Poor Man's Limited Slip Differential

FOR WHATEVER REASON, YOUR MIATA DOESN'T HAVE A LIMITED SLIP DIFFERENTIAL– BUT YOU "NEED" ONE. A LIMITED SLIP REAR UPGRADE IS A BOLT-IN BUT CAN BE EXPENSIVE. MANY SALVAGE YARDS MAY CHARGE UP TO $2000 FOR AN ENTIRE MIATA TORSEN BRAND LIMITED SLIP REAR. THERE IS AN AFFORDABLE ALTERNATIVE. LIKE MANY OTHER CAR COMPANIES, MAZDA PARTS OFTEN INTERCHANGE BETWEEN MODELS.

A LSD (limited slip differential) maximizes the amount of engine power getting to the ground by partially locking the two rear drive wheels together so the tires do not spin independently. There are three basic types of LSDs: the torque-sensing "Torsen" brand, viscous (VLSD) and clutch type. The Torsen is a gear driven LSD that uses the phenomenon of incompatible worm gears which keep two wheels turning at the same rate. The worm gear drives a roll, but the roll cannot drive the worm gear. A viscous uses thin plates stacked in a bath of thick silicone fluid. The plates have perforated holes. The resistance of shearing the silicone fluid produces limited slip. A clutch type has metal disks that act as a friction surface between the two wheels.

The 90-93 1.6 liter Miata used a rear that was derived from the rear of the 88 323GTX AWD and dates back to the 1978 RWD GLC. It has a 6" ring gear and optionally came with a VLSD. In 1994 Mazda used a larger and beefier rear unit for the 1.8 Miata that is related to many other Mazda models. It has a 7" ring gear and in the Miata used the Torsen brand LSD as am option. The 94+ Miata rear is not only stronger but offers many LSD options.

Installing the 94+ rear in a 1990-93 Miata is a bolt-in procedure, but requires installing the 94+ diff housing, driveshaft and half-shafts. Installing a 94+ Torsen LSD rear into a open differential 94+ Miata is strictly bolt-in.

The 94+ rear internals are basically the same type as what came with the 1984-85 and 1986-1991 normally aspirated RX-7s– which makes the clutch style LSD from the 84-88 RX-7 completely transferable to the Miata housing! The 1989-91 RX-7 LSD will also fit but it is the inferior viscous type. The earlier RX-7s had smaller axle shafts and the LSD won't fit the stub shafts. The clutch type limited slip was offered on many 1960's American muscle cars and are perfectly suited for racing and especially drag style racing. They are also rebuildable since the clutch plates are replaceable.

You can identify a RX-7 clutch type LSD by the "Use Limited-Slip Diff Gear Oil Only" tag on the fill bolt or by the fact a clutch type LSD will turn both stub shafts in the same direction at the same time.

Dropping a loose RX-7 LSD in a 94+ Miata rear housing is a simple upgrade. For our purposes we built a 94+ Miata-style limited slip from a maximum of RX-7 parts to keep the price down. (Note– if you install a RX-7 clutch type LSD in a genuine Miata rear, you will need to transfer the RX-7 stub shafts. This is because the RX-7 snap ring diameter is smaller making the Miata stub shafts non interchangeable). We started with the rear aluminum housing and internals from a '86-91 RX7, which are functionally the same as the Miata. Just transfer the Miata specific mounting bushings. You will still need the Miata specific cast iron pinion housing from the 94+ Miata for the PPF mounts. They are regularly available in RX-7 racing shops since the Torsen brand LSD is often swapped into racing RX-7s.

We found a 1986 RX-7 limited slip rear end locally in www.thepartstrader.com for $35. A few calls to RX-7 racecar setup shops found a Miata front pinion housing and short pinion gears for $55 shipped– essentially free plus shipping!

NET RESOURCES:

LOOK HERE FOR MORE INFO–

HTTP://WWW.SOLOMIATA.COM/DRIVETRAIN.HTML
HTTP://WWW.SOLOMIATA.COM/MIATAVLSD.HTML
HTTP://WWW.TORSEN.COM/
HTTP://WWW.ZEXEL.CO.JP/ZXLE/PRODUCT/TORSEN_E.HTM
HTTP://WWW.MINDSPRING.COM/~AUDIDUDI/TORSEN.HTM
HTTP://WWW.A1.NL/PHOMEPAG/MARKERINK/DIFFS.HTM
HTTP://WWW.OZEMAIL.COM.AU/~GREENS/TORSEN.HTML

1 **BUDGET LSD BUILD-UP**

THIS LSD EQUIPPED RX-7 DIFF WAS FOUND ON WWW.THEPARTSTRADER .COM FOR $35. THE RX-7 USES A LONG PINION SO THE GEARS ARE INCOMPATIBLE WITH THE MIATA PINION HOUSING.

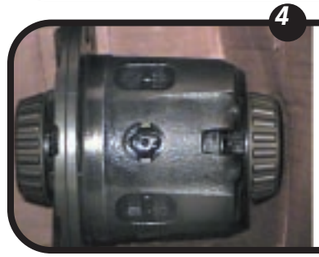
2

PULL THE STUB SHAFTS AND REMOVE THE ALUMINUM HOUSING TO ACCESS THE GEARS. REMOVE BEARING CAPS.

3

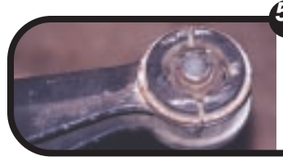
PULL THE LSD AND RING GEAR ASSEMBLY TO SEPARATE THE RING GEAR (PIC) FROM THE LSD.

4



ATTACH THE RX-7 CLUTCH TYPE LSD TO THE MIATA SHORT PINION RING GEAR.

5



TRANSFER MIATA SPECIFIC MOUNTING BUSHING

6

REINSTALL LSD/RING GEAR ASSEMBLY. RE-ALIGN RING GEAR BACK TO ORIGINAL SET WITH BEARING BACKLASH ADJUSTMENT.

7

INSTALL DIFF AND REFILL WITH CLUTCH TYPE LIMITED SLIP GEAR OIL. FINISHED LSD REAR FOR $100 TOTAL COST.

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IDENTIFYING A TORSEN WITHOUT DISSASEMBLY

If you have a 94-97 PEP, R, Leather package or M it came with a Torsen. Base, Trim ring, Power Steering, STO, or Touring packages did not.

The Torsen will not always turn both wheels when you turn the driveshaft. Though difficult– the Torsen gears can be viewed through the fill hole on the case.

THE SPIDER BAR– A DEAD GIVE-AWAY THIS IS AN OPEN DIFFERENTIAL

Or, with the transmission in neutral, attempt to turn both half shafts in the same direction at the same time. This is possible with an open rear end, but NOT possible with a Torsen. The foolproof method for identifying a torsen is to pull the stub axle (or single piece halfshaft on 96+). Look into the stub's hole. If a bar is visibly intersecting the hole, the diff is open. If you cannot see directly thru the diff, it is a Torsen.

DISTINGUISHING A TYPE I FROM A TYPE II TORSEN

The housing must be disassembled to view the actual Torsen LSD unit. The easy way to tell is the worm gears on the Type I are perpendicular to the axle shaft

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(crossed axis helical) and the worm gears on the Type II are parallel (parallel axis helical). The Torsen pictured below is a Type I.

THE GEARS THAT DRIVE A TORSEN– THIS IS A TYPE I TORSEN.

TORSEN TYPE I VS. TYPE II

Type I and II Torsens have different characteristics but neither is stronger or better than the other. The Type I is designed to put out more bias on acceleration and the Type II is designed with subdued acceleration bias and stronger bias on deacceleration. i.e. The TypeII is more forgiving with trailing throttle.

CENTER OF A TORSEN– NO SPIDER BAR.

FITTING A TORSEN LSD TO A 94+ OPEN DIFFERENTIAL

The Torsen drops into place of the open diff. No additional parts are needed unless you want to replace the halfshaft seals (always a good idea). The bearings are the same. It is also unlikely that they will need a crush collar since they should be able realign the ring and pinion to it's original set with just the bearing backlash.

ON THE INSIDE– ANATOMY OF THE RX-7 CLUTCH TYPE LSD

1– CASE
2– THRUST WASHER
3– CONICAL SPRING
4– FRICTION PLATES
5– FRICTION DISCS
6– PRESSURE RING
7– SIDE GEAR
8– PINION GEAR
9– SPIDER BAR