



# **ELECTRIC LOCKING DIFFERENTIAL**

**INSTALLATION MANUAL**



## WARRANTY POLICY

TRE4x4 provides after-sales service only to the original purchaser who purchased from authorized TRE4x4 resellers and distributors, the warranty can not be transferred. All products is warranted against defects by material or workmanship that cause the product to perform below the specified limits set by TRE4x4, to the extent that TRE4x4 will repair or replace any parts which are caused the defective.

If a repair will be made or a replacement issued once the product has been inspected by TRE4x4 authorized resellers/distributors and deemed to be warrantable claim, It is at the discretion of TRE4x4. All warranty claims must be submitted with Proof of original purchase via original purchasing store or resellers, unless otherwise arranged.

Before installation of any product, please ensure you have received the correct parts for your application. Ordering of the correct parts is the responsibility of the buyer.

### **1. Terms of Service and Commitment:**

1.1 The non-artificial fault happen in normal use during warranty period.

1.2 The fault caused by TRE4X4 allowed dismantlement, installation, and other operations.

1.3 The warranty is not transferable to another party.

1.4 If defective workmanship or materials become apparent in the Warrant period, TRE4x4 will replace or repair the defective TRE4x4 Products. But products may be required to be returned to TRE4x4 for assessment or repair. TRE4x4 is not responsible for postage or removal costs involved, but assistance may be considered at the discretion of TRE4x4 in the event of such a claim being verified.

1.5 TRE4x4 will not be liable for labor charges and other intangible or consequential losses that might be claimed as a result of a failure of any TRE4x4 component or part thereof to the extent permitted by Chinese law.

## 2. Exemption clauses:

- 2.1 The products exceed the warranty period or can not provide the required proof(warranty card, proof of purchase, etc.)
- 2.2 The fault caused by incorrect operation or installation.
- 2.3 The fault caused by accident, neglect, abuse (overload working), and misuse.
- 2.4 Commercial used/competition used.
- 2.5 Product has been modified.
- 2.6 Used in racing or competition conditions without the prior consent of TRE 4x4.
- 2.7 Used beyond the expectations of the original vehicle manufacturer.

## 3. Warranty

Product	Warranty period	Note
Electric locker	5 years	the damages caused by misuse such as the clutch gears, side gears, springs are not covered under warranty, customers need to purchase the spare parts.
Electric locker parts: FLANGE CAP ASSEMBLY, CLUTCH GEAR, SIDE GEAR, PINION GEAR	2 years	
Electric locker parts: SIDE GEAR THRUST WASHER , PINION THRUST WASHER, ELECTROMAGNETIC COIL, WAVE SPRING	1 year	

## INSTALLATION MANUAL

### **Product Description:**

The car with conventional differential is the same as the car with TRE electric locker when it is not turn on. The driving force is transmitted to the ring gear (Large tooth or Pelvic teeth) of the differential to rotate the differential. Instead of driving the half shaft directly, the small bevel teeth are free to rotate on the transverse axis of the differential. The half shaft is linked by splines and large bevel teeth, and when one of the half shafts rotates, the other half shaft rotates in the opposite direction. This process is called differential motion. Under normal circumstances, this differential rotation is beneficial to the car. When turning, the outer wheel of the car can rotate faster than the inner wheel, which is necessary for road driving. However, the differential will transmit the driving force to the wheel that is easy to rotate (such as the wheel that is idling) on a slippery ground or when a wheel is suspended, then all the driving torque is lost. TRE electric locker is the perfect solution to this problem. Turn on electric locker switch to lock the differential gear, so that the two half shafts form a rigid connection, and both half shafts rotate with the large teeth, then the maximum adhesion can be maintained.

### **Regular use of TRE electric locker:**

When you need extra adhesion, press the electric locker switch when approaching difficult terrain. (Note that you must first open the rear locker and then open the front locker. It is generally not recommended to use the front locker separately. The rear locker can be used separately. Once the difficult terrain segment has been passed, press the electric locker switch again, then the electric locker will return to the normal state. It is important to note that the switch should not be opened when the wheel is idling, as this can damage the locking device.

When the TRE electric locker switch is closed, there is no difference between the operation of the electric locker and the differential of the original car. No need to have any control worries and driving skills.

## Installation Method:

### A. PREPARATION

#### 1. Remove the old differential

- Remove the axles according to your vehicle's service manual.
- Disconnect the drive shaft from the flange of the differential.
- Remove the differential cover.
- Remove the cross shaft retaining pin.
- Rotate the differential until the 'C' clip access window is accessible.
- Remove the cross shaft, and thrust block.
- Gently tap the axle ends inward to release the 'C' clips.
- Remove 'C' clips with needle nose pliers.
- Gently tap axles outward and remove them from the differential center.

**NOTE: Rubber oil seals can be easily damaged. Support the weight of the axle when extracting it across the edges of the seals.**

- Remove all nuts and washers retaining the differential housing.
- Carefully remove the differential third member from the axle housing.

**NOTE: Pry bars may be required to split the third member from the axle housing.**

**NOTE: The differential third member is heavy and quite difficult to handle when covered in oil. Do not drop it!**

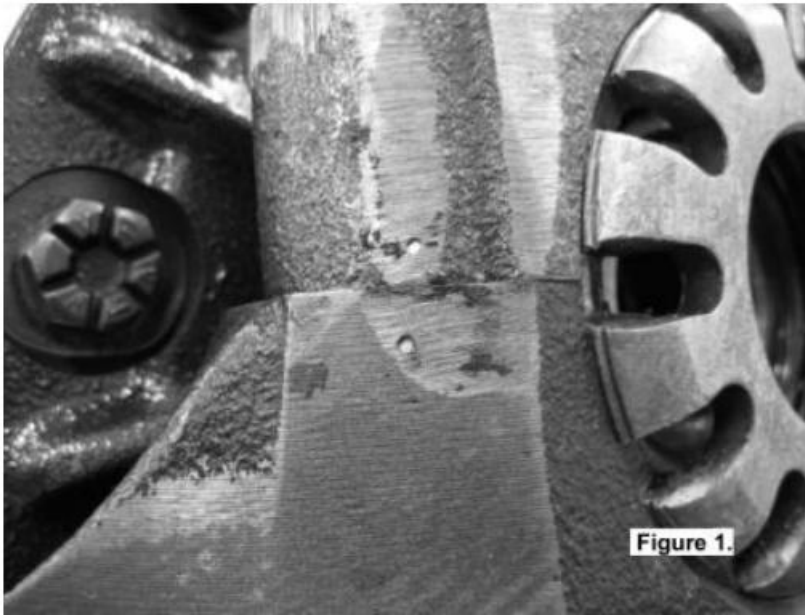
- Secure the third member to a workbench with the differential carrier facing upward.

#### 2. Marking the Bearing Caps

- Using a small pointed center punch, gently mark the bearing caps in a way that will enable you to know which cap is 'LEFT' and which cap is 'RIGHT', which way is 'UP' and which way is 'DOWN'. (Fig.1.)
- Mark the right hand cap in a similar way.



**HINT : Many installers choose to make one punch mark on the left hand side of the left hand bearing cap and a similar mark on the housing at close proximity to the cap mark. The right hand side is then designated with two punch marks on the right hand side of the cap and two similar punch marks on the housing.**



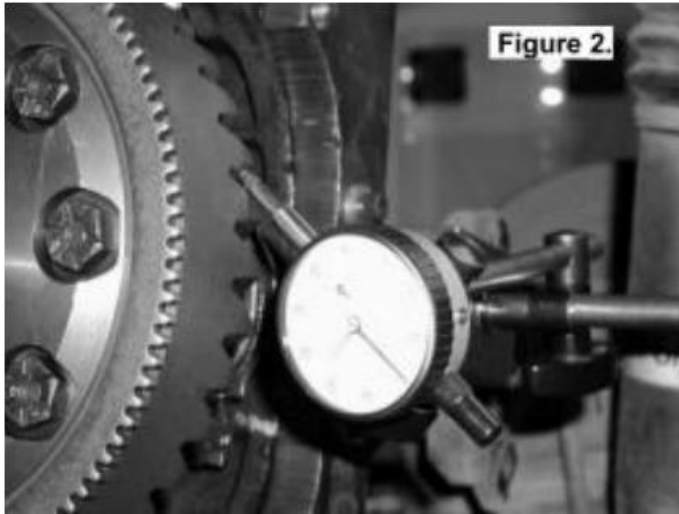
### **3. Checking the Current Backlash Amount**

**IMPORTANT:**

This step is a precautionary measure recommended by TRE due to the fact that some aftermarket ring and pinion sets have been manufactured to run with different backlash settings than those specified by your vehicle manufacturer. Although TRE must recommend you set backlash according to your service manual guidelines, we also advise that you compare the backlash measurements taken here to there commended backlash settings in your vehicle service manual. Measurements found to be outside of your service manual recommendations may indicate the need to deviate from those settings in order to achieve quiet running with a good contact mark.

Refer to your vehicle service manual or your local authorized TRE installer for more information.

- Set a depth indicator on one of the ring gear teeth as in Figure 2.



- While supporting the pinion gear by holding the drive flange, rotate the differential in both directions while observing the maximum variation in depth from the indicator (i.e., the highest value minus the lowest value). This value is referred to as the ring and pinion backlash.
- Rotate the differential center 90° and measure again for accuracy.
- Record the average of all measurements.

## 4. Electric LOCKER installation

### 4.1. Mounting the Ring Gear

- Remove the bolts that hold the ring gear in place.
- Using a plastic or copper hammer, tap in a circle around the ring gear to separate it from the differential carrier.
- Thoroughly clean any thread locking compound or other foreign matter from the holes of the ring gear, the threads of the ring gear bolts, and the mating surfaces of the ring gear and the Electric locker flange.

**NOTE: Rubbing the ring gear mounting face with a flat oil stone before installation will remove any high spots around the threads.**

- Remove the electromagnet of the electric locker. (TE90 and TE219 don't need



to remove the electromagnet.)

Use a screwdriver to pry the spring out, then remove the electromagnet.

**Note:** this part need to be reinstalled after installing the ring gear.

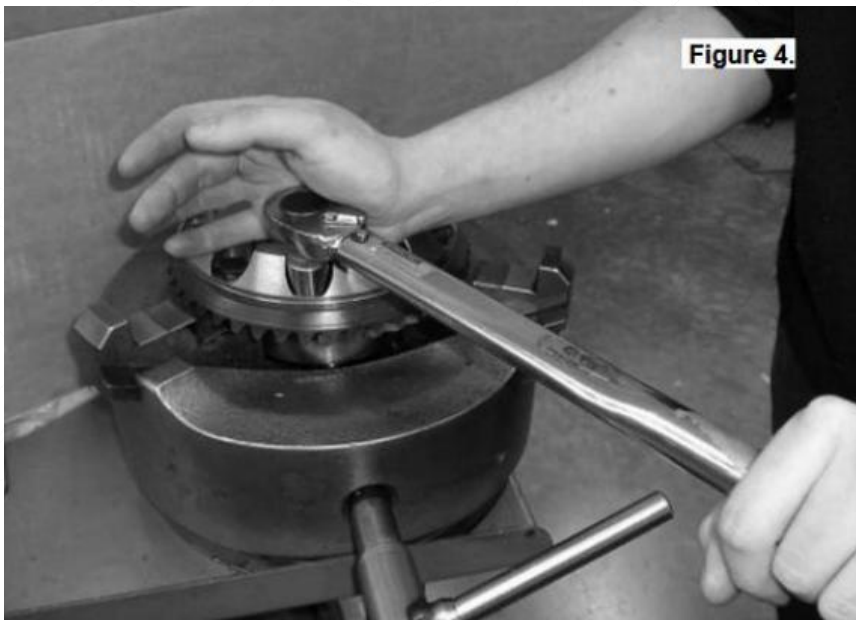
Install the ring gear onto the Electric locker by aligning the holes in the flange with the tapped holes in the ring gear, then gently tapping it around in a circle with a plastic or copper hammer.

Apply a thread locking compound to the thread of each ring gear bolt before inserting it.

Install the electromagnet which is moved before from the electric locker.

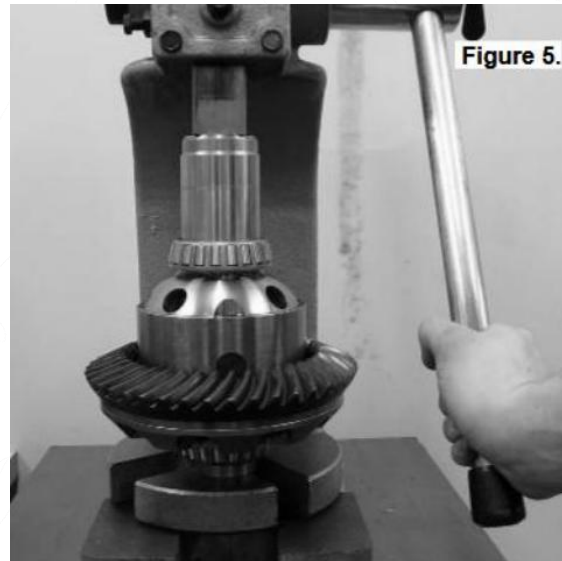
**NOTE:** On some models, the crown wheel bolts cannot be reused and should therefore be replaced. Refer to your vehicle manufacturer's service manual for details.

Tighten the ring gear bolts in a star pattern with a torque wrench according to your vehicle (Fig.4) manufacturer's specified torque.



#### 4.2. Installing the Carrier Bearings

Apply a thin film of high pressure grease to the bearing journals of the Electric locker, then press the bearing cones onto the bearing journals as shown in Figure5.



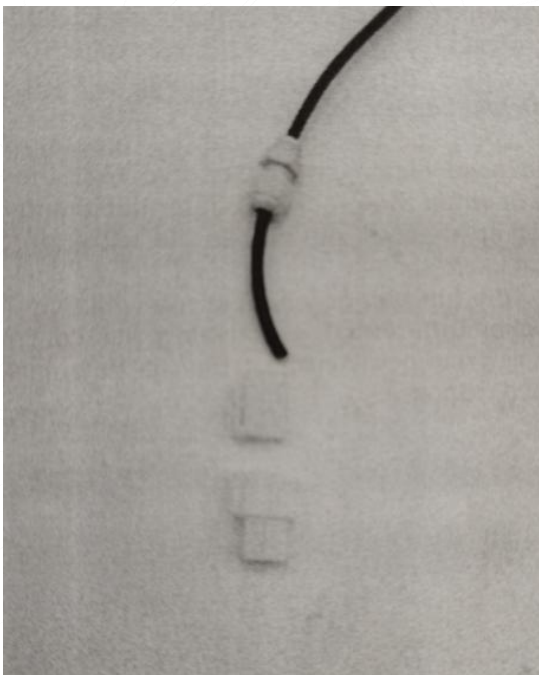
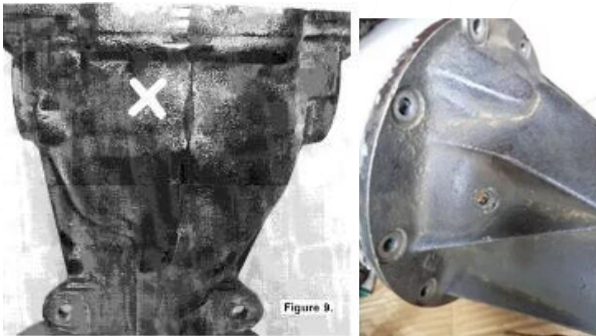
**Note: Depending upon your specific axle size, you may have one of two different electric locker design. They are the locking pin type and locking collar type.**

**Two methods are used to retain the electromagnet and prevent it from rotating .**

**4.3 Grind the bearing fixing bracket so that the electric suction cup bracket can be placed in (if the size is sufficient, it does not need to be ground).**



**4.4.** Locate the thicker part of the housing where the differential case is facing up. As shown in the figure, drill a hole with a drill of 10.5 and tap the wire of M12\*1.5 on it. Take care when drilling not to contaminate the differential sump with metal shavings. Cover bearings and bearing surface before drilling and clean area after drilling . A shop vacuum cleaner works well.



**4.5** Cleaning the differential case and differential.

**4.6** Install the cleaned Electric locker on the differential case. Refer to vehicle service manual for applicable procedures regarding side bearing preload.

As you install, orient the electromagnet so the wire leads exit the newly drilled hole.



Be caution not to pinch or damage the wires while installing the electric locker.

**Note: Anti-rotation tabs may need to be ground or filed to ensure free plan in the electromagnet when the differential is sitting in the axle housing.**



#### 4.7 Identify type of Electric locker differential

Depending upon your specific axle size, you may have one of two different Electric locker differential designs. Show at below are the lock collar type and the lock-pin type.



Also shown are two methods used to retain the electromagnet and prevent it from rotating. The Electric locker differential on the left utilizes two tabs on the electromagnet which contact the inside surface of the differential carrier to prevent the electromagnet rotation.

The Electric locker differential on the right shows a design that uses a retaining bracket that bolts to the top of the bearing cap. The retaining bracket slides around a post on the electromagnet.



Retaining Bracket

Knowing the design and what type of retaining system you have will aid in your installation.

#### 4.8.1 Install anti-rotation Bracket (If required)



Locate the anti-rotation tab on the electromagnet. With the bearing cap seated on the electromagnet side, place the anti-rotation bracket over the anti-rotation tab. Install and

finger-tighten the bearing cap bolts over the anti-rotation bracket, ensuring it is well aligned.  
Note: The anti rotation bracket configuration may vary depending on application. The bracket may need to be adjusted by bending to ensure electromagnet free play.

**Attention:**

Please add the small anti-rotation tab to the **two tab retainer** directly, not attach to the third member, and the iron sheets need to be far away from the third member about 1mm.

Please refer to the Figure7 (before installing iron sheet) and Figure 8 (After installing the iron sheet)



**4.8.2 Grind the bearing cap (If required)**

If the electromagnet can not be installed, please grind or cut the both sides of the bearing cap.





Note: Don't tap on the electromagnet.

If tap on the electromagnetic coil, the Electric Locker will not work normally.

**4.9** Adjust the clearance with the adjustment collar (original adjust nut), tighten the fixing screws, and fix the bearing.

**NOTE : Be sure to check that the bearing caps are on the correct sides of the third member and are correctly aligned.**

#### **4.10 Final Checking the Backlash**

- Set a depth indicator on one of the ring gear teeth (Fig.8.).
- While supporting the pinion gear by holding the drive shaft flange, rotate the differential in both directions while observing the maximum variation in depth from the indicator (i.e., the highest value minus the lowest value). This value is referred to as the ring and pinion backlash.
- Rotate the differential center 90° and measure again for accuracy.
- Refer to your vehicle service manual for the specified maximum and minimum amounts of backlash.

#### **4.11 Reinstall axle shafts**

If C-clip equipped, temporarily remove the differential pinion shaft. Carefully push both axle shafts inward so that their C-clip grooves may be accessed at the center of the differential. Again, it is important to take care not to damage bearing and shaft seals when moving the axles. Install each C-clip onto the groove in the axle, and gently pull the axle out, ensuring that the C-clip fully seats in the counter-bore on the differential side gear. Reinstall differential pinion shaft and pinion shaft lock screw, tightening the lock screw to the proper torque specification .

## 4.12 Test Electronics

Temporarily connect the electric locker differential to the lead lines from the relay as installed previously. Note: A special weather-tight connection for the coil wires is provided along with the wiring harness. This is to be installed once the installed coil wires and grommet are in place. Test the electronics by turning on the ignition in the vehicle. Activate the dash switch to the "ON" position, examine the armature plate directly next to the electromagnet and confirm that it is firmly drawn into the electromagnet. Rotate the drive shaft a minimum of one full revolution while attempting to hold one wheel stationary. While the drive shaft is being turned, you should feel the wheel that is being held stationary "Lock" as both wheels begin to rotate together. If lock-up is not evident, check to confirm proper electrical connections.

## 5. Reinstall the differential cover

Wipe both surfaces clean before lining up the new gasket to the axle assembly. Line up the bolt pattern of the cover plate to that of the gasket and axle assembly. Use sealant if recommended. Tighten differential cover bolts finger-tight then tighten differential cover in an alternating manner up to the proper torque specification .

## 6. Complete Wiring

Install plastic conduit over any exposed wiring harness sections requiring protection. Confirm that all wiring and connectors are securely fastened and cannot be caught in moving parts or road terrain. Make sure that the wiring harness is securely fastened with wire ties as necessary. **Be certain to leave excess wire to provide slack for suspension travel.**

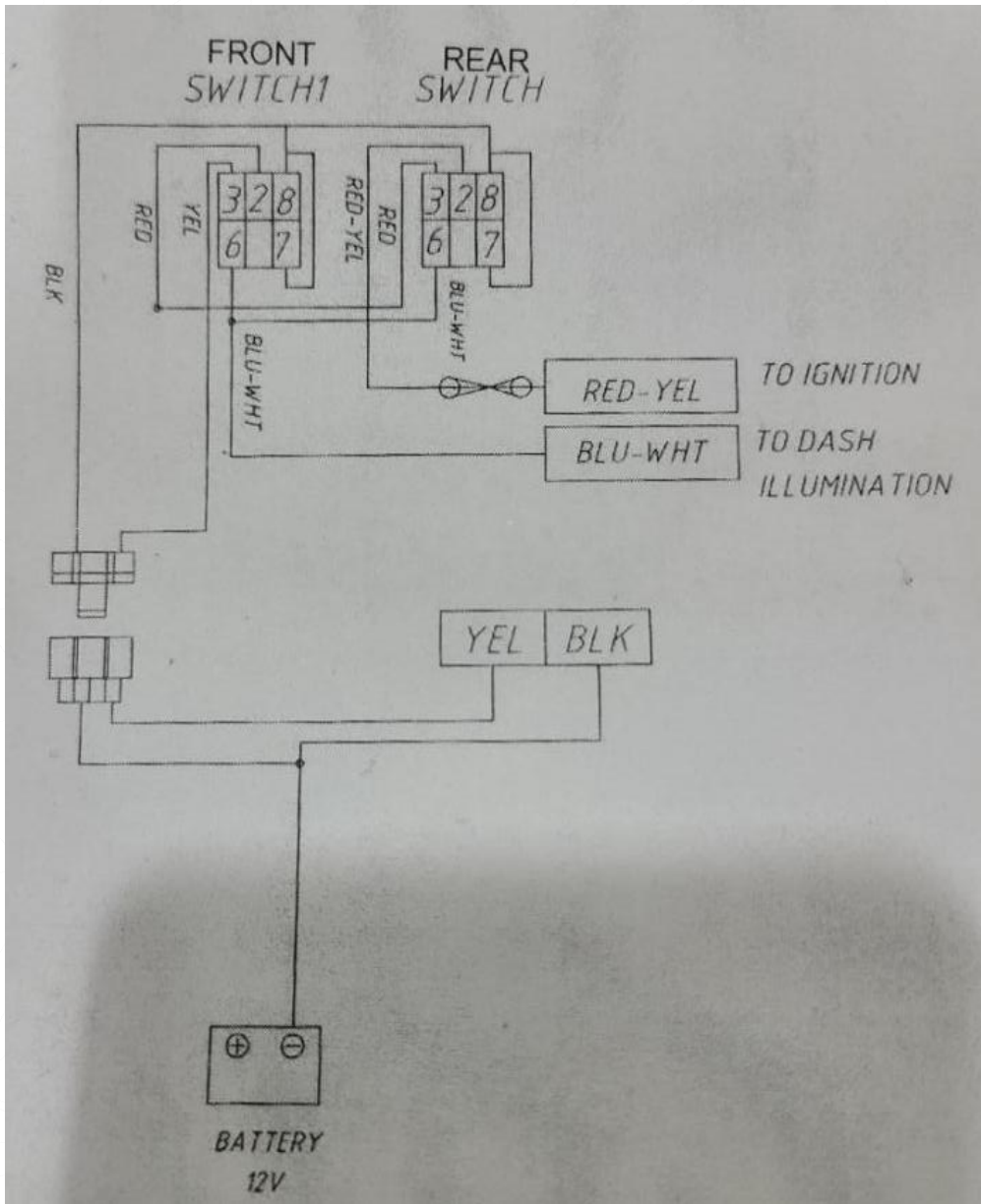
7. Find a suitable place to open the hole in the cab to install the switch.



8. If you need to change the switch panel, please use professional tools (sold by the company), don't be hard, so as not to cause damage to the switch. Methods as below:



9. The wiring diagram is as follows:



10. Conduct a field test and check if the electric locker device is working properly.

**PRECAUTIONS:**

In order to ensure the safety of vehicles and occupants, there are several points that must be understood and observed.

1. When driving at high speed on high-adhesive pavement (i.e. dry pavement, cement pavement, asphalt pavement, gravel pavement, etc.), opening the electric locker device will damage the transmission components and may cause accidents. The locking device can only be opened when it is required to pass the road surface with low adhesion.
2. When the electric locker is turned on, it will affect the steering. Please take time to learn how the differential will affect the steering. If you use it without knowing it, it may put you and the occupants at risk.
3. The electric locker switch should be installed within the easy range of the driver, but it must be ensured that the switch will not be accidentally touched by the driver, the occupant or the object released in the car. Unexpected opening or closing will cause the vehicle to lose control.
4. Although the design and manufacture of the TRE electric locker is very strong, the locking device should not be opened when the wheel is idling. Otherwise, the impact force generated when the two wheels are suddenly forced to rotate at the same speed may cause the half shaft. The damage is distorted and the locking part is worn. When starting the locking device, make sure that the vehicle is in a stopped state or is not activated or decelerated. Do not open the locking device when turning, do not open the locking device while braking.
5. In order to reduce the damage to the vehicle transmission system and reduce the risk of vehicle control, the speed should be reduced when driving the locking device, and the off-road driving should be carried out slowly and skillfully to achieve the optimal life of the vehicle and improve the service life.
6. Do not make sharp turns after locking the electric locker. Especially when the front and rear lockers are locked at the same time, keep the straight line as much as possible, otherwise it is easy to twist the half shaft or electric locker.
7. If the electric locker device is not used frequently, it will produce oil film. Please try it several times a month to ensure the normal use of the electric locker device.



## TROUBLE SHOOTING

### 1. When you install the new Electric locker, the locker could not engaged:

Following the below steps to check :

Step 1. Check the fuse, if the fuse is broken, please change the fuse. If the fuse has no problem , follow the step 2.



Step 2. Check the wire's connection . If the connection has no problem , follow the step 3.





Step 3. Check the ramp plates (part 15, part 16 ) could move or not. If the ramp plates could not move, please grind the electromagnet's tab (part 17) or the bearing cap, to make sure that there is 1mm clearance between the electromagnet's tab and the bearing cap. Check the installation manual.

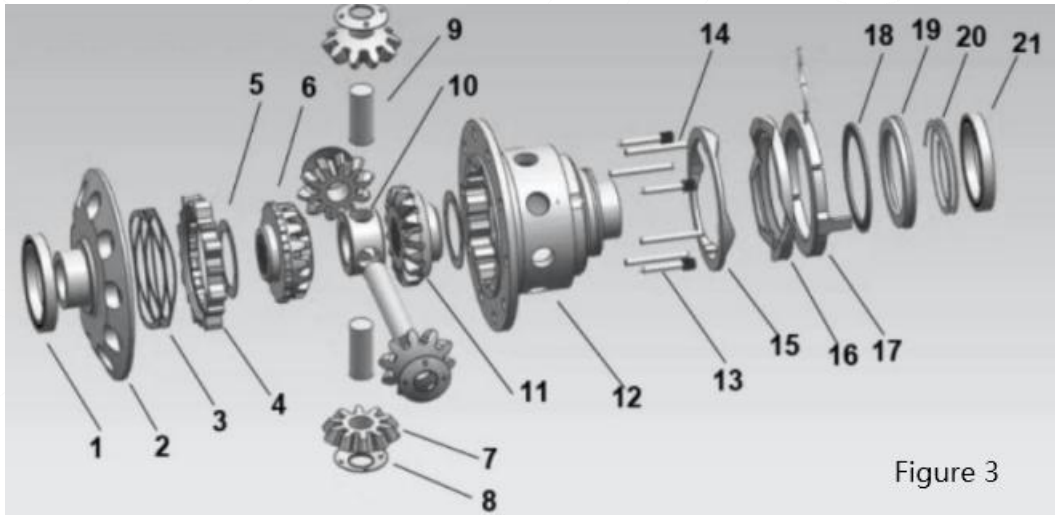


Figure 3

Step 4. Check whether the ramp plates (part 15, part 16 ) are deformed or not. if they are deformed, please use the sandpaper to sand the pointed side of part 15 and part 16 (Picture: Figure 4)

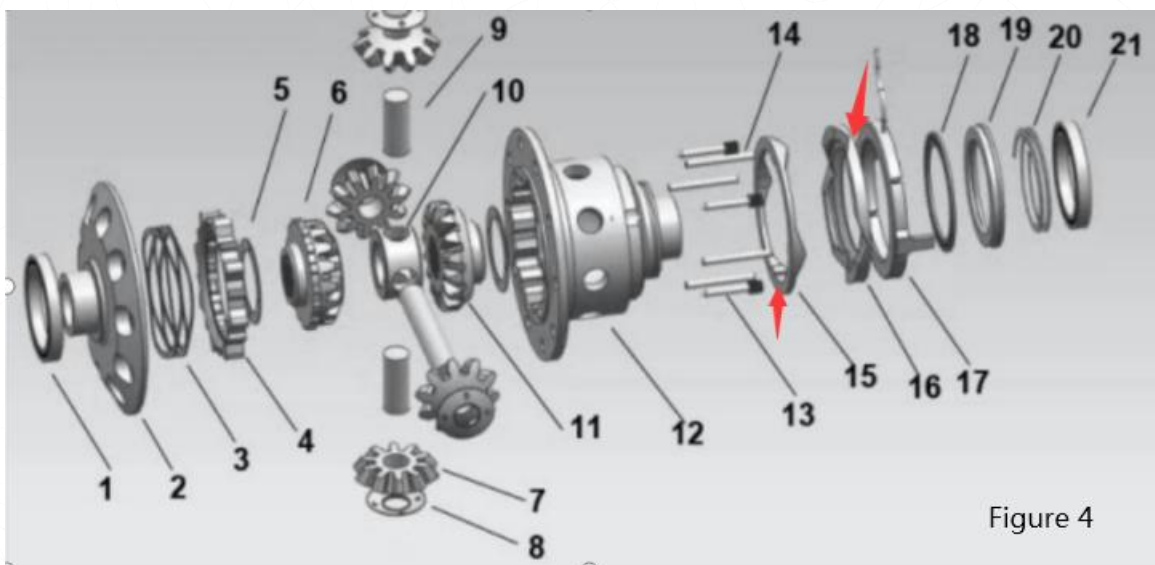


Figure 4

Step 5. Check whether the electromagnet's tab is hit or not during the installation process. If the tab is hit or knocked during the installation, it will cause the deformation of the electromagnet, please use the sandpaper to sand the electromagnet till the electromagnet is flat. At the same time, please check if the gears are broken.



Step 6. If the locker still could not work, **contact TRE after sales teams to get supports.**

## **2. Electric locker makes noise when engage**

If there is noise in the locker, check whether the ring and pinion gears are installed in place, and measure the clearance and occlusion after the ring and pinion gears are installed.

**A:** There is noise when the vehicle drive straight, it is the problem of the ring and pinion gears;

**B:** If noise only happen when the car turns around, and no noise when going straight, it's the problem of the locker. You need to disassemble the locker to check the parts:

- 1) If the parts are worn, take photos to record.
- 2) Measure the thickness of the clutch gear.
- 3) Spin the gears and make the video to record, the after sales team need the video to check.

### **3. Electric locker doesn't work after using for a long time.**

If it does not work after turning on the switch, consider whether the wire is energized, or damaged.

If when the switch is turned on, the Electric locker will lock but slip, there may be a problem with the inside of the locker.

- 1) Use the battery to connect with the Electric locker directly to check if the Electric locker could be charged or not.
- 2) Measure the resistance of the coil to confirm whether the coil is burnt out.
- 3) If the above two tests are OK, it may be that the locking parts inside the Electric locker are worn out.
- 4) If you meet other problems, please contact TRE4x4 after sales team or the local distributors.

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