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915 Series Porsche Transmission

Introduction

The type 915 transmission was a four or five speed transmission designed and manufactured by Porsche between 1972 and 1986. The transmission was used in the type 911 and type 916 cars.

History

With the introduction of the 2.4 L engine to the 911 in 1972, Porsche felt that the increased torque of the 2.4 L over the previous 2.2 L warranted a stronger transmission. The design of the 915 is based upon, but is not identical to that of the 916 transmission that had been used years before in the 908 racing car. One feature of the 916 that carried over to the 915 is the orientation of 1st through 5th gears. There are a number of similarities as well as differences between the 915 transmission and the 901 series transmission that it replaced.

Similarities include...

- Constructed using either magnesium or aluminum
- Similar main and pinion shaft as well as differential layout.
- Sharing of some parts such as the 3rd, 4th and 5th gear synchronizer components.
- Porsche synchronizer system.
- Shift linkage.

Differences include...

- Revised shift pattern.
- Ordering of gears within the transmission case.
- Case component design.
- Method for setting pinion depth.
- Larger in most all dimensions.

The 915 shift pattern uses a more commonly used "H" pattern that covered the first four gears with fifth gear to the right and up and reverse to the right and down. The previous 901 transmission had reverse and first on the left and this made for an awkward shift from first to second gear. Opinions as to why Porsche made this change vary depending upon who you ask. One theory is that customers complained about the pattern used in the 901 series so it was changed in the 915. Another theory is that having 5th gear and reverse in the end cover was so that it would be easy to change the ratio for 5th gear to suit specific tracks for the racing versions of the 915 transmission. Maybe both factored into the decision.

Like the 901 series, the 915 case consist of three main parts. However instead of using an intermediate plate like in the 901 series, the 915 is roughly broken up into three section with the first housing the differential and bell housing, the middle housing the main gear stack, and the last housing 5th gear and reverse as well as the transmission mounting structure. While the earlier 915 transmission were cast using magnesium housing, Porsche eventually transitioned to aluminum.

The racing type 916 transmission used a low sump to keep the gears out of the oil and relied upon an oil pump and internal oil squirters for lubrication. The original 915 used a splash lubrication system with no pump or external cooler. Race versions of the 915 used a 916 style oil pump and external cooler while production car versions used a different style oil pump that was incorporated into the differential cover plate.

The 4-speed is the same as a 5-speed, except that in place of the fifth gear, a spacer on the shaft is used and the associated shift fork, etc, is omitted. The type 925 transmission is the Sportsmatic version of the 915. The internals from a 915 were used in one of the transmissions used by the type 924 car. A version of the 915 transmission was used in the type 916 car. The significant modifications included the flipping of the differential to allow for mid-engine use as well as a "side shift" style shifter. This utilized a custom end cover as well as moving the shift input to the side of the transmission. Existing 915 transmissions can be converted to this configuration with the proper parts.

The larger sized gears and bearings, and associated increase in the spacing between the shaft centers from 68mm to 76mm (the 916 used 77mm), allowed for an increase the torque capacity of the 915 over the 901 series. It is believed that Porsche set a 181 lb/ft maximum torque value for the Aluminum cased version of the 915. However this value most likely represents a torque level that maximized longevity and that while the 915 can handle higher torque values, they would be expected to impact the lifespan of the transmission. It is believed that Porsche set a 275 ft/lbs maximum torque value for the racing versions (using a reinforced final drive as oil pump, cooler and squirters) of the 915 transmission and 239 ft/lbs for the earlier 916 racing transmission.

Typically these transmissions were provided with a standard "open" differential. However some examples were provided from the factory with a ZF clutch type Limited Slip Differential (LSD). The 915 series transmission was eventually replaced by the G50 series transmissions.

Production Changes

The basic design changed very little over the production life. Main transmission case material changed from magnesium to aluminum. The speedometer changed from a mechanical to an electronic mechanism. The first gear synchronizer system changed from a symmetric to asymmetric dog tooth design. The ring and pinion were changed due to the 8:31 version being more robust as well as it placed less stress on the differential side cover. The original version had a design flaw with regards to the serviceability of the input shaft seal. For the earlier versions, the input shaft seal is hidden behind a non-removable clutch throwout bearing guide tube. Replacement of this seal in earlier transmissions requires disassembly of the transmission. Later improvements allowed this tube and seal to be removed and replaced without any other disassembly of the transmission. Due to later engines producing more torque, transmission oil pump, squirters and coolers were offered on various models. A number of other various internal items changed during production. As you would expect with the transmission being used in various cars there are design features specific to those cars. Those used for mid-engine placement have the differential "flipped".

Listed below is a more specific history of production changes...

1972 - Start of production; magnesium case; 7:31 ring and pinion; mechanical speedometer; early style clutch throw out bearing tube.

1973 - Change to input shaft seal design to address service issue flaw.

1974 - Change (final) to input shaft seal design to address service issue flaw. Transmission disassembly no longer required.

1975 - Midyear change from 7:31 to 8:31 ring and pinion

1976 - Change from mechanical to electronic speedometer.

1977 – Start of transition from magnesium to aluminum case.

1977 - Change to 1st and 2nd synchros?

1978 - Reinforced differential side cover (addition of extra ribs)

1979 - All models 5 speed now

1984 - Reduction in diameter of input shaft bearing in differential case. This significantly helped in the reduction of problems with bearing bore ovaling.

1984 - Addition of oil pump and cooler for some models

1986 - End of production

19?? - Mainshaft design was changed with respect to the conversion to using a spacer sleeve between 1st and 2nd gear.

Known Issues

When used within its design parameters the 915 series transmissions are well built and tough. However those that are pushed beyond these design limits, have high mileage and/or are poorly maintained can expose the weak spots in the design.

Ovaling of differential case input and pinion shaft bearing bores. Over time the holes machined into the differential case that hold the input and output shaft bearings can experience an oval wear pattern. This allows the bears to lose support, spin in the bores and eventually cause failure of the bearings. To repair this problem the case must be machined to allow steel inserts to be pressed in place. There are also aftermarket bearing clamping plates that utilize a single plate (vs. the factory double/split plate design). These single plate designs are meant to try to do a better job at tying the loads from the two shaft bearings together to prevent future bore ovaling.

Porsche Synchronizer System. This is the last Porsche transmission to use the Porsche “balk ring” synchronizer system. Compared to current day modern designs that use the Borg Warner synchronizer system, the 915 was not really compatible with “quick shifts”.

Drivers who try to shift the transmissions quickly (especially in 1st to 2nd up shifts) find that they may experience some grinding and ultimately do damage.

Weakness of the 7:31 ring and pinion. It is generally felt that the later 8:31 ring and pinion have fewer failures. Associated with this are later improvements to the differential side cover to increase its strength. This was done to prevent changes to the ring and pinion depth and backlash from changing under heavy load conditions.

Versions

Listed below is a chart of the various versions that Porsche produced. Currently the chart is incomplete.

Manual

Version	Gears	R&P	1st	2nd	3rd	4th	5th	Serial Number	Case	Speedometer	Note
915/00	5		AZ	HX	NT	QP	TM	? - ?			
915/01	5		AZ	HX	NT	QP	TM	? - ?			
915/02	5	7.31:1	AZ	HX	NT	QP	TM	73 20001 - 73			1972-73 911 T/E/S

								2????, 73 30001 - 73 3????			
915/03	5		AZ	HX	NT	QP	TM	? - ?	Magnesium		
915/05	5							? - ?			1973-74 911, 911S, Carrera
915/06	5							7340001 - 7349999			1974 911 USA, 911S USA and 911 Carrera USA
915/08	5		AZ	HX	NT	RP	TM	78 30001 - 78 2????			1973 Carrera RS with oil pump
915/10	4		AZ	HW	OR	SN		? - ?			
915/11	4		AZ	HW	OR	SN		? - ?			
915/12	4	7.31:1	AZ	HW	OR	SN		72 20001 - 72 2????, 72 30001 - 72 3????			1971-72 911T, 911E, 911S
915/13	4		AZ	HW	OR	SN		? - ?			
915/14	5?							? - ?			?
915/16	4	7.31:1	AZ	HW	OR	SN		? - ?			1973-74 911, 911S, Carrera
915/18	4		AZ	HW	OR	SN		? - ?			1973 Carrera RS with oil pump
915/40	5							71 5???? - 71 5????			1975 911S, US Carrera
915/43	5							? - ?	Magnesium		1974-75 911
915/44	5	8:31	AZ	HX	NT	QQ	SN	71 6???? - 71 6????			1975-76 911, US 911S
915/45	4	8:31	AZ	KW	PR	SN		? - ?			1975 911S
915/48	4							? - ?			1974-75 911
915/49	4							? - ?			1975-76 911
915/50	4							? - ?			1977 Racing

											911 Carrera
915/61	5	8:31	AZ	HX	NT	QQ	SN	71 7???? - 71 7????, 71 8???? - 71 8????, 71 9???? - 71 9????			1977-79 911 with clutch assistance, asymmetrical dog/slider teeth
915/62	5	8:31	AZ	HX	NT	QQ	SM	73 A???? - 73 A????, 73 B???? - 73 B????, 73 C???? - 73 C????, 73 D???? - 73 D????			1980-1983 Europe & ROW without oil cooler
915/63	5	8:31	AZ	HW	NT	QQ	SN	74 A???? - 74 A????, 74 B???? - 74 B????, 74 C???? - 74 C????			1980-1983 USA & Japan - without oil cooler
915/65	4							? - ?			1977 without clutch assistance
915/66	4							? - ?			1977 with clutch assistance
915/67	5	8:31	AZ	HX	NT	TS	ZD/T	73 E00001 - 73 E10000			1984 Europe & ROW - with oil cooler
915/68	5	8:31	AZ	HW	NT	QQ	ZD/U	74	Aluminum	Electronic	1984-1985

								E00001 - 73 E10000			USA & Japan - without oil cooler
915/69	5	8:31	AZ	HX	NT	TS	ZD/T	73 E10001 - 73 E11000			1984 Europe & ROW Turbo-look - with oil cooler
915/70	5	8:31	AZ	HW	NT	QQ	ZD/U	74 E10001 - 74 E11000			1984 USA & Japan Turbo- look - without oil cooler
915/72	5	8:31	AZ	HX	NT	TS	ZD/T	73 F00001 - 73 F10000			1985 Europe & ROW - with oil cooler
915/73	5	8:31	AZ	HW	NT	QQ	ZD/U	74 F00001 - 74 F10000	Aluminum	Electronic	1985-1986 Europe & ROW - without oil cooler
923/01	5								Magnesium	Mechanical	1972 916
923/02	5	7:31	AZ	HX	NT	QP	TL	5060001 - ???????			1976 912E

Sportomatic

Version	Gears	R&P	1st	2nd	3rd	4th	5th	Serial Number	Case	Speedometer	Note
925/00	4							76 20001 - 76 2???? 76 30001 - 76 3????			1971-72; 911T, 911E
925/01	4	7:27						76 20401 - 76 2????			1972; 911S
925/02	4	7:27	C	I	Q	Y					1973-74; 911, 911S, US Carrera
925/09	3										1976; 911 (Mech. Speedometer)
925/10	3	8:27	DA	M	V						1974-75; US 911S, US Carrera
925/12	3	8:27	C	K	V						1976; 911, US 911S

925/13	3										1976; Carrera 3.0
925/15	3										1977; 911
925/16	3										1977; Carrera 3.0
925/17	3	8:27	C	K	V						1977; US Japan 911S

Gearing and Differential

Differential

915 transmissions were either delivered with a standard open differential, or an optional ZF clutch type limited slip unit.

Final Drive

The final drive consists of a pinion and ring gear. As this is a transaxle design, the pinion gear is on the end of (part of) the output shaft. The ring gear is bolted to the differential. The final drive ratio is the ratio of the teeth count between the pinion and ring gears. For example a typical 915 final drive has a ratio of 8:31 (3.875). This translates to 8 pinion teeth and 31 ring teeth.

Ratio	Gear
7:31 (4.429)	Pinion and Ring
8:31 (3.875)	Pinion and Ring
7:27 (3.857)	Pinion and Ring
8:27 (3.375)	Pinion and Ring

Main Gears

Each gear set generally consists of two gears. One for the input shaft and one for the output shaft. There are some slight exceptions. As while reverse has two gears (one of which is the "idler") it also has it's own shafts. On most 915 series transmissions the input shaft includes 1st gear however a special input shaft that does not include 1st gear does exist. So most 1st gear sets would include the input shaft. The gear ratio for a gear set is the ratio of the teeth count between the input and output shaft gears. For example an 915 "A" 1st gear has a ratio of 11:34 (3.091). This translates to 11 teeth on the input gear and 34 teeth on the output gear. While all 915 series gears can be described via their teeth count (and associated ratio), to make it easier to identify specific ratios, Porsche used an A through Z based naming system. With "AZ" being a low 11:35 1st gear and "TL" being a high 31:22 5th gear.

In a perfect world, any of these gear sets could be used in any location to provide ultimate flexibility with respect to gearing. However due to the basic design of the transmission (internal case space, shift fork locations, input/output shaft design, etc.), specific gears can typically only be used in specific locations.

Code	Ratio	Gear
AZ	11:35 (3.182)	1
BY	12:34 (2.833)	1
D	14:37 (2.643)	1
E	15:36 (2.4)	1

DV	14:31 (2.214)	1
FZ	16:35 (2.188)	1,2
GZ	17:35 (2.059)	2
EU	17:34 (2)	2
ET	15:29 (1.933)	2
HY	18:34 (1.889)	2
HX	18:33 (1.833)	2
HW	18:32 (1.778)	2
JW	19:32 (1.684)	2
KW	20:32 (1.6)	2,3,4
LV	21:31 (1.476)	2,3,4
LU	21:30 (1.429)	2,3,4
LT	21:29 (1.318)	3,4
MT	22:29 (1.318)	3,4
NT	23:29 (1.261)	3,4
NS	23:28 (1.217)	3,4
NR	23:27 (1.174)	3,4
OS	24:28 (1.167)	3,4
OR	24:27 (1.125)	3,4
PR	25:27 (1.08)	3,4
PQ	25:26 (1.04)	3,4,5
QQ	26:26 (1)	3,4,5
TS	29:28 (0.9655)	3,4,5
QP	26:25 (0.9615)	3,4,5
RP	27:25 (0.9259)	3,4,5
RO	27:24 (0.8889)	3,4,5
SO	28:24 (0.8571)	3,4,5
SN	28:23 (0.8214)	3,4,5
ZD/U	38:30 (0.7895)	3,4,5
SM	28:22 (0.7857)	3,4,5
ZD/T	38:29 (0.7632)	3,4,5
TM	29:22 (0.7586)	3,4,5
TL	31:22 (0.7097)	3,4,5

Serial Numbers

The type and serial number are stamped on the bottom of the case below the differential near the drain plug. Unfortunately area is also the lowest part of the transmission and it is not uncommon for the stamping to be inadvertently ground off.

915/AA BB CD ENNNNN

A = Type (i.e. 62 = 915/62)

B = Differential Designation, 12 = ZF LSD, missing = no LSD

C = Application, 7 = 6 cylinder engine

D = Gearing, 1 = ?, 2 = ?, 3 = 5 speed Europe and RoW, 4 = 5 speed USA, Japan, 6 = Sportomatic, 8 = ?

E = Model Year, 2 = 1972, 3 = 1973, 4 = 1974, 5 = 1975, 6 = 1976, 7 = 1977, 8 = 1978, 9 = 1979, A = 1980, B = 1981, C = 1982, D, = 1983, E = 1984, F = 1985, G = 1986

N = Sequential Serial Number (i.e. 00001, 00002, etc.). May be 4 or 5 digits. Some models did not start with serial number "1"

Links

http://en.wikipedia.org/wiki/Manual_transmission

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