

# OWNER'S MANUAL



Leader of the Three World

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Leader of the Three World

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# SAFETY INFORMATION

## UNDERSTANDING SAFETY LABELS & INSTRUCTIONS

STATEMENTS IN THIS MANUAL PRECEDED BY THE FOLLOWING WORDS ARE OF SPECIAL SIGNIFICANCE:

### WARNINGS & CAUTION SYMBOLS:



This is the safety alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury. Your safety is involved!



#### **WARNING**

SAFETY ALERT WARNING indicates a potential hazard that may result in severe injury or death to the operator, bystander or person (s) inspecting or servicing the vehicle.



#### **CAUTION**

Indicates a potential hazard that may result in minor personal injury or damage to the vehicle.

#### **CAUTION**

CAUTION indicates special precautions that must be taken to avoid vehicle damage or property damage.

#### **NOTE:**

NOTE provides key information by clarifying instructions.

#### **IMPORTANT:**

IMPORTANT provides key reminders during disassembly, assembly and inspection of components.

## SAFETY INFORMATION CONTINUED

### WARNING:

**NEVER** remove your feet from the floorboards or foot pegs. Dragging your feet along the ground may put them at risk of being caught under the rear wheels. Only carry passengers on a proper passenger seat behind the rider. **NEVER** allow passengers on the rear trike fenders as this can be extremely dangerous and may also damage your trike. Your passenger's safety is your responsibility.

### WARNING:

Brake shoe and pad wear limits **ARE NOT TO BE EXCEEDED**. Checking hydraulic brake line condition and fluid level is also necessary. Ensure that drum brakes are manually adjusted at regular service intervals to ensure optimal safe braking performance or when brake pedal travel increases.

Rear drum brakes **MUST BE INSPECTED AND MANUALLY ADJUSTED BY A QUALIFIED MECHANIC**. Drum brakes **DO NOT SELF ADJUST**.

### WARNING:

Lehman EFX, for Harley-Davidson and Honda models, are designed to be used with standard foot pegs and controls only. Installation and use of accessory footboards and/or controls could result in situations where the use of the controls are obstructed. This could result in a potentially dangerous situation and is therefore not recommended.

### REPORTING SAFETY CONCERNS:

Notify your nearest authorized Dealer or LEHMAN TRIKES, Inc. immediately.  
**DO NOT OPERATE THE VEHICLE.**

### REPORTING SAFETY DEFECTS:

If you believe that your vehicle has a defect that could result in a crash or cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying LEHMAN TRIKES in writing. If NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer or LEHMAN TRIKES.

To contact NHTSA, or obtain other information about motor vehicle safety, you may either call the Vehicle Hotline toll-free at 1-888-327-4236 (TTY 1-800-424-9153), visit the NHTSA website at [www.safercar.gov](http://www.safercar.gov) or write to:

ADMINISTRATOR  
NHTSA  
US Department of Transportation • 400 7th St. Southwest • Washington, DC 20590

## WELCOME TO LEHMAN TRIKES

Your new trike kit has been designed, engineered and manufactured to stringent quality standards to be the finest in the trike industry.

This manual has been prepared to acquaint you with the operation, maintenance and care of your Lehman trike. It also provides you with important safety information. This information is supplemental to your original motorcycle manufacturer's instructions. Follow these instructions carefully for maximum trike performance, safety and enjoyment.

Your Lehman Owner's Manual contains instructions for operation and basic maintenance. For technical assistance contact your nearest authorized Lehman Trikes dealer.

# OPERATION

## OPERATING RECOMMENDATIONS

Your Lehman trike conversion is designed to provide you with the open air advantages of a motorcycle combined with added stability.

Adding a trike conversion to a motorcycle may impact its ability to use the full capacity of fuel in the tank. The vehicle may behave as if it is running low on fuel sooner than it would as a two-wheeled motorcycle. To avoid this experience, always keep the fuel tank half-full or more.

**Important Note:** If host motorcycle came with an anti-lock braking system (ABS), that system has been disabled.

### **WARNING:**

**NEVER** remove your feet from the floorboards or foot pegs. Dragging your feet along the ground may put them at risk of being caught under the rear wheels. Only carry passengers on a proper passenger seat behind the rider. **NEVER** allow passengers on the rear trike fenders as this can be extremely dangerous and may also damage your trike. Your passenger's safety is your responsibility.

### **WARNING:**

Because your trike does not lean like a motorcycle during turns, lateral forces will build up, depending on speed and rate of turn. When riding, insure that you and your passenger remain in an upright position firmly holding onto the handlebars or passenger grab handles. Hold the trike with your legs and steer the trike around corners and through curves.

### **Before each ride, consider the following:**

- Air pressure checked and adjusted; tires and wheels checked; rear brakes checked and adjusted.
- Brakes, clutch, controls, suspension adjusted as per OEM recommendations; smooth action.
- Trike is clean and safety is checked.
- Weather conditions are safe; traffic and road conditions are clear.
- Government-approved helmets, eye protection and protective clothing for rider and passenger.

## OPERATION CONTINUED

### **TRIKE STEERING GEOMETRY - Rake & Trail**

Although there are many kits on the market that change trike steering geometry, the affect of these kits on trike handling characteristics is often not fully understood. Rake is the angle measured between the steering axis and vertical. The steering axis is the line about which the steering system turns. Although the angle of the fork tubes from vertical is often the same as the rake angle, they are not always the same.

Trail is the distance measured from where the steering axis meets the ground to where a vertical line drawn through the front axle meets the ground. It can be thought of as the distance that the front wheel "trails" the steering axis.

The effects that rake and trail have on steering performance can best be explained using a shopping cart front wheel as an example. The front wheel of a shopping cart is a castor that has a vertical steering axis that is in front of the wheel. The vertical steering axis results in zero rake, and having the pivot in front of the wheel results in a significant amount of trail.

This results in the front wheel tracking directly behind the pivot regardless of the direction the cart is pushed. If the vertical pivot axis were directly above the wheel axle, the wheel would not track directly behind the pivot. In this case both the trail and the rake would be zero resulting in a wheel that has as much possibility of turning sideways as it does going straight. This is a very unstable condition for both a shopping cart and a motorcycle.

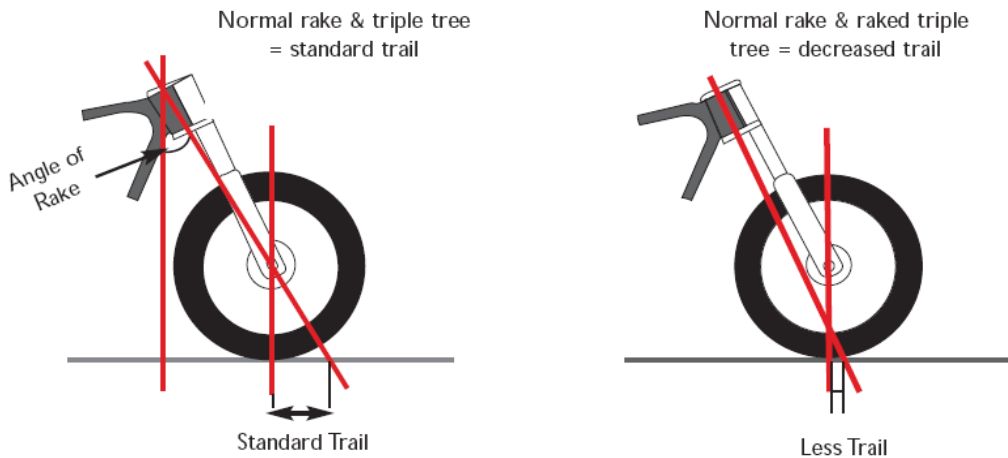
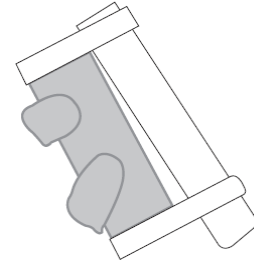
Motorcycles and trikes both use a certain amount of rake and trail to ensure proper handling and steering response. In general, more rake provides greater straight-line stability and less rake makes the bike more responsive. This is why the forks on a sport-oriented motorcycle are more vertical than those on a cruiser or touring motorcycle. In short, smaller rake values result in quicker steering and larger rake values result in slower steering.

Installation of a Lehman Trikes Triple Tree kit improves the trike riding experience by reducing the steering effort required to turn the trike, while making the steering more responsive. The triple tree kit modifies the fork tube angle moving the front wheel further out in front of the trike, reducing the trail.

## OPERATION CONTINUED

Lehman Trikes has experimented with a variety of different triple tree angles and has determined the optimum angle for both the Honda Gold Wing and Harley-Davidson Touring models. The angle chosen reduces the steering effort and improves steering response while maintaining the stability required at higher speeds.

RAKED TRIPLE TREE



### WHAT CAUSES HEADSHAKE?

Headshake is the result of some fundamental differences between a two wheeler and three wheeler. A motorcycle is designed to turn at higher speeds by leaning into corners. In fact, at speeds above 15 mph, when a motorcycle's handlebars are turned to the left, the motorcycle actually steers right. This is referred to as "counter-steering",

Conversely, a trike turns in the direction that it is steered. This is one of the differences in the steering and handling characteristics of a trike. In many cases, a slightly increased front end rake angle over that of the stock motorcycle is beneficial for a trike conversion. There are many other factors that contribute to headshake, but a properly designed unit will control headshake at all but low speeds on rough surfaces. Increasing the steering neck bearing preload will contribute to better low speed handling as well.

Some minor headshake in the handlebars is not uncommon with a trike at very low speeds. Hold the handlebars firmly but allow them to shake



## OPERATION CONTINUED

slightly. This is the same technique used on a motorcycle to handle the shudder caused by steel bridge gratings. As your speed increases, the headshake will disappear. For optimum performance, ensure the wheel bearings and steering neck bearings are serviced regularly and properly tightened according to your motorcycle owner's manual.

### SUSPENSION DESIGNS

#### Trike Suspension and Swingarm Dynamics

There are basically two common suspension systems currently in use on trikes today. They can be identified as either "independent" or "solid axle." Each have unique advantages and disadvantages.

#### Independent Suspension

These systems allow each rear wheel to travel through its range of motion independently of the other wheel. This occurs as the vehicle travels over rough surfaces and while cornering.

The primary advantage is increased ride compliance over obstacles and rough surfaces. The level of ride compliance may be affected by suspension geometry, loading, components, use of restrictive anti-sway mechanisms, and other factors.

The significant disadvantage to independent suspension is decreased cornering stability. This is most commonly referred to as *body roll* or *sway*. The ability of the suspension to move independently also allows compression at the outer wheel and extension at the inner wheel.

Centrifugal force causes the vehicle's center of gravity to shift toward the outside of a corner, which can be felt by the rider as the motorcycle wants to lean opposite the direction the trike is being steered. And we all know that a motorcycle wants to travel in the direction that it is leaning. Essentially, the trike rider is forcing the vehicle in a direction opposite the lean angle. As speed increases, cornering becomes more uncomfortable. This design is more effective for an automobile where there are two wheels up front to help stabilize the vehicle.

#### Solid Axle Suspension

Solid axle suspension remains the most popular design used for a trike application. With this design, cornering performance takes priority over ride compliance.

## OPERATION CONTINUED

However, the final result is still dependent upon suspension geometry, loading, suspension components and, most importantly, swingarm design. Again, there are additional factors that can affect performance as well.

### **Lehman "No Lean" Advantage**

The Lehman "No Lean" philosophy begins with a solid, one-piece swingarm that is designed to be the most sturdy and inflexible in the industry. This minimizes the trike's ability to sway or roll to the outside of a corner. The noticeable benefits are increased stability and easier steering, especially at highway speeds. This is our simple "No Lean" philosophy that is responsible for the best handling trikes for over 20 years!

### **LEHMAN "NO-LEAN" SUSPENSION**

#### **What is "No Lean" suspension?**

The greatest factor that determines trike performance is swingarm design. No other single component has such an impact on handling and ride quality.

"No-Lean" refers to the Lehman proprietary design, which minimizes flex in the swingarm and rear-end system. This design features a differential rear end with internal solid axles. The Lehman swingarm is a one-piece reinforced design, specially constructed to reduce the effects of sway and body roll.

### **OPERATION**

Why should the swingarm be so rigid? In a word, *performance*. The best way to maximize stability and improve handling is to use the most rigid one-piece swingarm possible. Using a rigid swingarm ensures that all three wheels remain firmly planted on the ground while cornering. The center of gravity remains centered between the rear wheels regardless of how the vehicle is maneuvered. Flex within the swingarm would cause the trike to lean resulting in decreased stability and heavier steering.

#### **How do "No Lean" suspensions compare to independent suspensions?**

"No-Lean" is the opposite of independent suspension. Independent suspensions are designed to allow shock compression on one side of the trike while allowing extension on the opposite side. For this reason, body roll or

## OPERATION CONTINUED

sway must be expected. Body roll shifts the center of gravity to the outside wheel in curves and creates a less stable condition. To compensate, the rider must slow down. A trike with independent suspension will allow the center of gravity to shift from side to side. This effect increases with speed while cornering which makes the vehicle feel unstable. The addition of anti-sway devices simply limits this tendency by restricting some of the independent movement, which also limits the smooth ride benefits.

### **Conclusion:**

No other motorcycle-trike conversion is as stable or handles as well as the Lehman "No-Lean" trike.

## **DRIVESHAFT-EQUIPPED MODELS**

### **Lehman Trikes Drive System**

The three main components to a basic drive shaft system are a front universal joint, driveshaft and a rear universal joint. The purpose of the shaft is to transfer power from the motorcycle transmission to the differential. The universal joints are required because the differential must travel through a range of motion allowed by the suspension.

### **Driveshaft Angle**

All universal joints are designed to have a minimum of 1/2 degree working angle. This angle is necessary in order to keep the needle bearings contained in the caps rolling. At angles less than 1/2 degree, the needles stay locked in the same position and wear into the cap, causing vibration and eventually failure.

### **Vibration**

All universal joints vibrate due to joint design. You might ask, "If universal joints vibrate, then why does my car not vibrate?" When a drive shaft is designed for application in a car, the joints are always in pairs. With two joints, they can be phased, canceling each other out and no vibration is experienced.

### **Universal Joints (U joints)**

When an output shaft turns, the two caps of the front U joint must turn around the center of the output shaft. The other two caps on the U joint must turn around the center of the drive shaft. Because the driveshaft is at an angle to the output shaft, the cross of the U joint must wobble back and forth to allow the bearing caps to trace these circles while rotating. This causes the rotating speed of the

# MAINTENANCE

driveshaft to fluctuate on every turn, at first speeding up slightly faster than the output shaft, then slowing down to slightly below the output shaft speed. If this effect is not counter-acted with a second U joint, vibration will occur.

At the other end of the driveshaft is a rear U joint. This joint is phased opposite the front U joint. When the driveshaft speeds up from the action of the front U joint, the action of the rear U joint slows it down, and vice versa. This produces a constant shaft speed at the differential shaft. Automotive drive shafts are not straight for the reasons explained above. If a shaft were designed to run perfectly straight, U joints would not be required. As the rear end moves up and down, the drive shaft can never remain perfectly straight.

## **BREAK-IN**

After the first 25 miles, re-torque the rear wheel lug nuts to the proper torque specifications.

## **TORQUE SPECIFICATIONS**

Standard Wheel.....85 ft. lbs.  
Dayton - Wire Wheels .....75 ft. lbs.

## **REGULAR MAINTENANCE CHECKS**

Service on your trike components should be performed in conjunction with your regular motorcycle service.

- Brake pad/shoe wear limits are not to be exceeded.
- Ensure proper drum brake adjustment.
- Follow recommended differential service requirements
- Ensure that the emergency/parking brake functions smoothly and effectively.
- Tires should be inflated to recommended pressures.  
Recommended rear tire inflation is 26 psi.
- Follow motorcycle manufacturer's recommended maintenance schedule.

## MAINTENANCE CONTINUED

### **WARNING:**

Brake shoe and pad wear limits **ARE NOT TO BE EXCEEDED**. Checking hydraulic brake line condition and fluid level is also necessary. Ensure that drum brakes are manually adjusted at regular service intervals to ensure optimal safe braking performance, or if either brake pull or increased pedal travel occurs. Rear drum brakes **MUST BE INSPECTED AND MANUALLY ADJUSTED BY A QUALIFIED TECHNICIAN. These brakes DO NOT SELF ADJUST.**

### **REAR END DIFFERENTIAL SERVICE**

#### **For Shaft Drive Models**

Check rear differential oil level. It should be checked once yearly. Use an 80/90 weight Hypoid gear oil, which must be added through the inspection hole at the rear of the differential housing. Grease the rear U joint every 3,000 miles or more often under more severe riding conditions. Differential and u-joint service should be performed by a qualified technician.

#### **Belt Drive Models**

Remove the plug and look into the inspection hole on the side of the rear end housing, rolling the trike very slowly with the transmission in neutral to locate the grease fitting on the carrier. The differential carrier is a sealed unit that will require using a grease gun and a high quality EP (extreme pressure) grease. Give the carrier approximately 1-2 pumps per 1000 miles at regular service intervals. Belt tension and tracking should be inspected and adjusted by an authorized Lehman Trikes dealer when required. Contact your nearest authorized Lehman Trikes dealer for this procedure.



## HELPFUL HINTS

### **TRANSPORTING YOUR TRIKE**

When hauling your trike, there are things you can do to help ensure the safety of both you and your trike. Following are some pointers to help you safely load and properly secure your trike.

#### **Ramps**

Use three sturdy ramps (unless you have a single ramp wide enough for the trike), preferably of metal construction and long enough to provide a gentle incline onto the trailer. Ramps need to be securely fastened to the trailer.

#### **Loading**

Proceed slowly up the ramp, ensuring all 3 wheels are aligned with the ramps. Check to ensure the undercarriage will not high-center at the top of the ramp.

#### **Tying down**

Always inspect your tie down straps for wear, cuts or other damage. To secure the front-end of the trike, tie below the suspension to the fork lower legs, axles, or wheels using high quality, ratchet-type tie downs. Be sure to tie downward, preferably to the trailer floor. A 45 degree opposing angle from the front of the trike to the trailer floor is ideal. A front wheel chock can also be utilized.

To secure the rear of the trike, you may use the provided tie down links located on the undercarriage. Again, be sure to tie downward, preferably to the trailer floor. A 45-degree opposing angle to the trailer floor is again ideal. You may also tie through the wheels instead of using the links, but be sure to use a soft cloth between the tie down and the wheel to protect the wheel finish and the tie down strap. Avoid tying around brake lines, wiring, sharp edges, and abrasive objects that can damage the vehicle and/or the tie down straps. To prevent damage to the trike while in transit, be sure to use the park brake and place the trike in neutral for the duration of the trip. The park brake, not the transmission, should be used to help hold the trike in place. Finally, be sure to secure any excess strap lengths.

#### **In Transit**

Be sure to stop (in rest areas and other safe areas) and check all tie

## HELPFUL HINTS CONTINUED

downs frequently while traveling. Your load can shift in transit!

### **Unloading**

Be sure the ramps are securely fastened to the trailer. Also ensure the ramps are long enough to avoid high-centering at the top of the ramps. Proceed slowly down the ramps and avoid dragging the trailer hitch (if present) and exhaust at the bottom of the ramps. Use front and rear brakes while unloading.

## **TRAILER TOWING**

### **Getting Started**

When hooking up your trailer, always inspect the hitch ball and all bolts for tightness. Be sure that the hitch and tongue are free from stress fractures and there are no distortions in either. Safety chains should be heavy enough to support the weight of the loaded trailer. Safety chains should be crossed UNDER the trailer tongue to help prevent the tongue from dropping down and digging into the roadway. After securing the trailer, check all running, brake and signal lights.

One of the most important aspects of safely pulling a trailer is knowing the weights involved and where they are placed. The first thing to determine is how much is being towed and confirming that it is within the capacities of the equipment being used. Never load a trailer beyond its rated capacity.

### **Loading**

Gross trailer weight (GTW) is the weight of a loaded trailer in its actual towing condition. GTW is measured by placing the loaded trailer on a vehicle scale. Do not exceed 200 lbs. trailer weight. Tongue weight (TW) is the downward force exerted on the hitch ball by the trailer coupler. Do not exceed 30 lbs. tongue weight.

Determining where the load is placed is critical to the way your rig will handle on the road. Remember to load your trailer with slightly more weight in front of the trailer axle than behind it. About 60 percent of the cargo weight should be in the trailer's front half. This properly places about 10 to 15 percent of the loaded trailer weight on the trike hitch. Always place heavy items inside the trailer. Make sure that the load is evenly distributed from side to side within the trailer.

Too much weight on the hitch will cause the rear suspension to compress and



## HELPFUL HINTS CONTINUED

may cause the rear wheels of the tow vehicle to drag. This can negatively affect the handling of your trike. Too much weight on the rear of the trailer may cause the trailer to "fishtail" or even lift the rear wheels of the trike off the ground. The lifting of the rear wheels will reduce traction. Both conditions could result in a loss of control.

### **Hit the Road**

Do not hook up to the trailer and expect to run at highway speeds right away. Remember to start out easy and get used to the combination of trike and trailer. With a trailer behind your trike, your unit now is about twice as long. Allow extra room before pulling back into your lane when passing vehicles and also when turning corners. Vehicle-to-vehicle distance should be increased when towing a trailer.

Side winds and passing traffic (particularly large trucks) may affect stability as well as bumps and undulations in the road. Consequently, towing a trailer can be more stressful and fatiguing for the rider. Observe all posted speed limits and avoid inclement weather or slippery conditions.

### **Trailer Tips**

- Inspect the hitch and trailer prior to loading.
- Do not exceed 30 lbs. tongue weight (TW).
- Do not exceed 200 lbs. trailer weight (GTW).
- Load the trailer with 60 percent of the weight in front of the axle and evenly from side to side.
- Maintain a greater space to the vehicle in front to allow for longer stopping distances.
- Provide extra distance when passing other vehicles.
- Select a lower gear on long or steep downhill grades to increase control and conserve brakes.
- Avoid sudden lane changes or swerving to reduce the risk of developing sway.
- Be cautious in high winds or when passing large oncoming vehicles as buffeting may induce sway.
- Take more frequent rest breaks.

# WARRANTY

Proper maintenance is a condition of warranty. Refer to your warranty booklet for details. Your Lehman Trikes dealer is responsible for providing the warranty repair work on your trike. For normal warranty work under the above conditions, please refer to the information at the bottom of this page. If there is no information contact Lehman Trikes at 1-888-394-3357 for the name and location of your nearest authorized Lehman Trikes dealer or [www.lehmantrikes.com](http://www.lehmantrikes.com).

## TECHNICAL ASSISTANCE

Please contact your local authorized Lehman Trikes dealer.

Place dealer sticker here.