granning
axle and suspension solutions

GENERAL AGRI AXLE SERVICE MANUAL

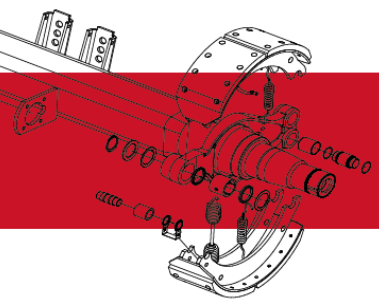
97000 SERIES

97100 SERIES

97200 SERIES

97300 SERIES

97400 SERIES



www.granningaxles.ie

Revision Date: October2020

Part Number 80268 REV D

Whilst every effort has been made to ensure that this manual is as accurate as possible, Granning cannot be held responsible for any omissions or errors. We reserve the right to alter specification without prior notice.

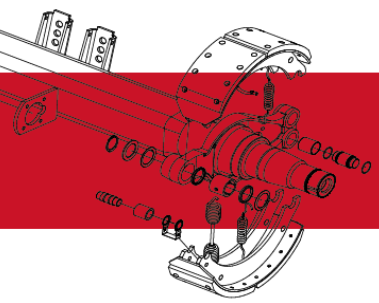
Revision: October 2020

Congratulations on your purchase of a Granning axle.
Granning are one of the Europe's primary Suspension and Axle Manufacturers. Part of the Toughline Manufacturing Group, we are experts in road vehicle axles, brakes and suspensions. Operators throughout the world are reaping the benefits of our road friendly air suspensions and high quality non driven axles. We hope you get many years of service from your Granning axle and in order to ensure you do, please follow the instructions contained in this manual.

Please record the below information as you may require it when identifying service components.

Axle information record:

Date Fitted:	/ /
Chassis Number:	
Axle Model Code:	/ /
Axle Serial Number:	



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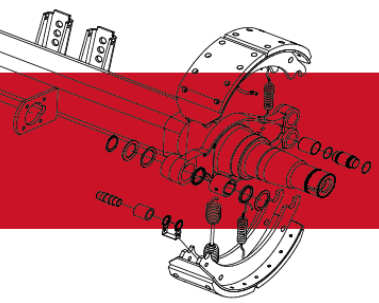

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Health and Safety Guidelines

Do ✓

ALWAYS use genuine GRANNING components. ✓

ALWAYS use suitable tools for the job. ✓

ALWAYS work in good, safe working conditions. ✓

ALWAYS use safety equipment. ✓

Always follow your own Health and Safety systems. ✓

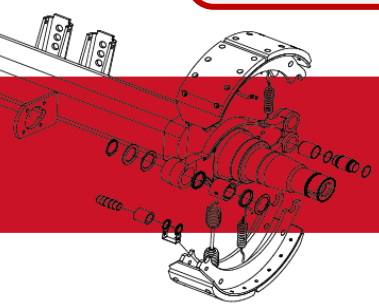
Don't ✗

NEVER work under an unproped body or axle. ✗

NEVER leave an un-propped body or axle unattended. ✗

NEVER work without supervision. ✗

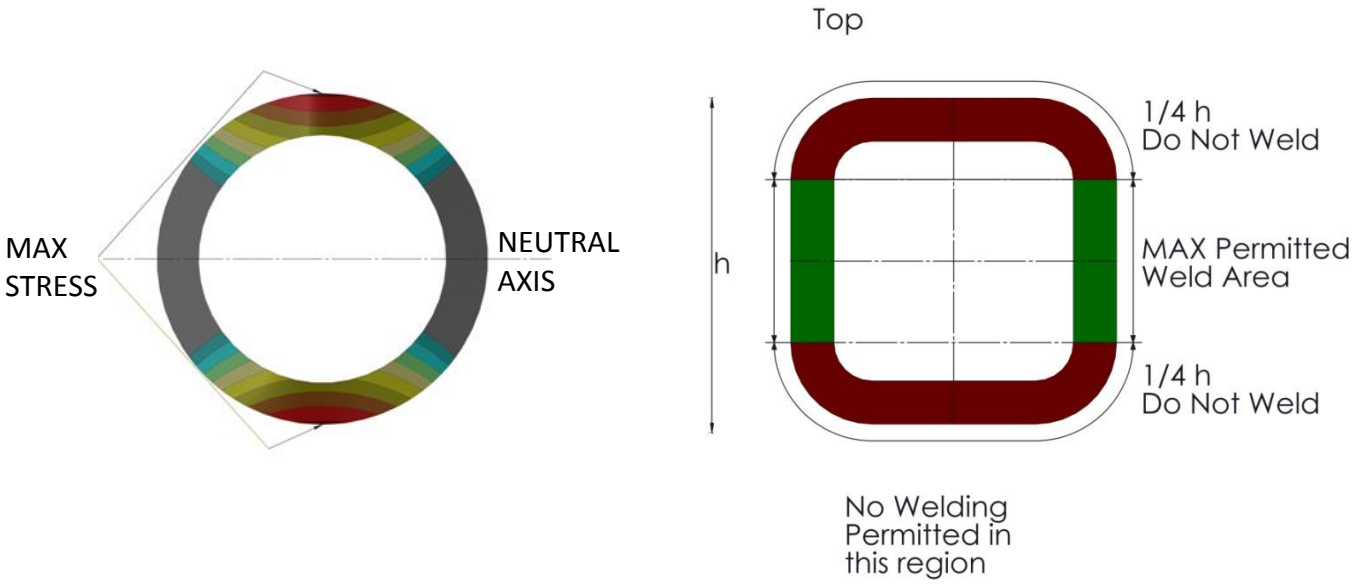
All Granning axles employ Asbestos Free friction material, however, when servicing a used axle, take care Asbestos might be present in brake linings. Always assume that Asbestos is present and take appropriate steps to ensure the safety of all involved.



Read this section before welding the axle saddles

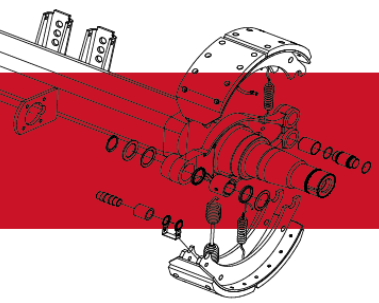
Beam Stresses

Granning Axle beams are manufactured from high tensile, solid beam. In service these beams are subjected to combined bending and torsional stresses. Maximum combined stresses occur along the top and lower surface of the beam. The minimum stresses occur along the front and rear centre line, called the neutral axis.



Effects of Beam Welding

When a weld is made on the beam, it creates in effect an area of extreme localised heat treatment. The heat generated by the welding process will cause the beam material, within the immediate vicinity of the weld, to become hardened. This results in a small area of brittleness replacing the required property of ductility. It can be seen that should an area of localised hardening appear at either point of maximum stress, the strength of the beam could seriously be affected. Therefore any welding must be in the neutral zone, ie not in top or lower 100 degrees.



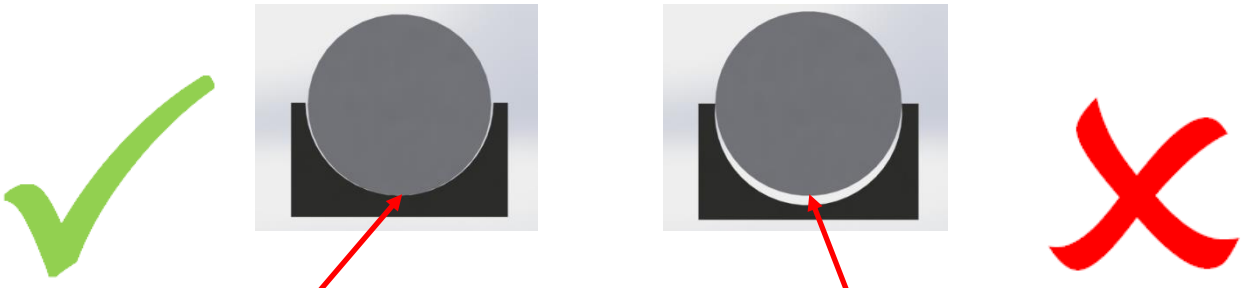
Welding precautions

- Connect the earth directly to the work piece. Not to spring beam
- NEVER weld to the upper or lower surfaces of the axle.
  Confine welds to axle surfaces not exceeding 40° above or below the horizontal.
- Remove oil and paint from areas to be welded.
- As far as possible, try to avoid overheating the axle.
- Protect the spring Beam / Leaf and rubber components from weld splatter.
- Welds must contain NO voids, craters, inclusions or cracks.
- When ambient conditions are below 20°C, preheat the weld areas.

Locating axle seat/saddle before welding

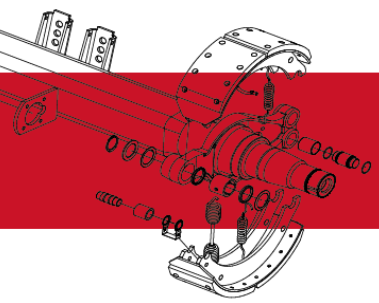
Ensure axle beam sits correctly in the seat/saddle, and that the spring face is square.
See below

BELOW DRAWINGS ARE EXAGERRATED FOR ILLUSTRATED PURPOSES



Ensure contact at this point between axle and saddle

Gap Present
(Incorrect contact, as shown, will cause excessive weld stress and lead to the axle cracking)



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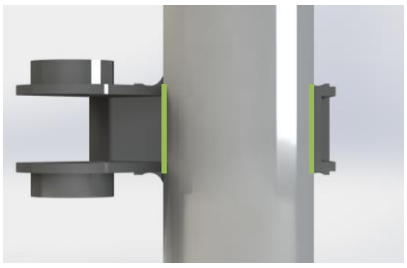
Saddle / Seat welding

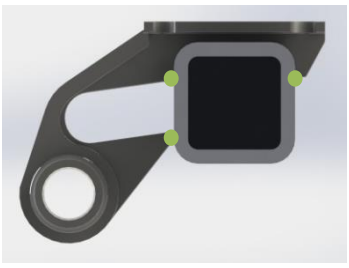
- Set saddle centres to the given dimension.
- Ensure that the axle tube and saddle cup are clean.
- Centre axle between the saddles.
- Locate camshaft/brake position ensuring correct rotation and position.
- Set saddle spring surfaces parallel to one another.

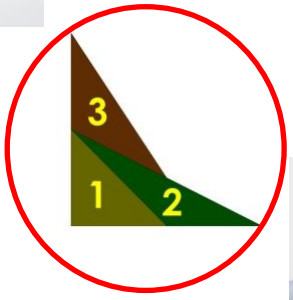
Once all of the above has been assured and re-checked, weld saddles as below.

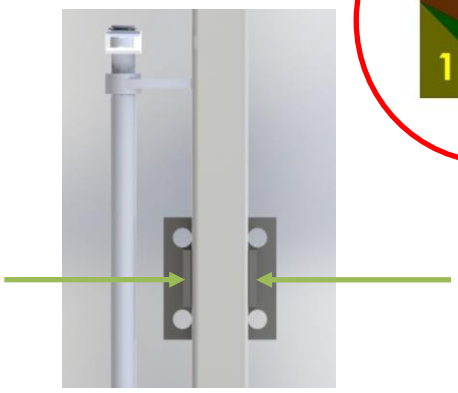
Although it is possible to make a 10 mm fillet weld in one pass, we recommend that this be done in three passes. The order of which are shown in the close up below. Make second and third runs before previous welds are cool, de-scaling first.
The weld is to be in direction towards the axle centre, it is to start on outer side and be completed on inboard side of saddle.

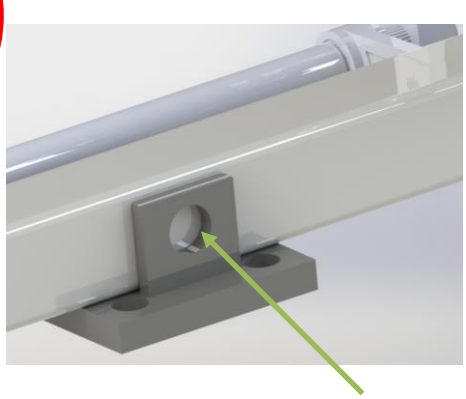
All welds should be triple pass, as pictured below.



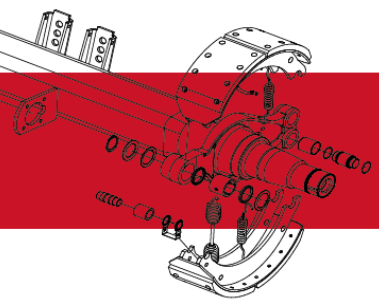








5mm Fillet Weld around this hole



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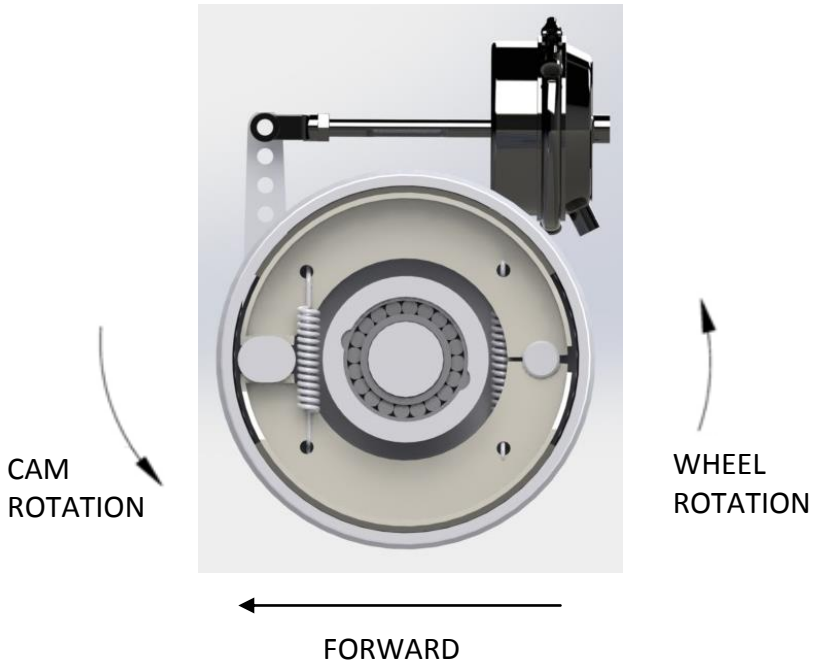
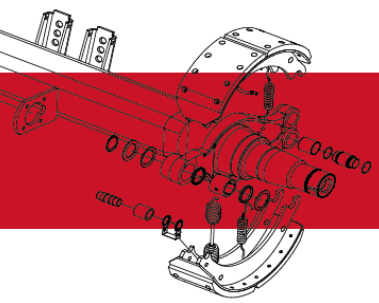
Brake Camshaft Rotation

To assure safe operation and maximum durability on parts such as brake linings and tyres, it is necessary to position and install the axle properly. It is essential that the axle assembly be installed so that the cams rotate in the same direction as the wheels in FORWARD travel.
Installation in which the camshaft rotation is opposite to that of the wheel rotation could cause noisy brakes, chatter and wheel 'hop'. With this in mind, the axle should be ordered with placement of air chamber and slack adjuster assemblies that will ensure the correct directional rotation of the cams when the axle is installed. See below.

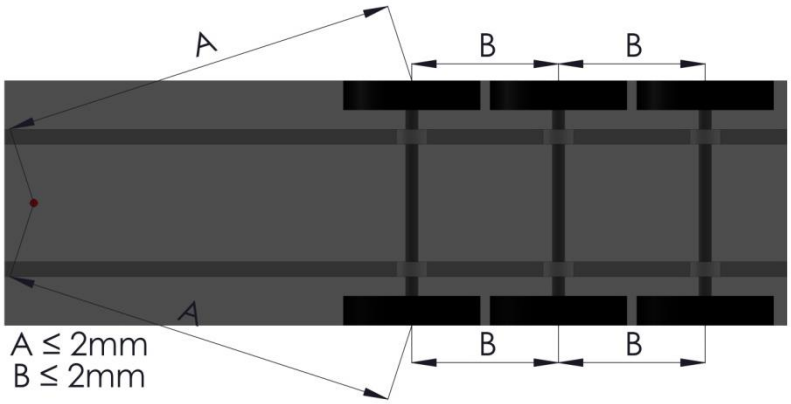




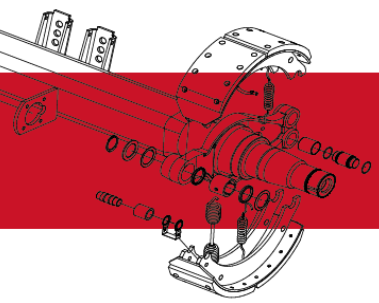
All Granning axles are constructed so that the toe in / out is less than 2 mm / metre. Responsibility for proper axle alignment lies with the axle installer. The Granning Axle Range includes Trailer axles and Truck axles.

Trailer axles are aligned (tracked) from the trailer king pin to fixed points on the front axle. Following axles are tracked from the front axle.

Truck Axles should be aligned parallel to the DRIVE axle.



Tracking of trailer axles

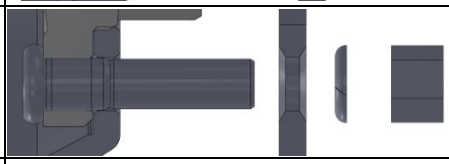
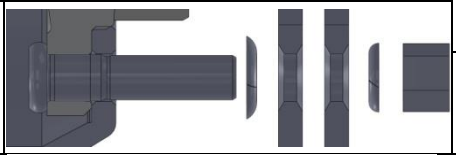


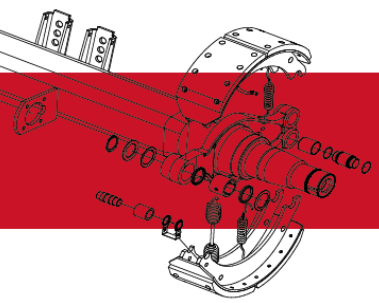
It is vital that operators and manufacturers ensure that the correct type of wheel cones and nuts are fitted to specified bolts, before torquing to full setting.

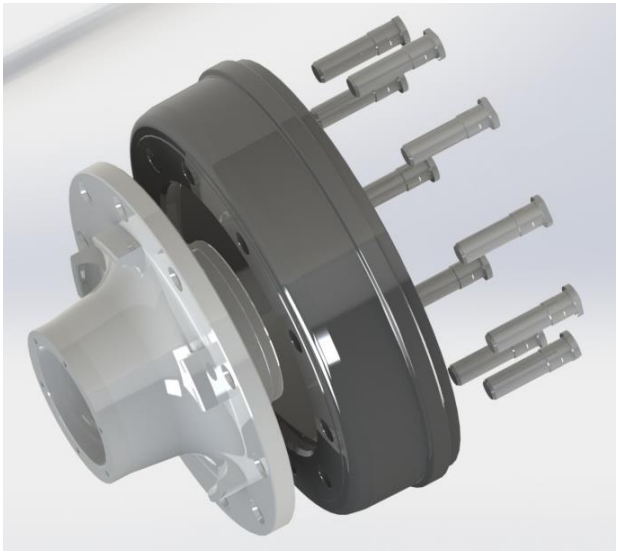
Wheel Rims and Fasteners of different standards must not be interchanged or mixed in any combination.

Mating surfaces between Hubs and Wheel Rims should be primer painted only. Thick gloss will result in loss of torque.

The below table shows the main nut and bolt configurations and sizes.

Nut Type		Thread	Tightening Torque	Leverage *L	Force *F
		mm	N m	mm	Kg
A		M12x1.5	90	300	30
		M14x1.5	130	300	40
		M18x1.5	270	450	60
B		M18x1.5	270	450	60
		M20x1.5	380	600	60
C		M22x1.5	500-535	800	63
D		M20x1.5	450	800	55
		M22x1.5	600-630	1000	63

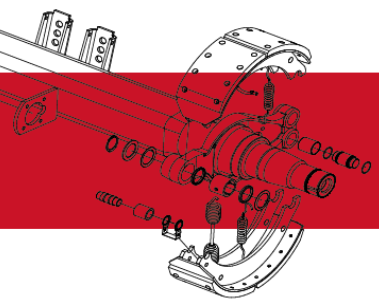




For Hubs without an integrated Drum ensure the holes are perfectly lined up before pressing in the bolt

Press Wheel bolt into the Hub/Drum ensuring that they are pressed in straight to avoid damaging them

Ensure when installing the wheel bolts that the flat edge is facing the edge of the drum



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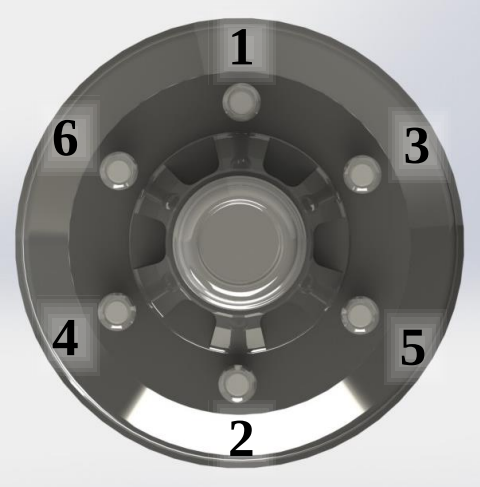
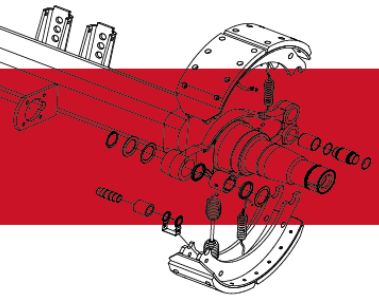
Wheel Tightening Sequence

To achieve correct tension in each of the wheel locating bolts, and thus optimum wheel security, Tighten wheel nuts in the order shown below.





Axle servicing

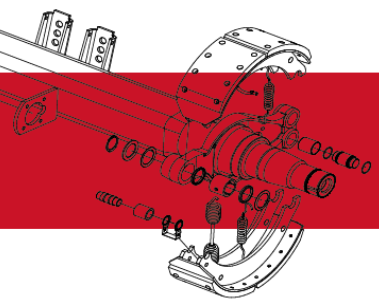
In order to achieve maximum performance from your Granning axle it requires regular servicing outlined below.

Service intervals depend on operating conditions and are best decided by the Operators Fleet Engineer, the following guidelines are noted as a maximum recommended intervals and should be reduced accordingly under extreme conditions. It s recommended that records of this servicing are kept for future reference.

Note: local legislative regulations should always be followed.

□ Maintenance Work ○ Lubrication	On Initial Receipt	Before and After the First Laden Journey	After the first 1,000Km	Before any period of intensive use	Every 3 Months	Every 6 month or 25,000Km	Annually and every Brake Lining Replacement	Every disassembly of the Axle
Service Intervals		□						
Check all Nuts for Recommended Torque	□							
Wheel Nut Check*	□	□	□			□		
Bearing Play Check			□	□		□		
Brake Lining Check				□	□			
Manual and Automatic Slack Adjuster check				□	□			
Brake drum inner diameter and crack check					□			
Visual inspection of all components for damage and wear						□		
Lubrication Intervals		○						
Camshaft Bearings and Bushings			○	○	○	○	○	
Manual and automatic slack adjusters			○	○	○	○	○	
Change wheel hub grease							○	○
Check condition of the wheel bearings and oil seals							○	○

* - Repeat every time wheels are removed or changed



Maintenance Intervals

On Initial Receipt >

Check all nuts, etc. for recommended torque.

Wheel nut Check

- First use of the vehicle
- Before and After first laden Journey
- After the first 1,000Km
- Every 6 months or 25,000Km

Repeat every time the wheels are changed or removed

Bearing Play Check

- After the first 1,000Km
- Before any intensive period of use
- Every 6 months or 25,000Km

Brake lining Check
(Minimum lining thickness 2mm Min thickness)

- Every 3 months
- Before any intensive period of use

Manual and Automatic slack adjusters Check

- Every 3 months
- Before any intensive period of use

Brake drum inner diameter and crack Check

- Every 3 months

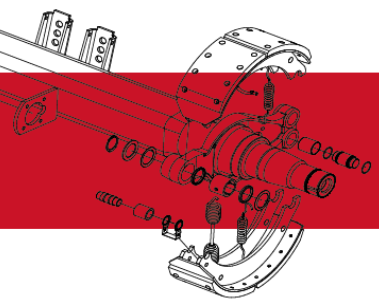
Visual inspection of all components for damage and wear

- Every 6 months

Lubrication Intervals

Cam shaft Bearings and Bushings

- After the first 1,000Km
- Before any intensive period of use
- Every 3 months



- Every 6 months or 25,000Km
- Annually and every brake lining replacement

Manual and automatic slack adjusters

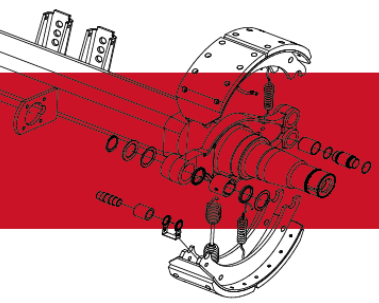
- After the first 1,000Km
- Before any intensive period of use
- Every 6 months or 25,000Km
- Annually and every brake lining replacement

Change wheel hub grease

- Annually
- every brake lining replacement or disassembly of the axle

Check condition of the wheel bearings and oil seals

- Annually
- every brake lining replacement or disassembly of the axle



Bearings

Checking Bearings for Play

This check should be preformed:

- After the first 1,000Km
- Before any intensive period of use
- Every 6 months or 25,000Km

Wheel bearings are subject to wear during their service life. The life time of a bearing depends heavily on the operating conditions:

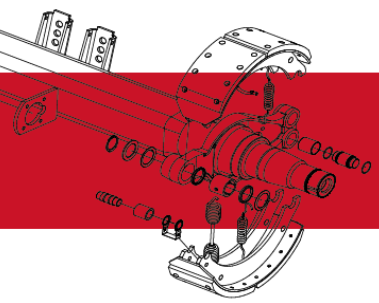
- Load
- Speeds

As well as the maintenance to suite the operating conditions, by correct adjustment and lubrication.

To check wheel bearings for wear and Play:

- Lift the wheel to be inspected of the ground using suitable workshop jacks, ensuring proper Health and safety regulations are followed,
- Chock the vehicle and ensure the vehicle cannot move, and release the brakes
- Rotate the wheel in both directions slowly to check for any rough points or friction
- Rotate the wheel at high speed and listen for any unusual noises, such as knocking or grating, coming from the hub or bearings.
- Grip the wheel at the top and bottom, and try tilting/rocking the wheel, to see if any movement can be found.
- Rotate the wheel by 90 degrees and try rocking the wheel again.

If play can be felt during this process, the bearings should be adjusted, as per the procedure noted later, and the process above repeated. If the play is still found the bearings should be removed and inspected/ or replaced.



Bearings

Cleaning Bearings for inspection or fitting

The bearings used in Granning axles are of the finest materials, and produced to exacting standards. They are selected to give the user considerable service life. To protect this longevity, the following procedure is recommended when servicing is required:

a) Immerse cups and cones in a suitable cleaning solution. After soaking, agitate bearings around in fluid to flush out any old residue grease. Never spin a bearing; this could cause the rollers to skid, thus damaging the highly finished internal surfaces of the bearing.

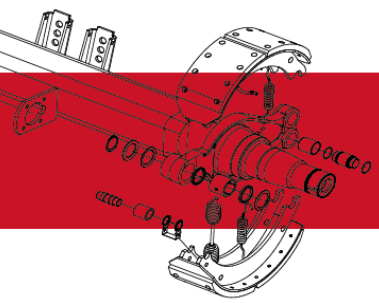
b) When clean, thoroughly drain and dry, preferably in warm air at around 65 - 80°C.

c) The bearing must be now checked for any signs of corrosion, discoloring, pitting or flaking. Should there be any doubts as to the condition of the bearing, replacement is strongly advised.

d) If the bearing is to be refitted immediately, ensure the rollers are fully pre-packed with lubricant (see recommended lubricants) before fitment. Alternatively, immerse the bearing in rust-preventative oil, wrap in wax paper, and box for storage.

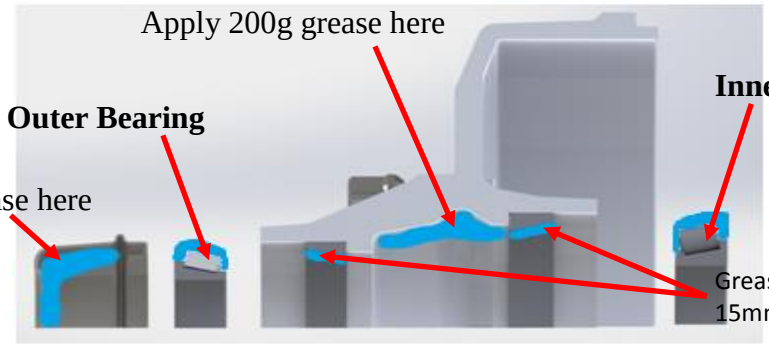
Recommended Lubricants

Manufacturer	Recommended	Alternative
Shell	Shell Retinax 'LX2'	Shell Retinax 'LX'
Mobile	Mobile Grease H.P. 222	Mobile Grease H.P.
Castrol	Castrol LMX	Spheerol A.P.T.Z.
Texaco	Hytex EP2	
Esso	Unirex EP2	
BP	Energrease LC2	



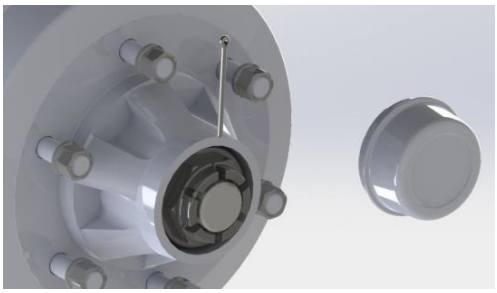
Bearing setting

Lubrication

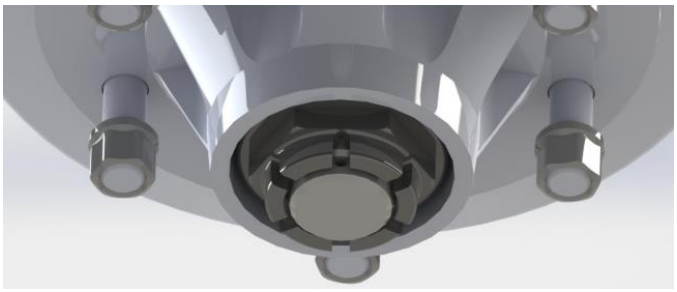


Apply a generous coating of grease to the areas shown above. It is important not to overfill the hub with grease!

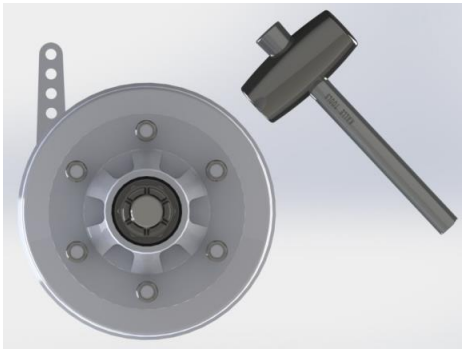
Bearing Setting



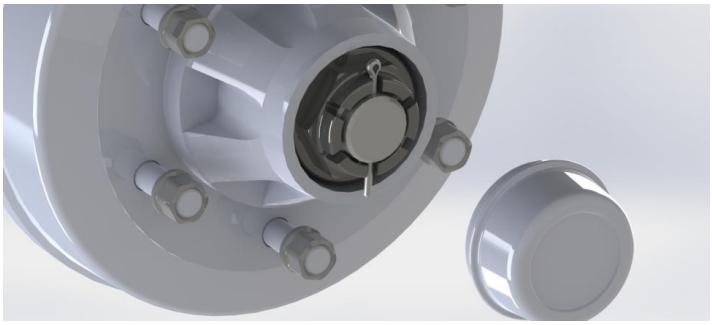
Remove the Hub Cap and Split Pin and tighten the castle nut until wheel feels slightly stiff to rotate



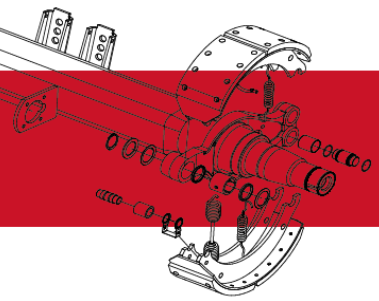
Slacken off the castle nut until there is no friction between the castle nut and the outer bearing, and the hole in the axle beam, aligns with a notch in the castle nut.



Tap the hub gently in several places with a mallet. Rotate the hub, which should rotate more freely.



Once adjusted if the hole does not line up with the castle nut loosen the nut until it does. When the hub has been adjusted, fit a new split pin and refit the hub



Brakes

It is important that operators develop a schedule for periodic cleaning, inspection, adjustment and lubrication of brake components. This will provide the prevention rather than cure of brake problems. Adjustment of brakes should be carried out as frequently as required, in order to maintain the original safety standard. Slack adjuster travel and uniform lining clearance must be maintained.
At regular intervals, brake drums should be removed and linings checked for wear.

Observe the minimum thickness set out for each series of axle as below:
97000 series axle minimum thickness is 2mm
97100 series axle minimum thickness is 2mm
97200 series axle minimum thickness is 2mm
97300 series axle minimum thickness is 2mm
97400 series axle minimum thickness is 2mm.
After fitting new or re-lined shoes, always fit new return springs. Each time the hubs are removed for brake inspection, check the following parts for wear:

1) All hub components.
2) Grease seals. (It is recommended that new seals are fitted, see Pg. 24)
3) Bearing cups, cones & rollers.
4) Brake anchor pins and location holes.
5) Wheel studs and nuts.
6) Check brake drum for cracks, scoring or any form of deterioration.

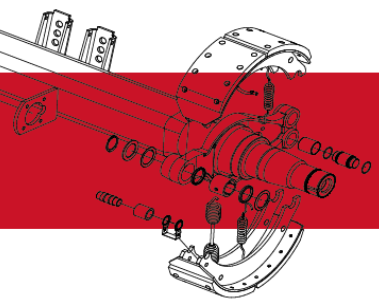
Prior to re-assembly, the following parts should be lightly coated with ‘axle grease’ or equivalent product:

1) Anchor pin location holes in brake shoes.
2) Brake Anchor Brackets (spiders) camshaft bores.
3) Cam head/roller contact

Note: Brake Linings should be replaced as a complete axle set!
Once new linings have been fitted braking performance will be reduced until the new linings have ‘bedded in’. This can take up to 1000km depending on operating conditions. Therefore it is recommended that linings are replaced well before critical brake performance inspections such as MOT tests etc.

Check with the manufacturer of your slack adjusters for any adjustment that it requires.

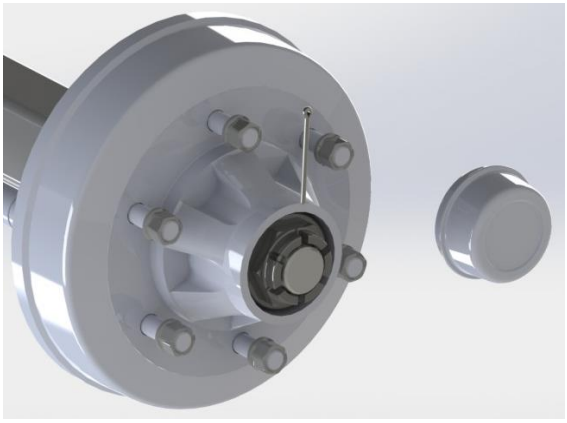
Slack adjusters should be installed and serviced in line with their manufacturers guidelines.



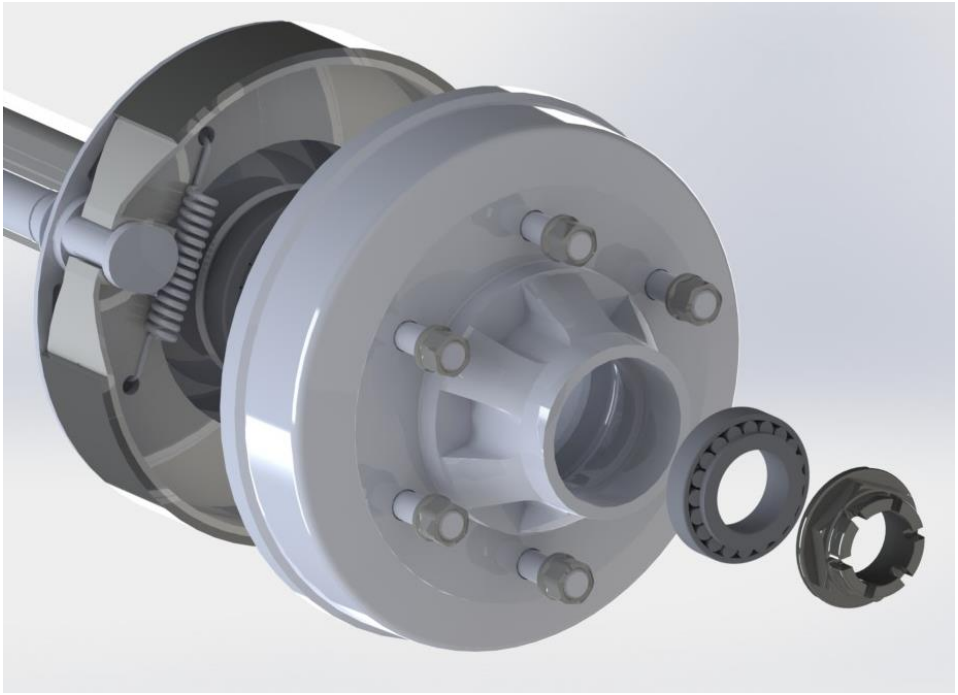
Disassembling your Axle

Hub Removal

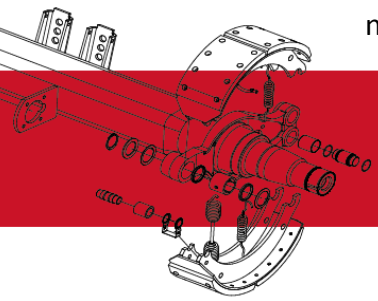
Ensure the axle/wheel are lifted from the ground, and correctly supported.



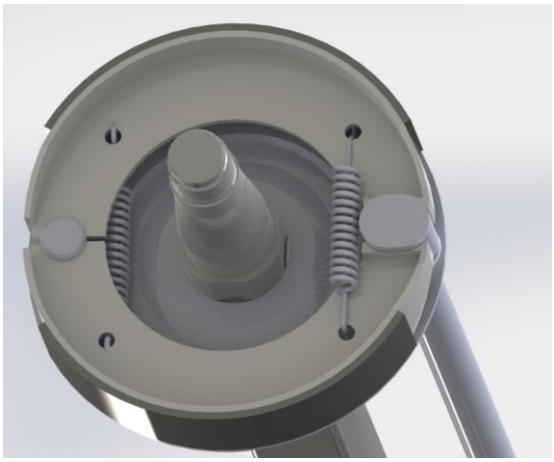
Remove hub cap. Remove split / cotter pin.



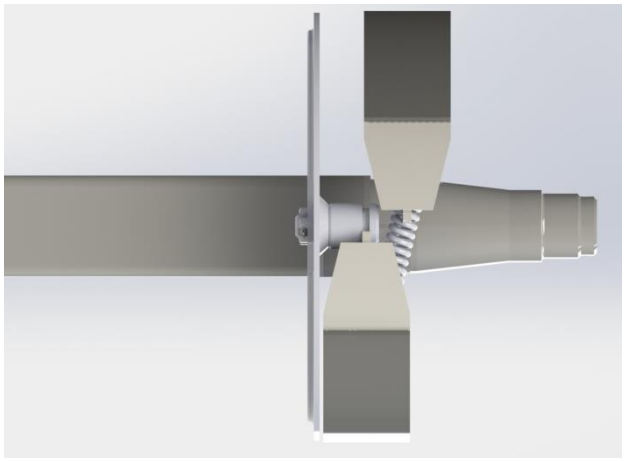
Remove Castle Nut which will allow the outer bearing to be pulled straight out of the hub. Then remove the Hub using a hub puller if necessary



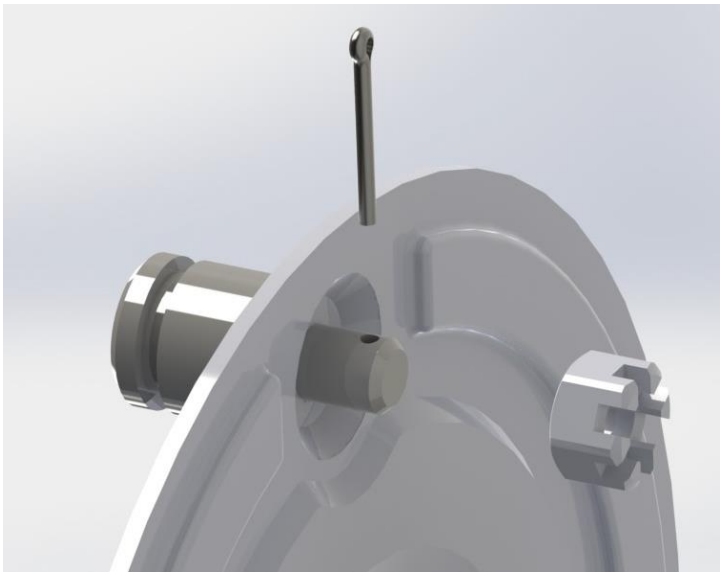
Removal of Quick Fit Brakes



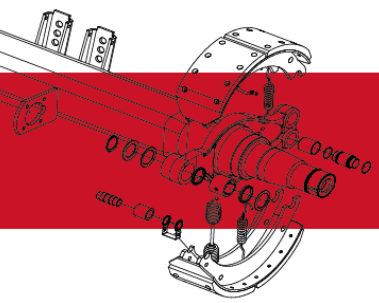
Pull up the top brake shoe allowing it to come clear of the anchor pin and camshaft



Allow the retaining springs to relax, once they are relaxed the second brake shoe will drop clear of the anchor pin and camshaft

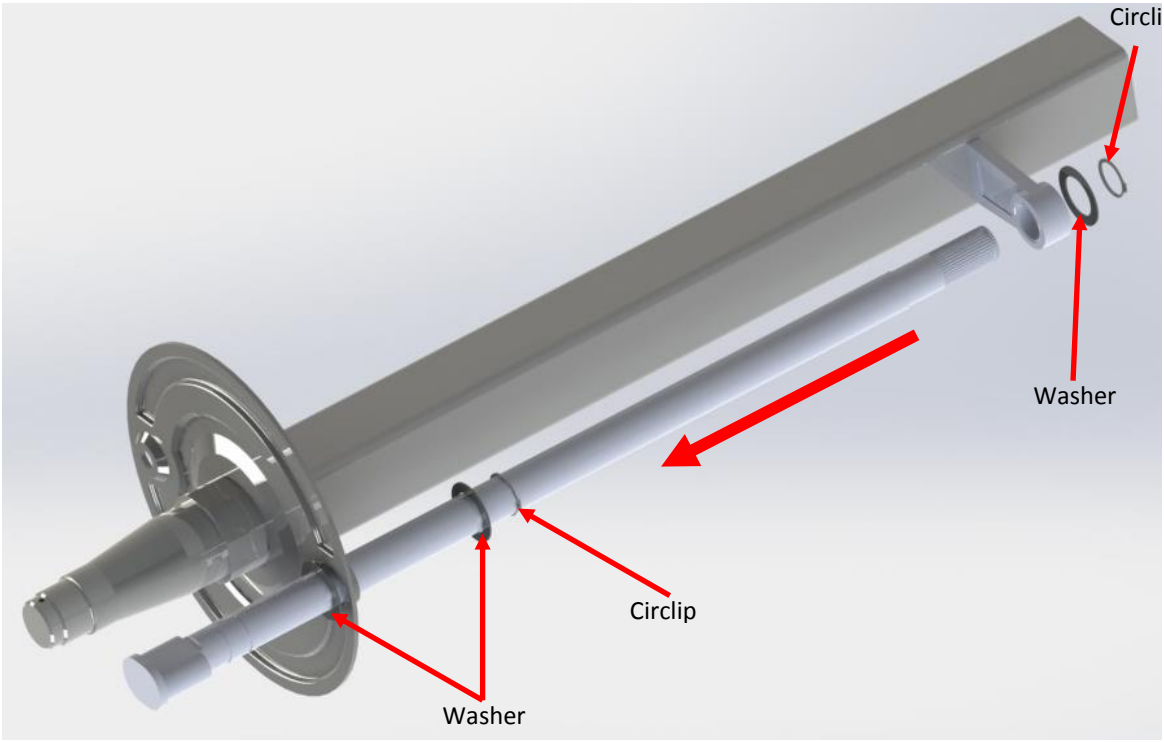


To remove the Anchor pin remove the split pin and castle nut and pull from anchor plate



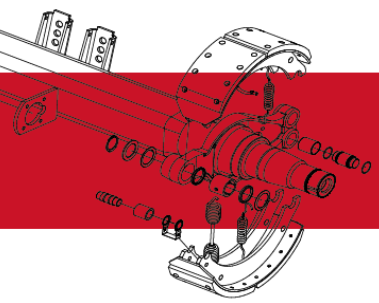
Removal of Cam Shafts

Firstly, if the brake shoes are still fitted, then you can either open them out using the appropriate tool or remove the brake shoes.

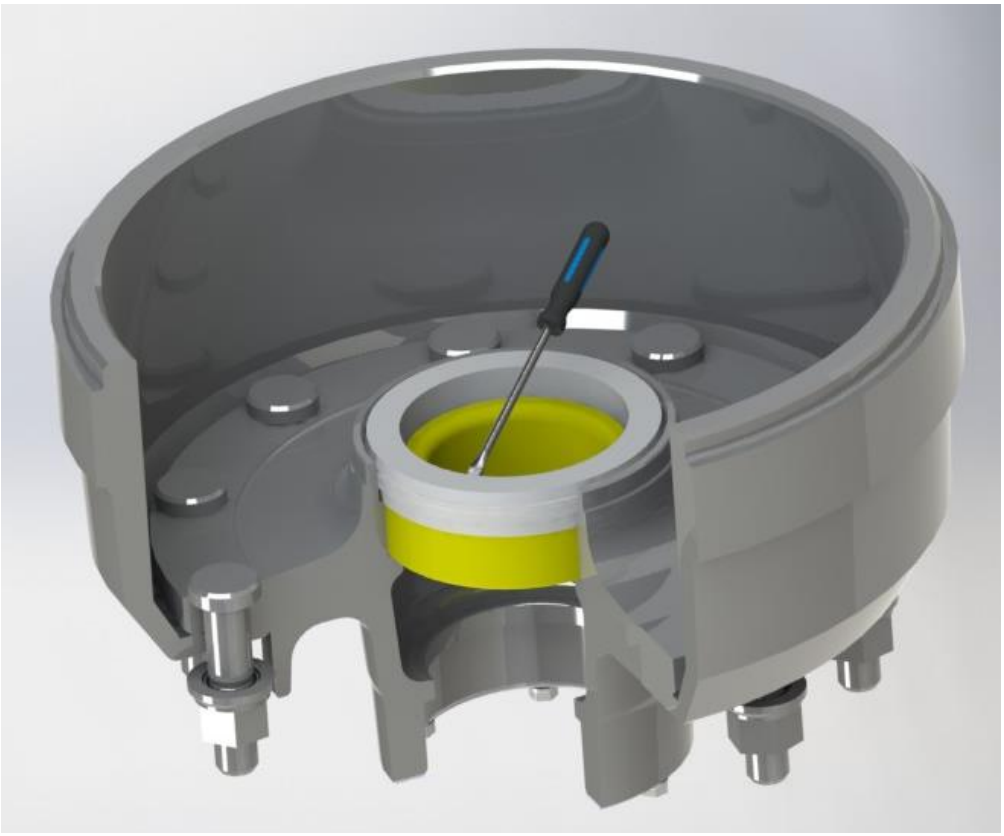


Remove the slack adjusters if they are still fitted, then unlock and move the circlips and washers at the anchor plate.

While pulling the camshaft back, use an appropriate mallet and drift. Keep moving the circlips and washers collecting them before they fall off.

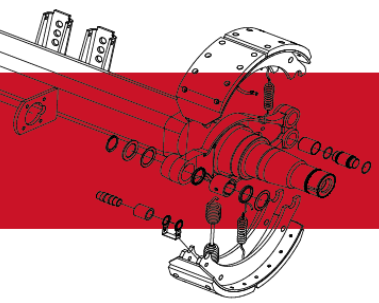


Grease Seal removal



It is acceptable to remove the grease seal with a screwdriver as long as great care is taken as not to damage the bearing and journal beneath it.

Once a grease seal has been removed, **NEVER** refit it as the seal will have been broken and will only be the cause of further problems.



Bearing Removal (Twin bearings)

The inner race and rollers should easily be removed, leaving the outer race (cup) in place.
If you wish to remove the outer race (cup), then you will need to use a hammer and drift to knock the race out of the hub. Use a bearing removal tool or the two slots in the hub for the location of the drift.

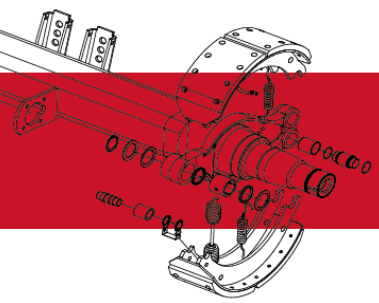
(See page 15 for information about care needed for the bearing)
The inner bearing is removed in much the same way; however, the grease seal must first be removed. See page 23 for grease seal removal.

Removal of Bearings

It is far more difficult to remove bearings from a shaft than to put them on. It is necessary to remove the bearings by using the correct tools, otherwise damage may be sustained to the balls/rollers or races. Since such damage is seldom visible, it does not become known until after complete reassembly. It is good preventative maintenance to replace most bearings during the overhaul period. If a bearing is not going to be replaced, avoid removal during low mileage rebuild.

Interchangeability:

Most bearings are interchangeable in regard to standardised dimensions, tolerances and fits.



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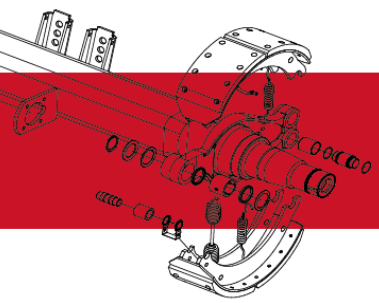
Reassembling your Axle

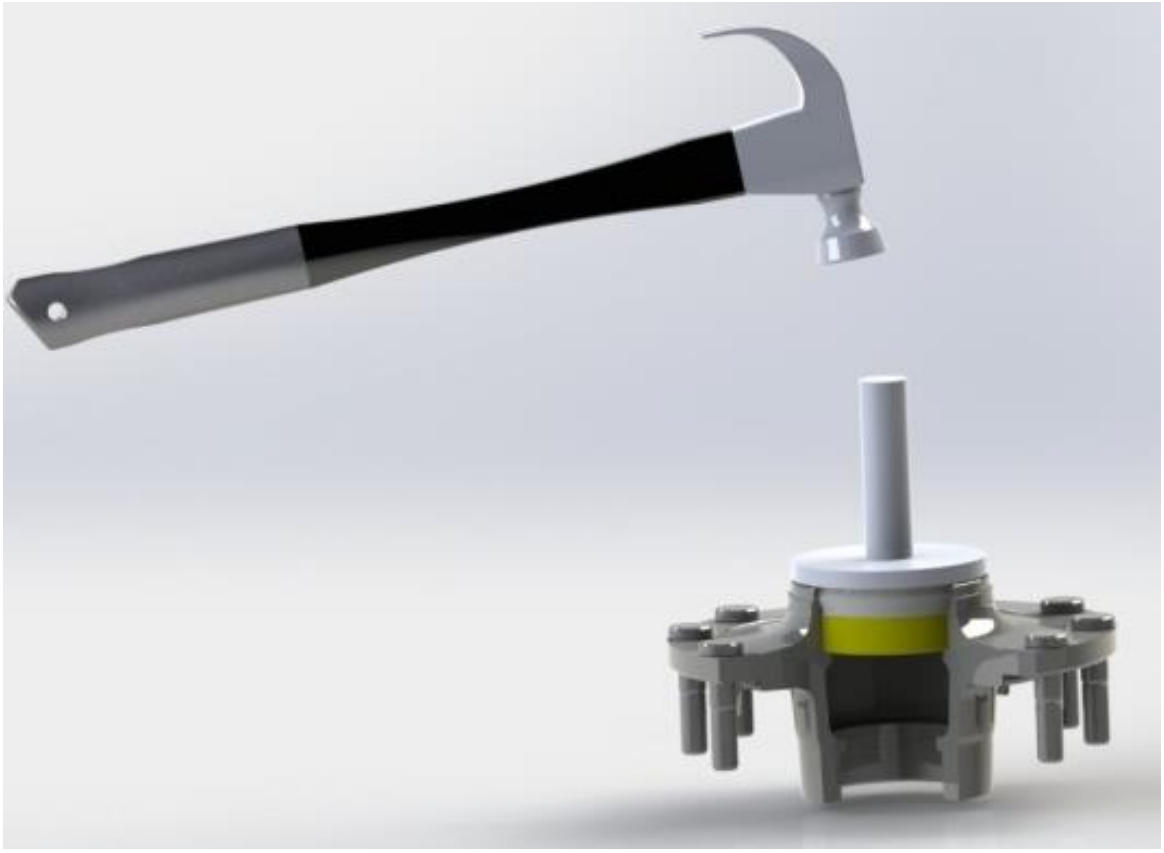
Bearing Cup Fitment

Before fitment remember to check that the bearing is fully pre-packed with grease.
When fitting bearings it is essential to use proper tools that have been designed for the task. Using these tools will help to prevent damage to the bearing y ensuring they are pressed in square and even.

Damaging a bearing on fitment could cause increased wear and premature failure.



Grease seal replacement

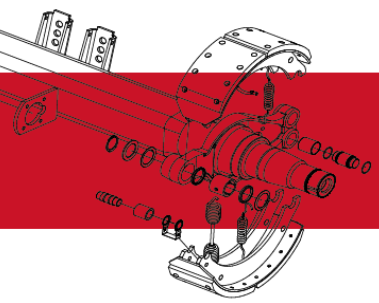


Never Refit a Grease Seal once it has been removed.

Always fit genuine **Granning** Grease Seals.

The grease seal fitment is shown here for clarity, remember to fit the inner bearing (cup and race) before the grease seal. See page 24 for bearing fitment.

When fitting a grease seal always take care as not to damage the seal on fitment. Granning advise the use of a grease seal driver, as this will help to correctly fit the grease seal by ensuring it stays square and even.



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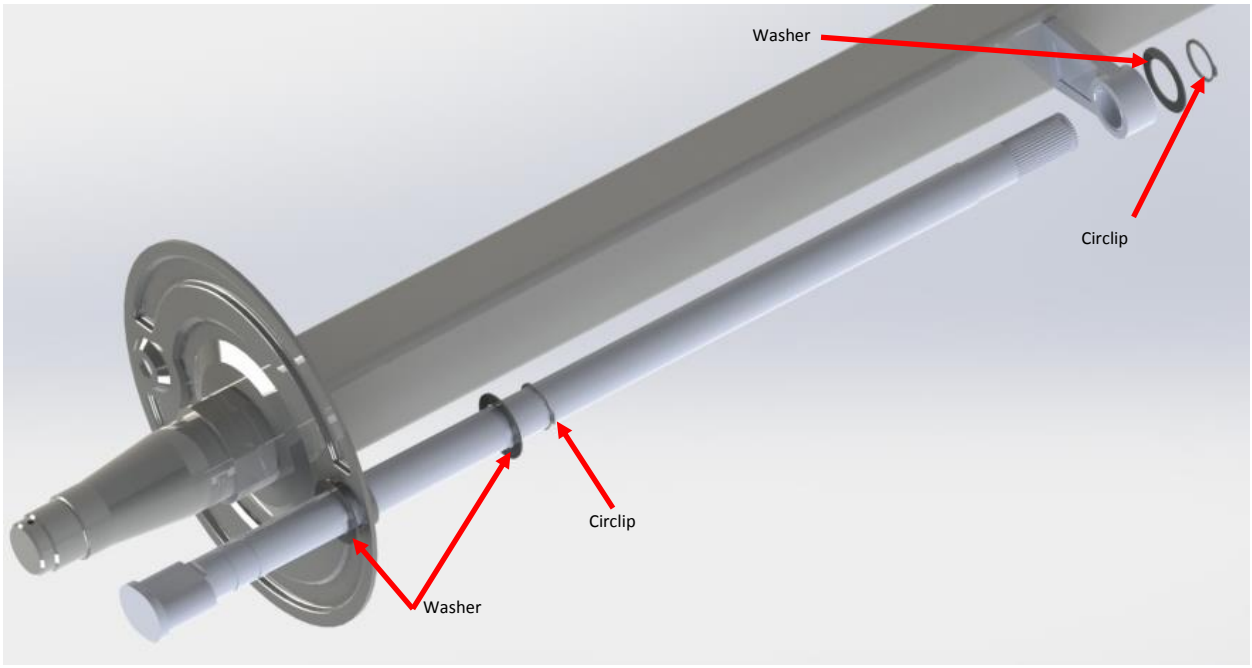
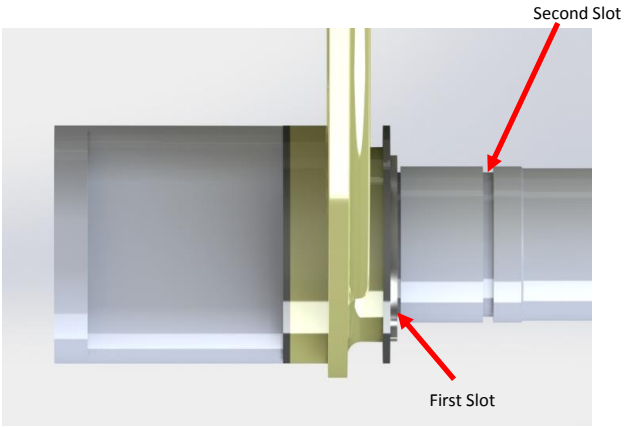
Fitment of Cam Shafts

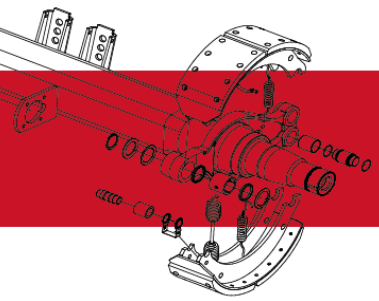


Add washer to the camshaft and gently knock the camshaft through the anchor bracket (spider) and adding the necessary circlips and washers, before knocking through the cam support bracket.

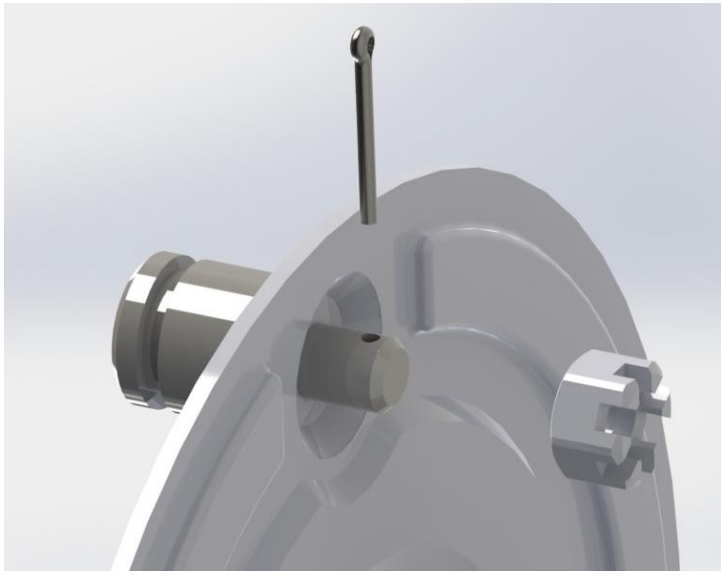
Confirm that all washers and circlips are in correct grooves for the correct axles
Small Axles without Greasing point use first slot
Axles with Greasing point use second slot.

See below.

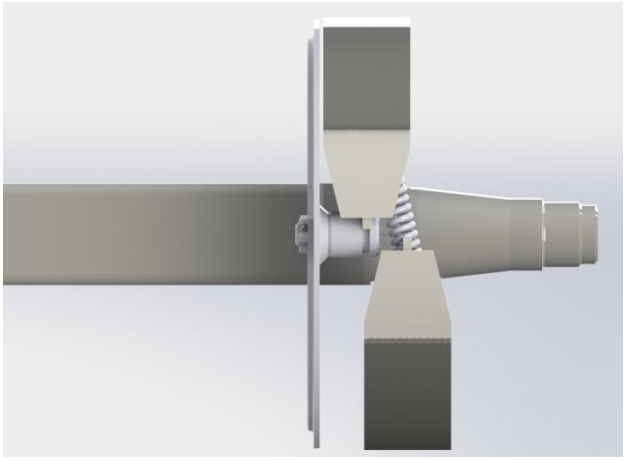




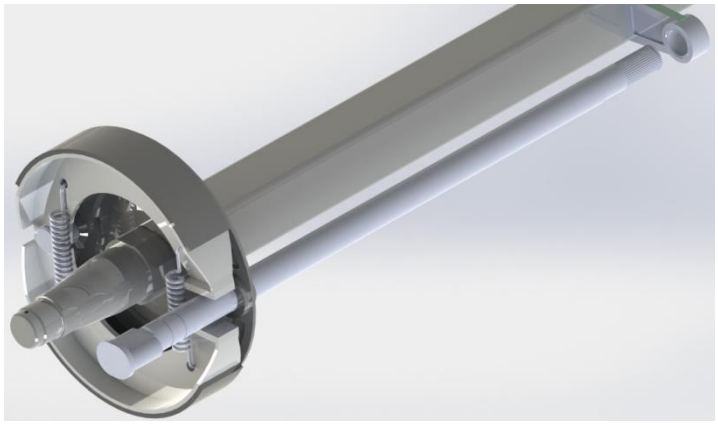
Fitment of Quick Fit Brakes



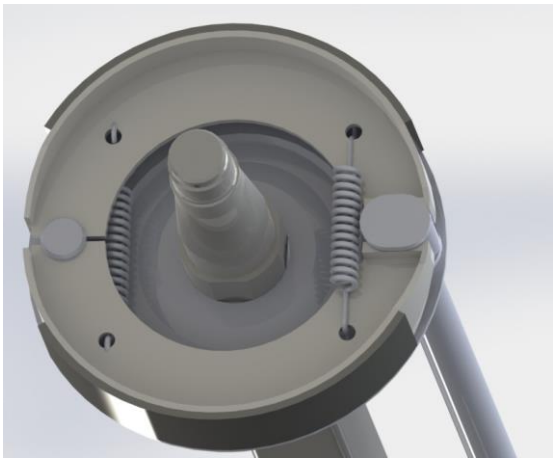
Insert the anchor pin through the hole in the dust cover and lock in place with the Castle nut and cotter pin. Connect the two shoes together by the retaining springs ensuring that one spring is on the back of the brake shoes and the other on the front.



Next place the top brake shoe onto the anchor pin and stretch the lower brake shoe down until it locates into the groove in the anchor pin

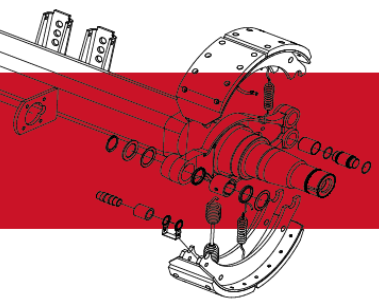


If the camshaft is not already fitted, using an appropriate tool separate the brake shoes at the camshaft end to allow the camshaft to be slid into place.
Ensure all washers are positioned in the right places when installing the camshaft

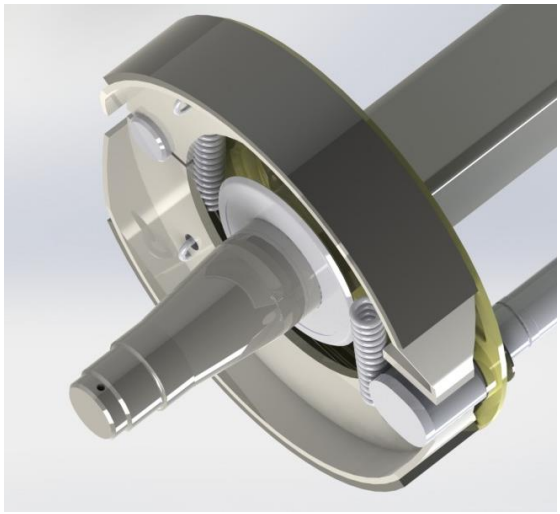


Relax the springs around the camshaft and lock the camshaft in place with the circlip

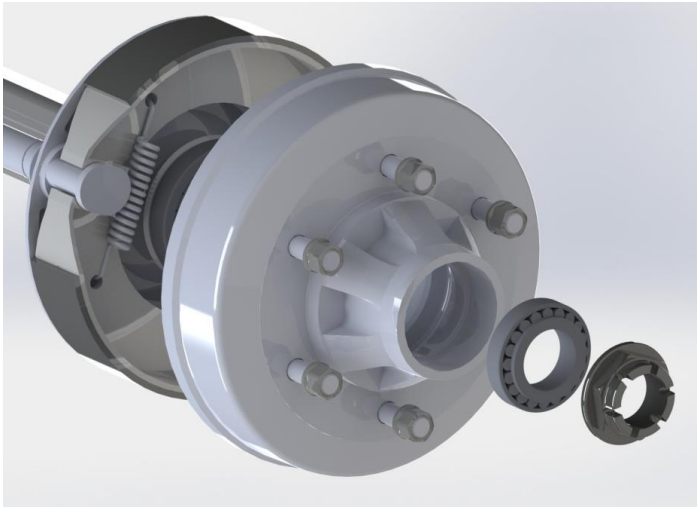
Check that the camshaft is free to rotate smoothly



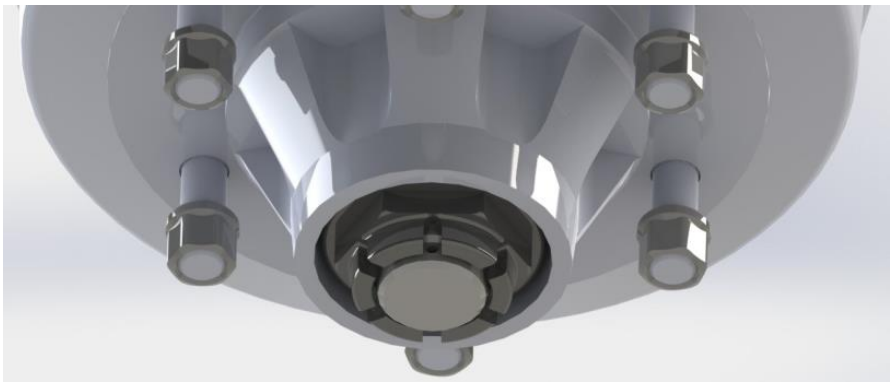
Hub Fitment



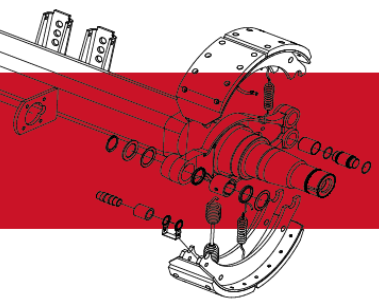
After installing the bearings into the hub apply a light film of grease to the spindle

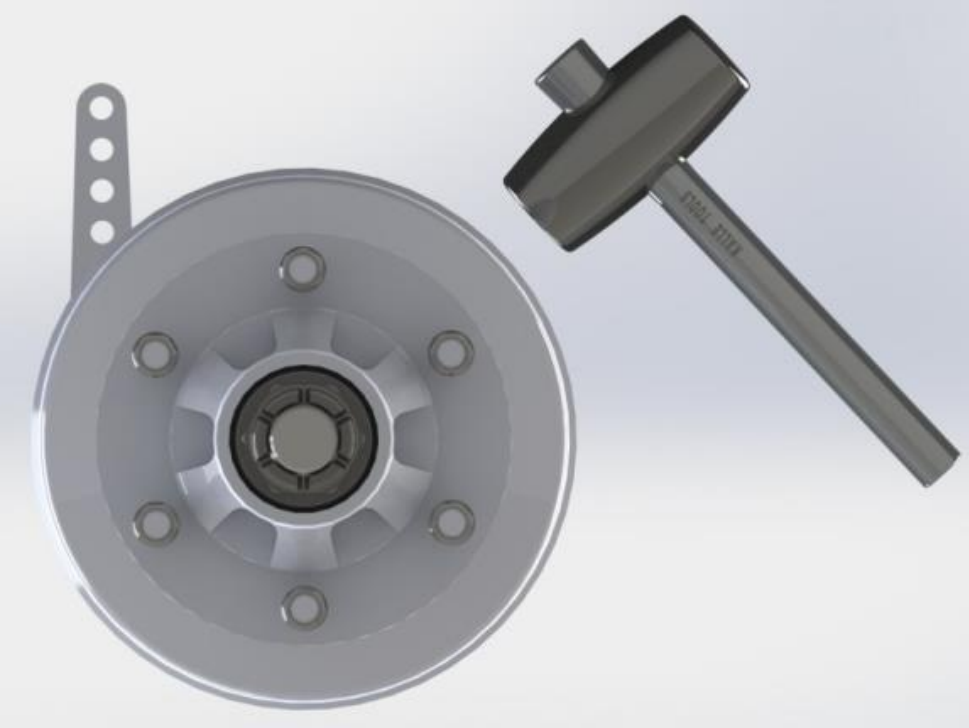


Slide the hub over the spindle ensuring it stays straight until is fully onto the spindle
Place the outer bearing and nut onto the spindle and tighten until the hub is fully seated and the wheel feels slightly stiff to rotate

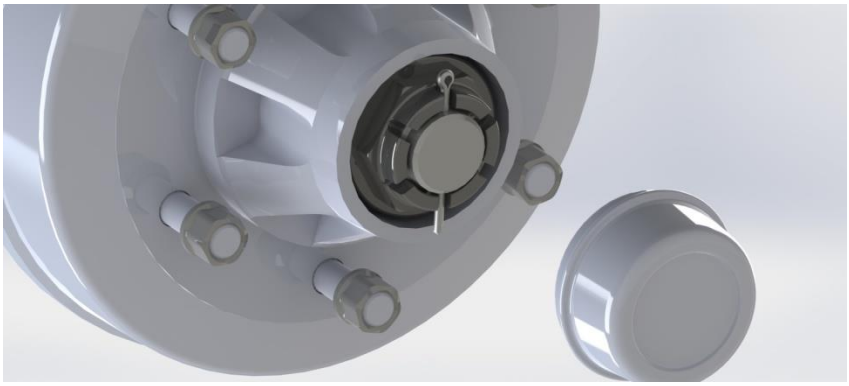


Loosen the castle nut until the hub rotates freely, and the hole in the axle beam aligns with a notch in the castle nut.

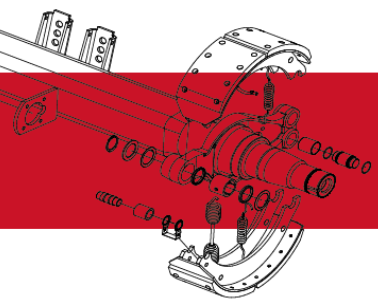




Rotate the hub, which should rotate more freely and tap the hub gently in several places with a mallet to settle the bearings.
Always choose a slightly loose setting, rather than too tight.



When the hub has been adjusted, fit a new split/cotter pin and fold the ends
Refit the hub cap.



Hub Cap Fitment

Small Axles

Fill the hub cap with 100g of grease

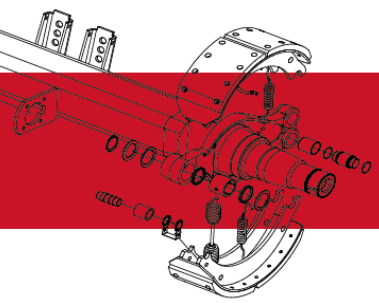
Large Axles

Add the gasket and align the gasket with the holes in the hub. Fill the hub cap with grease, and locate on the hub. Align the holes of the gasket with holes in cap.

Press Hubcap into hub

Insert the locating bolts and tighten to between 20 & 25 Nm. (or between 15 & 18 lbs.ft.).

It is important not to overfill the hub with grease. Greasing at high pressure may cause damage to the seals.

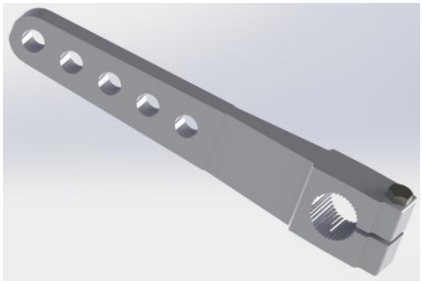


Brake Adjustments

NOTE: Never change the linkage position for the actuator on the lever without authorization from the vehicle manufacturer as the vehicle will have been tested with the actuator at this position (The brake operating levers have several holes, always use the original hole)

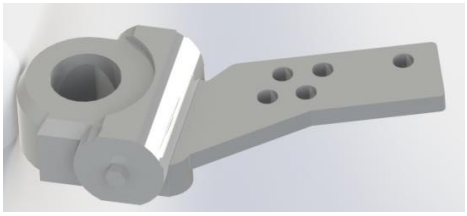
For braking systems with a yoke, the yoke must remain parallel with the axle especially when the brakes are fully applied. This means that the stroke of the levers on the bakes at each side must be identical. Otherwise, the brake slack must be adjusted.

Adjusting Brakes with Fixed Levers



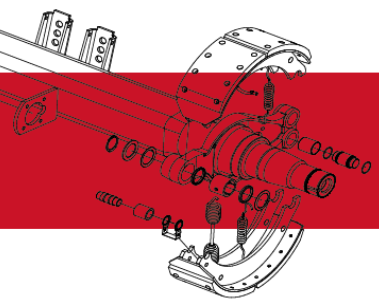
Take up the slack when the actuator reaches about two thirds of the maximum travel. To take up the slack, turn by one or more splines, ensuring that the brakes are not touching when released (to prevent overheating of the brakes)

Adjusting Brakes with Adjustable Levers



Take up the slack when the actuator reaches about two thirds of the maximum travel. To take up the slack, ensure the slacks are as close as possible by moving to the correct spline as in "Adjusting Brakes with Fixed Levers", once this adjustment is close the remaining adjustment can be made by turning the slack adjustment screw, taking care to turn it in the direction that takes up the slack

Ensure the brakes are not touching when released (to prevent overheating of the brakes).



Trouble Shooting

Important Procedure

When locating and correcting axle troubles, a systematic procedure should be followed.

Check Functioning Prior to Disassembly:

Many times the answer to the trouble is apparent when the unit is inspected prior to disassembly, but this evidence is often lost when parts are separated. If possible, check the unit prior to disassembly. Bear in mind that a careful inspection of the unit should be made as each disassembly step is performed.

Inspect Thoroughly During Disassembly:

It is poor practice to disassemble an axle as quickly as possible without bothering to examine the parts as they come off. It happens many times that a mechanic has completely disassembled a unit and failed to find the cause of the trouble because he did not bother to examine the parts as they came apart. After the axle is disassembled, check the lubricant for foreign particles which often reveal sources of troubles that are overlooked during the disassembly.

Repair or Replace Defective Parts:

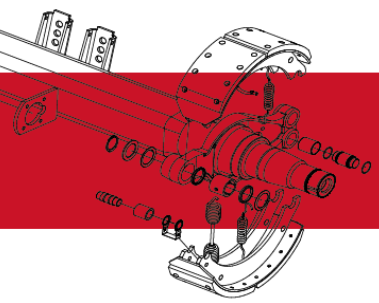
Many times the parts or critical adjustments that have caused the trouble are not replaced or corrected because the mechanic will only inspect and replace parts that have failed completely. All pieces should be accurately examined because the broken parts are often just the result and not the cause of the trouble. All parts that are broken or worn and no longer meet specifications should be replaced with genuine NEW components.

Trouble shooting

Excessive Brake Drum Wear:

Possible Causes:

a) Overheating through excessive braking
b) Contaminated Brake linings



Grease or Oil Leaks:

Possible Causes:

a) Incorrect assembly or damaged seal
b) Seal lips distorted (low loader)
c) Damaged / worn hub cap gasket
d) Hubometer stem leaks

Loose Wheels:

Possible Causes:

a) Incorrect torque
b) Worn Cones / bolts
c) Mismatched wheels and fasteners
d) Damaged wheels
e) Excessive paint on hub

Hubs Overheating:

Possible Causes:

a) Bearing adjustment too tight
b) Insufficient lubrication
c) Low loader on heavy duty operation

Brakes Binding or Dragging:

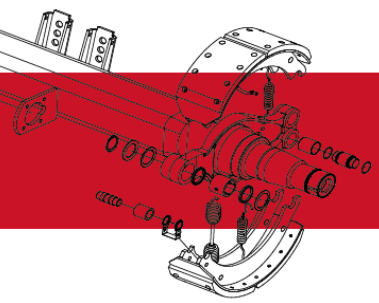
Possible Causes:

a) Failed brake shoe return spring
b) Badly worn bearings
c) Incorrectly adjusted brakes
d) Brakes not releasing properly
e) Faulty valve in brake system
f) Faulty trailer air coupling

Bearing Failure:

Possible Causes:

a) Abrasive contamination
b) Overheating due to lack of end float
c) Forcible assembly
d) Incorrect end float



Bearing Failures:

More than 90% of all bearing failures are caused by dirt, which is always abrasive. Dirt may enter the bearings during assembly of the unit, or be carried into the bearing by the lubricant while in service. Dirt may enter through seals, or even dirty containers used for the addition or change of lubricant.

Softer material such as dirt, dust etc., usually form abrasive paste or lapping compounds within the bearings themselves since the unit pressure between the balls/rollers and raceways makes a perfect pulveriser. The rolling motion tends to entrap and hold the abrasives. As the balls/rollers and raceways wear, the bearings become noisy. The lapping action tends to increase rapidly as the fine steel from the balls/rollers and raceway adds to the lapping material.

Hard, coarse material such as chips etc., may enter the bearings during assembly from the hammers, drifts, power chisels etc., or may be manufactured within the unit during service from raking teeth, etc. These chips produce small indentations in balls/rollers and races. Jamming of these hard particles between balls/rollers and races may cause the inner race to turn in the housing.

Corrosion:

Water, acid and corrosive materials formed by deterioration of lubricant, will produce a reddish-brown coating and small etched holes over outer and exposed surfaces of race. Corrosive oxides also act as a lapping agent.

Brinelling is caused by improper assembly or removal, usually hammering with offcentre blows. Use tubes, preferably under a press or extractor.

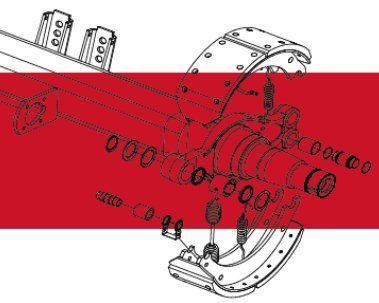
Fatigue:

All bearings are subject to fatigue and must be replaced eventually. Your own operating experience will dictate mileage replacement of bearings showing only normal wear.

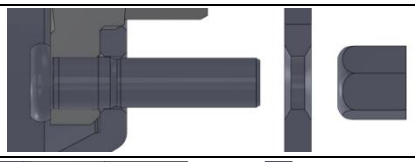
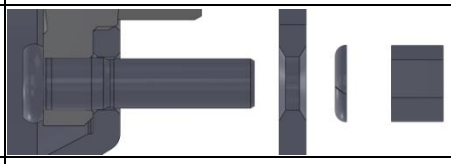
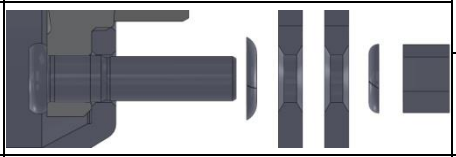
Shaft Fits:

Excessive looseness under load is very objectionable because it produces a creeping or slipping of the inner ring on the rotating shaft. This causes the surface metal of shafts to scrub or wear off.

When play or looseness even 0.0025 mm exists between the bearing and shaft, there is a very powerful force tending to rotate the inner race on the shaft.

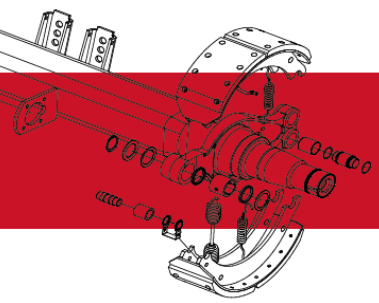


Tightening Torques (found on page 10)

Nut Type		Thread	Tightening Torque	Leverage *L	Force *F
		mm	N m	mm	Kg
A		M12x1.5	90	300	30
		M14x1.5	130	300	40
		M18x1.5	270	450	60
B		M18x1.5	270	450	60
		M20x1.5	380	600	60
C		M22x1.5	500-535	800	53
D		M20x1.5	450	800	55
		M22x1.5	600-630	1000	63

Recommended Lubricants (found on page 13)

Manufacturer	Recommended	Alternative
Shell	Shell Retinax 'LX2'	Shell Retinax 'LX'
Mobile	Mobile Grease H.P. 222	Mobile Grease H.P.
Castrol	Castrol LMX	Spheerol A.P.T.Z.
Texaco	Hytex EP2	
Esso	Unirex EP2	
BP	Energrease LC2	



Contact Information

For axle and suspension products: **www.granningaxles.com**

For replacement parts: **www.airsprings.com**

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