



LIPPERT COMPONENTS

***TRAILER AXLE
OPERATION AND SERVICE MANUAL***



REV032910

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Introduction

Combining years of experience in the trailer frame and recreational vehicle industry with the newest and most innovative technology, Lippert Components, Inc. introduces it's newest addition, The Axle and Running Gear Division.

The following publication is designed to give the customer an easy-to-understand operation and service manual to provide useful and important information. The quality of the Lippert name and the finest materials utilized in the production of the Axles and Running Gear provide you with hubs, brakes, drums and spindles that make trailering and braking the finest in the industry.

Quality comes threefold in Lippert Components, Inc.

- ◆ The finest quality materials
- ◆ The latest technology and design
- ◆ The quality standards maintained from materials to final assembly

All three points provide the customer with the best product they can possibly buy and the satisfaction of knowing they can trust the equipment on which they have spent their hard-earned money.

Lippert Components, Inc. thanks you for purchasing our Axles and Running Gear. When you speak of Lippert Components, Inc., our quality stands beside you.



Safety Information

The "WARNING!" symbol above is a sign that a service or maintenance procedure has a safety risk involved and may cause serious injury or death if not performed safely and within the parameters set forth in this manual.

Always wear eye protection when performing service or maintenance to the vehicle. Other safety equipment to consider would be hearing protection, gloves and possibly a full face shield, depending on the nature of the service.

This manual provides general service and maintenance procedures. Many variables can change the circumstances of the service procedure, i.e., the degree of difficulty involved in the service operation and the ability level of the individual performing the operation. This manual cannot begin to plot out procedures for every possibility, but will provide the general instructions for effectively servicing the vehicle. In the event the skill level required or the procedure to difficult, a certified technician should be consulted before performing the necessary service. Failure to correctly service the vehicle may result in voiding the warranty, inflicting injury or even death.

The owner's manual for your unit may have more procedures for service and maintenance.

IMPORTANT!

Break-in period for electric drum brakes

The break-in period is a typical phenomenon with drum brakes and especially electric drum brakes. Electric drum brakes will require a break-in period to achieve full performance. This break-in period applies for new axles and any time new brake shoes and/or magnets are installed as part of regular maintenance.

Lippert Components has found through extensive brake testing that the break-in period for our drum brakes can range from 20 to 50 brake applications.

Brakes can be seated in by applying approximately 8-10 volts to the trailer brakes at an initial speed of 40 mph and allowing the truck/trailer combination to slow down to 20 or 25 mph. For best results do not use truck brakes during this procedure. The trailer brakes will seat in faster by using them to stop both the truck and trailer. The easiest method is to apply the trailer brakes using the manual activation lever located on the in-cab brake controller. Care must be taken to not overheat the lining material, therefore brake applications conducted at one mile intervals will suffice. The driver should feel a noticeable difference in the brake performance during this period, sometimes in as few as 10 applications. After 50 applications, the brake lining material will be fully cured from the heat and develop close to 100% contact with the brake drum surface.

This break in period not only seats the shoe lining material but also seats in the brake electromagnets. During the break-in period, the linings will wear at a faster rate than they do after they are seated in.

NOTE: Brakes should be manually adjusted after the first 200 miles of operation and periodically thereafter, approx. 3,000 mile intervals.

Hubs/Drums/Bearings

Hub Removal

To remove the hub assembly for inspection, maintenance or service, follow the six (6) steps below:

WARNING!

Lift unit by the frame and never the axle or suspension. Do not go under unit unless it is properly supported by jack stands. Unsupported units can fall causing serious injury or death.

1. Lift trailer and support it per manufacturer's requirements.
2. Remove the wheel.
3. Remove the grease cap by prying the edge out of the hub.
4. Pull the cotter pin from the castle nut or, if the hub is equipped with the Super Lube system, bend the locking tang down and remove the outer spindle nut.
5. Remove the spindle washer.
6. Pull the hub off the spindle. Do not let the outer bearing cone fall free of the assembly. The inner bearing cone will be contained by the seal and will not fall out.

NOTE: A gear puller may be necessary to remove hub from spindle.

Brake Drum Inspection

The brake shoes contact the drum surface and the magnet contacts the armature. These surfaces are subject to wear and should be inspected periodically.

The drum surface should be remachined if wear is more than .020" or out of round by more than .015". The drum should be replaced if scoring or wear is greater than .090".

Drum	Diameter
10"	10.090"
12"	12.090"

The inner surface of the brake drum that contacts the brake magnet is the armature surface. If the armature surface is scored or worn unevenly, it should not be machined more than .030". The magnets should be replaced whenever the armature surface is refaced and vice versa.

NOTE: Make certain that the wheel bearing cavities are clean and free of contamination before reinstalling bearing and seals. Resurfacing procedures can produce metal chips and dust that can contaminate the wheel bearings and cause failure.

Bearing Inspection

Wash all grease and oil from the bearing cone using a suitable solvent. Dry the bearing with a clean, lint-free cloth and inspect each roller completely. If any pitting, spalling, or corrosion is present, then the bearing must be replaced. The bearing cup inside the hub must be inspected.

NOTE: Bearings must always be replaced in sets of one cone and one cup.

WARNING!

Always wear eye protection when servicing the axle, brakes, hubs, springs and wheels. Failure to wear eye protection may result in serious injury.

Follow the procedure below to replace the bearing cup:

1. Place hub on a flat surface with bearing cup on the bottom.
2. With brass drift punch, lightly tap around the small end of the cup to push it out.
3. Clean the hub bore. Replace the cup by tapping it back in with the brass drift punch. Cup should be seated against the retaining shoulder in the hub.

Consult Bearing Replacement Chart for proper replacement bearings.

NOTE: Replacing the bearing cup is a very precise process. The cup must be perfectly seated when replaced. If the cup is not seated correctly, damage to the assembly may not be covered by the warranty. Consult Lippert Components, Inc. prior to replacing bearing and bearing cup. The trailer should be taken to a certified service center for this work to be done.

WARNING!

DO NOT mix Lithium, calcium, sodium or barium complex greases. Chemical compatibility problems may occur. If you are changing from one chemical grease to another, be sure all old grease is removed prior to applying new grease.

Bearing Lubrication - Grease

Bearing grease should be replaced every 12,000 miles or 12 months, whichever comes first. Remove all old grease from wheel hub and bearings first. Bearings should be packed by machine if possible. Packing bearings by machine is preferable; however, packing by hand is a viable alternative.

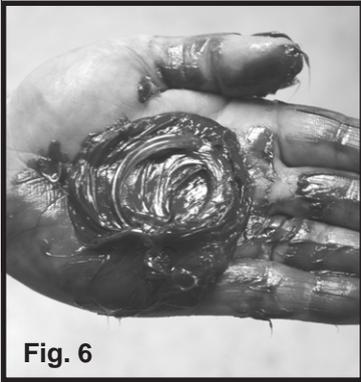


Fig. 6



Fig. 7

Follow these procedures to repack bearings by hand:

1. Place grease into the palm of your hand (See Fig. 6).
2. Press widest end of bearing into the outer edge of the grease pile, forcing grease into the inner area of the bearing between two adjacent rollers (See Fig. 7).
3. Repeat this process while turning bearing from roller to roller until all rollers are coated.
4. Apply a light coat of grease into the bearing cup surface.
5. Reassemble bearing into cup.

Bearing Lubrication - Oil

If your axles are equipped with oil lubricated hubs, then your lubrication procedure is to periodically fill the hub with a high quality hypoid gear oil to the level indicated on the clear plastic oil cap. The oil can be filled through the rubber plug hole in the cap.

Recommended Wheel Bearing Lubrication Specifications

Grease:

Thickener Type	Lithium Complex
Dropping Point	230°C (446°F) minimum
Consistency	NLGI No. 2
Additives	EP, Corrosion & Oxidation Inhibitors
Base Oil	Solvent Refined Petroleum Oil
Base Oil Viscosity	@40°C (104°F) 150cSt(695 SUS) Min.
Viscosity Index	80 Minimum
Pour Point	-10°C (14°F) Minimum

Approved Sources:

Mobil Oil	Mobilgrease HP
Exxon/Standard	Ronex MP
Kendall Refining Co.	Kendall L-427
Ashland Oil Co.	Valvoline Val-plex EP Grease
Pennzoil Prod. Co.	Premium Wheel Bearing Grease 707L

Seal Inspection and Replacement

Always check the seal to make sure that it is not damaged, nicked, cracked or torn and is in good working order. If there is any question of condition, replace the seal.

Procedure to replace seal:

1. Pull seal from the hub with a seal puller. Never push the seal out with the bearing. The bearing may get damaged.
2. Apply a PERMATEX sealant to the outside of the new seal.
3. Tap the new seal into place using a clean, hard wood block (See Fig. 8).



Bearing Adjustment/Hub Replacement

For adjusting bearings or replacement of removed hub, follow procedures below:

1. Place hub, bearing, washers and castle nut back on axle spindle in the reverse order from which they were removed. Castle nut should be torqued to 50 ft.-lb. Hub will rotate during this process.
2. Loosen castle nut to back off the torque.
3. Tighten castle nut finger tight until snug.
4. Insert cotter pin (or locking tang if equipped with Super Lube). If cotter pin or tang does not line up with hole, back castle nut up slightly until pin or tang can be inserted.
5. Bend cotter pin over to lock nut in place (or locking tang in the case of Super Lube). Nut should be free to move with only the cotter pin keeping it in place.

ELECTRIC BRAKES

The basic structure of the Electric Brakes on your trailer will resemble the brakes on your car or tow vehicle, with one major difference; your trailer implements an Electric Actuation system and your tow vehicle utilizes a hydraulic system. The Electric Braking System operates in the following order of steps; refer to the Electric Braking System diagram and the brake diagram to follow along:

1. Electric current is supplied to the trailer's braking system when the tow vehicle's brakes are applied.
2. From the tow vehicle's battery, the electricity flows to the brake's electromagnet.
3. When energized the electromagnets are attracted to the rotating surface of the drums.
4. This moves the actuating levers in the direction the drums are turning.
5. The actuating cam at the end of the shoe forces the primary shoe out to the drum surface.
6. The force of the primary shoe actuates the secondary shoe to contact the drum.
7. The force applied to the brake drum can be increased by elevating the current flow to the electromagnet.

Front of Brake

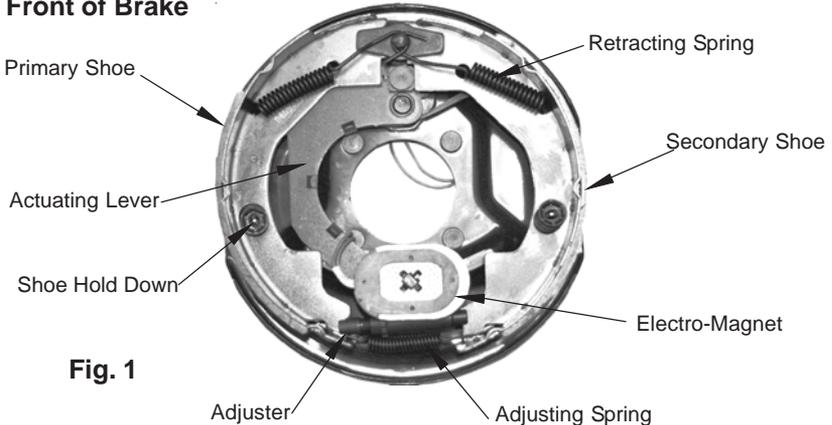


Fig. 1

How to Use Your Electric Brakes Properly

The Lippert Components, Inc. Electric Braking System is synchronized with your tow vehicle brakes.

WARNING!

Never attempt to stop the combined load of the tow vehicle and the trailer by using either the tow vehicle brakes or the trailer brakes only. They are designed to work together.

You may have to manually make small adjustments occasionally to accommodate changing loads and driving conditions.

Synchronization of tow vehicle to trailer braking can only be accomplished by road testing. Locking up, excessive grab, or delayed application is quite often due to the lack of synchronization between the tow vehicle and the trailer being towed. High voltage (2V+), Low voltage (2V-) or improperly adjusted brakes are the most common cause of these problems and can be easily remedied.

Prior to any adjustments, your trailer brakes should be burnished-in by applying the brakes 20-30 times with a 20 m.p.h. decrease in speed, e.g. 40 m.p.h. to 20 m.p.h. Allow ample time for brakes to cool between application. This allows the brake shoes and magnets to begin seating to the brake drum.

Trailer Wire Gauge Chart

Number of Brakes	Hitch-to-Axle Distance In Feet	Minimum Hookup Wire Gauge
2		12 AWG
4	Under 30	12 AWG
4	30-50	10 AWG
6	Under 30	10 AWG
6	30-50	8 AWG

General Maintenance - Electric Brakes

Brake Adjustment



Lippert Components, Inc. Electric Brakes are manually adjustable only. If manual adjusting is needed, the following 6-step procedure can be utilized. Initially, brakes should be adjusted after the first 200 miles of operation when the brake shoes and drums have "seated." Next, check and adjust brakes at 3,000 mile intervals or sooner if they are not performing as intended. The brakes should be adjusted in the following manner:

1. Jack up trailer and secure on adequate capacity jack stands. Follow trailer manufacturer's recommendations for lifting and supporting the unit. Make sure the wheel and drum rotates freely.

WARNING!

Lift unit by the frame and never the axle or suspension. Do not go under unit unless it is properly supported by jack stands. Unsupported units can fall causing serious injury or death.

2. Remove the adjusting hole cover from the adjusting slot on the bottom of the brake backing plate.
3. With a screwdriver or standard adjusting tool, rotate the starwheel of the adjuster assembly to expand the brake shoes. Adjust the brake shoes out until the pressure of the linings against the drum makes the wheel very difficult to turn.
4. Then rotate the starwheel in the opposite direction until the wheel turns freely with a slight lining drag.
5. Replace the adjusting hole cover and lower the wheel to the ground.
6. Repeat the above procedure on all brakes. For best results, the brakes should all be set at the same clearance.

Clean and Inspect Brakes

In the event the braking system encounters symptoms of improper application or failure, immediate inspection and service must be implemented. During normal use, servicing the braking system once a year is considered normal. Increased usage will require service on a regulated schedule based on 3000-6000 mile increments. As magnets and shoes become worn, they need to be changed to maintain maximum braking capability.

Be sure, when disassembling brakes for cleaning, to clean the backing plate, magnet arm, magnet and shoes. Also, make sure that any and all parts removed for cleaning are placed back into the same brake drum assembly. This is also an excellent time to check for parts that have become loose or worn.

WARNING!

POTENTIAL ASBESTOS DUST HAZARD!

Older brake linings have the potential to contain asbestos dust, which has been linked to serious or fatal illnesses.

Certain precautions need to be taken when servicing brakes:

1. Avoid creating and/or breathing any brake dust.
2. Do no machine, file or grind the brake linings.
3. Remove with a damp brush or cloth. Dry brushing or compressed air will cause dust particles to be airborne.

Lubricate Brakes

Prior to reassembling the brake drum assembly, remember to apply a light film of white grease or an anti-seize compound on the brake anchor pin, the actuating arm bushing and pin, and the areas on the backing plate that are in contact with the brake shoes and magnet lever arm. In addition apply a light film of grease on the actuating block mounted on the actuating arm.

Magnets

This electric braking system utilizes an electromagnet to actuate the brake shoes. These high-quality magnets provide superior force and friction to safely and effectively stop the trailer. These magnets should be inspected and serviced on the same schedule as the rest of the axle system, at least once a year for normal use and more often if the trailer is used extensively. Abnormal or uneven wear is a sign that the magnet needs to be replaced. Check the surface of the magnet with a straight edge to check for uneven wear. The surface of the magnet should be completely flat.

If the magnet's coil is exposed in any way, even if normal wear is evident, the magnets should be replaced immediately. If the electromagnets are replaced, the drum armature surface should also be refaced. If a magnet is replaced on one side of an axle, it is recommended that the magnet on the opposite brake assembly also be replaced to ensure even braking capacity.

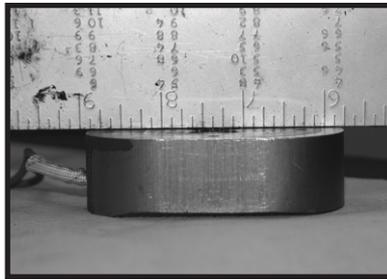


Fig. 2

Figure 2, above, shows an Electro-Magnet with little or no wear. If there are any pronounced gaps on the surface of the Electro-Magnet, the magnet should be replaced.

Shoes and Linings

Linings should be replaced if the material is worn to 1/16" or less. Shoes should also be replaced if they become contaminated with grease or oil or have become scored, pitted or gouged. Heat cracks are normal and rarely require attention. When replacing shoes, both shoes on the same brake and the brakes on the same axle should all be replaced at the same time, once again ensuring even braking capacity.

After replacing shoes and linings, your trailer brakes should be burnished-in by applying the brakes 20-30 times with a 20 m.p.h. decrease in speed, e.g. 40 m.p.h. to 20 m.p.h. Allow ample time for brakes to cool between application. This allows the brake shoes and magnets to begin seating to the brake drum.

Axle & Suspension Installation

The single most important portion of axle installation is parallel alignment of the trailer axle(s) to the tow vehicle or drive axle(s). Parallel installation allows for correct and safe control, prolonged tread life and will all but eliminate dog-tracking. Proper alignment is most readily achieved by measuring from the center of the trailer king pin to the center of each end of the axles.

The tolerance should not vary any more than 1/16". The difference between the centers of one axle and end centers of the other axle must not vary more than 1/8" in multiple axle configurations.

Lippert Components, Inc. tubular axles are made of high strength steel to prevent metal fatigue and provide the best possible welding conditions. The round tubular axles allow for even and uniform structure.

WARNING!

Always wear eye protection when servicing the axle, brakes, hubs, springs and wheels. Failure to wear eye protection may result in serious injury.

Suspension Systems

The suspension systems incorporated into Lippert Component, Inc. axles are designed to provide the following benefits:

1. Attach the axle to the trailer.
2. Dampen the effects of road shock.
3. Provide stability to the trailer.

All Lippert suspension systems are available in single and multiple axle configurations. For specific or custom applications, please contact Lippert Components, Inc. Axle Division.

Double-Eye Leaf Springs

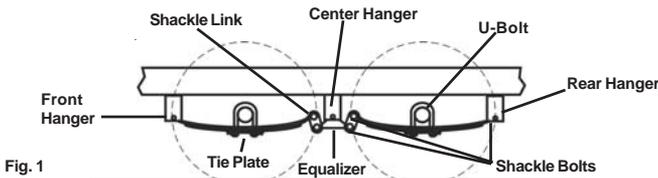
Double-eye leaf springs have eyes at either end of the spring assembly with nylon bushings to assist in preventing wear. U-bolts hold the springs to the axle with a plate.

The articulation of this suspension occurs when the eyes rotate on the wear surfaces provided in eyes of the springs and on the equalizers. This suspension is also available in single and multiple axle configurations.

In trailers with 2 or more axles, the additional movement is maintained by an equalizer. This feature allows for even load handling from axle to axle.

Torsion Suspension System

1. The Lippert Components, Inc. Torsion Suspension system is designed to offer superior qualities over leaf spring technology. The Lippert Components, Inc. Torsion Suspension system is bracketed to the trailer's frame and housed inside the trailer axle's tube.
2. The spindle is connected to a swing arm, the swing arm is connected to a square inner bar that is sheathed in rubber and as the swing arm rotates and experiences the torque and resistance of driving conditions, the characteristics of the rubber absorb and distribute the load providing benefit over leaf spring suspensions.
3. The Lippert Components, Inc. Torsion Suspension system requires very little attention in regards to maintenance. Normal inspection of the entire Lippert Components, Inc. Trailer Axle system can be applied to the Torsion Suspension system. See inspection procedures for system components in this manual.



Sprung Axle Torque Specifications

Axle Size	Minimum ft.-lb.	Maximum ft.-lb.
U-Bolts	55	70
Shackle Bolts	30	50

Inspection

All the components of your suspension system should be visually inspected for signs of wear, damage or loose fasteners at least every 6,000 miles. When replacing or tightening loose fasteners, consult the torque specs on page 16 for correct torque values.

Worn spring eye bushings or sagging or broken springs should be replaced using the following method:

1. Support the trailer with the wheels just off the ground. Follow the trailer manufacturer's recommendations for lifting and supporting the unit.
2. After the unit is properly supported place a suitable block under the axle tube near the end to be repaired. This block is to support the weight of the axle only so that SUSPENSION COMPONENTS can be serviced or replaced.
3. Disassemble the U-bolts, nuts, and tie plates.
4. Remove the spring eye bolts and the spring.
5. If the spring eye bushings are to be replaced, press out the old bushing by hand or tapping out with a punch.
6. Free-floating nylon bushing needs no lubrication. Press the new bushing into the spring eye by hand or gently tapping it in with a bounceless rubber or plastic mallet.
7. Reinstall repaired or replaced components in reverse order.

NOTE: For multiple axle units, the weight of each axle must be supported as outlined in Step 2 before disassembly of any component of the suspension system.

WARNING!

Lift unit by the frame and never the axle or suspension. Do not go under unit unless it is properly supported by jack stands. Unsupported units can fall causing serious injury or death.

WARNING!

Always wear eye protection when servicing the axle, brakes, hubs, springs and wheels. Failure to wear eye protection may result in serious injury.

If the equalizer or equalizer bushings must be replaced, follow the instructions above for lifting and supporting the trailer unit and then proceed as follows:

1. With both axles blocked up, remove the spring eyebolt, keeper bolt, and equalizer bolt from the equalizer to be repaired or replaced.
2. Press the old nylon bushing out of the equalizer.
3. Reassemble in reverse order.

Suspension Replacement

1. Make sure springs are on straight. Align spring eyes to front hanger. Insert spring eye bolts but do not torque at this point.
2. Assemble springs into equalizer.
3. After leveling equalizer to frame, torque equalizer nuts and spring eye nuts to a minimum of 55 ft.-lb. and a maximum of 70 ft.-lb.

Wheels

Wheel Selection

When specifying or replacing your trailer wheels it is important that the wheels, tires, and axle are properly matched. The following characteristics are extremely important and should be thoroughly checked when replacement wheels are considered:

1. **Bolt Circle.** Wheels have many bolt circle variations and some are so close that it could be possible to attach an inappropriate wheel that does not match the axle hub.
2. **Capacity.** Wheel load capacity should match tire and trailer max. load ratings.
3. **Offset.** The relationship of the center line of the tire to the hub face of the axle should match any replacement. Failure to match offset may result in reducing the carrying capacity of your axle.
4. **Rim Contour.** Replacement wheels should be direct replacements to match the rim contour.

WARNING!

Use only rim contours suggested by manufacturer. Failure to use correct rim contour may cause dramatic separation of tire and wheel and could cause serious injury or death.

WARNING!

Attempting to modify or repair a wheel can cause unsafe conditions that may result in an explosion. Air pressure on a weakened or cracked rim can cause serious injury or death.

Torque Requirements

It is extremely important to apply and maintain proper wheel mounting torque on your trailer axle. Torque wrenches assure the proper amount of torque is being applied to a fastener. Use no other method to torque fasteners.

WARNING!

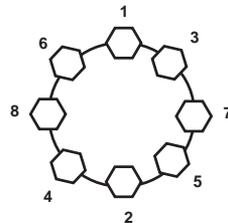
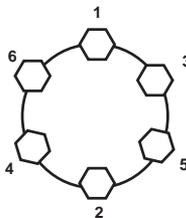
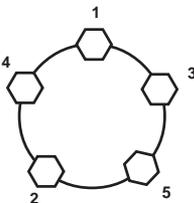
Proper and accurate torque must be maintained to prevent wheels from loosening, studs from cracking and/or breaking or other possible hazardous breakage resulting in serious injury or death.

Be sure to use only the fasteners matched to the cone angle of your wheel (usually 60° or 90°.) The proper procedure for attaching your wheels is as follows:

1. Start all bolts or nuts by hand to prevent cross threading.
2. Tighten bolts or nuts in the following sequence.
3. Tightening fasteners should be done in stages.
Follow the recommended sequence, tighten fasteners per wheel torque requirements diagram (see below).
4. Wheel nuts/bolts should be torqued before first road use and after each wheel removal. Check and re-torque after the 10 and 25 miles and again at 50 miles. A periodic check during regular service is recommended.

Wheel Size	Stud Size	Torque Sequence		
		1st Stage	2nd Stage	3rd Stage
14"	1/2"	20-25	50-60	90-120
15"	1/2"	20-25	50-60	90-120
16"	1/2"	20-25	50-60	90-120
16.5" x 6.75"	1/2"	20-25	50-60	90-120
16"	9/16"	20-25	60-70	120-130
16.5" x 6.75"	9/16"	20-25	60-70	120-130
17.5" w/long nut	5/8"	50-60	100-120	190-210
17.5" w/flange nut	5/8"	50-60	150-200	275-325
14.5" Demount	1/2"	tighten sequentially to 85-95		

NOTE: All torque in ft.-lb.



Tires

Prior to mounting tires onto wheels, be sure the rim size and contour are approved by the Tire and Rim Association Yearbook or the tire manufacturers catalog. In addition, confirm that the tire will carry the rated load. If the load is not evenly distributed on all tires, use the tire rated for the heaviest wheel position.

The Rubber Manufacturers Association or the tire manufacturers guidelines should be consulted for mounting procedures.

Tire inflation pressure is the most important factor in tire life. Tire pressure should always be what is recommended by the manufacturer for the load. Always check pressure cold before operation. **DO NOT** bleed air from tires when they are hot. Check inflation pressure weekly during use to insure maximum tire and tread life.

The following tire wear diagnostic chart will help you pinpoint the causes and solutions of tire wear problems.

NOTE: Tire wear should be checked frequently because once a wear pattern becomes firmly established in a tire it is difficult to stop, even if the underlying cause is corrected.

		PROBABLE CAUSE	CORRECTIVE ACTION
CENTER WEAR		Over-inflation	Adjust pressure to particular load per tire catalog.
EDGE WEAR		Under-inflation	Adjust pressure to particular load per tire catalog.
SIDE WEAR		Loss of camber or overloading	Make sure load doesn't exceed axle rating. Align at alignment shop or service center.
TOE WEAR		Incorrect toe-in	Align at alignment shop or service center.
CUPPING		Out-of-balance	Check bearing adjustment and balance tires.
FLAT SPOTS		Wheel lockup & tire skidding	Avoid sudden stops if possible and adjust brakes

Introduction to Troubleshooting

The following section is a guideline for ensuring operation of your braking system. The safety of you, those traveling with you and those sharing the road paramount and it starts with the ability to safely stop the tow vehicle and the towed vehicle.

Troubleshooting

Most brake malfunctions can be corrected by utilizing the Troubleshooting Chart on the next page. Mechanical failure is the most common form of malfunction, however, if the brake system fails and it's not mechanical, it is usually electrical. A Voltmeter and Ammeter are essential tools to diagnose these problems.

Mechanical problems are mostly self-evident; something is bent or broken. Consult the following troubleshooting chart to determine the probable cause and corrective actions for a variety of issues with the braking system.

Please remember to use only Lippert Components, Inc. replacement parts on these systems. Consult the Limited Warranty or call our Service Department for any other related issues.

Troubleshooting Chart

PROBABLE CAUSE

CORRECTIVE ACTION

NO BRAKES	
Open Circuits _____	Find & Correct
Short Circuits _____	Test & Correct
Severe Underadjustment _____	Adjust Brakes
WEAK BRAKES	
Grease or Oil on Magnets or Linings _____	Clean or Replace
Corroded Connections _____	Clean & Correct Cause of Corrosion
Worn Linings or Magnets _____	Replace
Scored or Grooved Brake Drums _____	Machine or Replace
Improper Synchronization _____	Correct
Underadjustment _____	Adjust Brakes
Glazed Linings _____	Reburnish or Replace
Overloaded Trailer _____	Correct
LOCKING BRAKES	
Underadjustment _____	Adjust
Improper Synchronization _____	Correct
Loose, Bent or Broken Brake Components _____	Test & Correct
Out-of-Round Brake Drums _____	Machine or Replace
Insufficient Wheel Load _____	Adjust System Resistor and Synchronize
INTERMITTENT BRAKES	
Broken Wires _____	Test & Correct
Loose Connections _____	Repair or Replace
Faulty Ground _____	Find & Repair
BRAKES PULL TO ONE SIDE	
Wrong Magnet Lead Wire Color _____	Adjust
Incorrect Adjustment _____	Correct
Grease or Oil on Linings or Magnets _____	Clean or Replace
Broken Wires _____	Find & Repair
Bad Connections _____	Find & Repair
HARSH BRAKES	
Underadjustment _____	Adjust
Improper Synchronization _____	Correct
NOISY BRAKES	
Underadjustment _____	Adjust
Lack of Lubrication _____	Lubricate
Broken _____	Replace Component
Incorrect Brake Components _____	Correct
SURGING BRAKES	
Grease or Oil on Linings or Magnet _____	Clean or Replace
Out-of-Round or Cracked Brake Drums _____	Machine or Replace
DRAGGING BRAKES	
Overadjustment _____	Readjust
Out-of-Round Brake Drums _____	Machine or Replace
Incorrect Brake Components _____	Replace
Loose, Bent or Broken Brake Components _____	Replace
Faulty Breakaway Switch _____	Repair or Replace
Loose Wheel Bearing Adjustment _____	Adjust
Bent Spindle _____	Replace Axle

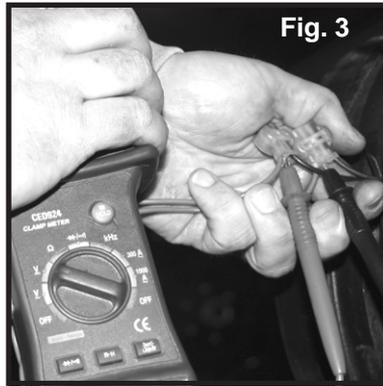
NOTE: If all trailer lights and brakes do not work, check your wiring plug connection and make sure the ball is making solid contact with the coupler (that is how a trailer is grounded). Too much grease or not using dielectric grease on the ball and coupler can cause this to happen.

Measuring Voltage

The Braking System voltage is measured at the two lead wires of the magnet on any brake. Use the pin probes inserted through the insulation of the lead wires. To ensure that the battery is indicating a full charge, the towing vehicle engine should be running with the trailer coupler connected when checking the voltage.

Voltage in the system should begin at 0 volts and, as the brake pedal of the tow vehicle is applied, voltage will gradually increase to about 12 volts. If the system does not indicate at least 12 volts, problems may occur in the wiring of the system, the battery or alternator of the tow vehicle.

When the brakes are applied, a gradual increase in voltage is preferable to a quick increase to 12 volts. A gradual increase in voltage ensures smooth and firm trailer braking. A quick increase in voltage will cause the braking system to feel like the trailer is grabbing too quickly.



Taking a Voltage reading is usually done with probes inserted into the wire connector (See Fig. 3).

Measuring Amperage

The Braking System amperage is the amount of current flowing through the system when all magnets have been energized. The amperage will change proportionately with the voltage. To ensure that the battery is indicating a full charge, the towing vehicle engine should be running with the trailer coupler connected when checking the voltage.

If a resistor is used in the brake system, it must be set at zero or bypassed completely to obtain the maximum amperage reading. Individual amperage draw can be measured by inserting the ammeter in the line at the magnet you want to check. Disconnect one of the magnet lead wire connectors and attach the ammeter between the two wires. Consult Amperage Chart on the next page for normal amp readings.

Make sure that the wires are properly reconnected and sealed after testing is completed.

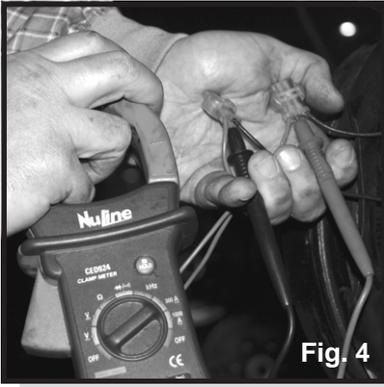


Fig. 4

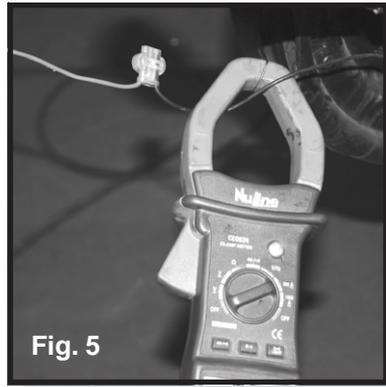


Fig. 5

Testing for Amperage can be done with probes (See Fig. 4) or alligator clips on the leads or an amp clamp (See Fig. 5).

Amperage Chart

Amps/ Magnet	Two Brakes	Four Brakes	Six Brakes
3.0	6.0	12.0	18.0

Low or no voltage are the most common problem with the Braking System. Amperage at the brakes is also a relatively common issue. Common causes of these conditions are:

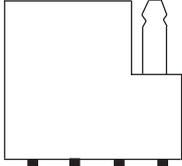
1. Low quality electrical connections
2. Open circuits
3. Insufficient wire gauge
4. Broken wires
5. Blown fuses (fusing of brakes is not recommended)
6. Short circuits (indicated by high amperage)

Possible causes of shorts are:

1. Shorted magnet coils
2. Bare wires contacting a grounded object

Finding the cause of a short circuit in the system is done by isolating one section at a time. If the high amperage reading drops to zero by unplugging the trailer, then the short is in the trailer. If the amperage reading remains high with all the brake magnets disconnected, the short is in the trailer wiring.

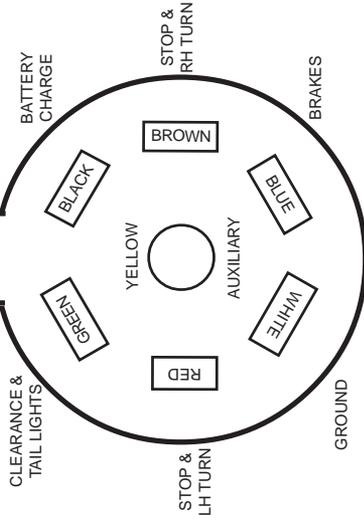
All electrical troubleshooting procedures should start at the controller. Most complaints regarding brake harshness or malfunction are traceable to improperly adjusted or nonfunctional controllers. See your controller manufacturer's data for proper adjustment and testing procedures. For best results, all the connection points in the brake wiring should be sealed to prevent corrosion. Loose or corroded connectors will cause an increase in resistance which reduces the voltage available for the brake magnets.



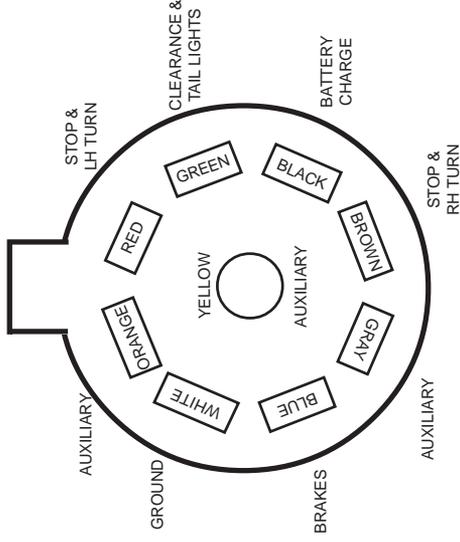
- BROWN - STOP & RH TURN
- YELLOW - STOP & LH TURN
- GREEN - RUNNING LIGHTS
- WHITE - GROUND

TRAILER LIGHTS PIGTAIL - DOES NOT OPERATE BRAKES

7-PIN COUPLER



9-PIN COUPLER



TRAILER BRAKE AND LIGHT COUPLER - OPERATES BRAKES

MAINTENANCE SCHEDULE

Item	Function Required	Weekly	3 Months/ 3000 Miles	6 Months/ 6000 Miles	12 Months/ 12000 Miles
Brakes	Test that they are operational.	At Every Use			
Breakaway System	Check battery charge and switch operation.	At Every Use			
Brake Adjustment	Adjust to proper operating clearance.		◆		
Brake Magnets	Inspect for wear and current draw.			◆	
Brake Linings	Inspect for wear or contamination.				◆
Brake Controller	Check for correct amperage & modulation.			◆	
Trailer Brake Wiring spots, fray, etc.	Inspect wiring for bare				◆
Hub/Drum	Inspect for abnormal wear or scoring.				◆
Wheel Bearing	Inspect for corrosion or wear. Clean & repack				◆
Seals	Inspect for leakage. Replace if removed.				◆
Springs	Inspect for wear, loss of arch.				◆
Suspension Parts	Inspect for bending, loose fasteners, wear.			◆	
Hangers	Inspect Welds.				◆
Wheel Nuts and Bolts	Tighten to specified torque values.		◆		
Wheels	Inspect for cracks, dents or distortion.			◆	
Tire Inflation Pressure	Inflate tires to mfg's. specifications.	◆			
Tire Condition	Inspect for cuts, wear, bulging, etc.		◆		

Storage

Storage Preparation

If your trailer is to be stored for an extended period of time the trailer will need to be prepared prior to going into storage. Follow these guidelines to setup your trailer for storage:

1. If the trailer has an emergency breakaway battery remove it and store it inside, out of the weather. Charge the battery at least every 90 days.
2. Jack up the trailer and place jack stands under the trailer frame so that the weight will be off the tires. Follow trailer manufacturer's guidelines to lift and support the trailer.
3. Lubricate mechanical moving parts such as the hitch, and suspension parts, that are exposed to the weather.
4. In the case of boat trailer axles that are subject to repeated immersion, remove brake drums; clean, dry and re-lubricate moving brake components; inspect bearings - clean and relubricate.



Extended Storage Inspection Procedures

Trailer should remain on jack stands during this procedure:

1. Remove all wheels and hubs or brake drums. Reinstall drum to same spindle and brake from which it was removed.
2. Inspect suspension for wear.
3. Check tightness of hanger bolt, shackle bolt, and U-bolt nuts of the suspension for correct torque.
4. Check brake linings, brake drums and armature faces for excessive wear, scoring, damage or corrosion.
5. Check brake magnets with an ohmmeter. The magnets should check 3.2 ohms. If shorted or worn excessively, they must be replaced.
6. Lubricate all brake moving parts using a high temperature brake lubricant.
7. Remove any rust from braking surface and armature surface of drums with fine emery paper or crocus cloth. Be sure to protect bearings from contaminating dust.
8. Inspect oil or grease seals for wear or nicks. Replace if necessary.
9. Lubricate hub bearings.
10. Reinstall hubs and adjust bearings.
11. Mount and tighten wheels.

WARNING!

Avoid getting any grease or oil on brake linings and pads or magnet surfaces.

Trip Preparation Checklist

The following checklist offers several guidelines to prolonging the quality of your running gear and will provide trustworthy and safe trailering for years to come.

Using the following checklist before starting a trip with your trailer is highly recommended. Allow plenty of time prior to any trip for any service or repairs that may need to be done before using the trailer.

1. Maintenance schedule should be current.
2. Inspect hitch for corrosion, lubrication and wear.
3. Inspect safety chains for rust and wear. Engage chains and breakaway switch actuating chain securely. Breakaway battery should be fully charged.
4. Electronic coupler must be secure. Run check on all lights and break engagement and synchronization.
5. Load trailer with 10% of total weight on the hitch end of trailer. Smaller trailers front end load should be increased to 15%.
6. **DO NOT OVERLOAD!** Consult your trailers i.d. plate for gross vehicle weight restrictions.
7. Tires should be inflated to manufacturer's specs. Inspect tires for any damage or wear.
8. Inspect lug nuts/bolts. All should be torqued to spec. (See Page 15 for specs).
9. Check torque of hanger bolt, shackle bolt, and U-bolt nuts on suspension.
10. Check that your trailer is towing level. Adjust hitch height if necessary to level trailer.