leaving stock of gauge in the above position, rotate swing arm in a clockwise direction until it contacts the top of flange – point ‘C’. The measurement point is at junction of zero mark on the swing arm and scale on stock of gauge. The scale on the gauge is read in millimeters. Note that the term “Tread Wear” and “Flange Height” is used concurrently by industry to describe the radial difference between a point at the extremity of the flange and a point at the centerline of the wheel tread.

- 0 on the gauge equates to a wear of 0 mm and a flange height of 28 mm (New Profile ANZR-1, ANZR-2)
- 5 on the gauge equates to a wear of 5 mm and a flange height of 33 mm
- 7 on the gauge equates to a wear of 7 mm and a flange height of 35mm (condemn limit)
8.4 Tread Hollowing

Visual examination of the wheel tread is necessary to determine the presence of hollow tread. This condition results in the loss of effective wheel conicity that produces high flanges and significantly reduces the tracking ability of a bogie. The amount of tread hollowing is measured by applying a straight edge across the wheel tread so that the inner edge is near the root of the flange and 90 mm from the rim face as shown in Figure 8.4. The gap between the straight edge and the wheel tread is measured and if more than 3 mm the vehicle shall be marked “For Repair”. The straight edge may be any convenient item, the extended leg of the standard wheel gauge being a suitable device. No speed restriction is required.

On a new profile the tread surface is flat at a gradient of 1:20 fall toward the inside rim face away from the flange. The wheel will wear on the contact band between the wheel and the rail head and hence tread hollowing will develop.
9.0 WHEEL SET BACK TO BACK GAUGE

The back-to-back dimension of a wheelset should be checked at all scheduled inspections, after any derailment and at any other time the wheel condition may indicate a bent axle or incorrectly positioned wheel. All measurement taken shall be recorded on Rail Wheel Inspection Record ISF-QA-07.

These conditions are sometimes indicated by visible misalignment in wheel rotation or uneven wear patterns on the flange or tread.

The back-to-back dimension should be gauged at not less than three (3) locations equally spaced around the rim of the wheels and should be within the range of:

Broad Gauge (1600mm, 5ft 3in) – Back to back gauge = 1522 to 1525 mm

The back-to-back dimension shall be measured from the flat gauge side face of the wheel tread ensuring that the radius leading to the flange is not included in the measurement.

A variation of 3 mm or more between any of the back-to-back dimensions on a single wheelset may indicate a bent axle or distorted wheel and further examination is required. This wheelset should be forwarded to an appropriate repair facility for further inspection by spinning between centres and checking run-out with dial gauges etc.

9.1 Wheelset Derailments

Whenever a wheelset is involved in a derailment or similar incident each wheel shall be given a thorough examination to identify any potential defects that may have resulted from or to the incident.

Such examination shall include a complete back-to-back gauge check of each wheel set involved in the derailment and measurement recorded on ISF-QA-07 Rail Wheel Inspection Record.