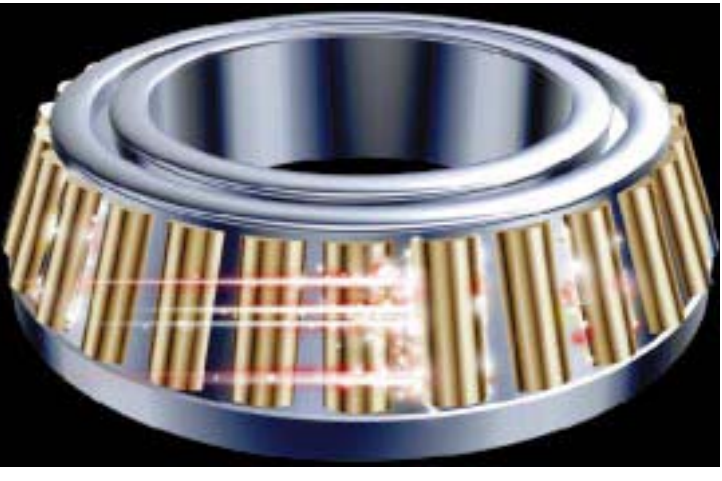
WHEEL LOSS DUE TO FAULTY BEARINGS

SOCIÉTÉ DE L'ASSURANCE AUTOMOBILE DU QUÉBEC

WHEEL LOSS DUE TO **FAULTY BEARINGS**



SOCIÉTÉ DE L'ASSURANCE AUTOMOBILE DU QUÉBEC

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FOREWORD

This manual, prepared by the road safety policy and programs division of the Société de l'assurance automobile du Québec, is intended to raise the awareness of heavy vehicle drivers and maintenance staff to 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 question of a legal nature, please refer to the Highway Safety Code and attendant regulations. The information contained in this manual does not bind the SAAQ.

Please note that the masculine form is used in some instances to include both genders, with the sole intent of readability.

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1. INTRODUCTION

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

This manual tells you 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 manufacturers' specifications.

2. RESPONSIBILITY

This manual is aimed at making heavy vehicle owners, drivers and maintenance staff aware of the problem of wheel separation due to defective bearings.

The Société de l'assurance automobile du Québec considers preventive maintenance and knowledge the best ways to prevent wheel loss and its potentially tragic consequences.

◆ THE OWNER

The owner must see to it that his vehicles undergo preventive maintenance and that his staff has the know-how and tools necessary to detect and repair problems.

◆ THE DRIVER

In addition to conducting a daily safety check before setting out, as required by regulation, the driver is responsible for regularly checking his vehicle before resuming his travels after stopping in a rest area or other suitable place. As the person closest to the vehicle, the driver can detect anything out of the ordinary, particularly where potential wheel problems are concerned, and take appropriate action, thereby ensuring his own safety as well as that of other road users.

◆ THE PERSON IN CHARGE OF MAINTENANCE

The person in charge of maintenance must see that the carrier's preventive maintenance program contains a section on the installation, inspection, maintenance and repair of wheel bearings in order to ensure that they remain in proper working order.

3. WHAT TO LOOK FOR

A. DRIVERS, DURING SAFETY CHECKS

When conducting his daily safety check before starting out, the driver must pay particular attention to any trace of lubricant on the wheel hub or any part next to it. If there is a leak, the wheel bearings may not be lubricated enough, in which case the vehicle is not safe to drive. Or it may be an indication that there is no lubricant at all, which could spell disaster. In the short term, improper 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 driving the vehicle again.

B. DRIVERS, ON THE ROAD

When resting at a rest stop or other appropriate location, drivers are encouraged to do another inspection similar to the safety check conducted before starting out. For example, they should look for traces of lubricant near the wheel hub.

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 parts. (Leaking can occur once you've left, particularly in a trailer that has been stationary for a long period of time);

- A burnt smell emanating from a wheel;
- Smoke coming from inside the wheel;
- On a wet wheel, water evaporating from the surface of the hub and the hub drying quickly;
- Strong heat 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 bursting. Remember that the temperature on a rig which has been stopped is likely to be higher for a while due to reduced air passage over the area. Do not, under any circumstances, get back on the roadway until you have identified the exact cause of the problem. However, it is important to remember that braking can also cause wheels to heat. To properly assess the situation, then, ask yourself whether or not the wheel in question is hotter than the others.

C. MAINTENANCE STAFF, IN THE SHOP

Wheel bearings should automatically be inspected by a qualified mechanic during preventive maintenance.

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

The mechanic has all the equipment he needs in the shop to conduct a thorough inspection of wheel bearings. Although this inspection is different from the one carried out by the driver during roadside stops, lubricant on the outside components of wheels still indicates a problem requiring immediate attention.

To inspect wheel bearings in the shop, proceed as follows:

N.B. Safety equipment such as goggles, appropriate footwear and clothing should be worn for the optimal protection of maintenance staff.

- Check to see if there is enough lubricant;
- Using a magnet, check for pieces of metal in the lubricant. To do this, remove the center fill 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 alerted to the problem.)**;
- Place chocks under the wheels and release the parking brake;

- Jack the vehicle, rotate the wheel and listen for any unusual noises;
- For single-wheel assemblies, check the bearing end play by grasping the top and bottom of the wheel, in a swinging movement from the inside outward. For dual-wheel assemblies, we recommend using a pry bar, given the weight to be moved. **(N.B. There should be zero end play)**.

If there is water or pieces of metal in the lubricant, or if there is end play in the bearings, remove the wheel as follows (the wheel will have been raised to check for end play):

- Place safety stands under the vehicle.
- Allow the vehicle chassis to rest on the stands.
- Remove the hub cap, or 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 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 if damaged or unserviceable, replace with new ones.
- Carefully inspect the contact surfaces of bearings.
- Replace the bearings if they are worn or show any signs of deterioration, such as illustrated opposite. Even if just one bearing shows signs of deterioration, both must be replaced.
- Follow the procedure described on page 16 for reassembly.
- Always use a new oil seal.

N.B. We recommend removing wheels and closely inspecting bearings every 500,000 km. This inspection can be carried out at the same time as other repairs, such as during brake replacement.

D. 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
Pieces of metal or grit in the lubricant.

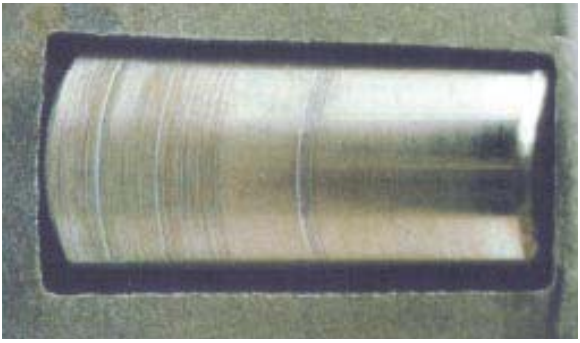


Figure 3
Pieces of metal or grit in the lubricant.

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

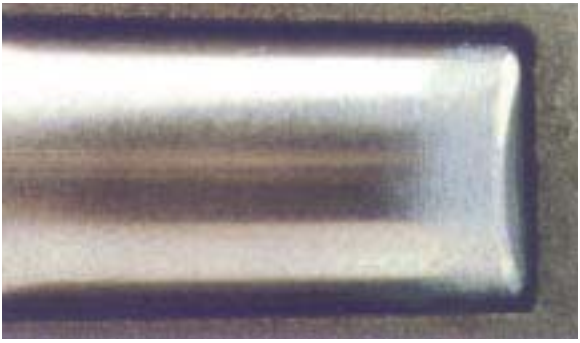


Figure 5

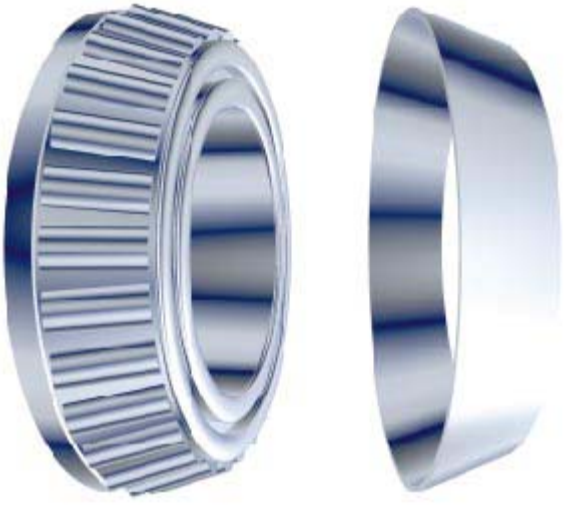
Chipping on the outer edge at the narrowest diameter of the tapered roller: indicates that bearing is too loose.

Figure 6

A bearing that is too tight can lead to premature wear of its inner race.

4. MOUNTING BEARINGS

Mounting bearings is tricky and 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. Note that this procedure uses tapered roller bearings (see illustration below) designed in keeping with similar performance standards, regardless of the make. The manufacturer's specifications should be used if different from below.



To mount bearings, proceed as follows:

A. PREPARING 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 coarseness.
- Where necessary, polish the entire spindle surface using an emery cloth. The shoulders and bearing surfaces must be smooth and free of burrs.
- Clean thoroughly with a clean cloth to remove any grit.
- 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 burrs.

B. ASSEMBLING BEARINGS

- Make sure 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 manufacturer-recommended tools.
- Using the proper tool, place the inner bearing cup in the hub housing.
- Lubricate the conal assembly using 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. **(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.)**
- Rotate the wheel and place the outer bearing cup in its housing using the proper tool.

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 leaking. The pages of this section contain some illustrations of oil seals which were damaged during installation due to the use of improper tools or carelessness.

- Put the wheel back on using a wheel dolly, proceeding as follows:
  - First of all, make sure the wheel dolly is in good working order.
  - Sweep the floor to remove any debris that may block the dolly wheels and cause 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 indicated in the section **"Adjusting Bearings"**.
  - Put the hub cap on 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 leave for around 5 minutes.
  - If needed, adjust the amount of lubricant one last time.
  - Put back the center fill cap or plug from the filler port, depending on the wheel type.
  - Wipe any oil off the wheel hub so that the next user doesn't mistake it for a leak.

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

C. OIL SEALS DAMAGED DURING INSTALLATION

The following figures illustrate oil seals which have been damaged during installation.

Figure 7

Figure 8
Distortion of metal casing due to use of the wrong tools

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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.

D. 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 bearings as follows:

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

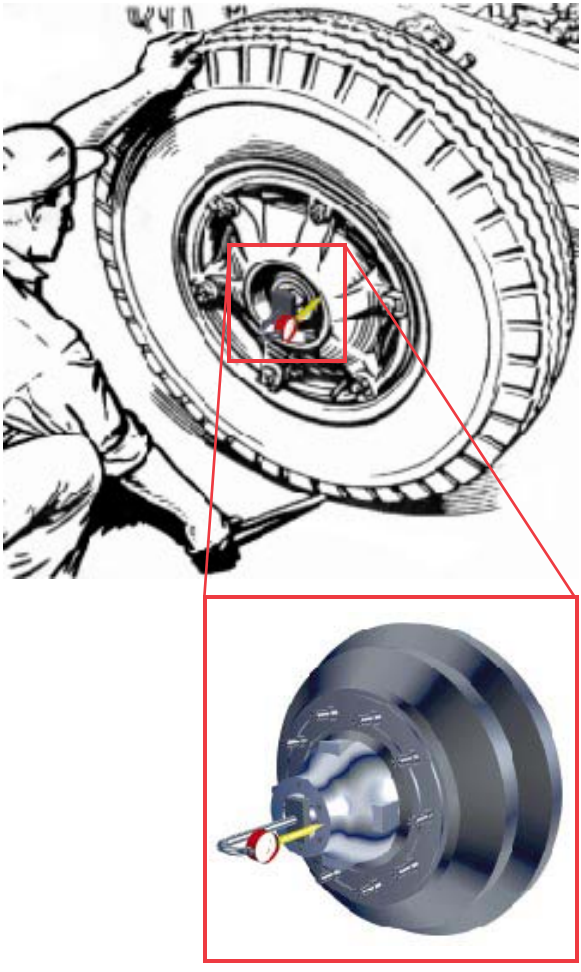
  N.B. This step must be carried out while rotating the wheel.
- Loosen the adjusting nut one complete turn.
- * Now tighten it again to a 50 ft-lbs torque.
- Loosen the nut 1/6 to 1/2 turn depending on the axle type (see Reference Table pp. 28, 29); while doing so, determine the right position for the locking device.
- Install the locking device.

- * Screw the jam nut on the spindle thread and tighten to the recommended torque level (see Table, pp. 28, 29).
- Before putting the hub cap on, measure the play using a dial gauge as illustrated below.

  N.B. Play should be between 0.001" and 0.005" (from one to five thousandths of an inch).

While the above procedure is suitable in most cases, the Table on pages 28 and 29 must be consulted to determine the appropriate torque levels for jam nuts and the type of locking device to be used. However, if components differ from those referred to in this document, the manufacturer's specifications must be followed.

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



E. LOCKING DEVICES

The locking device ensures that torque levels are maintained once bearings have been mounted. The installation of locking devices and the torque level vary with the

- Dowell type locking device

- Tang type locking device

- Single-nut locking device

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model, diameter and thread pitch of the spindle used. The most common locking devices are illustrated below.

BEARING ADJUSTMENT	
Axle type	**Steering axle**
Initial adjustment	• Torque to 200 ft-lbs • Loosen 1 turn
Final adjustment	▮ ***Single nut*** • Torque to 50 ft-lbs • Loosen 1/6 turn for 12 threads/in., • Loosen 1/4 turn for 18 threads/in. ▮ ***Double nut*** • Torque to 50 ft-lbs • Loosen 1/2 turn in all cases
Torque level for jam-nuts	**See table below...**

BEARING ADJUSTMENT Recommended torque level for jam nuts	
Axle type	**Locking device**
Steering axle	Double nut adjustment
Drive axle	Tang type locking device
Drive axle	Dowell type locking device
Trailer device	

N.B. **Use of a torque wrench is essential for tightening to the recommended values; do not use an impact wrench for this.**

Drive axle	Trailer axle
• Torque to 200 ft-lbs • Loosen 1 turn	• Torque to 200 ft-lbs • Loosen 1 turn
• Torque to 50 ft-lbs • Loosen 1/4 turn in all cases	• Torque to 50 ft-lbs • Loosen 1/4 turn in all cases

Torque level	
200 - 300 ft-lbs 300 - 400 ft-lbs	nut of 2⅝ in. or less nut of more than 2⅝ in.
200 - 275 ft-lbs	
300 - 400 ft-lbs	
200 - 300 ft-lbs 300 - 400 ft-lbs	nut of 2⅝ in. or less nut of more than 2⅝ in.

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BIBLIOGRAPHY

C.R. Chicago Rawhide-S.K.F. , *Brochure 4*.

T.M.C. The Maintenance Council, *Recommended Maintenance Practices Manual 1994-1995*. Page 29.

Mack, *Truck Maintenance Manual*.

Kenworth, *Maintenance Manual*.

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