

Miata Drivetrain Interchange Guide

REAR:

The 1990-93 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 had a 6" ring gear and is not very strong. In 1994 Mazda used a larger and beefier rear unit for the 1.8 Miata that has a 7" ring gear and is derived from the 1986-1991 NA RX-7 rear with the exception of the shorter pinion and front pinion housing.

The 94+ Miata uses the same length pinion as the 1st gen RX-7 (and B2000/2000 trucks/RWD626) and the front housing is unique to the Miata to allow a mount for the PPF. Swapping the later 94+ rear into a 1990-93 Miata is a bolt-in but requires replacing the entire diff housings assembly, driveshaft and half-shafts from the later 1994+ cars. If you can't find a 1994+ Miata rear in a salvage yard then try the rear aluminum housing from a '86-91 NA RX7, they are nearly the same. You'll still need the short pinion cast iron front housing from the 94+ Miata (for the PPF mounting) and Miata specific rubber mounting bushings.



Housing comparison. 1.6 top, 1.8 bottom



The smaller diameter and shorter Miata rear bushing vs the 86-91 RX-7 bushing



Long pinion RX-7 front housing



Short pinion Miata front housing

While the 1990-93 Miata rear had a viscous LSD option, the 1994+ Miata's could have been ordered, based on package, with the superior Torsen type LSD. A poor mans alternative to the Torsen is a clutch type LSD from the '84-88 NA RX-7. They will also bolt into the later 1994+ Miata housing since they are the same diff type (the 1989-91 RX-7 LSD will also fit but it is a viscous type, the earlier RX-7's had smaller axle shafts and won't fit the halfshafts). The OEM RX-7 clutch type LSD does have replaceable friction plates and is rebuildable.

(According to the literature all 84-85 RX-7's had the large axle. It has surfaced that some 84 12A's with the 3.933 ratio has the "small axle").

Honda also sourced the Mazda 7" rear for the S2000. The rear housing is different and the axles are larger so nothing is a direct interchange other than the ring and pinion gears. The Honda Torsen does have a clutch disk to preload the worm gear (the R type Torsen). If you adapt the larger S2000 halfshafts and stub shafts it is a nice upgrade.



RX-7 Clutch type LSD



Note screws on ring gear flange to access clutch plates for replacement.

The 1990-93 rear had 4.30:1 gears and there are no factory alternate ratio's available (an aftermarket 4.875 ratio is available). Mazda OEM Gears currently available new for the later 1994+ differential assembly are 3.636:1, 3.909:1, 4.10:1, 4.30:1, 4.44:1, 4.625, and 4.778.

The 4.10:1 and the 4.30:1 came on the 1994-97 and '99+ Miata respectively (4.10:1 on automatic starting in 2000). The 4.44:1 came as original equipment on 1987-88 4x4 trucks on the front axle and some commercial light duty trucks. The 3.909 came as original equipment on the 79-85 RX-7 12a as well as the 99+ 6-speed Miata. The 3.636:1 came on the 79-82 RWD 626 5-speed and is currently available new on the 2001+ Australian 6-speed. The 4.625 and the 4.778 come on the Kia Sportage 4x4 on the front axle. The 4.778 is US spec and the 4.625 is unique to the NZ market. Steeper 4.57: (S2000), 4.875:1, 5.125:1, 5.38:1 (Sportage) aftermarket gears are available.

All gears are interchangeable as a set. [Ring and pinion tooth counts](#)

Rear gear part numbers			
Gear ratio	ring and pinion part number	Assembled 3rd member part number	ring gear part # stamp
4.44	M054-27-110A	M053-27-100A (4x4 truck open)	M054
4.111	??	M075-27-100A (truck open)	8005
4.10	M068-27-110A	??	1245
4.077	?	?? early 84 GSL-SE	M090
3.636	MA02-27-110	?? ('01 Australian MX5 6-speed)	MA02
4.778	MM057-27-110	? US spec Kia Sportage 4x4	?
4.625	?	?? NZ spec Kia Sportage 4x4	?
4.30	M061-27-110C	??	M061
3.909	M037-27-110B	??	M037 (for Miata) 8088 for 1st gen RX-7
3.933	Discontinued	Discontinued	M050
4.875	1312-27-110A	??	??

The RX-7 Turbo II and TT rears are larger and stronger yet with an 8" ring gear. The TII rear will bolt to the Miata subframe since it uses the same 'wing' type frame mounts but requires modifying the PPF to accept the long pinion front housing (also using the Miata specific mounting bushings). A shortened drive shaft will need to be custom made with the larger TII pinion flange and the smaller Miata transmission yok and then having the larger TII specific halfshafts resplicing to fit the smaller Miata hub. The 93+ TT rear has a short pinion and uses a similar PPF mounting on the front housing, but unfortunately it does not use the wing type frame mounts and

something would have to be fabricated. The diff housing designs between the TII and the TT are quite a bit different so unlike the Miata and NA RX-7 where the housing parts can be mixed 'n matched, the TT front housing cannot be bolted to the TII rear housing.



The TT rear uses a short pinion/PPF mount but the housing does not fit to the Miata chassis.

Mazda also made what I call the "hybrid" 7.5 inch rear. It was installed on most '84-93 trucks and was also later used on the rear of the Sportage. They basically took the 7" pinion housing and pinion and mated it with a larger ring gear. It also used larger diameter axles. The 7.5 pumpkin will bolt into the rear aluminum housing of a 7" rear (the hold down bolts positions are the same) but you will have to perform minor grinding surgery to clearance the larger ring gear and then machine the side seal pocket for the larger diameter axles. It's been done.

differential shaft diameters and splines:

7" small axle = 25mm x 24 spline (808, RX-3, 79-83 RX-7)

7" large axle = 27mm x 26 spline

7" S2000 = 29mm x 28 spline

7.5" small axle = 27mm x 26 spline '84-03 B2000/B2200 & early 95-97 Sportage

7.5" large axle = 29mm x 28 spline ('98-05 Sportage)

8" = 31mm x 30 spline. TT/TII/929

Using the 7" rear is the only bolt-in way of retaining the PPF as a bolt-in. The strongest 7" rear can be made with the S2000 Torsen with the S2000 stub shafts and S2000 halfshafts and then using a gear ratio with the fewest teeth. Using the TII or the 7.5 pumpkin can also be done but neither will bolt to the PPF so fabrication for a pinion/nose mount must be done. I'm not convinced the slightly larger ring gear of the 7.5" will gain you much as it uses the same 7" rear sized pinion gear. The 7.5 option needs a nose bracket as there no provisions for a PPF mount.

CLUTCH:

Mazda upsized (Supersized, Biggiesized?) the clutch for the 1994+ 1.8 engine and also changed the design slightly. The flywheel, pressure plate and disk are not interchangeable individually with the 1.6 items, but as a whole assembly it will. The OEM 1.8 flywheel weighs 1 lbs heavier at 19 lbs vs 18lbs for the 1.6. Reportedly, the 99-00 flywheel is back down to 18 lbs and the 2001+ flywheel is 16.5 lbs.



Disk comparison, 1.6 on left

The 1.6 clutch disk diameter is 200mm OD (7 7/8") and the trans input shaft is 15/16" x 22 spline. The 1.8 clutch disk diameter grew to 215mm OD (8 15/32") and, counter to the Mazda Press release in 1994, the trans input shaft stayed at 15/16" x 22 spline.

HALF SHAFTS:

When Mazda upgraded the rear in 1994 they also changed the halfshafts to fit the larger rear. They are shorter overall by about 3/4" each to account for the over 1.5" larger width of the new rear. The stub shaft flange is also

larger to the same size as the 86-91 RX-7 (to 4x110mm from 4x100mm). The hub spline stayed the same at 26 spline by 27mm. The diff side splines are also 26 spline by 27mm.



flange comparison

*1990-93 half shaft.....25.299-26.681" travel range. (~26.00" resting)

*1994-3/1995 half shaft...24.556-25.936" travel range. (~25.25" resting)

(for reference the 86-91 NA RX-7 halfshaft is similar to the 94+ Miata halfshaft with the same ~25.25" length and the same 94/95 Miata stub shaft bolt pattern of 4x110 but it uses a larger hub shaft diameter of 28 spline by 29mm).

Starting with cars with build dates during March of 1995 (according to the interchange book it was VIN 14193), Mazda introduced a single piece half-shaft, gone was the stub shaft. The single piece half-shafts were typically used on Torsen equipped rears starting 3/95 but by the 1996 model year they were all that was used.



Single piece halfshaft



94-95.5 two piece halfshaft

halfshaft diameters:

Miata = 22mm

86-92 RX-7 NA = 24mm

TII = 26mm

929 = 30mm.

TT = 29mm

Resplining the FC halfshafts or swapping to the FC NA hub will gain you 2 or 4 mm halfshaft diameter when using a 1.8 style rear.



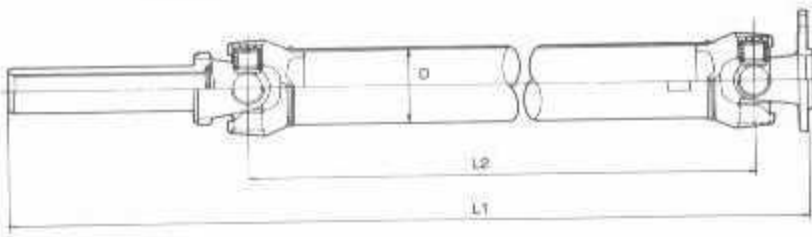
It is unlikely that a stub shaft will fail on you but if it does the NA 86-91 RX-7 item is the same. (there were some running changes in the oil groves for the seal and the snap ring wire diameter so be sure to get ones that match your original).



The single piece halfshaft uses different machined groves to oil the seal than the stub shaft design.

The stub shafts are not interchangeable between the 1.6 and the 94-3/95 1.8 rears because of the shaft diameter being smaller for the 1.6. ...insert stub shaft comparison picture here...

DRIVE SHAFT:



When Mazda upgraded the rear in 1994 they also had to change the driveshaft to fit the larger rear. It is 48mm shorter (L1= 1001mm vs 1049mm, 39.41/41.3" : L2= 864mm vs 816mm, 32.1/34.02) and used the larger 86-91 NA RX-7 pinion flange pattern of 4x67mm vs the 4x62mm pattern of the 1.6 rear.



flange comparison

TRANSMISSION:



Mazda has two 5 speed transmissions. One is used in NA applications (AKA 'type 2' or Model M) and came on such cars as the RWD 626, 79-85 RX-7, 86-91 NA RX-7, B2000/2200 truck, and Miata. The other is a stronger unit that came on all turbo RX-7's, 929, B2600, and MPV.

Within the type2 versions only the bellhousing & tailshaft cases and gear ratio's are really different between models. All the guts of the Type 2's are nearly the same and mostly interchangeable. The major differences came in '81 when the shifter was made remote, in '83 where some bearings and shafts were made larger and in '94 with improved seals and a double cone 2nd gear synchro. Between models the input/output shaft lengths may differ slightly (~ 1/2") so always measure. The 79 through mid-83 tranny guts should be avoided if reliability and torque rating is important.

Everyone asks me about changing the Miata 5th gear with that of the 2nd gen RX-7 so that their highway cruising rpms can be lower. The whole guts can be fairly easily transferred but individual gears, unless you are an experienced transmission repair technician and have all the proper micrometers and pullers (and have an idea what you are doing), is not a job for the average shade tree mechanic. The Miata trans also uses a different number of teeth on the input and counter shafts than the corresponding RX-7 transmissions so swapping to the RX-7 5th gears creates a different ratio than the advertised ones. See [5th Gear Interchange Chart](#).

The turbo trans (AKA 'type3' or model 'R') was derived from the original, and more robust, RX-2 through RX-4 5 speed type1 trans. It also has many internal design similarities to the Type 2. It mainly differs from the Type 2 in the input and output shafts grew from 15/16" to 1", a removable bellhousing and the case having strengthening ribs instead of being smooth. For more turbo trans info go to the links page and click on

Mazdatrix and Felix's. A variant of the turbo trans has been used in Ford light duty '88-91 F-150, Bronco and Ranger trucks. It is model M50D-R2 and also known as the "Kogyo"

The 99+ Miata 6-speed is made by Aisin and is not related to the Type II 5-speed (it is listed below for reference only). Will the 6-speed bolt in a 5-speed Miata? Yes, make sure to get the trans plate and shifter from the 6-speed donor since they are unique to it. You will have to use only two of the three 5-speed starter bolts but that shouldn't be an issue, otherwise it bolts in (same PPF mount, etc). Keep in mind the 6-speed is combined with a 3.909:1 rear in the USA (3.636:1 other markets) since the tranny gearing is much steeper so your '90-93 or 99+ 4.30:1 5-speed rear should also be changed to the 3.909 or at least the more common 4.10:1 otherwise you'll have a nice tree stump puller

'M' gear ratio's						
Car	1st	2nd	3rd	4th	5th	6th
79-83 RX-7	3.674	2.217	1.432	1.00	.825	
RWD 626	3.214	1.818	1.296	1.00	.858	
84-85 RX-7	3.622	2.186	1.419	1.00	.807 12A .711 '84.5-85 13B .758 '84-84.5 13B	
86-91 NA RX-7	3.475	2.002	1.366	1.00	.691, 86=.711	
Miata	3.136	1.888	1.330	1.00	.814	
'85+ B2000/2200	3.622	2.186	1.419	1.00	.858	
99+ Miata 6-speed	3.76	2.269	1.645	1.257	1.00	.843
High-strength Quaife (close)	2.350	1.550	1.240	1.00	.881	
High-strength Quaife (wide)	2.564	1.670	1.277	1.00	.794	

As you can see from the table the RWD 626 offers the closest gear ratio's from 3rd to 5th, making it a great road race transmission. It is however from the early pre-improvement generation, making it susceptible to breakage. See also [Felix's transmission ratio](#) page for more info on earlier models

'R' gear ratio's					
Car	1st	2nd	3rd	4th	5th
1988-89 929	3.483	2.015	1.391	1	.762
1987-88 TII	3.483	2.015	1.391	1	.762
1989-91 TII	3.483	2.015	1.391	1	.719
1993-95 TT	3.483	2.015	1.391	1	.719
89-93 B2600	3.730	2.158	1.396	1	.816

SPEEDOMETER GEARS:

The speedometer gears and gear housings between all the late model(1984+) 'M' transmissions interchange. If you have installed different rear ratio gears or different diameter tires then you will need to change the speedometer gears in the transmission to keep the speedometer accurate. The speedometer gear housing bolts to the transmission and is easily removed since it is external to the transmission

Mazda makes speedometer gears for the late model 'M' transmission with 17-23 teeth. The steeper the rear ratio gears or the shorter the tire diameter the more number of teeth is needed to compensate. The 90-91 Miata comes from the factory with a 20 tooth speedometer gear (which makes the 4.30:1 gear about 5mph fast). The pitch of all the speedometer gears is the same and only the diameter of the gear is different (1978-mid83, with the exception of the 626, use a coarse drive gear and are not interchangeable). The different gears housings are offset to account for the diameter change (see picture)

Speedo gear chart			
Car	tooth count	gear color	notes
84-85 12A RX-7	17	green	'79-83 coarse gears
84+ B2000/2200 truck, 84-85 13B GSL-SE RX-7	18	purple	
86-91 RX-7 convt	19	red (small diameter)	
90-91 Miata, 86-91 RX-7	20	black	
1989-90 RX-7 GTUS	21	white	4.30:1 rear ratio
1979-82 RWD 626	22	Red	
92+ Miata	23	Red	



FYI, If you cannot find a 626 or late model Miata unit then you can make one by using the abundant 1979-83 RX-7 17 tooth coarse gear drive, which is the same diameter as the 22 and 23 tooth fine tooth drives. This makes the housings interchangeable and then only the drive gear itself (22 tooth = part number 8854-17-441A) needs to be purchased.

Special thanks to John Sisler and [MazdaMart](#) for providing the info and picture. See also [Felix's speedometer gear interchange page](#) for more info.