

WHEEL LOSS

DUE TO FAULTY BEARINGS



Québec 

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Foreword

This guide is intended to raise the awareness of heavy vehicle drivers and maintenance staff about the problems caused by defective bearings. Faulty bearings have been known to cause wheel separation, resulting in fatal or serious accidents.

This is not a text of law. For any questions of a legal nature, please refer to the *Highway Safety Code* and attendant regulations. The information contained in this manual is provided for reference purposes only and does not bind the Société de l'assurance automobile du Québec (SAAQ).

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INTRODUCTION

Defective bearings, which are generally the result of poor assembly, improper adjustment or inadequate lubrication, can cause wheel separation in heavy vehicles.

This guide contains information on how to detect defective bearings, either on the road or in the shop, and explains how to install and adjust bearings in accordance with generally accepted trade practices and the manufacturers' specifications.



1

RESPONSIBILITIES

This guide is intended for heavy vehicle owners, drivers, persons designated by the operator to perform the circle check as well as the vehicle maintenance staff. Its purpose is to make them aware of the problem of wheel separation caused by defective bearings.

The Société de l'assurance automobile du Québec (SAAQ) considers preventive maintenance and knowledge to be the most effective ways to prevent wheel loss and its potential tragic consequences.

The owner

The owner must make sure that his or her vehicles undergo preventive maintenance and that his or her staff has the required knowledge and tools to detect defects and make any necessary repairs.

The driver

The driver or the person designated by the operator to perform the circle check is responsible for having performed a circle check and filling out a circle check report, as specified in the *Regulation respecting safety standards for road vehicles*, within the previous 24 hours. The driver must also regularly carry out certain verifications, e.g. when stopping at a rest stop or other appropriate location, to detect any potential problems with the wheels and to act accordingly, so as to ensure his or her own safety as well as the safety of other road users.

The person in charge of maintenance

The person in charge of preventive maintenance must check whether the carrier's preventive maintenance program contains a section on the installation, inspection and maintenance of wheel bearings and make sure they are working properly at all times.



2 DETECTING DEFECTIVE BEARINGS

2.1 For drivers or the person designated by the operator to perform the circle check

When performing the circle check, the driver or the person designated by the operator to perform this check must pay special attention to any trace of lubricant on the wheel hub or any adjacent part. Any leak in this area is an indication that the wheel bearings may not be sufficiently lubricated, in which case the vehicle is not safe to drive. Such a leak may also be an indication that there is no lubricant at all. In this case, danger is imminent and this constitutes a major defect. In the short term, inadequate lubrication will cause the bearings to overheat and become damaged, possibly leading to wheel separation.

The presence of lubricant anywhere near the wheel hub requires the immediate attention of a qualified mechanic to determine the exact cause of the leak and make the necessary repairs before the vehicle is operated again.

2.2 For drivers while they are on the road

When resting at a rest stop or other appropriate location, it is recommended that drivers perform certain inspections similar to those they performed during the circle check before getting back out on the road. For example, they should look for traces of lubricant near the wheel hubs.

Other signs of defective bearings may appear only after covering a certain distance, which is why drivers are urged to be particularly vigilant the next time they stop after adjusting or repairing a wheel.

Some of the signs of defective bearings are:

- Lubricant on wheel components (leaking can occur after you have gotten on the road, particularly when a trailer has been parked for a long period of time).
- A burnt smell emanating from a wheel.
- Smoke coming from inside the wheel.
- A wheel is wet and water can be seen evaporating from the surface of the hub, which is drying quickly.
- Strong heat can be felt near a wheel.

If any of the above signs are present, carefully check the hub temperature. If the hub is hot, i.e. if you can feel the heat just by approaching the hub, stay back and wait until it cools enough for a closer examination. The heat from the wheel could cause the air pressure inside the tires to rise, which in turn represents a risk of tire blowout. Remember that the temperature of a rig that has been stopped is likely to be higher for a while due to reduced air flow over the area. Do not, under any circumstances, get back out on the road until you have identified the exact cause of the problem. However, it is important to remember that braking can also cause wheels to heat up. To properly assess the situation, check whether the wheel in question is hotter than the others.

2.3 For maintenance staff in the shop

Checking the wheel bearings should be on the list of duties to be performed by a qualified mechanic as part of a preventive maintenance program.

In fact, one of the mechanic's main responsibilities is to evaluate wear and replace any vehicle components that risk breaking or failing before the next scheduled maintenance.

Mechanics have all the equipment they need at the shop to conduct a thorough inspection of the wheel bearings. Although this inspection is different from the one carried out by the driver during the trip or during the circle check, lubricant on the outside components of a wheel is always an indication of a problem that requires immediate attention.

Here is the procedure to properly inspect the wheel bearings in the shop:

N. B.: The operations described below are carried out in the shop. Safety equipment such as goggles, appropriate clothing and footwear or any other element must be worn for maximum protection of the maintenance staff.

- Check to see if there is enough lubricant.
- Using a magnet, check for metal particles in the lubricant. To do this, remove the centre filler cap or the plug from the filler port and insert a magnet in the fluid.
- Check for water in the lubricant.

N. B. Water can infiltrate the hub cap when vehicles are pressure washed. The people who do this job should be warned about this problem.

- Place chocks under the wheels and release the parking brake.
- Raise the vehicle, rotate the wheel and listen for any unusual noises.
- Check for bearing end play by tilting the wheel back and forth from the inside outward using a pry bar. Using a pry bar is necessary, given the weight of the heavy vehicle wheel to be moved.

N. B. There should be no noticeable end play.

If water or metal particles are found in the lubricant, or if there is end play in the bearings, remove the wheel as follows (given that the wheel is off the ground to check for end play):

- Place safety stands under the vehicle.
- Allow the vehicle chassis to rest on the stands to hold them in position.
- Remove the hub cap, or the axle shaft in the case of a drive axle.
- Loosen the jam nut, if there is one, and the adjusting nut.
- Remove the outer bearing.
- Using a wheel dolly, remove the wheel to locate the source of the metal particles in the lubricant.

- After removing the wheel, remove and thoroughly clean the bearings.
- Always use a new oil seal during reassembly.
- Carefully inspect all parts of the locking device, nuts and jam nuts, and replace with new ones if damaged or unserviceable.
- Carefully inspect the contact surfaces of the bearings.
- Replace the bearings if they show signs of wear or deterioration as illustrated in section 2.4.

N. B. Even if only one of the two bearings shows signs of deterioration, both must be replaced.

- Reassemble the bearings and the new oil seal using the method described in Chapter 3.

N. B. In all cases, we recommend removing the wheels to perform a close inspection of the bearings every 500,000 km. This inspection can be carried out at the same time as other repairs, such as during brake maintenance.

2.4 Signs of bearing deterioration

A bearing that shows any of the following signs of deterioration must be changed.



Figure 1
Pieces of metal or grit in the lubricant



Figure 2
Presence of metal or grit in the lubricant

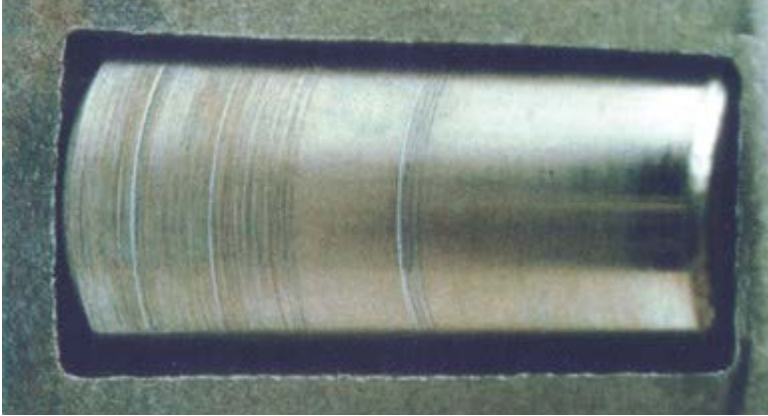


Figure 3
Pieces of metal or grit in the lubricant

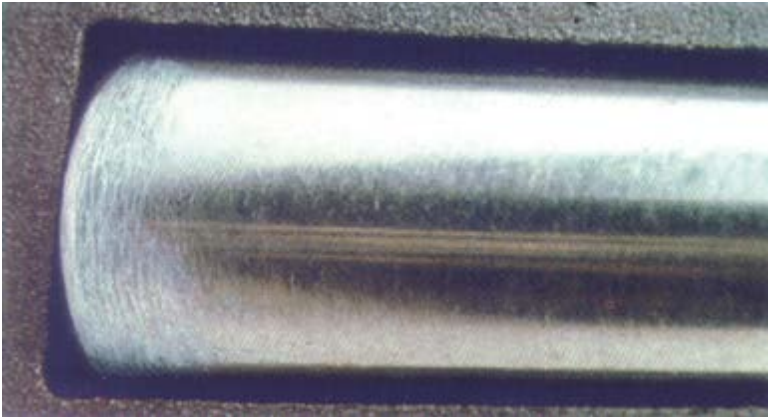


Figure 4
Chipping on the outer edge of at the widest diameter of the tapered roller indicates that the bearing is too tight.

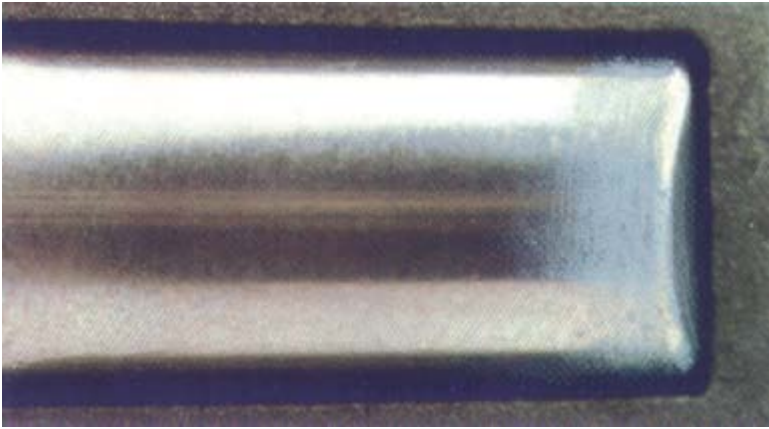


Figure 5
Chipping on the outer edge at the narrowest diameter of the tapered roller indicates that the bearing is too loose.

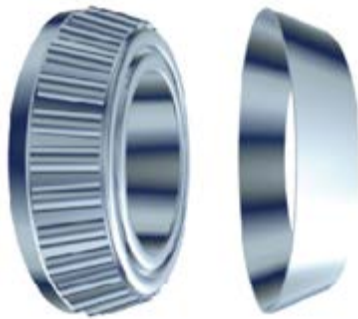


Figure 6
Premature wear of the inner race of a bearing caused by an overly tightened adjustment

3

MOUNTING BEARINGS

Mounting bearings is a delicate operation that requires careful attention on the part of the person doing it. This section describes a standard procedure that complies with generally accepted trade practices and is recognized as efficient by the industry. It should be noted that this procedure uses tapered roller bearings (see illustrations below) designed in keeping with similar performance standards, regardless of the make. Illustrations of this type of bearing are presented below. The manufacturer's specifications should be used if they are different from below.



Here are the steps to follow for proper mounting:

3.1 Preparing the parts

- Clean the spindle to remove any traces of lubricant or dirt.
- Buff any accidental tool marks using a smooth file or emery cloth of the appropriate grit.
- Where necessary, polish the entire spindle surface using an emery cloth (the shoulders and bearing contact surfaces, in particular, must be smooth and free of any burrs).
- Clean thoroughly with a clean cloth to remove any residual grit particles.
- Remove the hub bearings and cups, being careful not to damage the bearing housings.

- Clean any traces of lubricant or dirt off the hub.
- Buff any accidental tool marks. The shoulders and bearing cups must be smooth and free of any burrs.

3.2 Assembling the bearings

- Make sure the new parts are identical or equivalent to the parts being replaced.
- Use the proper tools to ensure the bearing cups and oil seal are installed correctly.¹
- Use the tools recommended by the manufacturer.
- Using the proper tool, place the inner bearing cup in the hub housing.
- Lubricate the cone assembly with clean oil and insert it in the cup. Use the same type of lubricant as for the axle housing.
- Put the oil seal on the insertion tool. Use sealing material, or lubricate the ring according to the manufacturer's recommendations.
- Insert the oil seal in the wheel hub.

¹ To facilitate the task and prevent distortion, we highly recommend using a specially designed tool to install bearing cups and oil seals. Oil seals are particularly fragile and the wrong tool can easily cause distortion, which can prevent the bearing from functioning properly and eventually lead to premature lubricant leaks. The following pages contain illustrations of oil seals that were damaged during installation due to the use of improper tools or carelessness.

N. B. Certain types of oil seals must be mounted directly on the spindle. In this case, the oil seal and inner bearing must be placed on the spindle before putting the wheel back on.

- Turn the wheel around and place the outer bearing cup in its housing using the proper tool.
- Put the wheel back on using a wheel dolly, proceeding as follows:
 - First make sure the wheel dolly is in good working order.
 - Sweep the floor to remove any debris so that the dolly can roll freely and smoothly without any jarring.²
 - Align the wheel hub and spindle.
 - Gently push the wheel into place, being careful not to damage the inside of the oil seal.
 - Lubricate the outer cone assembly using clean oil and insert it in the cup.
 - Adjust the bearing according to the procedure provided in section 3.4.
 - Install the hub cap after examining it carefully.
 - Use a new gasket.
 - Fill the hub with clean oil to the specified level.
 - Spin the wheel a few times and let it rest for around 5 minutes.
 - Adjust the lubricant level one last time, if need be.
 - Put the centre filler cap or plug from the filler port back on, depending on wheel type.
 - If necessary, wipe off any oil from the wheel rim so that the next user will not mistake it for a leak.

² If any debris blocks the dolly wheels, it could cause jarring and damage the inside of the ring seal if the latter bangs into the spindle.

3.3 Oil seals damaged during installation

Figures 7 to 11 illustrate oil seals that were damaged during installation.



Figure 7



Figure 8
Distortion of the metal casing caused by the use of improper tools

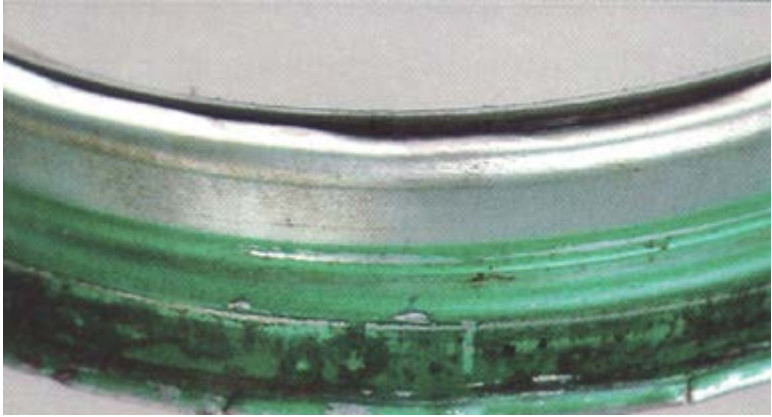


Figure 9





Figure 10

Damage caused by contact between the inside of the oil seal and the spindle

This can result from poor hub/spindle alignment, inadequate flooring, a dirty floor or carelessness.

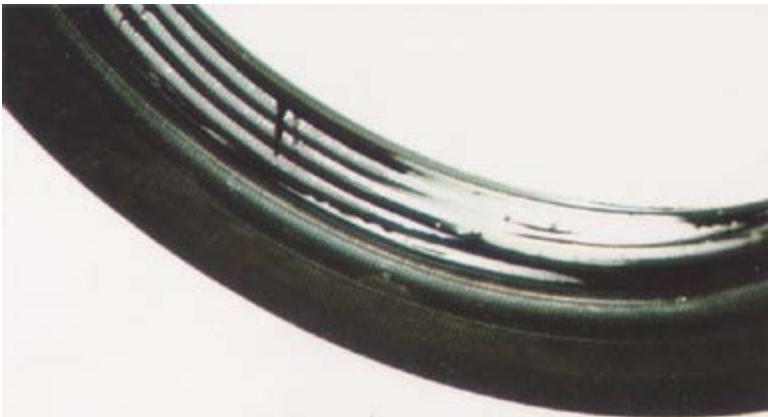


Figure 11

Damage caused by contact between the inside of the oil seal and the spindle

This can result from poor hub/spindle alignment, inadequate flooring, a dirty floor or carelessness.

3.4 Adjusting bearings

Bearings must be adjusted according to the type of axle involved, since the role and position differ for each, i.e.

- Steering axle
- Drive axle
- Trailer axle

Depending on the type of axle, adjust the bearings as follows:

- Lubricate the spindle threads.
- Screw the adjusting nut on the spindle thread.
- Set a bearing preloading by torquing the adjusting nut to 271.2 Nm (200 ft-lb) to make up for any play between the parts.*

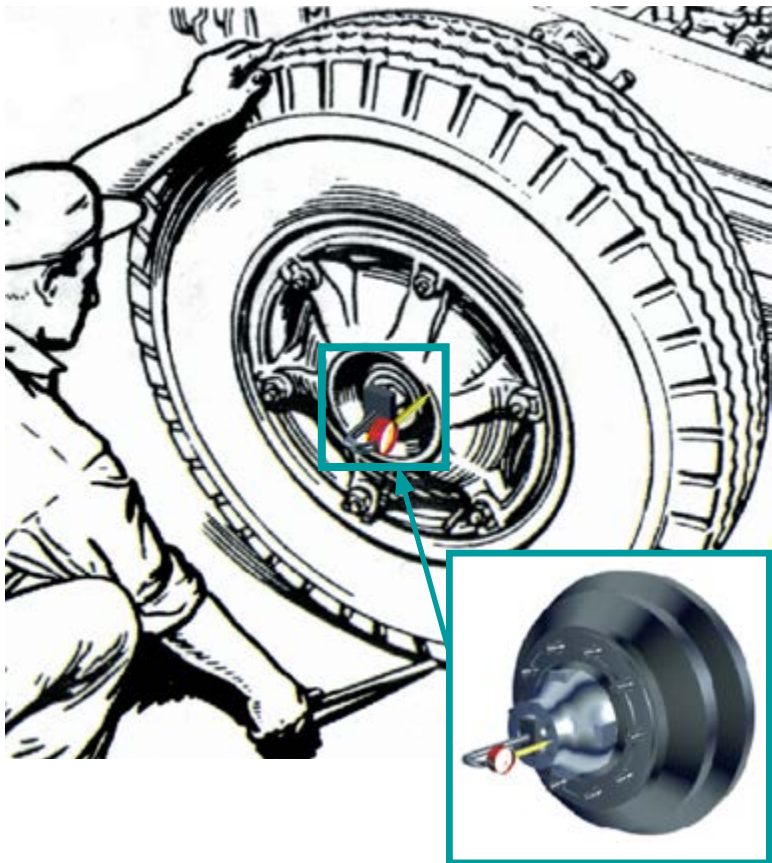
N. B. This step must be carried out while rotating the wheel.

- Loosen the adjusting nut one complete turn.
- Tighten the adjusting nut back to a torque level of 67.8 Nm (50 ft-lb).*
- Loosen once again 1/6 to 1/2 turn depending on the type of axle (see the Reference Table on page 26). During this operation, determine the right position for the locking device.
- Install the locking device.
- Screw the jam nut on the spindle thread and tighten to the torque level recommended in the Reference Table (page 26).*
- Before putting the hub cap on, measure the play using a dial gauge as illustrated in the next page.

* **The use of a torque wrench is essential; do not use an impact wrench for this operation.**

N. B. Play should be between 0.025 mm and 0.127 mm (0.001 to 0.005 in).

While the above procedure is suitable in most cases, the Reference Table (page 26) must be consulted to determine the appropriate torque levels for jam nuts and other information concerning the locking device to be used. However, if components differ from those referred to in this document, the manufacturer's specifications must be used.



3.5 Locking devices

The locking device ensures that torque levels are maintained once the bearings have been mounted. The installation of locking devices and the torque level vary according to the model, diameter and thread pitch of the spindle used. The most common locking devices are illustrated below.

■ Dowell type locking device



■ Tang type locking device



■ Single-nut locking device



REFERENCE TABLE

BEARING ADJUSTMENT PROCEDURE

Axle Type	Steering Axle
Initial adjustment	<ul style="list-style-type: none"> - Torque to 271.2 Nm (200 ft-lb) - Loosen 1 turn
Final adjustment	<ul style="list-style-type: none"> ■ Single nut <ul style="list-style-type: none"> - Torque to 67.8 Nm (50 ft-lb) - Loosen 1/6 turn for 12 threads/in - Loosen 1/4 turn for 18 threads/in ■ Double nut <ul style="list-style-type: none"> - Torque to 67.8 Nm (50 ft-lb) - Loosen 1/2 turn in all cases

BEARING ADJUSTMENT Recommended torque level for jam nuts

Axle Type	Locking Device
Steering axle	Double nut
Drive axle	Tang type locking device
Drive axle	Dowell type locking device
Trailer axle	

N. B. The use of a torque wrench is essential to correctly measure the torque levels recommended in the tables below; do not use an impact wrench in these circumstances.

Drive Axle	Trailer Axle
- Torque to 271.2 Nm (200 ft-lb) - Loosen 1 turn	- Torque to 271.2 Nm (200 ft-lb) - Loosen 1 turn
- Torque to 67.8 Nm (50 ft-lb) - Loosen 1/4 turn in all cases	- Torque to 67.8 Nm (50 ft-lb) - Loosen 1/4 turn in all cases

Torque Level
271.2 to 406.7 Nm (200 to 300 ft-lb) for a nut of 6.7 cm (2 5/8 in) or less 406.7 to 542.3 Nm (300 to 400 ft-lb) for a nut of more than 6.7 cm (2 5/8 in)
271.2 to 372.9 Nm (200 to 275 ft-lb)
406.7 to 542.3 Nm (300 to 400 ft-lb)
271.2 to 406.7 Nm (200 to 300 ft-lb) for a nut of 6.7 cm (2 5/8 in) or less 406.7 to 542.3 Nm (300 to 400 ft-lb) for a nut of more than 6.7 cm (2 5/8 in)

ENGLISH-FRENCH GLOSSARY

- **adjusting nut:** écrou d'ajustement
- **axle shaft:** arbre de l'essieu
- **bearing end play:** jeu des roulements
- **bearing housing:** logement de roulement
- **bearing preloading:** précontrainte
- **bearing:** roulement
- **center filler cap:** bouchon du chapeau de moyeu
- **circle check:** ronde de sécurité
- **cone assembly:** partie conique du roulement
- **cup (outer ring):** cuvette de roulement
- **dial indicator or dial gauge:** indicateur à cadran
- **dowell pin:** goujon de localisation
- **drive axle:** essieu de traction
- **gasket :** joint d'étanchéité
- **hub cap:** chapeau de moyeu
- **hub filler plug:** bouchon de l'orifice de remplissage
- **hub:** moyeu
- **impact wrench:** outil pneumatique à percussion
- **jam nut:** contre-écrou
- **leak:** fuite
- **locking device:** dispositif de blocage
- **magnet:** aimant
- **nut:** écrou

- **oil seal:** bague d'étanchéité
- **pry bar or crow bar:** levier
- **race:** voie de roulement
- **roller cage:** support de rouleau
- **safety stand:** chandelle de sécurité
- **sealing material:** produit d'étanchéité
- **spindle:** fusée
- **steering axle:** essieu directeur
- **tang:** languette métallique
- **tapered roller:** rouleau conique
- **tapered roller:** roulement à rouleau conique
- **torque level:** couple de serrage
- **torque wrench:** clé dynamométrique
- **trailer axle:** essieu de remorque
- **wheel chock:** cale de roue
- **wheel dolly:** chariot porte-roues
- **wheel loss:** perte de roue

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