Caravan Electric Brake (1.5-2 Tonne)

OWNER'S MANUAL

LIPPERT COMPONENTS®

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Introduction

The following publication is designed to give the customer an easy-to-understand operation and service manual to provide useful and important information.

NOTE: Images used in this document are for reference only when assembling, installing and/or operating this product. Actual appearance of provided and/or purchased parts may differ.

Safety

Read and understand all instructions before installing or operating this product. Adhere to all safety labels.

This manual provides general instructions. Many variables can change the circumstances of the instructions, i.e., the degree of difficulty, operation and ability of the individual performing the instructions. This manual cannot begin to plot out instructions for every possibility, but provides the general instructions, as necessary, for effectively interfacing with the device, product or system. Failure to correctly follow the provided instructions may result in death, serious personal injury, severe product and/or property damage, including voiding of the LCI limited warranty.

⚠WARNING

The "WARNING" symbol is a sign that precedes a service, maintenance or operational procedure containing a possible personal safety risk that could result in serious injury or death if stated safety precautions and procedural steps are not followed as set forth in this manual.

⚠WARNING

Failure to follow instructions provided in this manual may result in death, serious personal injury and/or severe product and property damage, including voiding of the component warranty.

⚠CAUTION

The "CAUTION" symbol above is a sign that a safety risk is involved and may cause personal injury and/or product or property damage if not safely adhered to and within the parameters set forth in this manual.

⚠CAUTION

Use personal protective equipment (PPE) whenever performing service work or routine maintenance. Make sure work space is clean and free of slip or trip hazards.

⚠CAUTION

Moving parts can pinch, crush or cut. Keep clear and use caution.

Electric Brakes

The basic structure of the electric brakes on the caravan will resemble the brakes on the tow vehicle, with one major difference: The caravan implements an electric actuation system and the tow vehicle utilizes a hydraulic system.

The electric braking system operates in the following order of steps:

1. Electric current is supplied to the caravan'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 magnets 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 magnet.

Break-In Period For Electric Drum Brakes

NOTE: Brakes should be manually adjusted after the first 320 kilometers of operation, then periodically every 4800 kilometers.

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

Brakes can be seated in by applying approximately 8-10 volts to the caravan brakes at an initial speed of 65 km/h and allowing the tow vehicle/caravan combination to slow down to 32 or 40 km/h. For best results do not use tow vehicle brakes during this procedure.

The caravan brakes will seat in faster by using them to stop both the tow vehicle and caravan. The easiest method is to apply the caravan 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's electromagnets. During the break-in period, the linings will wear at a faster rate than they do after they are seated in.

How to Use Lippert Electric Brakes Properly

The LCI electric braking system is synchronized with the tow vehicle's brakes. Never attempt to stop the combined load of the tow vehicle and the caravan by using either the tow vehicle brakes or the caravan brakes only. They are designed to work together.

Small manual adjustments may occasionally be necessary to accommodate changing loads and driving conditions. Synchronization of the tow vehicle-to-caravan 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 caravan being towed. High voltage (+2V), low voltage (-2V) or improperly adjusted brakes are the most common causes of these problems and can easily be corrected.

Maintenance Schedule

Item	Function Required	3 Months/ 4800 km	6 Months/ 9700 km	12 Months / 19 800 km (Whichever comes first)
Brakes	Test that they are operational.	At Every Use		
Brake adjustment	Adjust to proper operating clearance.	◆		
Brake magnets	Inspect for wear and current draw.		◆	◆
Brake linings and pads	Inspect for wear or contamination.			◆
Hub/drum and rotors	Inspect for abnormal wear or scoring.			◆
Wheel bearing	Inspect for corrosion or wear. Clean and repack.			◆
Seals	Inspect for leakage. Replace if removed.			◆

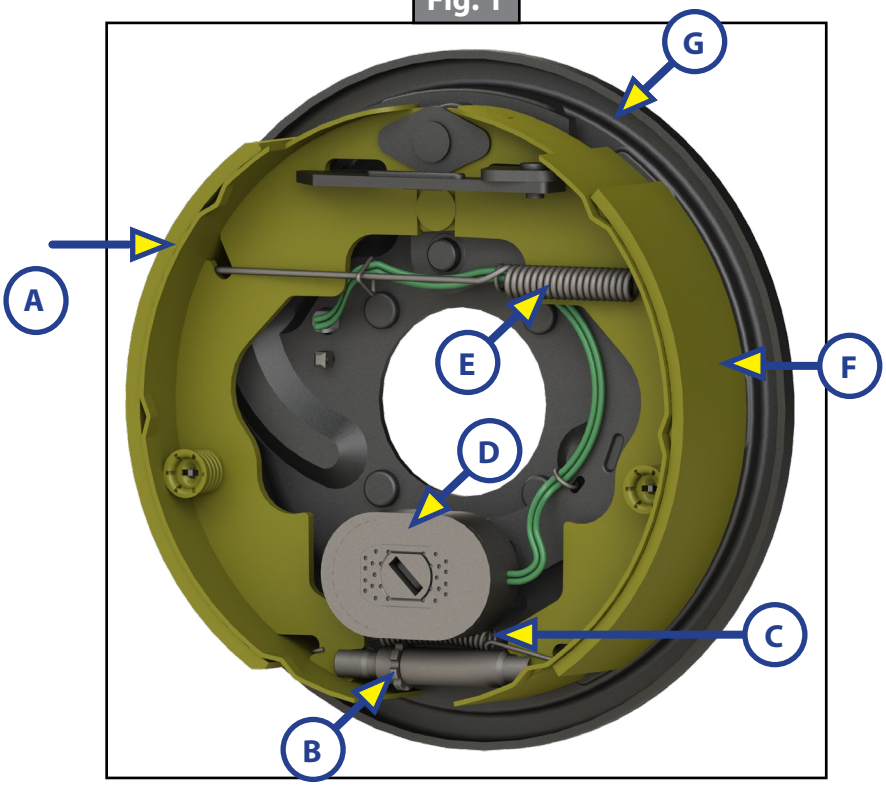
Recommended Component Inspection Periods

Periodic Bearing Inspection: Should be performed annually or every 19 800 kilometers, whichever comes first.

Bearing Lubrication Inspection: Should be performed annually unless periodic brake inspections reveal abnormal braking performance.

Brake Cleaning and Inspection: Should be performed annually or every 19 800 kilometers, whichever comes first.

Fig. 1



Brake Components	
Callout	Description
A	Primary shoe and lining
B	Adjustment screw
C	E-brake spring
D	Magnet
E	Reactor spring
F	Secondary shoe and lining
G	Backing plate

Brake Adjustment

⚠WARNING

Prior to testing or adjusting brakes, make sure area is clear of any people and vehicles. Failure to perform test in a clear area may result in serious injury or death.

⚠WARNING

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

The LCI electric brakes are offered in a manual and automatic adjusting form. If manual brake adjusting is required, do as follows:

1. Jack up caravan and secure on adequate-capacity jack stands.
2. Follow caravan manufacturer's recommendations for lifting and supporting the caravan.
3. Make sure the wheel and drum rotate freely.
4. Remove the adjusting hole cover from the adjusting slot on the bottom of the brake backing plate.
5. With an adjusting tool, rotate the starwheel of the adjuster assembly to expand the brake shoes.
6. Adjust the brake shoes out until the pressure of the linings against the drum makes the wheel very difficult to turn.
7. Rotate the starwheel in the opposite direction until the wheel turns freely with a slight lining drag, or approximately 10 click adjustments.

NOTE: A screwdriver will be needed to push the auto-adjusting lever away from the adjuster starwheel so that the starwheel can be rotated backward in the case of a self-adjusting brake.

8. Replace the adjusting hole cover and lower the wheel to the ground.
9. Repeat the above procedure on all brakes.

NOTE: For best results, the brakes should all be set at the same clearance. If the first brake's clearance was adjusted to 10 clicks, then adjust the remaining brake clearances to the same amount.

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. Above normal use will require servicing based on a 4800-9700 kilometer increment schedule. Change worn magnets and shoes as needed to maintain maximum braking capability.

When disassembling the brakes for cleaning, make sure to:

1. Clean the backing plate, magnet arm, magnet and shoes.
2. Make sure all parts removed for cleaning are placed back into the same brake drum assembly.
3. Check for parts that have become loose or worn.
4. Service or replace loose or worn parts.

Periodic Bearing Inspection

A physical bearing inspection should be conducted every 48 000 kilometers or 12 months, whichever comes first. An inspection of the bearing condition can detect early bearing issues. Upon inspection, bearings should look brand new and can be reassembled and used if in this condition. If discoloration, pitting, corrosion, flat spots or some abnormal condition is observed, the bearing and race should be replaced at the same time. Bearings are available at auto part stores.

Magnets

The LCI electric braking system uses high-quality electromagnets to actuate the brake shoes. These electromagnets provide superior force and friction to safely and effectively stop the caravan. Inspect and service the electromagnets annually if the caravan has seen normal use, and more often if the caravan is used extensively. Inspect the electromagnets and do as follows:

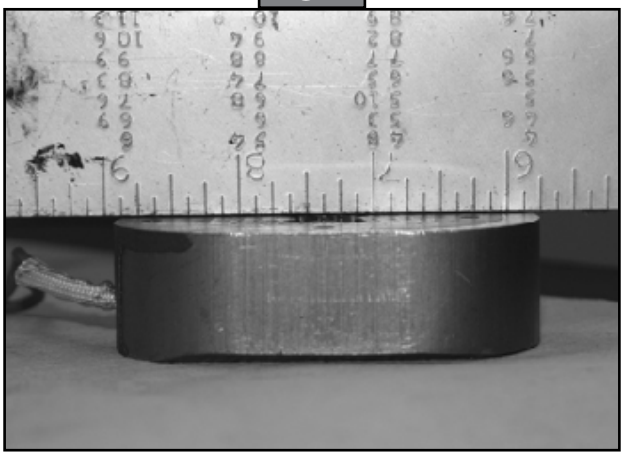
1. Use a straight edge to check the electromagnet surface for uneven wear (Fig. 2).

NOTE: Figure 2 shows an electromagnet with little or no wear.

2. Surface of electromagnet should be completely flat. If abnormal or uneven wear is indicated by pronounced gaps, replace the electromagnet.
3. If the magnet's coil is exposed in any way, even if normal wear is evident, the magnets should be replaced immediately.
4. If the electromagnets are replaced, the drum armature surface should be refaced.

NOTE: If an electromagnet is replaced on one side of an axle, LCI recommends replacing the electromagnet on the opposite brake assembly. This will ensure an even braking capacity.

Fig. 2



Shoes and Linings

Inspect brake shoes and linings for:

- Grease or oil.
- Surface scoring, pitting or gouges.

1. Replace both shoes if lubricant contamination or physical damage is present, even if found on only one shoe.
2. Replace both shoes on the brake and on both brakes installed on the same axle. Replace brake parts at the same time. This will ensure an even braking capacity.
3. Measure lining thickness.
   - **A.** Lining thickness shall not be less than 1.6 mm (1/16").
   - **B.** If lining measures less than 1.6 mm (1/16"), replace the shoe.

NOTE: Heat cracks are normal and rarely require attention.

After replacing the brake shoes and linings, burnish in caravan brakes. See Break-In Period for Electric Drum Brakes.

Hub Replacement

To adjust bearings or replace 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 68 N·m (50 ft-lbs). 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. If cotter pin does not line up with hole, back castle nut up slightly until pin can be inserted.
5. Bend over cotter pin to lock nut in place. Nut should be free to move with only the cotter pin keeping it in place.

Wheels

Wheel Selection

⚠WARNING

Air pressure on a weakened or cracked rim can create an unsafe, explosive condition resulting in serious personal injury or death. Do not attempt to modify or repair a wheel. Replace damaged or weakened wheel and rim with new parts.

⚠WARNING

Use manufacturer's suggested rim contours only. Failure to use recommended rim contours may result in dramatic separation between tyre and wheel, resulting in possible serious personal injury or death.

Caravan wheels, tyres and axles **MUST** be properly matched when specifying or replacing caravan wheels. Make sure the following critical wheel replacement characteristics are observed:

1. Bolt Circle — Wheels have varying bolt circle patterns, some close enough to allow installation of mismatched wheel bolt patterns to axle hub bolt patterns.
2. Capacity — Wheel load capacity **MUST** match tyre and caravan maximum load ratings.
3. Offset — The relationship of the tyre's centerline to the axle's hub face **MUST** match across replacement parts. Failure to match offset reduces axle carrying capacity.
4. Rim Contour — Replacement wheels **MUST** directly match the mating rim contour.

Torque Requirements

⚠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.

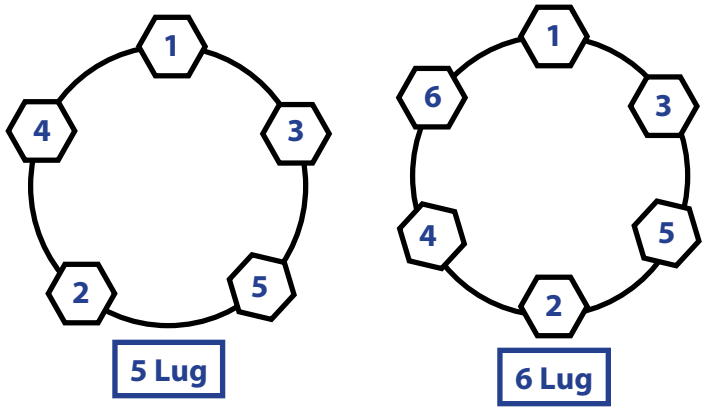
It is extremely important to maintain proper wheel mounting torque limits on the caravan axle. Use of torque wrenches will ensure proper torque limits are applied to wheel mounting lug nuts. Use no other method to torque wheel lug nuts.

Make sure wheel fasteners match the cone angle of the wheel (usually 60 degrees or 90 degrees) being serviced. Attach new wheel to the axle hub as follows:

1. Start all bolts or nuts by hand to prevent cross threading.
2. Continue to hand-tighten wheel lug nuts in the sequential pattern shown in figure 3.
3. After wheel lug nuts are fully hand-tightened, torque nuts in stages in the sequential pattern shown in figure 3.
4. Torque wheel lug nuts to the torque values listed in the Wheel Torque Requirement Chart.

5. Wheel lug nuts should be torqued before first road use and after each wheel removal.
   A. Check and re-torque wheel lug nuts after 16, 40 and 80 kilometers. A periodic check during regular service is recommended.

Fig. 3



Wheel Torque Requirement Chart				
Wheel Size	Stud Size	Torque Sequence		
		1st Stage	2nd Stage	3rd Stage
14″	½″	27-34 N·m	68-81 N·m	122-163 N·m
15″	½″	27-34 N·m	68-81 N·m	122-163 N·m
16″	½″	27-34 N·m	68-81 N·m	122-163 N·m
16.5″ x 6.75″	½″	27-34 N·m	68-81 N·m	122-163 N·m
16″	9⁄16″	27-34 N·m	81-95 N·m	163-176 N·m
16.5" x 6.75"	9⁄16"	27-34 N·m	81-95 N·m	163-176 N·m
16″ Dual and 17.5″ Cone Nut	⅝″	68-81 N·m	136-163 N·m	258-285 N·m
16″ Dual and 17.5″ Flange Nut	⅝″	68-81 N·m	203-271 N·m	373-441 N·m
14.5″ Demount	½″	Tighten sequentially to 115-129 N·m		

Tyres

Prior to mounting tyres onto wheels, do as follows:

1. Make sure rim size and contour are approved by the Tire and Rim Association Yearbook or the tyre manufacturer's catalog.
2. Verify tyre load rating. If the load is not evenly distributed across all tyres, use the tyre rated for the heaviest wheel position.
3. Consult the Rubber Manufacturers Association or the tyre manufacturer's guidelines for wheel mounting procedures.

Troubleshooting

Most brake malfunctions can be corrected by utilizing the Troubleshooting Chart. 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 diagnosing these problems.

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

Use LCI replacement parts on these systems. Consult the limited warranty or call the Service Department for any other related issues.

Electrical Troubleshooting

If all caravan lights and brakes do not work, check the wiring plug connection. Make sure the ball is making solid contact with the coupler (that is how a caravan is grounded). Too much grease on the ball and coupler can cause this to happen.

Measuring Voltage

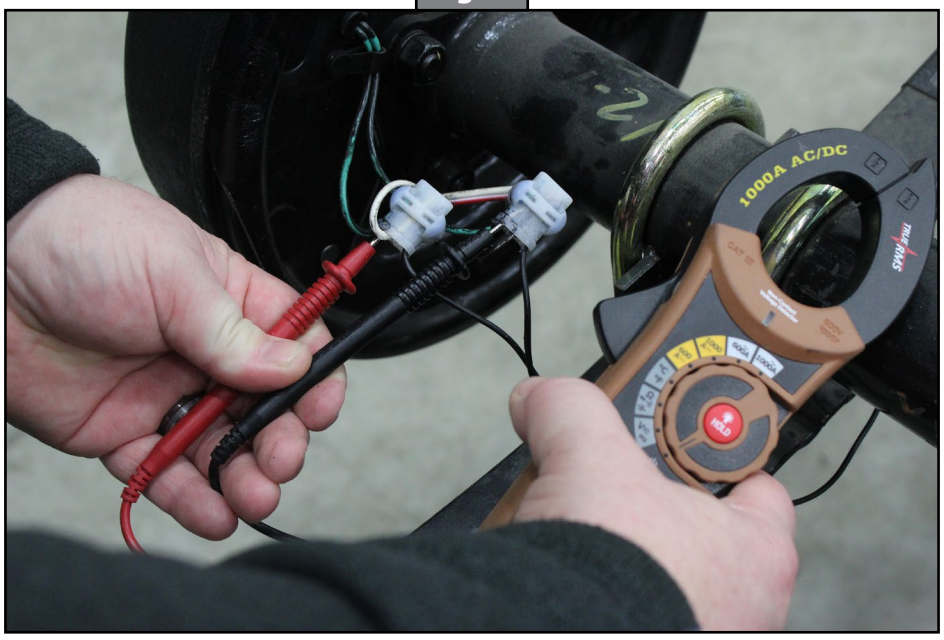
The braking system voltage is measured at the two lead wires of the magnet on any brake. Use the pin probes inserted through the insulation of the lead wires. To ensure that the battery is indicating a full charge, the towing vehicle engine should be running with the caravan coupler connected when checking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

Voltage in the system should begin at zero 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 caravan braking. A quick increase in voltage will cause the braking system to feel like the caravan is grabbing too quickly.

NOTE: Taking a voltage reading is usually done with probes inserted into the wire connector (Fig. 4).

Fig. 4



Measuring Amperage

Braking system amperage is the amount of current flowing through the system when all magnets have been energized. Amperage will change proportionately with voltage. To ensure the battery is fully charged, the tow vehicle engine should be running with the caravan 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 for normal amp readings. Make sure the wires are properly reconnected and sealed after testing is completed.

NOTE: Testing for amperage can be done with probes (Fig. 5) or alligator clips on the leads or an amp clamp (Fig. 6).

Fig. 5

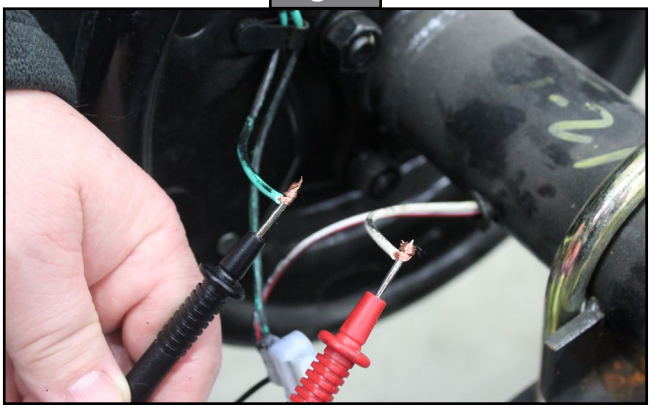
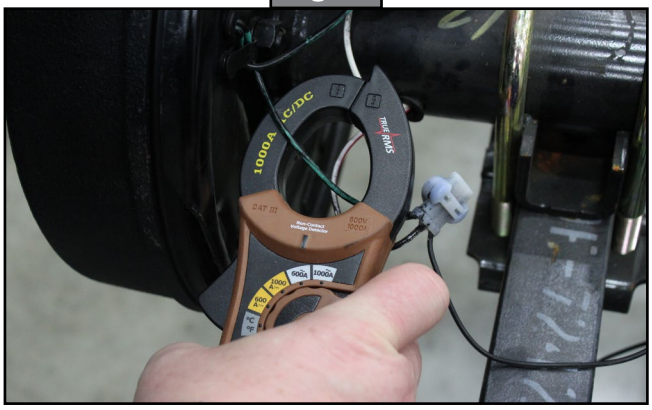


Fig. 6



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 problems 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.
(Reference Caravan Wire Gauge chart.)
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.

Caravan Wire Gauge Chart		
Cross Sectional Area/Wire Gauge and Type	Number of Axles	Length of Run
1.31 mm^2 Cross Sectional Area/16 GA Stranded Copper	1	N/A
2.08 mm^2 Cross Sectional Area/14 GA Stranded Copper	2	Under 9100 mm from hitch to center of axles
3.31 mm^2 Cross Sectional Area/12 GA Stranded Copper	2 or 3	Over 9100 mm from hitch to center of axles

Wiring Diagram

7- / 12-pin Plug

Pin #	Function	Color	Min. Wire Size*	
			mm^2	AWG
1	Left Indicator	Yellow	1.31	16
2	Reverse	Black	1.31	16
3	Ground	White	3.31	12
4	Right Indicator	Green	1.31	16
5	Electric Brakes	Blue	2.08	14
6	Stop Lamp	Red	1.31	16
7	Tail Lamps	Brown	1.31	16

*mm^2 refers to the cross-sectional area of the copper in the wire.

Storage

⚠WARNING

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

Storage Preparation

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

1. If the caravan 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 caravan and place jack stands under the caravan frame so that the weight will be off the tyres. Follow caravan manufacturer's guidelines to lift and support the caravan.
3. Lubricate mechanical moving parts such as the hitch and suspension parts that are exposed to the weather.
4. In the case of boat caravan 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

Caravan 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. Check tightness of hanger bolt, shackle bolt and U-bolt nuts of the suspension for correct torque.
3. Check brake linings, brake drums and armature faces for excessive wear, scoring, damage or corrosion.
4. Check brake magnets with an ohmmeter. The magnets should check 3.2 ohms. If shorted or worn excessively, they must be replaced.
5. Lubricate all brake moving parts using a high-temperature brake lubricant.
6. 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.
7. Inspect oil or grease seals for wear or nicks. Replace if necessary. Using the Trip Preparation Checklist before starting a trip with your caravan 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 caravan.
8. Lubricate hub bearings.
9. Reinstall hubs and adjust bearings.
10. Mount and tighten wheels.

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

Trip Preparation Checklist

Using the following checklist before starting a trip with your caravan is highly recommended.

1. Inspect hitch for corrosion, lubrication and wear.
2. Inspect safety chains for rust and wear. Engage chains and breakaway switch actuating chain securely. Breakaway battery should be fully charged.
3. Electronic coupler must be secure. Run check on all lights and brake engagement and synchronization. Load caravan with 10% of total weight on the hitch end of caravan. Smaller caravans' front end load should be increased to 15%.
4. Do not overload. Consult your caravan's identification plate for gross vehicle weight restrictions.
5. Tyres should be inflated to manufacturer's specifications. Inspect tyres for any damage or wear.
6. Inspect lug nuts/bolts. All should be torqued to specifications. Refer to Wheel Torque Requirement Chart for torque limits.
7. Check torque of hanger bolt, shackle bolt and U-bolt nuts on suspension.
8. Check that the caravan is towing level. Adjust hitch height if necessary to level caravan.

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Please recycle all obsolete materials.

For all concerns or questions, please contact
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