Class 66 Wheelset Overhaul Specification

Contents

1. SCOPE

This specification is for the overhaul of Direct Rail Services Limited (DRSL) Class 66 Wheelset assemblies to EMD Part No's 40123124 & 40143298. This specification also includes the overhaul of suspension tubes and inspection of gearwheels but excludes any procedures for the overhaul of axle bearings or the traction motor gearcase.

2. PURPOSE

This specification defines the minimum technical requirements for the overhaul of wheelsets in order to restore them to a condition which permits them to be re-used safely and reliably for a further service life.

3. DEFINITIONS, HANDLING & SAFETY

(Reference documents WOSS 612/10, RIS-2704-RST and TN/TS 0574)

3.1. DEFINITIONS OF TERMS

Within this specification, any of the terms used from the list shall be regarded as having the definition stated and any terms not defined shall be as defined in BS 5892 Part 6.

TERM	DEFINITION
AAR	Association of American Railroads.
Change	Remove the original, and fit a new or overhauled part or assembly in its place.
Check	Determine a particular nominated condition before, during or after repair, e.g. completeness, security, position corrosion etc.
Clean	Using an approved method, remove all dirt, deposits, corrosion products, oil, grease based compounds, and protective compounds that are not correctly adhered to the surface, e.g. loose paint.
Contract Officer	The person appointed by the customer to place and administer the overhaul contract.
Defect/Defective	Any fault or faults in a component or assembly, which may prevent the component or assembly from fulfilling its designed purpose, e.g. cracking.
Delivery	This shall be taken as the transportation of the product to another site for the next activity (or storage) to be carried out. For this purpose, final inspection and test shall include visual verification of the product on delivery and on removal from a vehicle.
Design Life	The total time or distance over which a wheelset is intended to provide a defined standard of performance subject to a pre-defined regime of maintenance, repair and overhaul.
Dismantle	Take to pieces.

Examine	Using visual methods, determine general condition before repair, e.g. wear, cracks, splits, leaks, scoring, corrosion, distortion, looseness.
Fit for purpose	No defects present, caused by handling, storage or transportation problems, which will impair the integrity of the wheelset through a further service life.
Gauge	Determine a nominated dimension by using suitable measuring equipment, e.g. ruler, micrometer, callipers, feeler gauge, or Go/No-Go gauge. Gauge over a representative number of points on the surface.
Handling	This covers means of moving the product within Contractors/Train Operator sites, and on or off transport used in transferring the product between sites.
Inspect	Determine conformity to required standards during and after overhaul and repair.
Locomotive Wheelset	A wheelset which will be fitted to vehicle which is solely a source of motive power.
Manager	The person having responsibility for controlling and directing the supplier's activities relating to wheelsets. For the purpose of this document the Manager is the Contract Officer.
MPI	Magnetic Particle Inspection.
Non-Destructive Testing (NDT)	The process of examination of the wheelset to enable its integrity to be assessed, by a means which does not compromise the service life or design life of the wheelset.
Overhaul	Overhaul is any attention given to the wheelset when it is removed from a vehicle or bogie and when an interference fit of any item other than a wheelset bearing is broken.
Packaging	This covers conventional packaging of roller bearings, etc, and the partial protection applied to prevent corrosion and damage of vulnerable parts of assembled wheelsets, such as bearings, gears, brake discs, earth return brushes, etc.
Product	This covers wheelsets and any attached components not fitted to vehicles, whether new, repaired or for repair, or for transfer to another vehicle. It covers any wheelsets being removed from or fitted to a vehicle. It also covers wheelset components and any components fitted to wheelsets.
Reassemble	Put together.
Record/Records	Put down in writing/enter in a computer system, the result of any specified examination, test or inspection, in accordance with defined procedures.
Rectify	To make serviceable using approved procedures (does not include renewal).
Refit	Put back and reconnect.

Re-manufacture	The process and assembly operations culminating in the production of a wheelset, which whilst incorporating a new axle, also incorporates re-used components.
Remove	Disconnect and take off.
Renew	Remove and scrap the original part, and provide a new or overhauled part as specified in its place.
Repair	Any attention given to the wheelset when it is removed from a vehicle or bogie which does not require the interference fit of any item other than a wheelset bearing to be broken.
Report	Convey to the person nominated by the contract officer, the condition of the item examined.
Scrap	Dispose of in a manner which prevents its re-use and is not detrimental to human safety or associated equipment performance, in accordance with environmental protection and COSHH regulations.
Serviceable	A component is serviceable if it is ready to be used in building up a wheelset during repair or overhaul. A wheelset is serviceable if it is new or has been overhauled or repaired and is ready to be fitted to a vehicle.
Service Life	The time or distance over which a wheelset safely continues to meet defined technical standards, before overhaul is required.
Storage	Covers the storage of the product between different activities. The degree of security and environmental protection required will depend on the product stored, for example roller bearings require more stringent conditions than rough rolled tyres.
Strip	Take off covering, e.g. paint, polish, and fabric.
Supplier	This covers the part of an organisation, e.g. Contractors workshop, Train Operator's Depot or store, etc dealing with the product.
Test	Prove correct operation by specified trial.
Transportation	This covers the movement of wheelsets or components between sites.
UAT	Ultrasonic Axle Test.
UAT Transparency	Sensitivity of axles to UAT is defined in terms of their transparency to UAT. For the purpose of this specification, axles defined as having FULL or MINIMUM transparency are ACCEPTABLE and axles defined as having LOW transparency are UNACCEPTABLE.
Unserviceable	A component is unserviceable if it has been removed from a wheelset and is awaiting repair or overhaul. A wheelset is unserviceable if it has been removed from a vehicle and requires repair or overhaul prior to being refitted to a vehicle.
Wheelset	A complete unit comprising an axle and two complete wheels together with gearwheel, suspension tube assembly, spacer, axle bearings and their end caps.

Table 1: Definition of Terms

3.2. HANDLING, STORAGE & TRANSPORT

3.2.1. HANDLING

3.2.1.1. LOADING / UNLOADING

Wheelsets must be loaded and unloaded using non-damaging fibre slings around the Axle bearing units, or by hooks or clamps with rounded corners locating under the rim or by suitably padded cradles (e.g. lined vee-blocks) under the suspension tubes, or by a mechanism in contact with the wheel tread (See figs 1 and 2).

Metallic lifting devices, such as lift truck forks or rope/chain slings must not come in direct contact with the wheelset. If forklift trucks are used to load and unload wheelsets they must be fitted with suitably padded cradles (e.g. lined vee-blocks), which will not cause damage to the suspension tube.

3.2.1.2. HANDLING OF WHEELSETS

Wheelsets shall be handled with the appropriate degree of care in accordance with RIS-2704-RST using the methods illustrated in Figure 1 and Figure 2 (or similar alternatives).

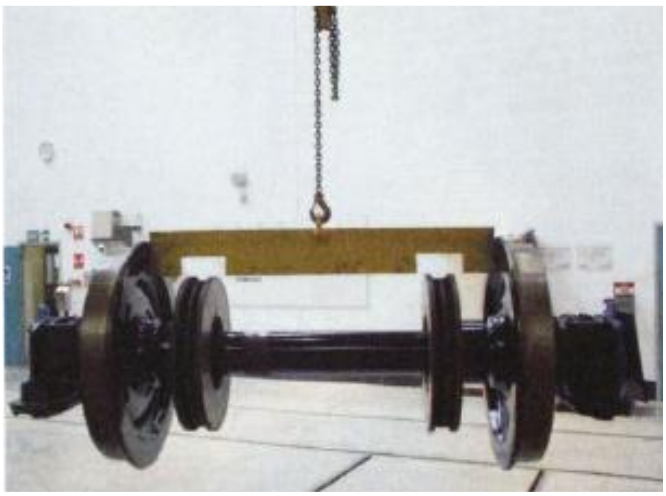


Figure 1: Wheelset lifting beam

Figure 2: Lifting beam with scissor clamps secured by locking pin

Wheelsets that require overhaul or repair, shall be handled in such a way as to ensure damage is not caused to the axle, axle mounted bearings or any other component that may be re-used.

3.2.1.3. HANDLING OF COMPONENTS

Finished or part finished parts such as bearings, axles, gearwheels etc, must not be loaded or unloaded when exposed to corrosive environments.

Where individually wrapped bearings are handled manually, hands, clothing and surfaces used to support the bearings must be free of grit or other potentially damaging material.

Finished machined wheels, gearwheels, suspension tubes and axle bearing units must be handled using non-damaging fibre slings or hooks with rounded off edges.

Finished machined wheels shall be handled with the appropriate degree of care in accordance with RIS-2704-RST using the methods illustrated in Figure 3 and Figure 4

Figure 3: Lifting wheel pan with scissor clamp

Figure 4: Lifting wheel pan with 3-point lift

Axles must be handled using non-damaging fibre slings, or hooks attached to temporary lifting attachments fitted on axle ends.

After removal of wheels from the axle, wheels seats shall be protected from mechanical damage and corrosion.

Magnetic hoists must not be used to handle components, as this will leave residual magnetism, which may prove detrimental to the bearings mounted on the axle.

Components must be transported securely on pallets, with adequate separation of adjacent items.

Covered transport must be provided for finished machined components such as axles, bearings, gearwheels and suspension tubes etc.

Care shall be taken to ensure that the exposed axle ends on partly assembled wheelsets, e.g. axle and gearwheels assemblies, are adequately protected during transport.

3.2.2. STORAGE OF WHEELSETS

Wheelsets should be stored under cover in a well ventilated area. The storage method shall prevent any contact between the wheelset and water or solid debris, and also prevent the formation of condensation.

Wheelsets may be stored outdoors provided that suitable precautions have been taken. However the period outdoors shall be kept to a minimum.

The following requirements shall apply;-

- The wheelset must be adequately protected to prevent water ingress to apertures e.g. suspension tubes. Due allowance should be made for bearing seals not being fully effective prior to the wheelsets use by the provision of alternative means of preventing water ingress to bearings.
- All exposed machined surfaces e.g. gearwheel teeth, shall be adequately protected from corrosion.
- If the wheelsets are stored on rails, they must be moved regularly to prevent a build up of corrosion at the contact point, either between the wheel and chock or between the wheel and rail.
- If the wheelsets are stored on concrete, the concrete needs to be flat, free of puddles and deposits of fine solids and free of rags or paper. It also needs effective drainage.
- Chocks should be used carefully as they may cause damage. Impact against metal chocks can cause indentations in the wheelset, whilst wooden chocks can absorb moisture and aid corrosion. Measures to prevent wheelset tread damage from chocks shall be in place as illustrated in Figure 5

Figure 5: Wheelset storage on concrete

- If wheelsets are sheeted, provision must be made to prevent water access at ground level.
- Wheelset stored outside shall have their bearings examined at least every two months to ensure that the sealing is intact and effective. The bearings shall be rotated for a minimum of two revolutions to work the grease as part of the examination.
- Before using wheelsets that have been stored outside, they shall be inspected for corrosion. Any corrosion found shall be dealt with in accordance with TN/TS 0574.

Wheelsets must be stored in line or, if staggered, with chocks arranged such that bearings, axles, or other vulnerable parts cannot be damaged by contact with other wheelsets. Any wheel to wheel contact must only be flange to flange.

3.2.3. STORAGE OF WHEELSET COMPONENTS

The storage of finished or part-finished wheelset components must be in a clean and weatherproof store with appropriate protection. The conditions must be regulated to prevent the formation of condensation.

Axle bearing units must be stored in their protective packaging in accordance with Timken Document A-71516.

Where possible, components should be stored indoors, however it is permissible for some components e.g. monobloc wheels awaiting final machining, to be stored outdoors for a limited period only with adequate corrosion protection applied for the method of stacking as illustrated in Figure 6

Figure 6: Stacking of wheels

Axles must be stored indoors, on timber baulks or other materials shaped to prevent rolling and contacting of adjacent axles and avoiding any contact damage as illustrated in Figure 7.

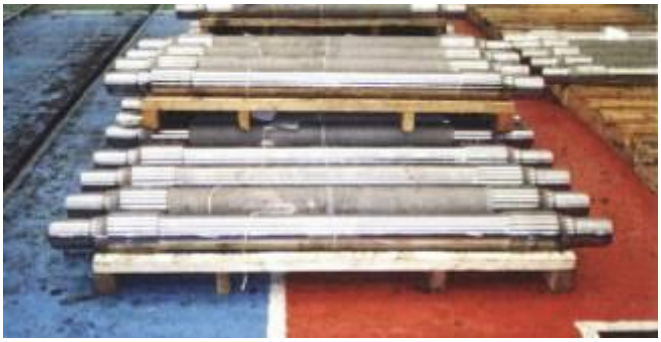


Figure 7: Axles stored on timber baulks

3.2.4. TRANSPORT

Sufficient packaging is required to protect wheelsets to the degree necessary to ensure delivery to the point of installation of the product in the 'as new', or 'as overhauled', or 'as repaired' condition, complying with the appropriate specifications as outlined in this document.

Wheelsets not required for immediate fitting to a vehicle shall have suitable protective coating applied to the exposed gearwheel that can be removed using facilities normally available at depots in accordance with WOSS 612/10. An instruction shall be made available by the wheelset supplier for removal of the protective coating.

Any protective coatings used must be checked for compatibility with any lubricants which may be used on installation to the locomotive.

All reasonable precautions shall be taken to ensure protection against entry of dirt, rain water, or other foreign matter, by the provision and use of temporary waterproof plugs, e.g. suspension tube drain holes.

NOTE: These instructions also apply to wheelsets that are being transported for overhaul or repair.

Movement of wheelsets must be restrained during transportation. This may be achieved by the use of secure chocks, fibre webbing and ratchet tensioner. Care must be taken to ensure that no damage to paint finishes is caused by the restraints.

3.3. SAFETY

The procedure detailed within this document has been produced in line with safe and best current practice. However, it is the responsibility of those involved in the implementation of this procedure to ensure that "safe systems of work" are applied. The safe system of work must incorporate the requirements of:

- The Health and Safety at work Act 1974.
- The Control of Substances Hazardous to Health (COSHH) Regulations.

Full account must be taken of any other relevant instructions and also local safe systems of work, concerning the health and safety of staff while carrying out maintenance duties.

4. EXAMINATION, CLEANING, INSPECTION & DISMANTLING

Requirements for dismantling have been sourced with due reference to the following reference documents WOSS 100/3, WOSS 612/10 Section 9, 10, 11 & 13 and MI 1518, 1553 & 3912 and RBS 1197.

4.1. INITIAL EXAMINATION

Before work commences, determine whether there is any requirement for special examinations related to the wheelset.

The initial examination shall be conducted before the cleaning process removes any evidence of damage.

4.1.1. RECORDS

Record the serial number of the wheelset and any other information received to maintain traceability of the wheelset throughout the overhaul process.

4.1.2. VISIBLE CRACKS IN MONOBLOC WHEELS

Examine monobloc wheels for cracks, other than thermal cracking in the wheel tread surface and report any cracks found to the contract officer.

4.1.3. OVERHEATING OF MONOBLOC WHEELS

Examine for signs of overheating, e.g. discolouration of the wheel rim and web or blistering of paint and report any signs of overheating found to the contract officer.

4.1.4. SUSPENSION TUBE BEARINGS INSPECTION

Rotate the suspension tube to check for smooth unrestrained movement without any feeling of roughness or unusual (e.g. intermittent, scraping) noise.
If any of these are found, suspension tube shall be overhauled in accordance with this procedure.

4.1.5. INTERFERENCE FIT COMPONENTS

Examine for evidence of disturbed rust or breaks in the continuity of the dirt/paint seal between the interface of components joined by interference fit and report any evidence to the contract officer.

4.2. CLEANING

- Wheelsets with axleboxes, axle bearings, or suspension tubes fitted, shall NOT be passed through tunnel washing plants unless approved by the contract officer.
- Before cleaning, all apertures, e.g. axle seals, shall be sealed/covered and all blanking plugs shall be in place to prevent ingress to the cleaning medium.

NOTE: If wheelsets are cleaned using hand held high pressure spray equipment, axle bearing units shall remain fitted and suspension tube apertures shall be plugged. The spray shall not be directed in the area between the wheel and axle bearing units rear face seals, nor at the suspension tube plugs or the labyrinth seals, failure to comply with this may result in bearings being contaminated, which is not permitted.

- The overhauler shall ensure that cleaning and stripping methods do not affect the integrity of the wheelset and shall submit a cleaning process for approval by the contract officer.
- The standard of cleaning required shall permit, without detriment to the product, the examinations detailed in this specification to be achieved.

NOTE: Wheelsets placed under quarantine shall not be cleaned until authorisation has been given by the contract officer.

4.3. INSPECTION OF GEARWHEEL

The gearwheel tooth involute profile is checked with a tooth contour gauge, and a 0.25mm (0.010”) wire gauge or narrow feeler gauge, as shown in Figure 8. If a feeler gauge is used, the width of the gauge should not exceed 3.2mm (0.125”).

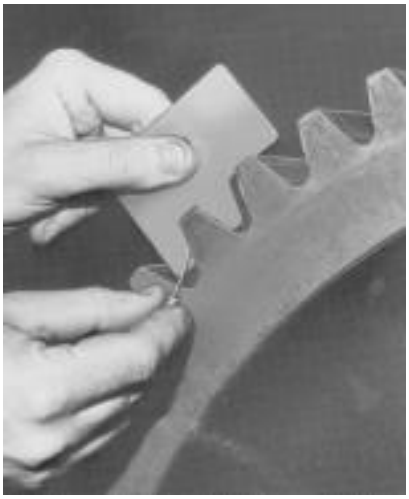


Figure 8: Inspection of Gearwheel

4.3.1. GEAR TOOTH CONTOUR GAUGE

Place the tooth contour gauge (Part No. 40098705) against one flank of the gear tooth as shown in Figure 9.
The gauge will normally contact tooth flank near the pitch diameter, which is the area of least wear. At this flank, measure and record the amount of deviation from tooth profile.

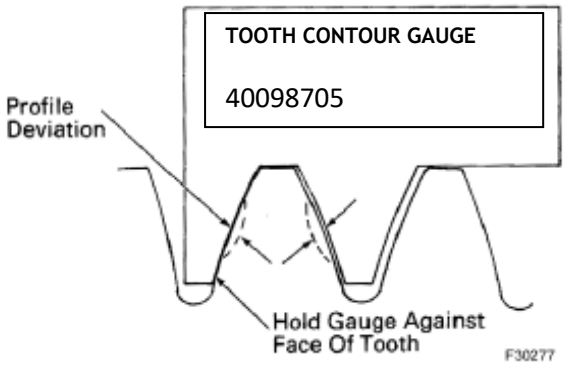


Figure 9: Gear Tooth Contour Gauge

4.3.2. DEVIATION FROM TOOTH PROFILE

Shift the tooth contour gauge until the gauge contacts the opposite tooth flank. At this flank, measure and record the maximum amount of deviation from tooth profile.
When deviation from original tooth profile is 0.25mm (0.010”) or less, the gear may be reused.
If profile error exceeds 0.25 mm (0.010”), report to the contract officer.

4.4. INSPECTION OF SUSPENSION TUBES & BEARINGS

Suspension tube bearings require mandatory removal and inspection at alternative wheelset overhaul events or as advised by the contract officer. Suspension tube bearings will also require removal for inspection in accordance with section 4.7 where the outcome of following checks dictate.

4.4.1. SUSPENSION TUBE BEARING END FLOAT CHECK

Check the suspension tube bearing end float using dial indicator gauge between suspension tube housing and gearwheel as shown in Figure 10.
Suspension tube bearings end float adjustment will not be required if the end float is within 0.025mm (0.001”) and 0.127mm (0.005”).
Suspension tube bearings are acceptable for adjustment in accordance with section 6.3.2 if the end float is greater than 0.127mm (0.005”) and less than 0.483mm (0.019”).
Suspension tube bearings are unacceptable and will require removal for inspection in accordance with section 4.7.1 if the end float is greater than 0.483mm (0.019”).

Figure 10: Suspension Tube Bearing End Float Check (different suspension tube is shown)

4.5. REMOVAL OF AXLE BEARING UNITS

Removal of axle bearing units should be carried out using fixture as shown in Figure 11. The adaptor shoe and reach rods required to attach the fixture to the bearing or wheel press shall be designed to suit the specific press conditions. The removal process should not cause damage to the bearing units.

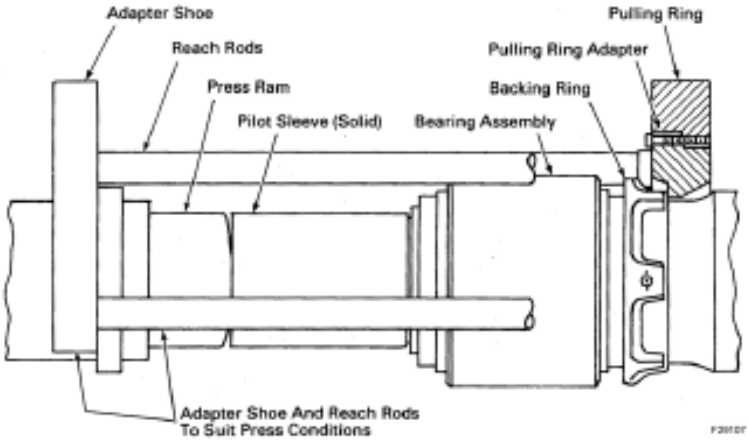


Figure 11: Fixture for Removal of Axle Bearing Unit

When wheel or gears are removed or assembled, the axle should be protected with an axle protection sleeve as shown in Figure 12. The protection sleeve eliminates upsetting the ends of the axle and prevents high spots on the bearing seats resulting from uneven pressure applied to the ends of the axle.

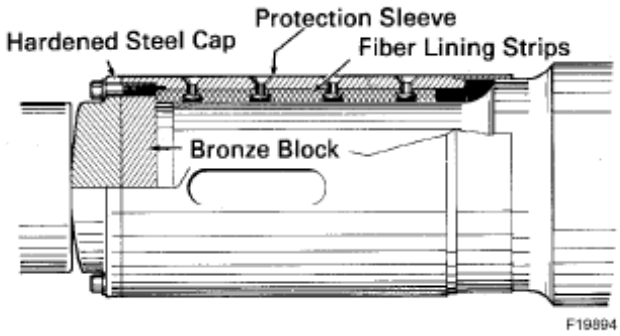


Figure 12: Axle Protection Sleeve

4.6. REMOVAL OF WHEEL PANS

Removal of wheelpans shall be carried out by using either of the following methods:

- Wheelpans fitted with oil injection facilities, may be removed using this process in conjunction with the gravity drop method.
- For wheelpans not fitted with oil injection facilities, or where the gravity drop method proves impractical or unsuccessful, a hydraulic press shall be used. The pressing off load shall be applied equally around the wheelpan so as to avoid metal pick-up of the seats or bending of the axle.

NOTE: Where the wheelpans are being removed by the hydraulic press method, an axle protection sleeve similar to that shown in figure 12, or another method approved by the Contract Officer, shall be used to:

a) prevent damage to the axle ends and the bearing journal surface.

b) prevent high spots on the bearing seats resulting from uneven pressure applied to the ends of the axles.

4.7. REMOVAL OF SUSPENSION TUBES & BEARINGS

Removal of suspension tubes and bearings will be required for any of the following events :

- Suspension tube bearing inspection (see section 4.1.4).
- Excessive bearing end float (see section 4.4.1).
- Gearwheel removal (see section 4.8).
- Axle replacement (see section 5.1.3.6).
- Suspension tube bearing overhaul is due (see section 4.4).
- Collision damage or derailment.

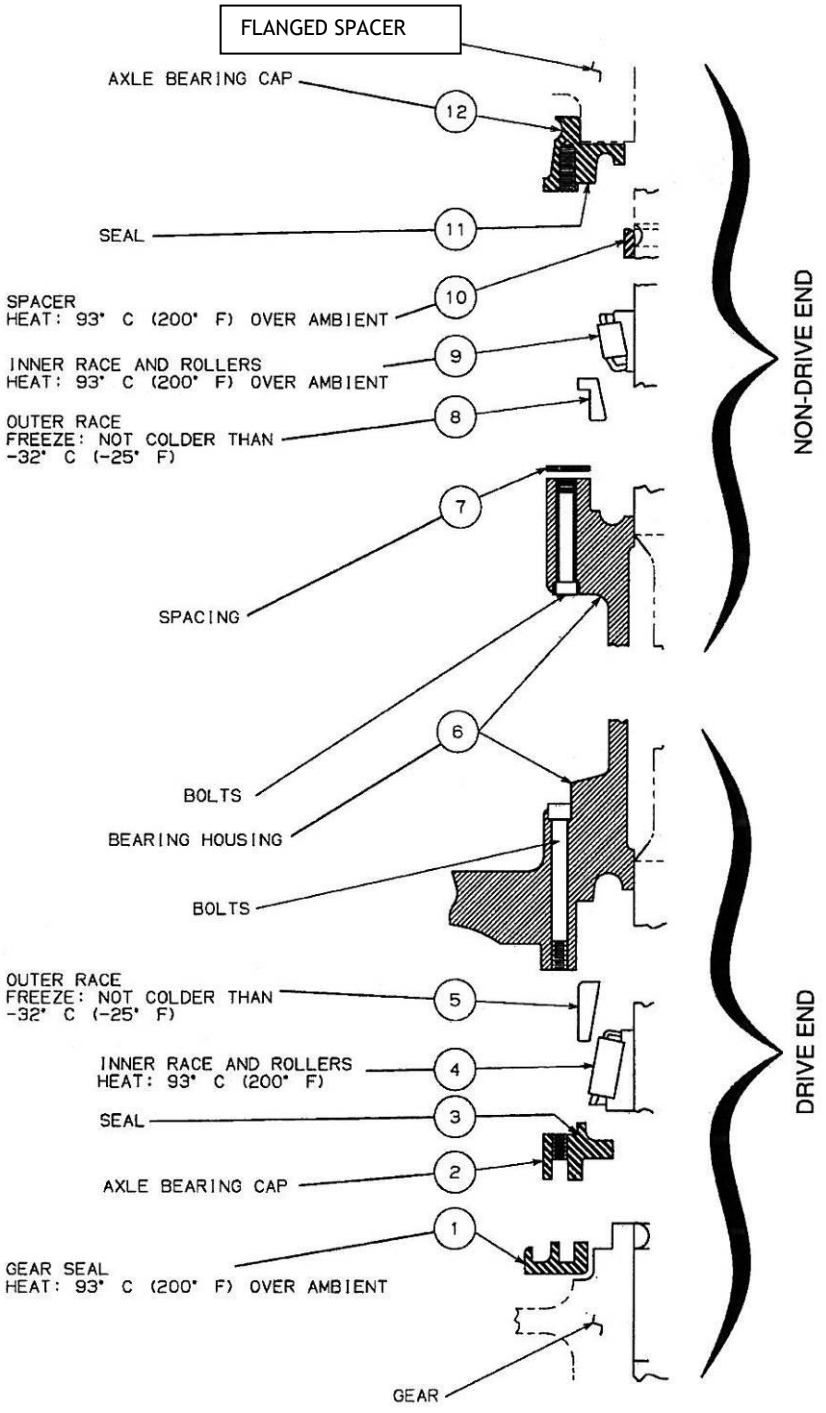


Figure 13: Suspension Tube & Bearings – Exploded View

4.7.1. PROCEDURE FOR REMOVAL OF SUSPENSION TUBE & BEARINGS

NOTE: Where the preferred method detailed below is not achievable, it is acceptable to use a horizontal press to initiate suspension tube removal.

Removal of suspension tubes and bearings is carried out after the removal of axle bearings and wheel pans with reference to Figure 13 as follows ;-

Place assembly in the vertical position with the gear end down in assembly fixture.

Remove the non-drive end flanged spacer (either Part No.40075633 or 40132267), from the axle, by even and gently heating it with a cutting torch (avoid burn marks or "blueing") and prying it off its seat.

Attach two jacking pads to the drive end of suspension tube (item 6 of Figure 13) as shown in Figure 14. Place hydraulic jacks between the pads and the gear rim. Connect the jacks to a common pump.

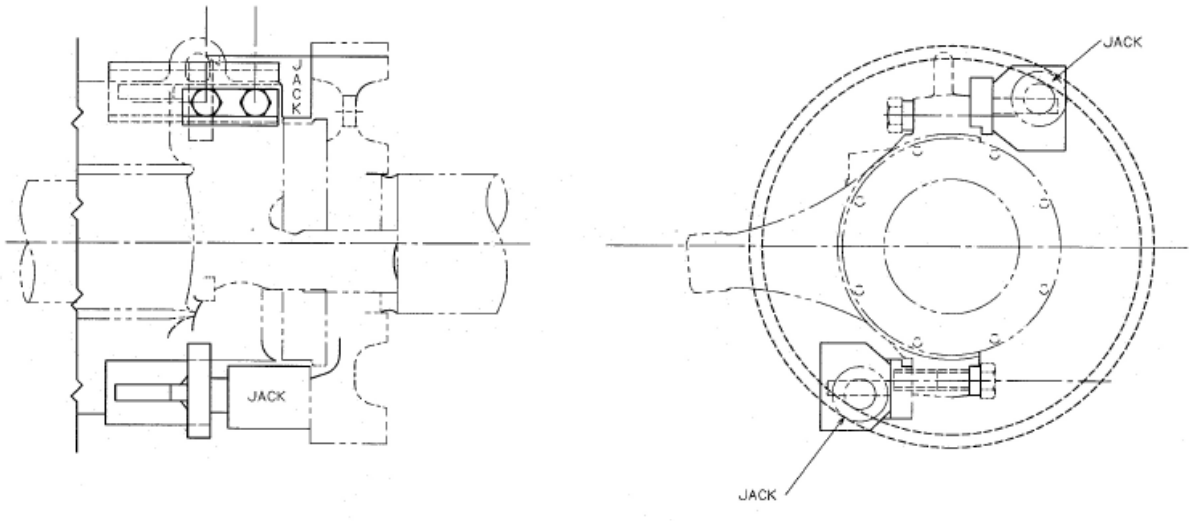


Figure 14: Orientation of Jacking Pads

Remove the cap screws holding the drive end bearing housing (item 2) to the suspension tube. The cap will fall loose preventing removal of the drive end bearing while the non-drive end bearing is removed.

Remove the non-drive end bearing housing (item 12) and the spacer halves (item 7) from behind the non-drive end outer race flange.

Raise the suspension tube with the jacks such that the suspension tube comes into contact with the non-drive end inner race. If the spacer halves are not removed, contact and jacking pressure will be transmitted through the rollers, damaging the bearing. Continue to apply pressure with the jacks until the non-drive end spacer (item 10) and non-drive end inner race (item 9) are forced off the axle seat.

When the non-drive end spacer and inner race are free of the axle seat allow the housing to gently lower back onto the drive end bearing. Remove the non-drive end spacer and inner race.

Re-attach the drive end bearing housing to the suspension tube with all eight cap screws. Tighten but do not torque the screws.

Raise the suspension tube with the jacks. Pressure will be applied to the drive end inner race through the drive end bearing housing (item 2). Continue to apply pressure with jacks until the drive end inner race is forced off the axle seat.

When the drive end inner race comes loose, free the housing from the drive end bearing housing by removing the cap screws. Lift the suspension tube (item 6) off the axle and set down on end. Remove the drive end inner race (item 4) and bearing housing (item 2).

If necessary, remove the non-drive end outer race (item 8) from the suspension tube using the jacking holes behind the outer race flange.

Turn the suspension tube over, if necessary, to remove the drive end outer race (item 5). Three cut-outs are provided in the housing behind the outer race to accept a conventional three-jaw puller.

NOTE: Removal of outer races (items 5 and 8) from the suspension tube (item 6) is required where track surface condition is found to be unacceptable following visual inspection to the TF/TT0025 criteria or where the corresponding inner race and roller assemblies have been scrapped following inspection.

If it is necessary to remove the drive end seal (item 1) from the gear, it can be removed by even and gently heating it with a cutting torch (avoid burn marks or "blueing") and prying it off its seat. For assembly rebuilding where the gear is left in place the drive end seal need not be removed.

The suspension tube and bearing end covers shall be thoroughly cleaned of all foreign matter using an approved de-greasing agent. Inspection of all tapped holes for stripped or damaged threads shall be implemented and remedial attention as approved by the contract officer carried out as necessary. All machined surfaces shall be free of burrs and mechanical damage.

4.8. REMOVAL OF GEARWHEEL

Removal of gearwheels shall be carried out by using either of the following methods;-

- Gearwheels are normally fitted with oil injection facilities and may be removed using this process in conjunction with the preferred gravity drop method.
- Alternatively, for gearwheels not fitted with oil injection facilities, or for gearwheels where the gravity drop method proves impractical or unsuccessful, a hydraulic press shall be used. The pressing-off load shall be applied equally around the gearwheel so as to avoid metal pick-up of the seats or bending of the axle.

NOTE: Where the gearwheels are being removed by the hydraulic press method, an axle protection sleeve similar to that shown in figure 12, or another method approved by the Contract Officer, shall be used to:

a) prevent damage to the axle ends and the bearing journal surface.

b) prevent high spots on the bearing seats resulting from uneven pressure applied to the ends of the axles

5. EXAMINE & RECTIFY

Requirements for examination and rectification have been sourced from reference documents WOSS 612/10 Sections 11 & 13, WOSS 100/3, MI 1519 & 3912, BS 5892 Pt6 and RBS 1197.

5.1. AXLE EXAMINATION

5.1.1. AXLE BODY RUN OUT

Check axle body run-out by placing the bearing journals on rollers or vee-blocks and measuring the total run-out at the axle centre with a dial test indicator as the axle is rotated.

Total axle body run-out (J) shall not exceed 0.5mm (0.0197”) as shown in Figure 15.

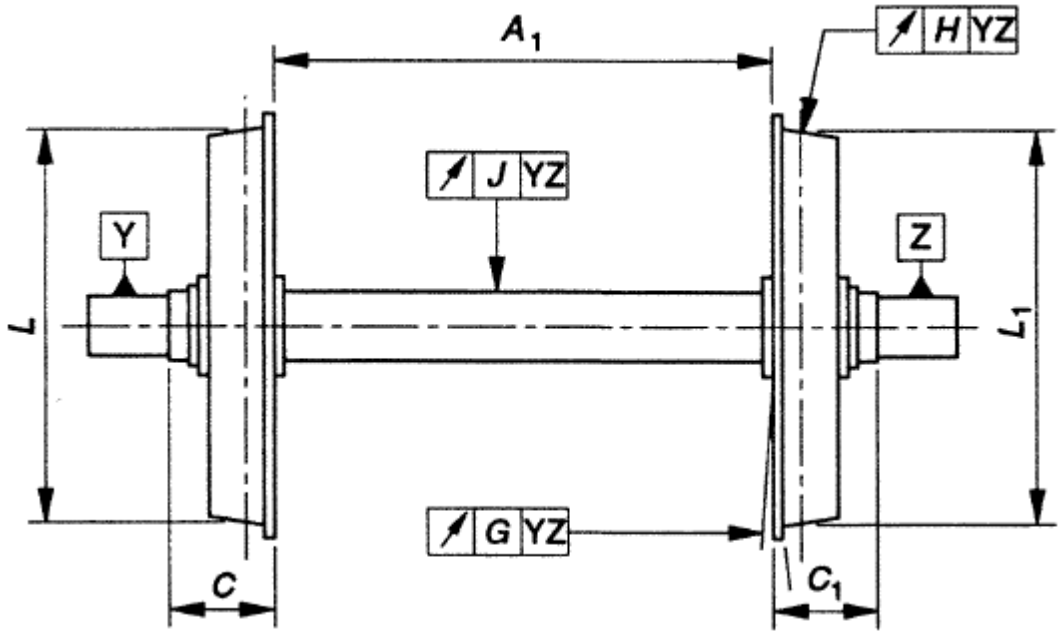


Figure 15: Wheelset tolerances

If the axle body run-out increases towards the centre of the axle beyond the limits specified, it is to be considered bent and shall be scrapped.

5.1.2. AXLE NDT

Axles shall be subject to Magnetic Particle Inspection (MPI) in accordance with BS 5892-1:1992 Clause 9.3.2 using a suitable 'MPI' procedure related to railway axles signed and approved by a level 3 operator.

Axles shall also be subject to UAT in accordance with the relevant approved procedure as follows;-

- For axles found to have full or minimum transparency UAT Procedure AIB-UTCS-136 issue 2 is to be used.
- For axles that have been modified with the additional Stress Relieving Groove (SRG), both UAT Procedure AIB-UTCS-136 issue 2 and UAT Procedure AIB-UTCS-Supplement 01 issue 1 are to be used.
- Further NDT is specified for the assembled wheelsets in section 6.6.

5.1.3. AXLE SURFACE CONDITION

5.1.3.1. AXLE SEATS EXAMINATION CRITERIA

Any fretting damage (indicated by brown staining of the surface) on axle bearing journals, wheelseats, traction gear seats and traction motor suspension tube bearing seats shall have a surface texture no worse than that specified in Table 2.

AXLE DETAIL	MAX. SURFACE TEXTURE (µm)	AXLE SCORING GROOVES, ETC	INDENT-ATIONS	CORRO-SION	FRETTING	HEATING, ARCING DAMAGE	DIMENSIONS
Axle End, including m/c centre	3.2	N/A	See 5.1.3.2	See 5.1.3.3	N/A	See 5.1.3.7	See 5.1.3.8
Axle Bearing Journal	1.2	See 5.1.3.1	See 5.1.3.4	See 5.1.3.3	See 5.1.3.1	See 5.1.3.7	See 5.1.3.8
Wheelseats, Gearwheel Seat & Suspension Tube Bearing Seats	1.6	See 5.1.3.1	See 5.1.3.4	See 5.1.3.3	See 5.1.3.1	See 5.1.3.7	See 5.1.3.8
Stress Relief Grooves	0.8	Nil	Nil	See 5.1.3.3	N/A	See 5.1.3.7	See 5.1.3.8
Journal Shoulder	0.8	N/A	See 5.1.3.4	See 5.1.3.3	See 5.1.3.1	See 5.1.3.7	See 5.1.3.8
Transition Radii	0.8	N/A	Nil	See 5.1.3.3	N/A	See 5.1.3.7	See 5.1.3.8
Other parts	3.2	N/A	See 5.1.3.4	See 5.1.3.3	N/A	See 5.1.3.7	See 5.1.3.8

Table 2*:* Axle Examination

Axle seats shall be examined for scoring resulting from the pressing on or off of wheelset components.

Axle score marks shall not have any raised edges, burrs, sheared metal or excessive depth, sufficient to cause suspect defects on ultrasonic examination or loss of oil injection pressure on subsequent wheelset overhaul/dismantling. Raised edges or burrs may be dressed off using an oilstone. Superficial scoring, which can be rectified using fine abrasive paper (finer than 360 grade), shall be so treated.

NOTE: Re-machined wheelseats shall be subject to MPI in accordance with BS 5892-1:1992 Clause 9.3.2 using a suitable 'MPI' procedure related to railway axles signed and approved by a PCN level 3 operator.

5.1.3.2. AXLE END FACE

The axle end face and machining centre shall have no raised sharp edges, burrs or grooves. Removal of any sharp edges, burrs or grooves, by use of an oilstone, smooth file or a rubber-backed abrasive grinding disc of grit 360 or finer, is permissible. There shall be no indentations or grooves which hinder ultrasonic testing of the axle. The axle end face shall have a surface texture no worse than that specified in Table 2.

Axle centres may be re-machined in accordance with EMD Drg No.40130620.

NOTE: Concentricity shall be checked after re-machining of axle centres has taken place.

5.1.3.3. AXLE CORROSION

There shall be no surface corrosion or pitting on the axle.

Any corrosion found on the transition radius between journal and journal shoulders which cannot be removed by hand using fine abrasive paper to 360 grade or finer is not permitted.

After treatment, the axle shall be cleaned to remove all traces of abrasive or polish.

NOTE: Any repairs shall be subject to MPI in accordance with BS 5892-1:1992 Clause 9.3.2 using a suitable 'MPI' procedure related to railway axles signed and approved by a PCN level 3 operator.

5.1.3.4. AXLE INDENTATION

Indentations on the axle are permitted providing they are no greater than 1.0mm deep and the edges can be blended in using abrasive paper to 360 grade or finer and also that the surface texture requirements for the axle detail are not exceeded.

There shall be no burrs or other raised material.

NOTE: Any repairs shall be subject to MPI in accordance with BS 5892-1:1992 Clause 9.3.2 using a suitable 'MPI' procedure related to railway axles signed and approved by a PCN level 3 operator.

5.1.3.5. AXLE CIRCUMFERENTIAL SCORING

There shall be no visible circumferential scoring. When circumferential scoring is found and the cause cannot be identified then the axle shall be placed in quarantine and the contract officer informed.

5.1.3.6. AXLE RECTIFICATION

Rectification of axle defects shall only take place in accordance with an approved procedure.

Rectification of wheel seat flaws shall be by machining to minimum wheel seat diameter of 231.78mm (9.125”) as specified in MI 1519 to the surface texture specified in Table 2.

After rectification work, axles shall be subject to UAT in accordance with the relevant approved procedure as follows;-

- For axles that have been identified as having minimum transparency UAT Procedure AIBUTCS – 136 issue 2 is to be used.
- For axles that have been modified with the additional SRG, both UAT Procedure AIBUTCS – 136 Issue 2 and UAT Procedure AIBUTCS – Supplement 01 issue 1 are to be used.

Any axles confirmed as cracked shall be placed in quarantine and the contract officer informed.

When an axle does not conform to the latest profile shown on Drg No. 40130620, it shall be modified and stamped in accordance with section 6.1.2.

NOTE: After rectification work, axle shall be subject to MPI in accordance with BS 5892-1:1992 Clause 9.3.2 using a suitable ‘MPI’ procedure related to railway axles signed and approved by a PCN level 3 operator.

5.1.3.7. AXLE HEAT DAMAGE

Axles shall be free of weld spatter, electric arc damage and signs of overheating e.g. ‘blueing’.

5.1.3.8. AXLE COMPLIANCE TO SPECIFICATION

Axle bearing seats and traction motor suspension tube bearing seats shall be subject to parallel and cylindrical tolerance not exceeding 0.025mm (0.001”). The journal dimensions shall be within the limits specified on Drg No’s 40075679, 40130620 and 40147717 with any taper to be in a direction to increase interference in the direction of pressing on.

The axle bearing journal diameter shall be checked in three places along its length and at three positions around the journal (see Figure 16) to ensure that it complies with the limits specified on the above drawings and is within the parallel and cylindrical tolerances.

Wheel seats and traction gearwheel seats shall be subject to parallel and cylindrical tolerance not exceeding 0.025mm (0.001”) with any taper to be in a direction to increase interference in the direction of pressing on.

All raised seats, journal ends, etc., shall have external corner geometry as specified on Drg No's 40075679, 40130620 & 40147717.

Tapped holes in the axle end shall be examined for thread depth and thread wear using a 7/8"-9 UNC-2B thread gauge. Damaged threads shall be rectified by re-tapping.

Stripped or worn threads shall be rectified using a threaded insert approved by the contract officer, in accordance with the manufacturer's instructions ensuring that the insert is installed at ¼" to ½" thread pitch below the axle end surface.

Lengthening of existing holes or creating additional holes in the axle end shall not be carried out unless authorised by the Contract Officer.

There shall be no dried grease, debris etc. left in the bottom of the tapped axle end holes.

Before assembly, it shall be confirmed that the overhauled axle complies with the run-out requirements specified in section 5.1.1.

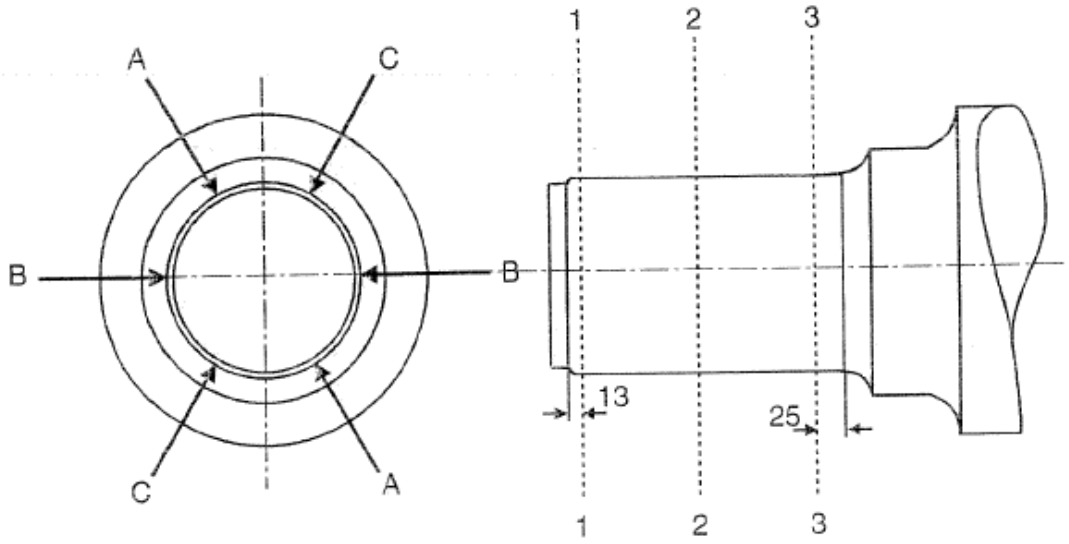


Figure 16: Measurement of Journal Diameter

5.2. AXLE BEARING OVERHAUL

Axle bearings shall be overhauled in accordance with TIMKEN Bearing Overhaul and Re-Manufacturing Standard for Cartridge Bearings in Rail Service A-69943.

5.3. GEARWHEEL OVERHAUL

Any gearwheel that fails inspection specified in section 4.3 shall be notified to the contract officer for a decision.

5.4. SUSPENSION TUBE OVERHAUL

With the bearing outer races removed, the suspension tube bearing housing bores shall be measured at two positions 90° apart and **must** be within the limits specified in Table 3.

BEARING HOUSING	DIAMETER MINIMUM	DIAMETER MAXIMUM
Drive End	326.949mm (12.872”)	327.000mm (12.874”)
Non-Drive End	314.274mm (12.373”)	314.325mm (12.375”)

Table 3*:* Housing Bore Diameters

The suspension tube and bearing end covers shall be thoroughly cleaned of all foreign matter using an approved de-greasing agent.

All tapped holes shall be examined for stripped or damaged threads. Repair by re-tapping or using threaded insert approved by the contract officer, in accordance with the manufacturer’s instructions ensuring that the insert is installed at ¼ to ½ thread pitch below the surface.

All machined surfaces shall be free of burrs and mechanical damage.

NOTE: Where a suspension tube fails inspection the cable bracket must be removed and refitted to the replacement suspension tube.

5.5. SUSPENSION TUBE BEARINGS OVERHAUL

Suspension tube bearings shall be removed in accordance with section 4.7.1.

The bearings shall be thoroughly cleaned in accordance with A-69943 and visually inspected in accordance with the axle roller bearing overhaul acceptance standard TF/TT0025.

Suspension tube bearings that meet the defect acceptance criteria defined in TF/TT0025 shall be measured and **must** be within the limits specified in **Table 4**

BEARING	OUTER RING DIAMETER MINIMUM	INNER RING DIAMETER MAXIMUM
Drive End	327.025mm (12.875”)	235.356mm (9.266”)
Non-Drive End	314.325mm (12.375”)	234.874mm (9.247”)

Table 4: Suspension Tube Bearing Diameters

Any rejected or defective bearings shall be placed in quarantine and the contract officer informed.

6. ASSEMBLY

Requirements for wheelset assembly have been sourced from reference documents EMD Service Parts Catalogues E73, E86 & E98, WOSS 612/10 Sections 16 & 17, MI 1553 & 3912, BS 5892 Pt6 and GM/RT2466

6.1. AXLE

6.1.1. AXLE TRANSPARENCY

Any axles that exhibit low transparency when tested to UAT Procedure AIB-UTCS-136 issue 2 **must** be replaced with full transparency axles in accordance with Service Modification 07066 : Replacement of Low Transparency Axles.

6.1.2. AXLE MODIFICATION

Any axles with single SRG that exhibit full or minimum transparency when tested to UAT Procedure AIB-UTCS-136 issue 2 are to be modified in accordance with Service Modification 06136 Rev B : 'JT42CWR Axle Replacement' and are to be stamped **'G'** at both axle ends.

6.1.3. AXLE SPECIFICATION

Axles are as specified in Table 5

CLASS 66 LOCO RANGE	WHEELSET ASSY EMD PART No.	ORIGINAL AXLE EMD DRG No.	ORIGINAL SPACER EMD DRG No.	REPLACEMENT AXLE EMD DRG No.	REPLACEMENT SPACER EMD DRG No.
66411 - 66420	40123124	40075679	40075633	40130620	40132267
66421 - 66430	40143298	40130620	40132267	40130620	40132267
66431 - 66434	40143298	40147717	40132267	40130620	40132267

Table 5: Axle Specifications

NOTE: All new wheelsets / axles shall be supplied to Part No. 40143298 (wheelsets) / 40130620 (axles).

6.1.4. AXLE IDENTIFICATION

All **new** axles machined with double SRG are stamped **'G1'** at both axle ends at the end of the axle serial number.

All **modified** axles machined with double SRG are stamped **'G'** at both axle ends at the end of the serial number.

Axle serial no. **must** be stamped on the axle end periphery at the drive end of the axle in accordance with GM/RT2466 (AAR Branding). No existing information should be removed from axle ends.

NOTE: Where an axle is identified with a SRG, but there is no identifying 'G' or 'G1', efforts must be made to identify the axle history and the correct branding subsequently applied.

6.2. GEARWHEEL

Where required, gearwheel may be fitted locating the gearwheel hub on the axle as shown in Figure 17where dimension A (nominal) = 368.10mm (14.492") by either of the following two methods;-

- Press fit gearwheel on to the axle with a recommended interference between the axle gear bore and the axle gear seat of between 0.25mm (0.010") and 0.31mm (0.012") and a surface texture of 3.2µm at the axle gear bore. Wheel mounting compound may be applied as a lubricant and the pressing on force shall be between 50 and 114 tonnes.
- Shrink fit the gearwheel to the axle by heating gearwheel uniformly to a maximum temperature of 180°C in accordance with BS 5892-6:1992. When cool, a minimum proving thrust test force of 559 kN is to be applied.

NOTE: Shrink fitted components shrink axially as well as radially. When required to abut another component the final movement shall be by oil injection.

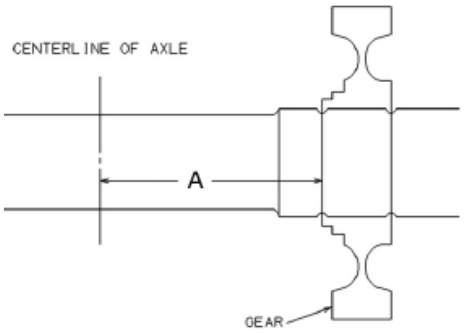


Figure 17: Gearwheel position on axle

6.2.1. GEARWHEEL SEALING RING

Heat the gearwheel sealing ring (item 1) on figure 13 to 93°C (200°F) above ambient temperature.

Place the gearwheel sealing ring over the upper end of the axle as shown in Figure 18, grooves upward, and slide down and install on the machined seat of the gearwheel hub and ensure the sealing ring is correctly seated by rotating it back and forth as it cools.

When the gearwheel sealing ring has cooled down, apply a thin coating of grease in the labyrinth grooves but do not fill grooves.

Figure 18: Gearwheel Sealing Ring

6.3. SUSPENSION TUBE & BEARINGS

NOTE: Where a new suspension tube is to be used, the cable bracket removed from the scrap suspension tube must be fitted to the new suspension tube in accordance with the procedure shown in Appendix D.

Refer to Figure 13, Suspension Tube & Bearings – Exploded View;-

Apply a thin coating of grease to the O-ring groove in Drive End (DE) suspension tube bearing end cover (item 2) and fit O-ring (item 3) as shown in Figure 19.

Figure 19: Drive End Bearing End Cover

Place the DE suspension tube bearing end cover (item 2) over the end of the axle and move downwards to engage with the gearwheel sealing ring (item 1). Position the drain slot, of the bearing cover, so that it will be located at the bottom (6

o'clock position) of the suspension tube bearing housing, when the suspension tube is lowered into position over the axle.

Heat the DE inner race and roller assembly (item 4) to 93°C (200°F) above ambient temperature for sufficient time to achieve uniform temperature throughout.

NOTE: Do not exceed 149°C (300°F). At no time should bearings be left in oven for extended periods such as more than a work shift or overnight.

Place the heated DE inner race and roller assembly (item 4) over the upper end of the axle with the small end uppermost and move down to seat against the gearwheel hub. As it cools, drive it home with a 'dolly' or a soft headed mallet ensuring firm contact with the gearwheel.

NOTE: A 'dolly' with a nominal bore diameter of 236mm (9.3") may be used as driving tool to seat the bearing inner ring.

When cool, apply a thin coating of grease over the rollers as shown in Figure 20.

Figure 20: Drive End Inner Race and Roller Assembly

Position the suspension tube (item 6), with the DE bearing housing uppermost (end with torque arm).

Place the DE bearing outer ring (item 5) in a freezer and shrink the outer ring into the DE bore of the suspension tube bearing housing in (item 6). The shrink temperature shall not be less than -32°C (-25°F).

NOTE: Do not leave the outer ring at this temperature for extended periods such as more than a work shift or overnight.

Ensure that the DE bearing outer ring (item 5) is firmly seated by driving it home with a mild steel drift. Check for seating with a 0.025mm (0.001") feeler gauge between the thick end of the bearing outer ring and the bottom of the suspension tube housing bore. A 0.025mm (0.001") feeler gauge shall not enter between the ring and the housing at any point as shown in Figure 21.

Figure 21: Drive End Outer Race Seating Check

Apply a thin coating of grease over the outer race of the DE bearing outer ring.

Turn over the suspension tube (item 6), so that the Non-Drive End (NDE) bearing housing is uppermost.

For suspension tubes being assembled at new build, position the 3.3mm (0.130”) spacers on the NDE of the suspension tube bearing housing. Use at least three spacers around the circumference between the bolt holes as shown in figure 22.

For suspension tubes undergoing overhaul, the original spacing shims (item 7), removed in section 4.7.1, may be re-used.

NOTE: The 3.3mm (0.130”) spacers are for assembly purposes at new build only and not for final end float adjustment. If left in place, they will interfere with proper fit-up of the suspension tube bearing housing to the traction motor frame.

Place the NDE bearing outer ring (item 8) in a freezer and shrink the outer ring into the NDE bore of the suspension tube bearing housing in (item 6). The shrink temperature shall not be less than -32°C (-25°F).

NOTE: Do not leave the outer ring at this temperature for extended periods such as more than a work shift or overnight.

Seat the NDE bearing outer ring flange (item 8) against the spacers with a mild steel drift or soft headed mallet. The spacers must be tight against the outer ring flange as shown in Figure 22.

Figure 22: Seating of Non-Drive End Outer Race

Apply a thin coating of grease over the outer race of the NDE bearing outer ring.

Lift up the suspension tube (item 6) with the NDE uppermost and lower over the axle until the bearing housing rests on the DE bearing inner ring assembly (item 4) as shown in Figure 23. Position the housing so that the drain in the bearing end cover (item 2) is located at the 6 o'clock position of the housing (opposite side to suspension tube lifting eye). Oscillate the suspension tube several times to ensure correct seating of the rollers.

Figure 23: Assembly of Suspension tube to Axle

Ensuring that the internal screw threads in the suspension tube and areas under the bolt heads are clean, bolt the DE bearing end cover item 2 to the suspension tube bearing housing using the hexagon socket head setscrews ½" -13 UNC, Part No's 138294 and 138304. Rotate the suspension tube to ensure that there is no binding or rubbing and torque tighten the bolts to 136Nm (100 ft-lbs) as shown in Figure 24.

Figure 24: Bolting of DE bearing end cover to suspension tube

Apply a thin coating of grease over the rollers of the NDE inner race and roller assembly (item 9) and heat to 93°C (200°F) above ambient temperature for sufficient time to achieve uniform temperature throughout.

NOTE: Do not exceed 149°C (300°F). At no time should bearings be left in oven for extended periods such as more than a work shift or overnight.

Place the heated NDE inner race and roller assembly (item 9) over the upper end of the axle and seat in to place against the NDE outer race (item 8) as shown in Figure 25. When cool, drive it tightly against the outer race (item 8) with a 'dolly' or a mild steel drift and hammer. Oscillate the suspension tube while seating the bearing. The bearing is sufficiently seated when all the rollers rotate and resistance to oscillation becomes noticeable.

NOTE: A 'dolly' with a nominal bore diameter of 236mm (9.3") may be used as driving tool to seat the bearing inner ring.

Figure 25: Non-Drive End Inner Race and Roller Assembly

Heat the NDE spacer ring (item 10) to 93°C (200°F) above ambient temperature for sufficient time to achieve uniform temperature throughout and install over the end of the axle. Seat the spacer ring against the NDE inner race and roller assembly (item 9) as shown in Figure 26.

NOTE: Check that a feeler gauge of 0.051mm (0.002") thickness will not enter between the spacer and the NDE bearing inner ring.

Figure 26: Non-Drive End Inner Spacer Ring Assembly

Apply a thin coating of grease to the O-ring groove in NDE suspension tube bearing end cover (item 12) and fit O-ring (item 11) as shown in Figure 27.

Figure 27: Non-Drive End Inner Bearing End Cover

Place the NDE suspension tube bearing end cover (item 12) over the axle and engage with the flange of the bearing outer ring (item 8). Position the drain hole in the bearing end cover downward (6 o'clock position). Ensuring that the internal screw threads in the suspension tube and areas under the bolt heads are clean, secure the NDE suspension tube bearing end cover (item 12) with the hexagon socket head setscrews ½" -13 UNC, Part No's 138292 and 138302, finger tight.

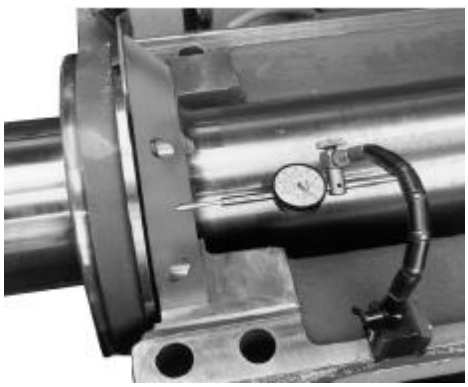
Apply a thin coating of grease to the labyrinth area of the NDE suspension tube bearing end cover (item 12) that engages the flanged spacer (Part No.40132267) to assist in preventing dirt ingress.

NOTE: If the suspension tube is to be lifted and placed in the horizontal position for the next operation, do not lift the assembly without having the spacers or shims on the NDE in place.

For new build suspension tubes only, loosen but do not remove the bolts securing the NDE bearing end cover and remove the 3.3mm (0.130") spacers.

With the assembly in position, set up a dial indicator to measure the relative movement between the NDE outer race (item 8) and the suspension tube (item 6). Position the indicator stem through one of the jacking bolt holes in the suspension tube (item 6) so that the indicator stem contacts the back of the bearing flange (item 8) as shown in Figure 28.

NOTE: Verify indicator contact by inserting a 0.25mm (0.010") feeler gauge between the indicator stem and the bearing flange. Leave dial indicator in place, while shrink fitting the flanged spacer.



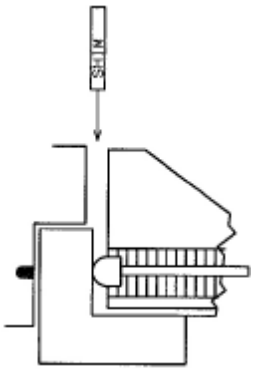


Figure 28: Movement indicator (different suspension tube is shown)

Heat the NDE flanged spacer , Part No. 40132267, to 93°C (200°F) above ambient temperature for sufficient time to achieve uniform temperature throughout and install over the end of the axle (flange face first).

Seat the flanged spacer against the spacer (item 10), using a 'dolly'. When contact is registered on the dial indicator the process shall be terminated.

NOTE: Excessive movement greater than 0.64mm (0.025") may prevent application of a final spacer, which requires the repositioning of the NDE bearing inner race on the axle.

6.3.1. ADJUSTING SUSPENSION TUBE BEARING END FLOAT AT NEW BUILD

Check the gap behind the bearing flange (item 8) in three or four locations around the circumference with feeler gauges as shown in Figure 29.

Set the bearing end float to within 0.025mm to 0.127mm (0.001" to 0.005") by selecting and installing a thinner final assembly spacer (see Table 6) that will fit snugly behind the NDE bearing flange.

After installing the appropriate shim halves, bolt the NDE suspension tube bearing end cover (item 12) to the suspension tube (item 6).

Oscillate the suspension tube on the axle several times to seat the bearing rollers.

Measure the bearing end float by moving the suspension tube on the axle with a crow bar as shown in figure 10.

Excessive force on crow bar can give false indications of bearing end float, needle deflection should be maintained when crow bar is removed.

Under no circumstances shall the halves of the spacers be of different thicknesses.

Do not use more than one spacing shim thickness to achieve the required bearing end float.

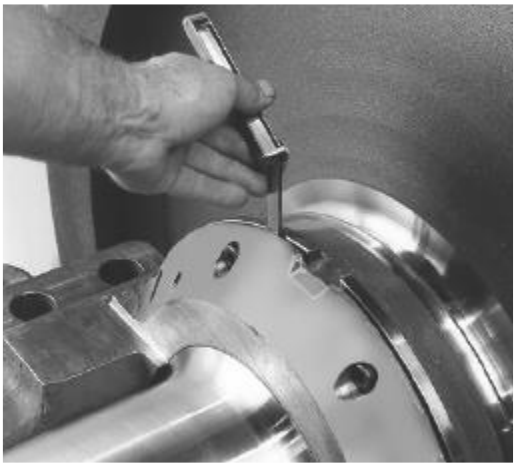


Figure 29: Checking gap for spacing shims

SPACING SHIM	PART No.
3.175mm (0.125”)	40006533
3.073mm (0.121”)	40006534
2.972mm (0.117”)	40006535
2.870mm (0.113”)	40006536
2.769mm (0.109”)	40006537
2.667mm (0.105”)	40006538
2.565mm (0.101”)	40006539

Table 6: Spacing Shims

6.3.1.1. ADJUSTING SUSPENSION TUBE BEARING END FLOAT AT OVERHAUL

Measure the bearing end float by moving the suspension tube on the axle with a crow bar as shown in figure 3.

Excessive force on crow bar can give false indications of lateral clearance, needle deflection should be maintained when crow bar is removed.

If the end float is less than 0.025mm (0.001”), remove the spacers and install the next thinner spacer. Recheck the end float.

If the end float is greater than 0.127mm (0.005”), remove the spacers and install spacer thick enough to bring the end float to within 0.025mm to 0.127mm (0.001” to 0.005”).

Oscillate the suspension tube on the axle several times to seat the bearing rollers.

After installing the appropriate shim halves, bolt the NDE suspension tube bearing end cover (item 12) to the suspension tube (item 6).

Under no circumstances shall the halves of the spacers be of different thicknesses.

Do not use more than one spacing shim thickness to achieve the required bearing end float.

NOTE: To install a thicker spacer, it will be necessary to move the bearing flange towards the axle end using the four (½” -13 UNC) jacking bolts in the bearing housing.

When the bearing end float is set, torque-tighten the NDE suspension tube bearing end cover bolts to 136Nm (100 ft-lbs). The two lower housing jacking holes should have ½” -13 UNC setscrews added flush with housing to keep threads clear of foreign matter and such making jacking easier. Also on the bottom of the housing are two 1/8” – NPT holes which shall have plugs, Part No.103877, applied to keep threads free from foreign matter. These holes are not for adding grease. The two grease plug holes need to have 3/8” PT plugs, Part No.8348619, inserted.

This completes the assembly of the suspension tube and bearings to the axle and gearwheel assembly.

6.4. WHEEL PANS

New wheel pans (Part No. 4013166) shall either be shrink-fitted in accordance with BS 5892-6:1992 or press fitted as an alternative. The preferred method is shrink fitting.

When shrink fitted, leave to cool for 24 hours and apply a proving thrust of 937 kN max in accordance with BS 5892-6:1992. The NDE wheel pan should be pressed into its final position when cool after shrink fitting using the oil injection method, ensuring that the wheel hub is in contact with bearing inner ring assembly (item 9) through the flanged spacer, Part No. 40132267 and spacer (item 10).

Alternatively, for press fitted wheel pans, the recommended interference between the wheel bore and the wheel seat shall be 0.216mm (0.085") min, 0.318mm (0.0125") max and the wheel bore shall have a surface texture of 3.2µm. Wheel mounting compound may be applied as a lubricant and the pressing on force for each wheel shall be between 86 and 132 tonnes with a permanent record of the tonnage graph being kept for each wheel mounting operation.

NOTE: Care shall be taken to ensure that the bearing inner ring assembly (item 9) is not displaced during this operation, which would affect the bearing end float adjustment already set at section 6.3.1 or 6.3.2.

The DE wheel pan shall be fitted in order to achieve correct 'Back to Back' dimension [Dim A_1 Figure 15] of 1362-1360mm and difference between 'C' and 'C1' dimension [Dim C, C1 Figure 15] equal to or less than 1.0mm.

Finished diameter of wheel pans on the same axle shall be within 0.5mm (0.01").

Check that the suspension tube bearing end float has not been disturbed during fitting of wheel pans and adjust if necessary as section 6.3.2.

Wheelset balancing is not required**.**

Lubricate the suspension tube bearings after removing both 3/8" PT plugs and fitting adaptors for the lubrication of each bearing using grease to BR specification 673. Rotate the tube slowly, while filling with grease to ensure even distribution around each bearing until new grease exudes from the labyrinth seals around full circumference. Wipe off any excess grease after completion of the task.

NOTE: For reference only, total quantity of grease required is as follows;-

- Gear End Bearing = 510.5g (18oz)
- Non Gear End Bearing = 227g (8oz)

6.5. AXLE BEARING UNITS

New, overhauled or remanufactured axle bearing units (Part No. H337844 – 90295) (as agreed by the contract officer) shall be fitted at each wheelset overhaul.

New bearings are supplied with a protective coating of grease over the vent fitting. Care should be taken to ensure that grease is not wiped off when the bearings are fitted to the axle.

Ensure that all temporary bearing identification labels are removed prior to assembly.

A thin coating of rust preventative must be applied to the axle bearing journal fillet, and the portion of the axle between the wheel seat and bearing journal fillet. The coating must be uniform and must not be applied more than 30 minutes before the bearings are fitted to the axle.

Lubricate the axle journal bearing seats with caster oil, heavy mineral oil, or a molybdenum-disulphide and oil mixture prior to fitting bearings.

Bearings must be pressed on to the axle using a seating force of 54.63t in accordance with MI 1553 section 4.3 as shown in Figure 30.

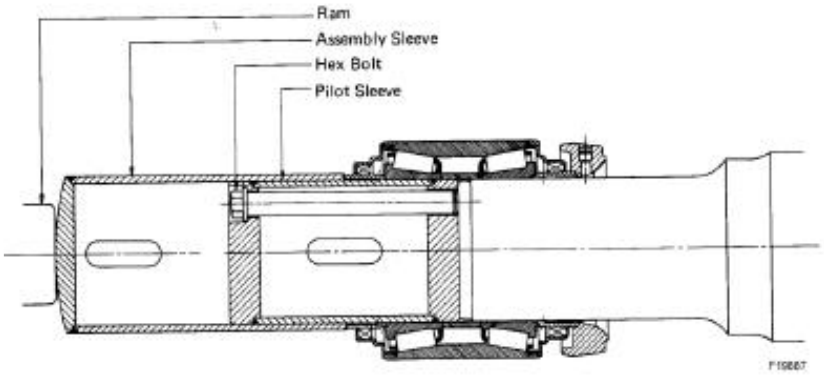


Figure 30: Press fitting of axle bearing units

6.6. POST-ASSEMBLY NDT

On completion of the overhaul, the wheelset shall be subject to NDT in accordance with AIB-UTCS-136 issue 2 and AIB-UTCS-136 Supplement 01 issue 1 for all axles.

Any wheelsets found with low transparency axles are not to be used and must be placed in quarantine for further investigation by the contract officer.

6.7. AXLE BEARING END FLOAT

Axle bearing end float shall be checked using a dial indicator mounted on a magnetic base. Oscillate the axle bearing unit casing slightly while forcing it towards and away from the wheel hub as shown in Figure 31. If the axle bearing end float is less than 0.02mm (0.001") or more than 0.51mm (0.020") it shall be removed from the axle for further investigation by the contract officer.

Figure 31: Checking axle bearing end float

6.8. AXLE END CAPS & LOCKING PLATES

Fit the axle end cap and locking plate in accordance with MI 1553 section 4.3 and torque-tighten all three screws progressively using a calibrated torque wrench to 420Nm (310 ft-lbs). Re check each screw several times to ensure that no further rotation occurs before tab locking as shown in Figure 32.

NOTE: Do not tighten or loosen screws after the specified torque has been applied in order to position the head flats relative to the locking tabs. Ensure that the locking tabs are bent firmly against alternate head flats in order to resist loosening of the screws as sh

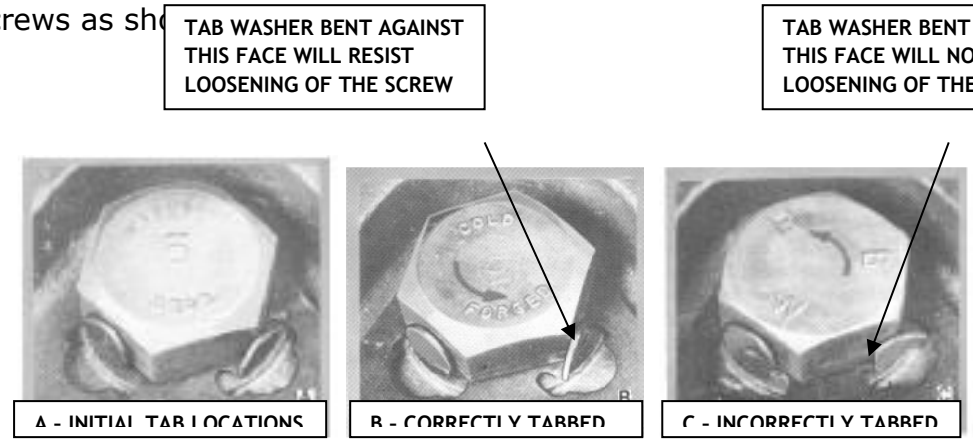


Figure 32: Correct method of tab locking

6.9. WHEELSET BRANDING

Branding of the wheelset is to be carried out by cold stamping in accordance with GM/RT2466 issue 3 Clause B2.2.1:Figure B7 on each wheel as follows;-

- Non Drive End (NDE) wheel is to be stamped on inside face of wheel.
- Drive End (DE) wheel is to be stamped on outside face of wheel at the same radial and circumferential position as the NDE wheel.
- In both cases, branding is to be diametrically opposite any branding on the rim carried out during manufacture.

6.10. WHEELSET PAINTING

Painting of the wheelset shall be as follows:

All exposed areas of the axle shall be painted, including wheel-axle boundaries, exposed axle shoulders and area between the gearwheel and drive-end wheel. DRS require that the paint to be used shall be SIGMACOVER 400.

All wheelpans shall be left unpainted.

Once the paint has cured, wheelseat overhangs and any other areas which cannot be painted shall be treated with a suitable corrosion preventative compound.

Wheelsets not required for immediate fitting to a vehicle shall have suitable protective coating applied to the exposed gearwheel that can be removed using facilities normally available at depots in accordance with WOSS 612/10. An instruction shall be made available by the wheelset supplier for removal of the protective coating.

6.11. WHEELSET IDENTIFICATION

On completion of the wheelset overhaul, a durable identity label shall be securely attached to the outside of the suspension tube in accordance with WOSS 612/10 section 17. The method of attachment of the label shall avoid any type of damage to the wheelset or its protective coating.

The label shall clearly show the following information;-

- Contractors identity
- Wheelset catalogue number
- Wheelset serial number (axle unique number)
- Wheelset Overhaul Date
- UAT/NDT date
- UAT/NDT operator names
- Warranty expiry date (if applicable)
- Axle bearing manufacturer date
- Axle bearing overhaul date
- Axle bearing fitting date

- Axle bearing serial numbers

NOTE: Auditable procedures shall be in use to ensure that, whenever a wheelset is dispatched to another location, the catalogue number on the documentation accurately represents the wheelset to which it refers.

6.12. WHEELSET RECORDS

A complete record of wheelset details and history shall be maintained on the DRSL document reference 'F GE 09 - DRS Wheelset Identity Record Card' in accordance with Annex A.

Wheelset records shall be freely available for examination and copying.

Wheelset records shall be amended before the wheelset leaves the contractors works (Annex A).

Records of all wheelsets held in store shall be maintained.

Full wheelset records shall be retained for five years after the scrapping date of the wheelset.

6.13. WHEELSET REPORTING

All safety related defects, as defined in GE/RT8250, shall be recorded and reported to the contract officer for consideration for further action.

If cracks are found in axles, then irrespective of whether or not the axle is scrapped, the length and depth of the cracks shall be recorded and reported to the contract officer for consideration for further action in accordance with GE/RT8520.

Cracks found in wheelset components other than axles shall be reported to the contract officer.

6.14. QUARANTINED MATERIAL

Wheelsets and wheelset components that have failed any of the above inspections and cannot be reclaimed shall be placed into quarantine by the contract officer.

The contract officer shall inform DRSL of any NDT or other failure of a wheelset within seven days of the inspection. This shall include special mention of any failure that involves cracks deeper than 2.0mm or longer than 5.0mm that require examination by a technically competent authority within eight weeks of the discovery of the crack.

APPENDIX A - WHEELSET RECORDS

The wheelset overhauler holds responsibility for recording following data;-

WHEELSET ASSEMBLY	**WHEEL**
Assembler identification (where not embodied in the axle number)	Wheel manufacturer
Date of assembly	Year of wheel manufacture
Previous assemblers and dates	Wheel cast number
Dimensional details relating to interference fits	Class of wheel material
Pressing on loads for wheels and gearwheels	Bore diameter
Record of test loads to check security of interference fit, as required by BS 5892, Part 6, section 4.2.1	Outside diameter
Wheel press recorder chart	Date of NDT test on wheel
Wheel tread profile	Type of NDT test
	Result of test including description and measurements of any defects found (crack, length, depth and orientation)
AXLE	NDT operator's name and signature
Axle manufacturer	
Year of axle manufacture	**JOURNAL BEARINGS**
Axle geometry code	Date of bearing manufacture
Axle cast number	Date of bearing overhaul
Class of axle material	Date of fitting to wheelset
Axle serial number	Bearing serial numbers
Axle wheel seat diameters	
Axle journal diameters	**SUSPENSION TUBES**
Date of NDT test	Date of last bearing renewal or overhaul
Type of NDT test and reference to the procedure	Suspension tube end float
Expiry date of test	**REPAIR / OVERHAUL WORK**
Result of test, including description and measurements of any defect found (crack length, depth and orientation) and record of areas of the axle covered by the test. The means used to measure depth shall be stated. NDT operator's name and signature	Wheelset details and history records are to be maintained by the overhauler as required by WOSS 612/10 Records to include wheelset mileage (where provided) Wheelset identification label to include;- Contractors identity and date of repair or overhaul Wheelset catalogue number and axle serial number Axle bearing serial numbers Axle bearing manufacture, overhaul and fitting dates UAT/NDT details and warranty expiry date (if applicable)
SCRAPPING DETAILS	**STORAGE DATA**
Date scrapped	Location of wheelset
Reason for scrapping	**SERVICE / MAINTENANCE / INSPECTION**
	1. Reporting of dimensional measurements outside of limits set out in GM/RT2466 Reporting of safety related defects to meet GE/RT8250

APPENDIX B - LIST OF REFERENCE DOCUMENTS

REFERENCE	TITLE
EMD Service Parts Catalogue No. E73 (Section 8)	JT42CWR-T1 Locomotive Wheelset Assembly Part No's for 66411 - 66420
EMD Service Parts Catalogue No. E86 (Section 8)	JT42CWR-T1 Locomotive Wheelset Assembly Part No's for 66421 - 66430
EMD Service Parts Catalogue No. E98 (Section 8)	JT42CWR-T1 Locomotive Wheelset Assembly Part No's for 66431 - 66434
WOSS 612/10	Wheelset Overhaul Procedures
WOSS 100/3	Inspection Procedures – General Mechanical
RIS-2704-RST	Rail Industry Standard for Wheelsets Handling and Storage
BS EN 473	NDT-Qualification & Certification of NDT Personnel
GM/RT 2466	Railway Wheelsets
BS 5892 Part 6	Specification for Wheelsets for Traction & Rolling Stock
MI 1518 (EMD)	Wheels, Axles, Axle Gears & Pinions
MI 1519 (EMD)	Wheels, Axles, Axle Gears & Pinions - Export
MI 1553 (EMD)	Grease Lubricated, Cartridge Type Journal Bearings
MI 3912 (EMD)	Traction Motor Roller Support Bearing
RBS 1197 (Timken)	Bearing Overhaul & Re-Manufacturing Standard for Cartridge Bearings
A-66943 (Timken)	Bearing Overhaul & Re-Manufacturing Standard for Cartridge Bearings
A-71516 (Timken)	Storage of Rail Bearings / Parts
TT/TF0025	Axle Bearing Overhaul Acceptance Standard
TN/TS0574	Wheelset Off-Vehicle Repair Specification
AIB-UTCS-136 (Iss 2)	Ultrasonic Axle Testing Procedure for Class 66 Modified Axle Design
AIB-UTCS-136 Supp 01 (Iss 1)	Ultrasonic Axle Testing Procedure for Class 66 Locomotive Wheelsets
Mod 06136 Rev B (EMD)	JT42CWR Axle Replacement
Mod 07066 (EMD)	Replacement of Low-Transparency Axles
SA# 07-033 JT42 (Class 66)	Ultrasonic Axle Transparency Issue
BR673	Requirements of Greases to be used in Railway Axle Bearings
F GE 09	DRS Wheelset Identity Record Card

APPENDIX C - ISSUE/REVISION RECORD

Issue	Date	Details
1	December 2010	Original Document
2	June 2016	Section 6.10 amended to state paint to spec 'Sigmacover 400' should be used for painting exposed axle areas.
3	February 2018	Minor updates as listed below
4	April 2020	Minor updates as listed below

The following changes are made within this document from Issue 3 issue to create E WI 752 Issue 4

Section	Change	Change Category	Reason for Change
All	Format Change to latest DRS Document Format	M	F WI 0540 01 01
5.1.3.2	Axle part no. / Drawing no. 40147717 replaced by 40130620	A	40147717 no longer supplied by EMD; 40130620 is the axle supplied. Axle is suitable when UAt is carried out annually in accordance with Job UN01
5.1.3.6	Axle part no. / Drawing no. 40147717 replaced by 40130620		40147717 no longer supplied by EMD; 40130620 is the axle supplied. Axle is suitable when UAt is carried out annually in accordance with Job UN01
6.1.3	Axle part no. / Drawing no. 40147717 replaced by 40130620		40147717 no longer supplied by EMD; 40130620 is the axle supplied. Axle is suitable when UAt is carried out annually in accordance with Job UN01

The following changes are made within this document from Issue 2 issue to create E WI 752 Issue 3

Section	Change	Change Category	Reason for Change
All	Format Change to latest DRS Document Format	M	F WI 0540 01 01
4.3.1	Contour Gauge part number clarified	L	Gauge part number not listed
4.6	Text amended to allow for gravity drop or horizontal press for oil injection-fitted wheelpans	A	Following technical review both methods agreed for this type of wheelpan
4.7.1	Note added to allow horizontal pressing of suspension tubes to initiate removal	A	Following technical review both methods agreed for this type of suspension tube
4.8	Note added to allow horizontal pressing of gearwheel	A	Following technical review both methods agreed for this type of gearwheel
5.2; 5.5	A-69943 added	J	Some references to RBS 1197 updated to reference A-69943
5.4; 6.3	Comments added referring to removal and refitment of cable clamp brackets	A	New suspension tubes are not fitted with the cable clamp bracket
6.4	Part number for wheelpan added	A	Part number for clarity
6.4	Diameter difference amended to 0.5mm on axle	A	Confirmed from BS5892 Part 6 Table 2 and EMD MI1518 Rev. F 13.2.1
6.5	Part number for cartridge bearing added	A	Part number for clarity
6.9	Additional Note added to axle branding	A	Axles have been identified with SRG and no branding
6.10	Removal of reference to BR6 Paint Schedule	N	Details covered by BR6 incorporated into this document
Appendix B	A-69943 added	J	New Timken document, replaces RBS 1197
Appendix B	A-71516 added	J	A-71516 supersedes IB/TS0692 for Timken bearings
Appendix B	Removal of reference to BR6 Paint Schedule	N	Details covered by BR6 incorporated into this document
Appendix B	IB/CEPS1039 removed from Reference Documents; Not referenced elsewhere	N	Document not referenced within text; used for best practice on creation of this document

Appendix B	IB/TS0692 removed	N	Document not referenced within text; used for best practice on creation of this document
Appendix B	GM/GN2498 replaced by RIS-2704-RST	J	RIS-2704-RST supersedes GM/GN2498
Appendix B	GM/RT2005 removed	N	GM/RT2005 no longer current; no reference listed within core document
Appendix B	GM/RT2030	N	GM/RT2030 no longer current; no reference listed within core document
Appendix D	Additional weld procedure added for Suspension Tube cable brackets	A	New suspension tubes are not fitted with brackets.

Change Category	**Definition**
A	New Requirement – Additional technical requirement following investigation.
B	Document Reference - Additional document reference called up in text.
C	Clarification - There has been no change in the technical requirements, but the text has been redrafted to improve understanding.
D	Group Standard and Technical Standard for Interoperability Compliance - Change incorporated to comply with standards.
E	Subsidiary Document Requirements - The technical details were previously identified in subsidiary documents and included in this document following review.
F	Clearer Drafting - There has been no change to the technical requirements, but the location of the text has been changed to improve understanding.
G	New Commercial Requirement - Additional commercial requirements as a result of change in industry structure.
H	New Reference - New reference document has been included in the table as it is now covered in the text.
I	British Standard Compliance - Change incorporated to comply with standards.
J	Changed Reference - Reference document including any Group Standard has changed its identification.
K	New Material - A new material is now called up.
L	Correction - Previous document contained an error.
M	Format Change - Layout of document has altered but there has been no change to the technical content.
N	No Longer Required - The previous requirement is no longer valid.

APPENDIX D – SUSPENSION TUBE BRACKET WELDING

TECHNICAL WORK INSTRUCTION

Re-weld Bracket on Suspension Tube

FOR

Class 66

	AUTHOR	APPROVED
SIGNATURE		
NAME	Ross Kerr	Chris Wilson
TITLE	Deputy Responsible Welding Coordinator	Engineering Manager

1. Contents

2. Issue Record

This document will be updated when necessary by issue of the complete document.

A vertical black line in the outside margin will mark the amended or additional parts.

Issue	Date	Pages Affected & Comments
Issue A	22/01/2018	Initial Issue – ECO WRS

3. Reference Documents

Ref	Document No.	Title
1.	BS EN 15085-2	Railway applications- Welding of railway vehicles and components - quality requirements and certification of welding manufacture
2.	QCP 023	Welding of Railway Vehicle & Components in compliance with EN 15085-2 CL1
3.	BS EN 1011-2	Welding. Recommendations for welding of metallic materials. Arc welding of ferritic steels
4.	BS EN ISO 15609-2	Specification and qualification of welding procedures for metallic materials. Welding procedure specification. Arc welding
5.	BS EN ISO 15614-1	Specification and qualification of welding procedures for metallic materials. Welding procedure test> Arc welding and gas welding of steels and arc welding of nickel and nickel alloys.
6.	BS EN ISO 15085-3	Railway applications —Welding of railway vehicles and components Part 3: Design requirements
7.	BS EN ISI 5817	Welding. Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) Quality levels for imperfections.
8.	BS EN ISO 17637	None destructive testing of welds. Visual testing of fusion welded joints
9.	QCP 048 A3	None destructive testing of welds. Visual testing of fusion welded joints in accordance with BS EN ISO 17637.
10.	BS EN ISO 9606-1	Qualification testing of welders. Fusion welding Steels

11.	BS EN 15085-5	Railway applications —Welding of railway vehicles and components — Part 5: Inspection, testing and documentation
12.	BS EN ISO 9934-1	Non-destructive testing. Magnetic Particle Testing – General Principles

4. Drawings

	Drawing No	Issue	Title
N/A			

5. Materials

	Description	Part Number	Quantity	Quantity
N/A				

6. Introduction

The purpose of this document is to describe the method of re-welding a bracket onto a class 66 suspension tube line. Prior to commencing this repair, the parts shall be pre-cleaned and correct positioning of bracket clearly identified before any welding operations taking place.

Due to lack of information regarding material grades and mechanical properties this technical instruction is based on Information supplied by DRS vie email dated 19/1/18 from Mark Halliburton of DRS.

7. Summary Scope of work

- Check all surface areas are cleaned for welding
- Check bracket is clearly marked in correct position
- Weld bracket
- Inspection

8. Safety Procedures

All work must be carried out with strict adherence to, Health and Safety guidelines, risk assessments and local safety procedures. Works isolation and protection procedures will be followed at all times.

All local site rules and risk assessment will be adhered to at all times.

Personnel will respond positively to all works requests regarding the movement of trains and health and safety issues.

This document does not override the requirements of existing quality and safety procedures in force at the location where the repair is to be undertaken.

9. Welding

Welding and associated operations shall be carried out in accordance with the requirements of BS EN 15085-2 Railway applications- Welding of railway vehicles and components-Quality requirements and certification of welding manufacture (Reference Document Item 1) and QCP 023 Welding of Railway Vehicle & Components in compliance with EN 15085-2 CL1(Reference Document item 2) and BS EN1011-2 Welding Recommendations for welding of metallic materials-Part 2 Arc welding of ferritic steels (Reference Document item 3)

All welded joints shall be made using the welding parameters shown in the relevant joint specific welding procedure specification (WPS) in accordance with the requirements of ISO 15609 (Reference document 4). All WPS's shall be supported with a welding procedure approval test in accordance with BS EN ISO 15614-1 (Reference Documents Item 5).

The weld performance class is CP C3 as defined in BS EN ISO 15085-3 (Reference Document 6)

10. Non Destructive Testing

The weld inspection class for this repair is CT4 100% visual inspection, as defined in BS EN 15085-3 table 3 - unless indicated otherwise.

Weld imperfections shall be assessed in accordance with level C of BS EN ISO 5817 Table 1 (Reference Documents Item 7).

Visual testing of welds shall be carried out in accordance with the requirements of BS EN ISO 17637 (Reference document 8) and QCP 48 (Reference document 9)

Magnetic Particle Testing shall be carried out in accordance with BS EN ISO 17638 and QCP 052 Issue A1

11. Staff Competence

All welding operators shall hold a current welder approval test in accordance with the requirements of EN ISO 9606-1 (Reference Documents Item 10) to cover the scope of work they are undertaking.

Welding operators carrying out visual inspection shall be trained to carry this out in accordance with inspection class CT4 and welds in accordance with the requirements of BS EN 15085-5 (Reference document 10) table 1.

MPI operators shall hold current PCN level II certification to cover the scope of work they are undertaking.

12. Repair Method

Prior to carrying out this repair the operator shall familiarise themselves with this document prior to starting work, and issues or questions shall be addressed to the engineer.

1) Using a grinder with a suitable pad or disk clean and prep bracket for welding, deburr rough edges.
2) Using a grinder with a suitable pad or disk also prep suspension tube. Clean all paint, rust, surface grease etc. avoiding any hollow grinding.
3) Using a calibrated thermal laser thermometer measure temperature of work piece, make sure the material is at least 50°F (10°C) this is our minimum pre heat requirement.

If the material is colder than the temperature above or damp, you can locally pre-heat the welding area with an oxy fuel torch to 100°F (38°C) to remove the dampness.

4) Using sketch shown in Fig 1 tack bracket on in correct position. Seek guidance from the Wheelshop Supervisor to ensure correct positioning prior to welding.
5) Using parameters in WPS (sus 66) Section 13, tack weld the bracket. Note - 3 off 25mm stitch welds on each side.
6) Once welded clean with wire brush and remove any spatter.
7) Carry out visual inspection acceptance criteria ISO 5817 cat B.

8) Carry out MPI inspection in accordance with ISO QCP 052 Issue A1

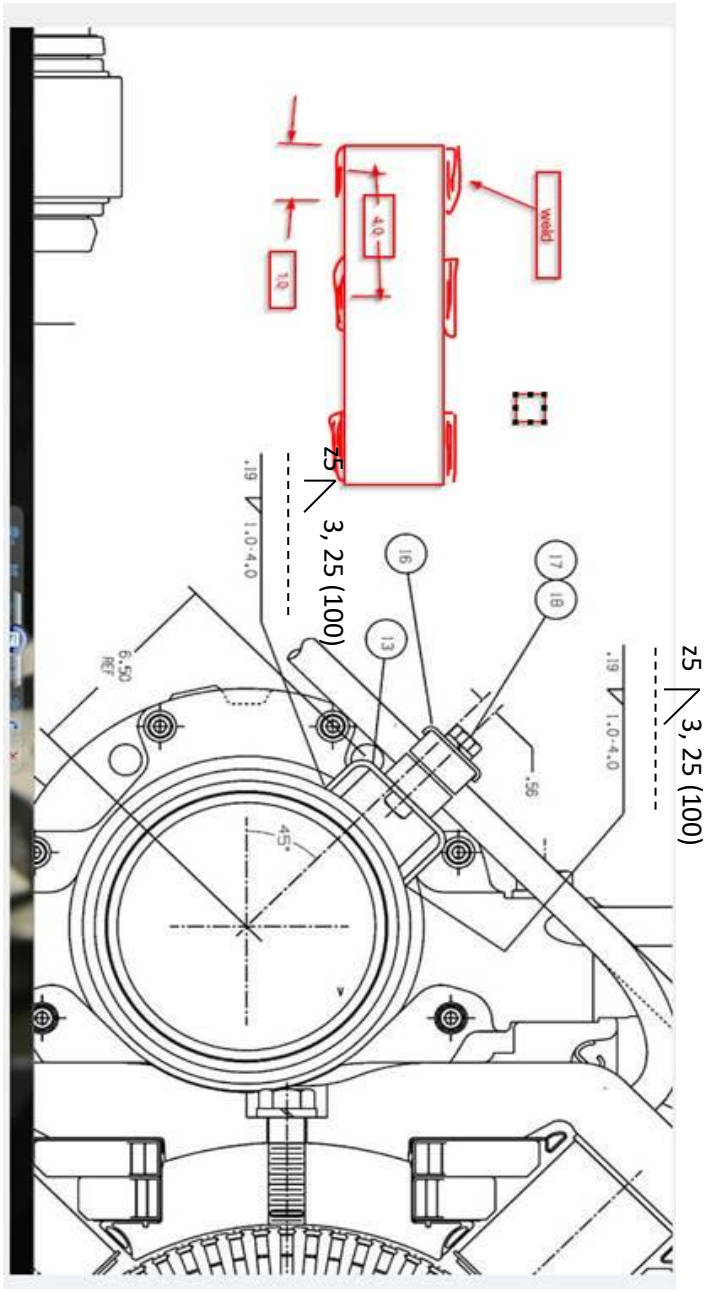


Fig 1

Welding Procedure Specification.

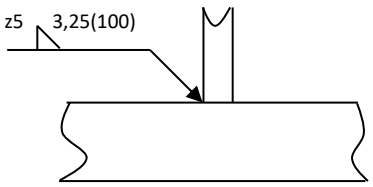
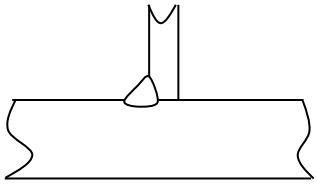
Preliminary Welding Procedure Specification

Wabtec RAIL SCOTLAND

No: 66 Sus
Issue 01

Location:	Workshop	Method of Preparation/Cleaning	Grinding/wire brush
WPAR No:	WPS 221	Parent Material:	Group 1 Steels
Manufacturer:	WRS		
Welding Specification	BS EN 1011-2	Material Thickness:	5mm to casting
Welding Process:	136	Outside Diameter:	N/A
Joint Type:	Lap Weld	Welding Position	PB

Weld Preparation Details

Joint Design	Welding Sequence
	

Welding Details

Run	Process	Size of Filler	Current A	Voltage V	Polarity	Wire Feed	Travel Speed	Heat Input
1	136	Ø1.2	220-230	27-28	DC+	7.5m/min	5mm/S	1.03 kJ/mm max

Filler Material Classification & Trade Name:		ESAB OK Tubrod 15.14 ISO 17632-A: T 46 2 P M 2 H5
Any Special baking or drying:		As per QPS 023
Gas/Flux	Shielding:	BOC Argoshield Heavy 20% Co2,2% O2 in Ar @ 15lts/min
	Backing:	N/A
Tungsten Electrode Type/Size:		N/A
Details of any back gouging/backing:		Grind back to sound metal between run 1 & 2
Preheat Temperature:		10°C min
Interpass Temperature:		150°C
Post Weld Heat treatment:		N/A
Time Temperature Method:		N/A
Heating and cooling rates:		Cool in still air

Notes
Spray Transfer
Stick out 20mm

Signed: K Taylor: MWeldI

Signature:

Date: 22/1/2018