



Automatic to Manual conversion

SAAB 900

Automatic to Manual Conversion

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This Document serves both as a record of a project on a 1984 Saab 900, and as a reference for do-it-yourselfers who wish to convert from automatic to manual shift. These notes apply only to the 1979-1993 Saab 900 including the 1994 convertible. The project these notes are based on was completed in December 1998 and posted on the internet in February 1999.
<http://www.redstone.net/mvj/900convert>

Getting Started

Since, it is necessary to remove the entire engine and transmission from a 900 in order to replace it's transmission, a certain amount of equipment is necessary. What follows is a list of the bare minimum required to complete this project.

Official 900 shop manual.

A covered, well lit workspace.

Metric open and close-ended wrenches

Metric socket set

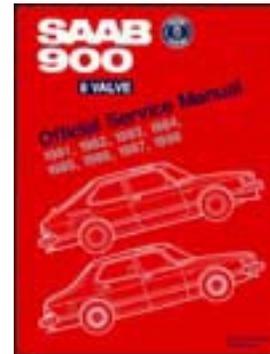
Metric "Allen" key set

Torque wrench

Engine hoist

A hydraulic floor jack

Four good jack stands. *Always use jack stands to support a car before working underneath it. Never get under a car that is only supported by a jack.*



Preparation

The following is strongly recommended:

1. A package of large plastic zip-lock type bags with labels for organizing parts.
2. Plastic adhesive backed labels for marking hoses and wires with numbers.
3. An assortment of cardboard boxes for storing various parts.
4. A notebook or clipboard for recording operations or drawing diagrams.
5. A still or video camera for photographing parts of the engine before disassembly, this will help immensely during the installation phase.

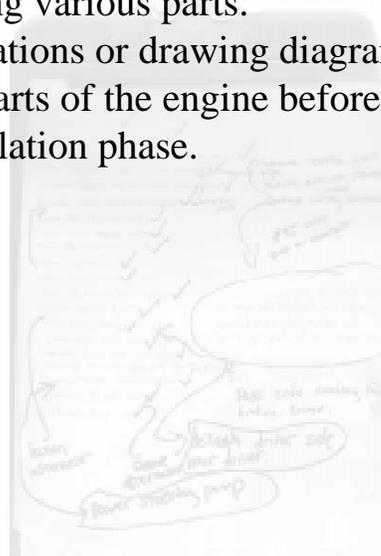
Other items:

Shop rags

Engine degreaser/cleaner

Threadlock for bolts.

general purpose and bearing grease



Project Outline

I. Remove engine/automatic transmission from car.

II. Separate automatic transmission from engine.

III. Replace automatic engine parts with manual parts

Remove torque converter driveplate

Install flywheel

Replace oil pickup tube



IV. Mount engine to manual transmission

V. Install clutch parts

VI. Remove interior parts from car.

remove front seats

remove center and floor consoles.

remove lower dash pad

remove front carpeting

remove HVAC ducting



VII. Remove automatic parts from car.

Remove brake pedal assembly

Remove shift lever housing and cable

Disconnect emergency brake cables
from handbrake lever

Remove rubber grommet in firewall



VIII. Install manual parts in car.

Install brake/clutch pedal assembly.
Install clutch master cylinder
Install clutch hydraulic line
Replace lower dash padding



IX. Swap shift lever housing parts

ignition switch
key cylinder

X. Install engine/transmission into car.

bolt in engine mounts
seat driveshafts into transmission
reattach lower balljoints

XI. Install manual shift lever housing and selector rod.

thread handbrake cables through grommet.
install taper pin in selector shaft.
adjust shift lever and check operation.
reconnect ignition switch wires.

XII. Reinstall interior parts

HVAC ducting
front carpeting
floor and center consoles
front seats.



XIII. Finish engine installation

Parts Checklist

A parts car such as the 1980 900T used on this project should provide almost all the parts necessary to make the conversion. Some parts such as the clutch and gaskets should be purchased new.

1. A manual 4 or 5-speed transmission from a late Saab 99 or any Saab 900 up to 1993. There are differences between different years and models but all are compatible with one another.

2. Gear shift lever housing and selector rod.

3. Brake and Clutch pedal assembly.

4. Clutch hydraulic line

5. Oil Pickup tube.

6. Clutch parts

Spring Diaphragm assembly,
Clutch Disc, Slave cylinder,
Throwout bearing, Shaft seal,
Input shaft, Propeller bolt,
cover plate and plate sprig.

7. Engine Flywheel from a manual-equipped 900 engine.

8. Plastic Clutch cover.

9. New engine to transmission gasket

10. Loctite 518 Gasket sealant.

11. Threadlock for bolts

12. Lower radiator hose



Manual Transmission Issues

Saab used the same bolt pattern on all 900 engines making it possible to swap any year engine with any year transmission 79-93 (+ '94 convertible). This applies to all Saab 900 models: 2-3-4 and 5-door as well as the convertible.

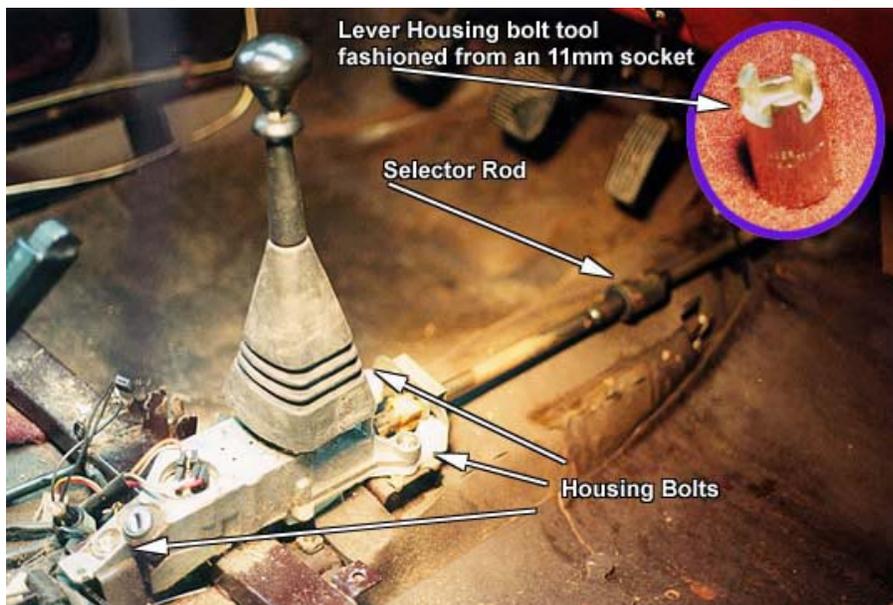
The inner drivers on manual and automatic 900 transmissions are different sizes depending on year/model. The drivers can be swapped if necessary.

The gearshift centering mechanism differs depending on the model year. Early 900's used a spring with blocks around the selector rod on the gear shift lever housing. In later 900's (1986-) this mechanism was internal to the transmission. Either system can be used with the other.



Some 900's do not have a center console and therefore employ a different style gearshift boot than console-equipped 900's. The center console itself is compatible between automatic and manual 900's.

Gearshift Lever and Selector Rod



The shift lever housing is interchangeable between automatic and manual 900's. A special tool is needed to remove the housing bolts which can be fashioned from an old socket.

Once the housing bolts have been removed on the manual car, the housing must be turned on its side and the plastic cover on the bottom removed to disengage the selector rod.

The selector rod is attached to the transmission by means of a taper pin which has a nut at one end. It can only be accessed from underneath the car. After removing the nut, the pin can be removed by tapping on it with a hammer.

There is a rubber grommet on the firewall through which the selector rod and emergency brake cables pass. The grommet is slightly different in the automatic car but is not necessary. The emergency brake cables must be disconnected from the handbrake lever in order to remove the selector rod and grommet from the car. When installing these components, it is recommended to wait until the engine/transmission has been reinstalled in the car. This makes installation of the selector rod much easier.

The shift lever housing contains the ignition switch and key cylinder. One may want to replace the key cylinder in order to keep the original key with the car being converted but this is not necessary. This was not performed on this project. There are instructions on how to replace the key cylinder in the Bentley repair manual.

When installing the lever housing in the automatic car, there will be extra wires that seem to have no place to go. These can be left disconnected. One of these is the light wire for the "PRND21" status window on the Automatic console. The other wire is the starter motor lockout which is a system found in automatic

cars that disables the starter motor when the shifter is not in "Park". Leaving this wire disconnected defeats the system. The reverse light wires are the same on both automatic and manuals and should plug right in to the reverse switch on the drivers side of the manual lever housing

Brake/Clutch pedal assembly.

It is recommended to first remove the engine/transmission before starting this part of the project as it makes much of this work much easier.

On the manual 900, the brake and clutch pedals are incorporated into a single bracket that is bolted to the firewall with 8 bolts. A similar bracket is used on the automatic car. However the automatic bracket contains a larger brake pedal, and no clutch pedal.

The brackets are interchangeable between cars.

Automatic 900 bodies are predrilled for manual parts such as the clutch master cylinder. therefore no modification must be made to incorporate manual parts. There is a cover plate on the hole for the master cylinder on automatic cars.

The lower dash, HVAC ducting and carpeting must be removed to access these parts.

The first step is to remove the Clutch master cylinder.

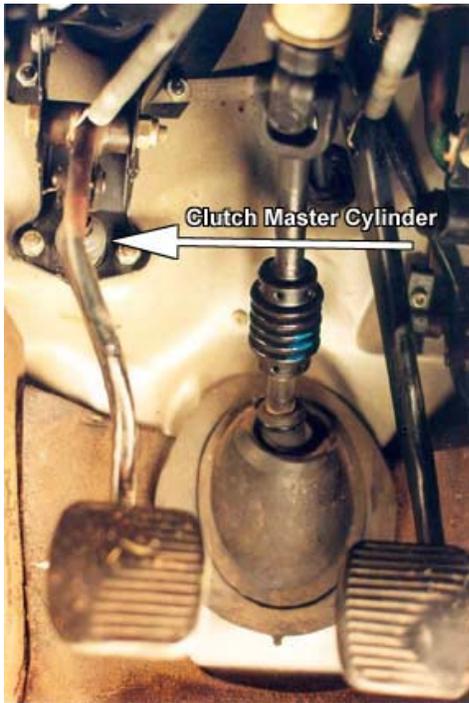
1. Remove the dowel that secures the clutch pedal to the clutch MC.
2. Disconnect the hydraulic line from the clutch MC in the engine compartment.
3. Remove the two bolts that hold the clutch MC to the firewall at the base of the clutch pedal.

The MC is removed through the engine compartment. Also remove the supply hose from the brake master cylinder and the rubber seal.

4. Next, disconnect the dowel that secures the brake pedal to the brake MC.
5. Remove the return springs for both pedals.
6. Remove the brake light and cruise control (if equipped) switches.
7. Remove the 6 bolts remaining on the bracket, 4 of these are accessed through the passenger compartment, Use a long extension on a socket wrench. The top two bolts are accessed from the engine compartment on the firewall above the brake M.C.



Automatic pedal bracket assembly.

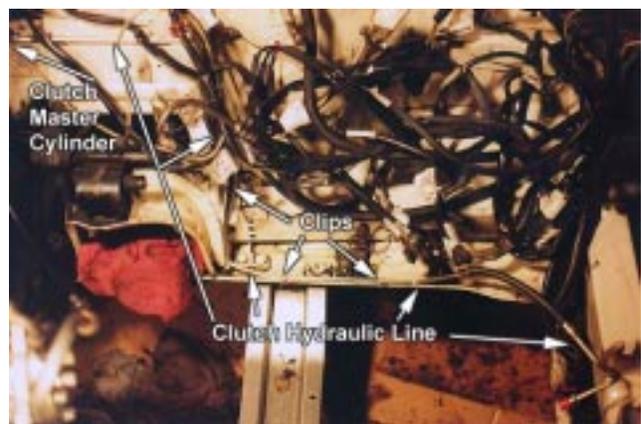


Once all of the bolts are removed the bracket will need to be rotated to clear the steering column. This can be very difficult as there is little room to maneuver the assembly. If necessary, the clutch pedal can be removed from the bracket to facilitate removal.

Installation is the reverse of removal. Installing the manual assembly is made much easier by removing the clutch pedal from the assembly. Maneuvering the assembly into position is difficult but possible with some patience.

Clutch Hydraulic Line

It is best to purchase a new clutch hydraulic line (about \$50), although a used one could be used if it is in decent condition. There are a series of clips which secure the line to the inner fender. The bodies of automatic 900s are pre-drilled with the mounting points for the clips. These should be available on the donor car. This part of the project is best done when the engine is out.



Engine Oil Pickup Tube



Automatic and manual 900 engine's are equipped with different oil pickup tubes. The pickup tube on the automatic is shorter than the one on the manual. This part must be replaced when converting to a manual transmission as using the automatic pickup tube on a manual transmission could result in low engine oil pressure. Once the engine has been separated from the transmission, this is an easy swap.

Engine Removal

The first step of this project is to remove the engine/transmission from the 900 to be converted. The engine removal steps listed here are from notes taken during the project and are based on those outlined in the Robert Bentley manual for an 8-valve 900. These are not instructions for how to remove the 900 engine. An official Saab 900 workshop manual provides the best documentation for engine removal. Non-turbo, 16-valve and early 900's equipped with the B-type engine will require different steps than those listed here.

- Drain radiator.
- Drain Engine block.
- Drain Power steering pump.
- Drain Engine oil.
- Drain ATF fluid.
- remove washer hose from hood.
- Remove Hood.
- Remove battery.
- Disconnect exhaust manifold from downpipe.
- Place front of car on jackstands.
- Disconnect speedometer cable.
- Remove exhaust pipe bracket.
- Loosen inner C.V joint boot clamps.
- Remove both front wheels.



* It is recommended to pull both drive shafts from the transmission rather than just the one as described by many manuals. This makes engine removal and installation much easier.

- Using a floor jack, lift each wheel, compressing the spring and insert a spacer between the upper a-arm and the body of the car. Then use the jack to lower the a-arm onto the block. A small block of wood or metal will work. This unloads the suspension.
- Loosen and remove lower balljoint bolts on each front wheel.
- Pull both driveshafts from their drivers on the transmission. Cover the tripod bearings with plastic.
- Disconnect power steering pump pressure line.
- Disconnect all cooling hoses.
- Disconnect APC harness (turbo only).
- Disconnect APC hoses (turbo only).
- Remove rubber bellows from Mixture Control Unit (MCU).
- Remove turbocharger intake pipe between MCU and turbocharger, cover all exposed inlets and outlets with plastic. (turbo only)
- remove air cleaner intake pipe and fuel booster switch.
- Disconnect fuel lines from
 - Warm up regulator
 - Cold start valve
 - Fuel distributor
 - Fuel injectors

Remove ground wire from MCU.
Remove MCU.
Disconnect accelerator cable.
Remove vacuum hoses from charcoal canister and brake booster.

Remove the following connections

- Throttle position switch
- Cold start valve
- Thermostatic switch
- Thermo-time switch
- Temperature sender
- Ignition distributor
- Auxiliary air valve
- Temperature sensor (top of cyl. head)
- Ground wires
- Warm up regulator
- Knock detector (turbo only)
- Starter Motor
- Oil pressure sender
- Alternator

Remove turbocharger inlet pipe - cover opening with plastic.

Remove exhaust pre-heater hose.

Remove wiring harness from the engine and set aside in the fender well.

Disconnect ground cables from timing cover and transmission.

Disconnect shifter cable from transmission.

Remove ignition coil.

Remove A/C radiator cooling fan.

Remove lower radiator hose - Some automatic 900's are equipped with an in line ATF cooler in this hose. This can be eliminated when converting but a manual hose will have to be aquired.

Remove positive battery cable.

Unplug oxygen sensor.

Remove A/C belt and A/C compressor, leave the hoses connected and place it on the side of the engine compartment.

Attach engine hoist to the lifting lugs provided at the top of the cylinder head and at the alternator bracket.

Raise engine slightly.

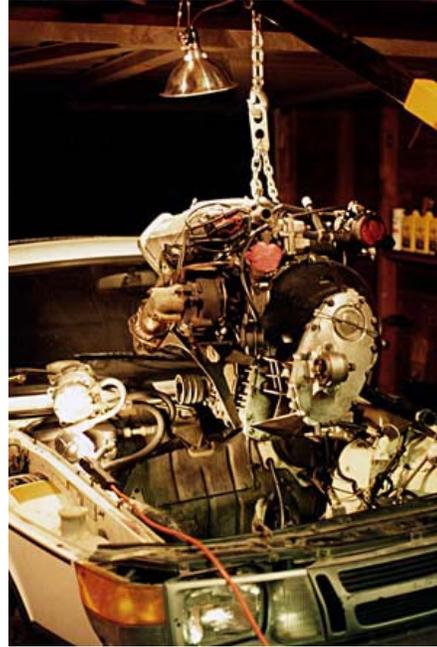
Remove the two rear engine mount bolts. Loosen the front bolt.

Raise engine a few inches to allow access to the oil cooler supply lines.(turbo only)

Disconnect oil cooler lines and oil pressure sensor connection.(turbo only)

Lift engine from car.

Cover tripod bearings with plastic to prevent them getting dirty.



Transmission Swap

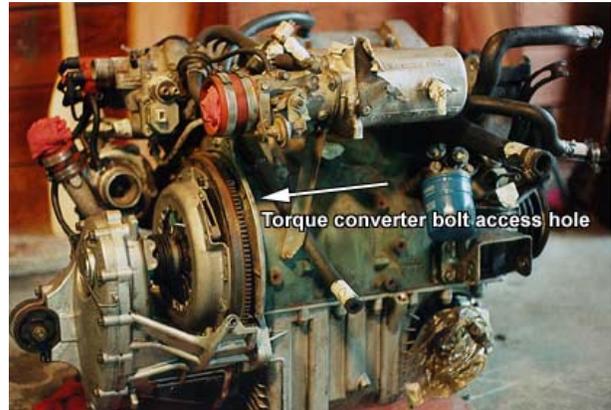
All major engine components should be cleaned and degreased.

Step 1. Separate engine from the automatic transmission

Remove the plastic cover that surrounds the torque converter housing.

On turbo models, remove the turbocharger support bracket.

Remove the bolts that hold the torque converter to the driveplate by putting a socket wrench with an extender bar through the access hole on the front plate of the engine.



Remove all of the engine to transmission bolts.

Attach an engine hoist to the engine lifting lugs. It is important that the engine is lifted perfectly straight. If the hoist does not lift the engine perfectly straight, the engine will bind to the transmission and it will not separate. If at first the engine does not separate from the transmission, it may be necessary to carefully pry the engine from the transmission.

Step 2. Preparing the engine for conversion

Replace engine oil pickup tube with one from a manual 900 engine. Two bolts connect the tube to the engine. The tube used as a replacement should be clean with a good o-ring on the end.

Remove converter driveplate. It will be necessary to prevent the engine from turning while these bolts are loosened. A small block of wood inserted between one of the engine's connecting rods and the outer wall of the engine block works well.

Install the 900 flywheel. There is a dowel on the end of the crankshaft that only allows it to fit one way. It is important to use threadlock on the flywheel bolts.

17mm bolt - 44 ft/lb

19mm bolt - 63 ft/lb.

Step 3. Mating the engine to the manual transmission.

Clean mating surfaces of both engine and transmission. Also clean thoroughly the top cavity of the transmission as this is the oil sump for the engine.

Place a new engine to transmission gasket on the transmission,



squeeze a bead of Loctite 518 gasket sealant both on the front and rear of the gasket in the grooves. This is illustrated in the Bentley manual.

Attach the engine to an engine hoist such that the engine is hangs perfectly parallel to the transmission. Lower the engine slowly. There are pegs in the engine that will help locate the engine properly. Once the engine is seated on the transmission, begin threading the engine to transmission bolts. Do not tighten any of them until all bolts are threaded. If the bolt holes are not lined up exactly, the engine can be shifted slightly using the hoist until all bolts are seated. There are six bolts that will require thread sealing compound. These are illustrated in the shop manual. Torque the engine-to-transmission bolts to 18-ft/lbs



Step 4. Installing the Clutch

The clutch diaphragm spring assembly, clutch disc, throw-out bearing and slave cylinder are installed between the engine flywheel and transmission final gear housing as a unit. In order to get the clearance necessary for these three components to fit, the diaphragm spring must be compressed and held in the compressed state by means of a special spacer tool.

The spacer tool is a metal dowel bent into a circle which is inserted between the spring fingers and the diaphragm body. It can be fashioned from an old bucket handle with a pair of pliers and a little patience.

Compressing the diaphragm spring is more of a challenge. This author used a hydraulic floor jack, and a pair of battery hold-down rods to compress the spring. A bottle jack can also be employed for this task.

1. Compress the spring fingers on the diaphragm assembly and insert the special spacer tool.
2. Mount the throw-out bearing onto the slave cylinder shaft.
3. While holding the slave cylinder/T.O bearing against the spring fingers, and the spring diaphragm unit against the clutch disc, place all three compo-



nents between the flywheel and transmission housing. The spring diaphragm should seat itself onto the small dowels in the flywheel. Make sure that the bolts holes for the slave cylinder line up properly. Insert two of the diaphragm-to-flywheel bolts loosely o keep the assembly in place.

4.Lubricate the splines on the input shaft with grease and insert it through the transmission casing and spring diaphragm assembly until it engages the splined center of the clutch disc. Using a plastic hammer, tap it lightly until it seats itself fully.

5.Install the slave cylinder screws using thread sealer.

6.Install and tighten the remaining spring diaphragm assembly-to-flywheel bolts.

7.Install the plastic "propeller" bolt to the end of the input shaft. Replace the input shaft cover and cover spring.

