



By *Chuck Andrews*

Clutches

The britannica Concise Encyclopedia says a clutch is “A device for quickly and easily connecting or disconnecting a pair of rotatable coaxial shafts. Clutches are usually placed between the driving motor and the input shaft to a machine and provide a convenient means for starting and stopping the machine and permitting the driving motor or engine to be started in an unloaded state (as in an automobile). Mechanical clutches provide either a positive (no-slip) or a friction-dependent drive, centrifugal clutches provide automatic engagement. An overrunning clutch transmits torque in one direction only and permits the driven shaft of a machine to freewheel (continue rotating after the driver stops); on bicycles, such clutches permit the rider to coast without moving the pedals.

Many owners do not understand which clutch they might have. A friction-dependent drive clutch would be found on most all Saabs and if you have a collector car with the free-wheeling device, that would be called an overrunning clutch. We do need a clutch if we are to have a manual transmission. I will try to explain how they work and why you may or may not choose a car that needs a clutch.

A clutch system consists of several components. The first component is the actuating mechanism that can be a series of levers or could be a cable or hydraulic. All are operated by the left pedal in a 3-pedal system found in US autos. Most Saabs have had hydraulic actuated clutches with the exception of the NG900s that used a cable, the Saxomat in the Saab 93s and Sensonic of the early 90s in Europe.

The mechanical parts of the clutch are the throw-out bearing, pressure plate, clutch disc and flywheel. Starting at the flywheel we have the component that is bolted to the engine crankshaft. Whenever the engine is running or turning, the flywheel is rotating. The flywheel has a gear around the outside edge that is used by the starter to start the engine and through the middle is a machined surface that the clutch disc will ride against. The flywheel is engineered, balanced and sized for each type and family of engines and should be different for higher horsepower and torque applications.

The second part is the clutch disc or plate. The Classic 900 Shop Manual describes it this way, “A spring-loaded, steel plate secured to a hub that slides on the clutch shaft (input shaft of the transmission). The hub is equipped with a damper mechanism. A friction lining is riveted to each side of the clutch plate.”

The friction lining could be described like the material on brake shoes or pads. The lining is engineered to slip without burning or chattering as it is applied. The lining is the obvious wearing part of the clutch. Each time it is used, a little is worn away. Depending upon driving habits, a clutch may last 30 or 40K to over 300K or more in the right circumstances. For example, we had a customer (pizza delivery company) who barely got 30K out of a clutch and set of brakes in their Saab 99. By the same token, we have a 1999 9/5 customer who got just under 300K on his car's clutch.

There are a variety of things available to enhance the performance of a clutch. The question is, “Why would I need it?” The answer would be; 1) for longevity--like for the pizza delivering folks. 2) for trailer towing or 3) for performance enhancement. All the tuners, I am sure, have upgraded clutches in their cars.

An example of a natural upgrade was in the Classic 900s. It was common practice to replace the non-turbo clutches with a turbo clutch. The turbo clutch didn't change the drivability of the car. It lasted longer and the parts were interchangeable. No modifications were needed to install them.

The Classic 900 Service Manual describes the pressure plate unit: “consists of the pressure plate, diaphragm-type spring, and sheet steel housing. The diaphragm spring serves as a lever and a spring.”

The pressure plate is bolted to the flywheel with a clutch disc sandwiched in between. The pressure plate is engineered with the disc so that when the clutch is released, (your foot is off the pedal), the pressure plate spring clamps the disc so tightly against the flywheel that it does not slip under engine power or deceleration. This is a “tall order” but that is the task that it must perform—day in and day out—regardless of the load or performance of the engine.

The throw-out bearing runs very close to the spring/lever of the pressure plate so when you step on the clutch pedal, the throw-out bearing pushes the spring to release the pressure so that the disc slips. The hydraulic actuated system is self adjusting. With the pedal fully depressed, the disc turns freely with the transmission shaft while the pressure plate and flywheel (being bolted together) are turning at engine speed. As the pedal is released, the pressure plate begins to apply spring pressure on the disc that slides against the flywheel surface. Your skill and coordination determine how smooth the application is AND how much or how long the slippage lasts. The only time the clutch can wear is when there is not enough pressure on the disc so that it slips. A clean, smooth acceleration in each gear and removal of your foot between shifts from the clutch pedal and at all other times, will give a full and happy life to the clutch.



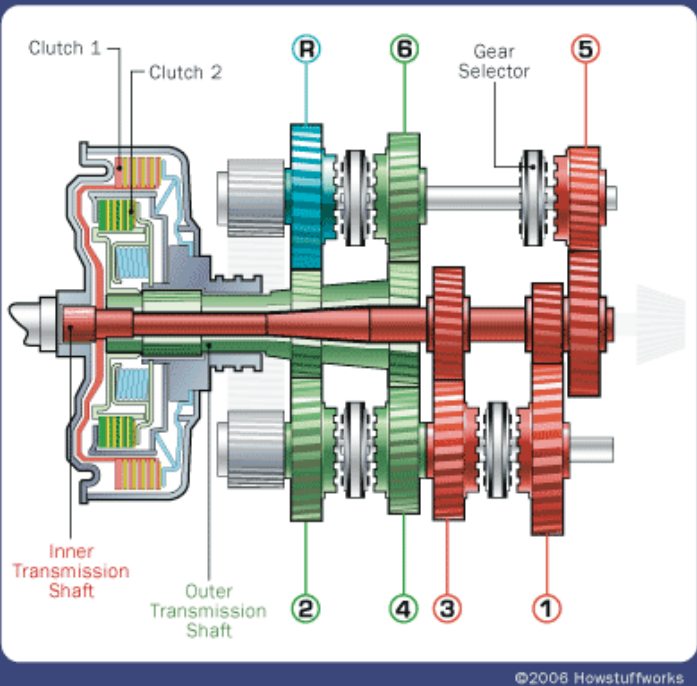
On the left is the 4 cylinder Aero Sport Sedan flywheel, center is 1964 3 cylinder flywheel and on the right is a C900 that has been resurfaced so it is ready to re install. You can easily make the size comparison based on engine size, horsepower and torque.

After-market performance clutches have become a major industry. An example from just one company called “Clutch Masters” is as follows: They list their clutches like this.

FX100, Street system with 70% increase in holding capacity. It has slightly increased pedal pressure, longer life than stock and normal clutch feel with smooth operation.

How Dual-Clutch Transmissions Work

6-Speed Basic Design



A dual-clutch gearbox, by contrast, uses two clutches but has no clutch pedal. Sophisticated electronics and hydraulics control the clutches, just as they do in a standard automatic transmission. In a DCT, however, the clutches operate independently. One clutch controls the odd gears (first, third, fifth and reverse), while the other controls the even gears (second, fourth and sixth). Using this arrangement, gears can be changed without interrupting the power flow from the engine to the transmission. This is a manual geared transmission. You could call it a semi-automatic. These transmissions have all the advantages of a manual including up to 15% better fuel mileage without a clutch pedal!

FX200, Steel -backed Kevlar friction system that has 2-3 times the life expectancy, etc.

FX300, Kevlar segmented steel-backed system that has 110 % increase in holding capacity and extra long life. For use with performance enhanced engines like Plus 100 HP with N02.

FX500, Ceramic sintered, iron system. 200-400 % more holding capacity. For race use only. This unit has a solid hub disc with no cushion springs. It engages and disengages instantly!

FX850, This option is a twin-disc clutch—that means it has two friction plates that can be of differing friction materials and it has additional two steel plates floating between. These are made for 600-1200 HP.

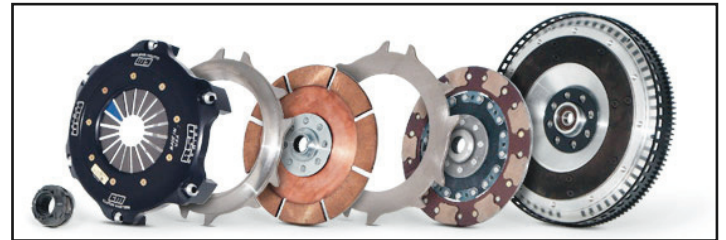
For complete descriptions see www.clutchmasters.com

There are other options out there, but I think you get the picture. Even though most of the clutches listed above are not made specifically for Saab, there ARE competition clutches made just for our Saab cars.

We all make a choice when we purchase a car whether it will be a manual or automatic transmission. Have you considered the reasons you might choose one or the other? Have you looked at the EPA fuel mileage numbers to see which transmission gets

the better fuel mileage? You will find, depending on the year and model of Saab, that the fuel mileage is virtually the same. (We are talking about newer cars.) If the fuel mileage (the reason most people choose a manual) is the same, and you have researched your purchase, there must be another reason to buy a manual.

The most likely reason I can think of is that **YOU LIKE TO SHIFT!!!** In older Saabs, like the 99s and Classic 900s, the clutch was replaceable without removing the transmission and was quite affordable. However, with the advent of computer-controlled engines, even clutches have become more costly. Even if we decided that each car would only need one clutch replacement in its entire life, how much more would you be willing to spend for the privilege of shifting? A Classic 900 clutch job costs a few hundred dollars as opposed to a 9/3 Aero 4 cylinder Sport Sedan with a 6-speed at maybe \$2500. But why so much? As a clutch disc wears out, they slip. After a shift is completed, the RPM may surge up alerting the driver to a problem. When the clutch starts to slip on the newer computer-controlled car, the engine computer retards the power until the clutch stops slipping. This adjustment is so subtle that most owners don't recognize that there is a problem. After a period of time with this situation, the flywheel surface becomes damaged as well as the other clutch components and usually a new flywheel is in order. In addition to the replacement cost of the clutch, the flywheel cost is over \$900. The Classic 900 flywheels were able to be re-machined so they could be re-used. However, with the newer computer-driven cars, this is not the case. Replacement is necessary. In our description, we are only talking about clutch costs and not any transmission repairs. Most manual transmissions, on average, require one rebuild within its life-time. (Cost=??).



This is known as a twin clutch because it has two clutch discs but much different than the dual clutch transmission. All graphics provided by the author.

Our experience has shown that most people don't spend money on repairs to their vehicle's automatic transmission. Since the NG900 days the automatics have been very, very good. We would like to see more preventative maintenance, but to most Americans, "if it ain't broke -- don't fix it!" My 2001 9/5 Aero has an automatic transmission with over 130K. No maintenance has been done except for a fluid flush. We'll see how that works out by the end of the car's life.

Another alternative that may become available in Saab some day is the dual-clutch transmission (DCT). It is available in a few makes, at this point in time. These units offer up to 15% better fuel mileage and allow you to shift without a clutch pedal. (See additional picture)

Let me dream for a minute. As I am writing this, the media is full of news that Koenigsegg is the leading buyer for Saab. I was thinking how exciting it would be to see the new Saab 9/5 with the variable compression 4 cylinder, supercharged engine and a 6-speed DCT behind it. Better fuel economy, lower emissions, and gobs of horse power! Cool!

For 35 years, Chuck has owned and operated a sales, service, auto body and parts facility specializing in Saabs. 