

Technical: XJ-S Transmissions

During its 21-year production life, eight different gearboxes were fitted to the XJ-S. Here's a guide to them all, including compatibility between models and aftermarket conversions.

Borg Warner Model 12 Auto (V12)

More widely known as a Ford FMX, the Borg Warner Model 12 was fitted to the XJ-S from launch in 1975 until mid 1977 when the TH400 took over.

The '12 has an incredibly strong three-speed transmission, but with a cast iron casing, it heavy as well. Advantages include simplicity, ease of repair (most repairs can be done without removal from the car), and an almost limitless range of performance enhancements courtesy of the Ford connection, the 'box being standard fitment in most late 1960s, early '70s V8 applications, including the Mustang.

There are, however, several issues to be aware of.

1. Firstly, to aid smoothness and prevent open throttle changes, the gearbox senses engine vacuum via a pipe from the inlet manifold, and the rubber diaphragm within the modulator can perforate with age, consequently drawing transmission fluid into the engine, causing smoke and a noticeable deterioration in shift quality.

2. The kick down is electrically operated from a switch mounted on a spring loaded bracket at the end of the accelerator cable; not only can this switch pack up, but the connections at the gearbox casing can also fail.
3. Be aware that over tightening will distort the sump pan, and it is very easy to cross thread the cooler pipe connections at the brass ferrules on the casing.

One annoying aspect of the Model 12, though not technically a fault, is the inability to kick back to (or manually select) first gear once the car's speed has risen above 30mph, the lock out not re-setting until it comes to a halt again. As far as we know, there is no way to change this without fitting an aftermarket shift kit.



From launch until 1977, if you specified an automatic V12 XJ-S, then it came with the three-speed Borg Warner Model 12.

Jaguar V12 Manual

As the only factory fit manual option for a V12 XJ-S, the four-speed 'box was not an option that was widely taken up by customers with only 350-odd cars built.

The unconfirmed story often quoted is that the manual was soon dropped as they were left over from V12 E Type production. However the option was available over a five-year period and it is thought it was more to do about those who bought the luxury GT.

This was also borne out with the unsuccessful five-speed gearbox offered by TWR in the late '80s, proving that no matter what enthusiasts might say, new buyers clearly prefer an auto.

Although not that refined by today's standards, the Jaguar all-synchro is a very strong transmission and will really only fail through abuse.

Conversion 'kits' including the gearbox, bell housing, flywheel and pedal box are available, but they are quite pricey.

The lack of a fifth gear has always limited the appeal of the four-speed, with Jaguar unwilling to offer overdrive, even as an option due to the immense torque of the V12.

Fitting an overdrive box is possible (an entire six-cylinder box must be used, as the main shaft is much longer), as long as the overdrive is beefed up with

stronger springs, improved clutch material and higher pump pressure, and the driver then takes care not to engage overdrive under power.

When using the XJ6 'box behind a V12, a 420 top cover and selector assembly will be needed to compensate for the fact that the V12 extends further back in the shell.

The gearbox will mate up to any V12, although a (Jaguar) 6.0-litre will need to be drilled and tapped as the original boss pattern is left blank, all post '77 blocks will need to be drilled for the alignment dowels.

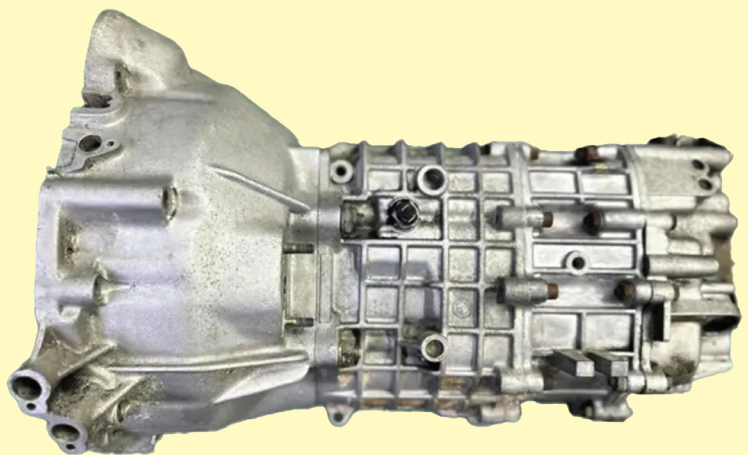
Getrag 265 Manual

For the XJ-S 3.6 of 1983, Jaguar turned to Getrag, the German company best known for supplying BMW.

The Model 265 manual transmission is a variation of the design used by the German marque. These gearboxes are generally very reliable and can cope with very high-power outputs, though any 'box with a few miles on it will rattle to a certain degree.

Its one big weakness, however, is the almost total lack (other than a few basic seals) of any parts backup, in fact the 'boxes even incorporate a 'self-destruct' mechanism to prevent repair by a non-Getrag authorised mechanic.

What this really means is that when fitting these gearboxes, or for that matter running any car fitted with one from new, it would pay to pick up a spare one if the opportunity arises.



Getrag 290 Manual

The Model 290 transmission replaced the 265 around 1990 and can be identified by the integral bell housing and finned sump.

It is supposed to be more refined and has a taller first gear, but the only thing most drivers spot is that reverse is moved from left and up, to right and back.

These gearboxes are one of the most common options for a manual V12 conversion, but it is important to remember that from 1987 Jaguar used a differential mounted transducer to operate the speedometer and so the cable drive on the gearbox was no longer fitted (for a short time the housing remained and can be fitted with the necessary drive gear etc).

For pre '87 cars use a pre '87 gearbox.

To fit either 'box to a VI2 block, a bell housing adaptor will be needed along with a bolt-on flywheel centre section to be used in conjunction with the original automatic drive plate and starter motor.

Note: An appropriate ABS/non-ABS pedal box will also need to be sourced.

GM THM400 Auto (V12)

From 1977 right through to 1993, the General Motors Turbo Hydramatic 400 is smoother in its changes than the Model 12 it replaced.

It has an alloy housing strengthened with cast iron insets at critical points for strength, and has proven generally reliable.

The lack of a fourth overdrive speed prompted an American company to market a bolt-on overdrive system specifically built for the THM400 and, made under license from Laycock/GKN, manufactures Jaguar's earlier overdrive assemblies.

Troubleshoot

1. Check the fluid level

The first thing to check if you suspect that the transmission is acting up is the

automatic transmission fluid (ATF) level in the transmission itself.

It can suffer from oil leakage at the modulator, as well as from the poorly designed dipstick tube where it enters the casing.

2. Check the linkages.

The linkages that are connected to the shift lever can get out of alignment at times, causing sloppy or difficult shifter response. Look for abnormalities such as bent or broken parts, loose attachment points, or blockages that would prevent smooth shifting.

3. Change the filter.

Perhaps the most annoying aspect of this process is the fact that the rear mount must be dismantled every time the filter is changed, a job that cannot be done without dumping a litre of warm fluid down your neck.

Care is needed to not put the bolts back on too tightly, as the gasket can become damaged. Preferably use a torque-wrench.

4. Inspect the cooler lines.

The number-one killer of automatic transmissions is heat. If the cooler lines that come from the radiator are damaged or leaking, it might be necessary to replace them. These items can also be found at the local parts store.

Replacing a Model 12

The Turbo Hydro can be fitted to an earlier VI2 but care is needed when aligning it as the earlier block lacks provision for the 400's larger dowels.

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ZF 4HP22 Auto

Prior to the launch of the XJ40 in 1986, all XJ-S 3.6-litre cars were manual. That changed with the arrival of the ZF 4HP22 (four-speed, 220bhp). Perhaps the best all-round auto 'box ever fitted to a Jaguar.

This all-mechanical four-speed gearbox is reliable, lightweight, easy to service and, with a moulded rubber seal for the sump, very oil tight.

Its torque converter would also lock up at 80kmh, eliminating slippage, reducing heat build-up and improving fuel consumption.

Common Faults

1. Clutch Pack Wear

One of the most common problems with the ZF 4HP22 is clutch pack wear, especially the A, B, and C clutches. As the friction material wears down over time, slippage becomes noticeable, leading to erratic gear changes and decreased performance. Slipping between gears is often the first symptom, especially under load or acceleration, signalling that the clutch packs are no longer engaging as they should.

2. Valve Body Problems

The valve body is the control centre for fluid distribution in the transmission, and it is prone to wear

over time. Contaminants in the fluid can cause blockages in the valve body channels, leading to harsh shifts, delayed engagement, or even total transmission failure if left unchecked.

3. Governor Wear

The governor controls the shift timing based on vehicle speed. When it becomes worn, you'll notice symptoms like delayed upshifts or staying in lower gears too long, resulting in poor fuel efficiency and over-revving of the engine.

4. Overheating/Fluid Degradation

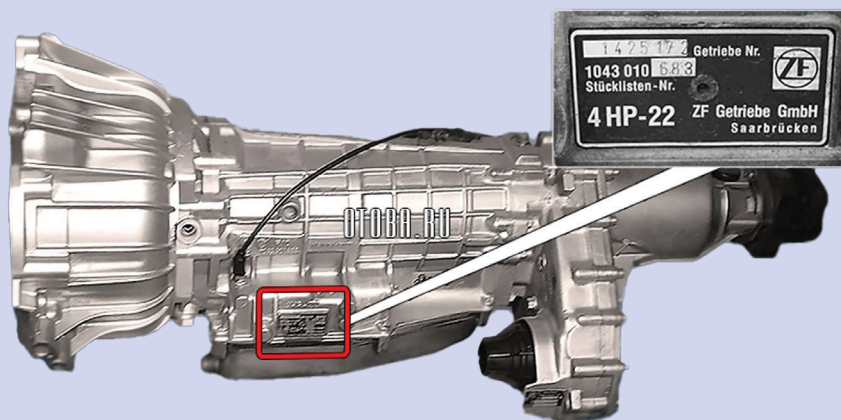
As with all automatic transmissions, ZF transmissions are prone to overheating if used under heavy load (such as towing) or in harsh conditions. Overheating causes fluid degradation, which accelerates wear

on internal components and can lead to catastrophic transmission failure. Regular fluid changes and ensuring proper cooling are critical, but if the damage is already done, it's time to look at repair or replacement options.

5. Torque Converter Failure

For many garages, the ZF torque converter issue is the most frustrating. When the torque converter starts to fail, it can lead to poor fuel economy, shuddering during acceleration, or complete loss of drive. The lock-up mechanism within the torque converter is particularly susceptible to wear, causing higher engine RPMs at cruising speeds and less smooth power delivery.

(ZF Friedrichshafen AG is a German technology manufacturing company).



ZF 4HP24E9 Auto

The 4HP24E9, fitted with the 4.0-litre engine, incorporated electronic controls for the first time with its own ECU linked to that of the engine. This is a reliable and durable automatic

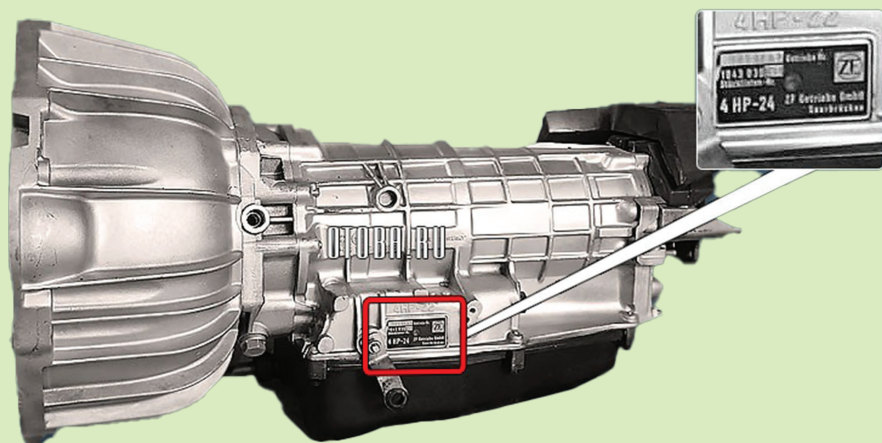
transmission and can time gear changes according to engine load and speed, offer differing shift patterns for sport and normal driving, and also send a signal to momentarily retard the ignition during a change for improved smoothness.

A rudimentary form of electronic fault diagnosis was also included — useful as most of the problems that have occurred since have been electronic rather than mechanical.

Common Faults

The 4HP24 service life really depends on ones driving style. Problems here begin after critical wear of the torque converter clutch, which causes vibrations that cause the pump bushing to break and leaks to begin.

It should also be noted that the electronics often put the gearbox into emergency mode, not through its fault, but due to malfunctions in the engine control unit or ABS sensors.



GM 4L80E Auto

As good as the THM400 was, its lack of a fourth overdrive speed was by the early '90s becoming a real handicap.

Launched in conjunction with the new 6.0-litre V 12 in 1993, the 4L80E was basically a Turbo 400 with an extra ratio and an electronic control module, though with a completely new case it looked nothing like its predecessor.

This 'box, shared with only the X300 XJR and V12 models, will rarely fail completely but can suffer from a whine in first and reverse,

Common Transmission Problems

1. Low Transmission Fluid

One of the most frequent culprits behind transmission issues is low fluid levels. If the fluid is low due to leaks or inadequate maintenance, the car may behave strangely!

2. Worn Clutch Packs

Over time, the clutch packs can wear out, leading to slipping or rough shifting. This wear and tear can be exacerbated by aggressive driving habits or towing heavy loads without proper precautions.

3. Faulty Solenoids

The solenoids control the flow of transmission fluid. If they malfunction, it can lead to erratic shifting or delayed engagement. This is often a result of electrical issues or wear over time.

4. Overheating

Excessive heat can cause significant damage. Overheating can be caused by low fluid levels, a malfunctioning cooling system, or heavy towing. If your transmission overheats, it can lead to catastrophic failure.

5. Contaminated Fluid

Lack of oil changes. Transmission fluid can become contaminated with debris, metal shavings, or burnt particles. This contamination can hinder the fluid's ability to lubricate and protect the transmission, leading to premature wear and failure.

6. Mechanical Failures

Sometimes, the issue lies within the internal components of the transmission. Broken gears, damaged bearings, or worn seals can all contribute to performance problems. These mechanical failures often require a complete rebuild or replacement.

5.3 Litre V12

Unfortunately for owners of 5.3 cars, the bell housing on the 4L80E required a larger mounting flange on the V12 block (the original mounting bosses remained but were left untapped), so this gearbox cannot be retro-fitted to an earlier car.



When the V12 XJ-S became a 6.0-litre in 1993, the gearbox was also upgraded to a four-speed unit.

Aftermarket Options

Manual Conversion

Many of the aftermarket manual conversion kits currently on the market use gearboxes made by Tremec (a Mexican company), and often rebuilt by specialist engineering companies with further changes to the gear sets, housings and gear lever positioning. The quality of each adaptation can vary considerably, so it pays to do plenty of homework and if possible, drive a converted car.

5-Speed Options:

- Tremec TKX: A modern, high-performance gearbox suitable for V12 conversions. Its compact design makes it the slimmest 5-speed available, improving tunnel clearance.
- Jaguar Getrag 265 or 290: As noted, originally used in the XJ-S six cylinder models, these gearboxes can be adapted for the XJS V12 engine.

- Tremec TKO: Previously used in conversion kits, offering higher torque capacities. However, TKO gearboxes are very cumbersome and the TKX is now a better option.

6-Speed Options:

Tremec T56 – A popular choice for high-performance applications, though it may require additional modifications.

Tremec TR-6060: An upgraded version of the T56, offering improved durability and smoother shifting. It is well suited to road/touring applications and can almost make an XJ-S seem economical.

Auto Upgrade.

Again, a number of firms offer an aftermarket upgrade to a modern auto.

6-Speed Auto

The ZF 6HP is 6-speed auto with Hydraulic converter and Planetary gearsets. The 6HP is no longer made but available second-hand.

The ZF auto has an internal controller that communicates directly with the engines ECU. Alternately, Fords version of the ZF 6HP (made under license) has a separate controller.

Various models of the 6HP have been used late model Jaguars including the V8 XKR.

8-Speed Auto

The ZF 8HP is a successor to the 6HP. It debuted in 2008 on the BMW 7 Series (F01) 760Li sedan fitted with the V12 engine. BMW remains a major customer for the transmission. Stellantis (made under license) also produce the 8HP under their own brand name, the Torqueflite 8. The 8HP is the first transmission to use this 8-speed gearset concept and has become the benchmark for automatic transmissions.

Various models of the 8HP have been used on late model Jaguars including the V8 F-Type.