

## **EVA "CLUTCHLESS DESIGN"**

*Electric Vehicles of America, Inc. (EVA) provides a "Clutchless Design". Our design eliminates the flywheel and the pressure plate, weighing approximately 30 lbs, which are required for an internal combustion vehicle, but not for an Electric Vehicle (EV). Think about it. The EV motor does not rotate when the vehicle stops; the internal combustion engine did rotate. Why keep the extra parts?*

*EVA has used a clutchless design since 1987 and it works successfully. With more than 24 years experience, our customers have 1,000,000 miles using the clutchless design. One customer had more than 50,000 miles on his EV. So simply consider the facts - lighter weight, more efficient.*

*Our design could be called a "clutch pedal-less design". We eliminate the need for clutch pedal but not the clutch disk. The clutchless design is a direct connection between the motor and the transmission. We mount your clutch disk on an aluminum coupling; therefore it matches the input shaft of your transmission and the springs in the clutch disk absorb the initial shock from the motor. Very simple; very unique - just like an EV.*

*The clutch disk (provided by the customer) is critical. And we use the existing clutch disk to connect the motor output shaft to the input shaft of the transmission.*

### **Advantages**

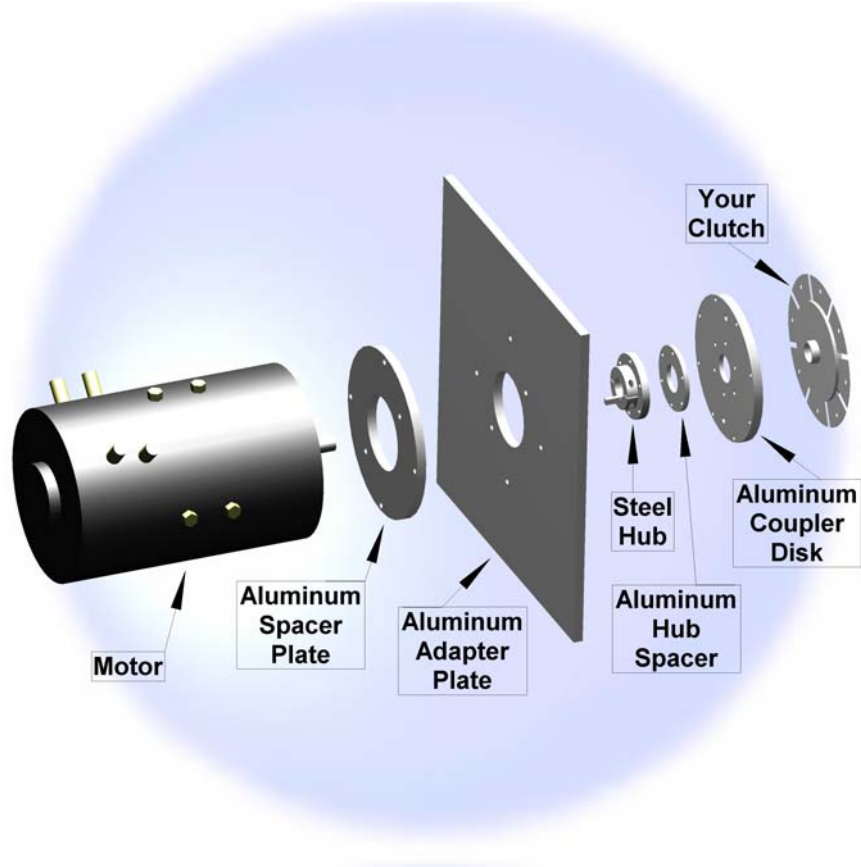
*The advantages of the clutchless design are:*

*1. **More efficient design!** One racing customer stated that for every 7 lbs in rotational weight is equivalent to 100 lbs of vehicle weight. So by eliminating the flywheel and pressure plate (~30lbs); it could be the equivalent to removing 400 lbs of vehicle weight. That makes the clutchless design about 10% more efficient in rolling resistance! The same goes with aluminum wheels vs steel wheels; less rotational weight - less energy required.*

*2. **It allows the conversion** of vehicles for which a clutch design is not available or affordable. A manual transmission is recommended because it allows you to operate the motor at higher rpms but you do not have to add a clutch pedal assembly. This makes it easier to convert vehicles that have an automatic transmission to a manual transmission.*

*3. **It eliminates the potential of overspeeding the motor** with different EV Users. If new drivers step on the accelerator and rev the motor before popping the clutch, there is the possibility of overspeeding the motor. This is a concern here in New England because of the hills. With the clutch pedal-less design, you simply put the transmission in gear and step on the accelerator. This helps many high school drivers who may not have experience with driving with a clutch.*

4. **The design is simple.** We need only three dimensions and the clutch disk and we can make the adapter plate and coupling.



**Figure 1 – Exploded view of Clutchless Design**

5. **It allows the conversion of vehicles that once were automatics** without having to install the hydraulics etc. We have converted existing S10s for the U.S. Air Force; they were automatics. We just replaced the automatic transmission with a manual transmission and used our design. We did not have to install a clutch pedal and all of the other hydraulics. This allows greater flexibility when looking for a potential EV. The manual transmission is only \$150.-\$300

6. **Shifting is accomplished because of the minimal inertia of the motor** (no flywheel or pressure plate) and the synchromesh.

## Disadvantages

The disadvantage of the clutch pedal-less design are:

**1. It takes a little longer (1-2 seconds) to shift.** You cannot speed shift. However, an EV may drive in 2nd gear in town and 3rd gear on the highway. An S10 can be driven in 2nd gear from 0 -45 mph. So you don't need to shift very often. With your car standing still and engine off. Shift gears without pressing the clutch pedal. Notice how you can go from one gear to the next without using the clutch. Why? Because there is no inertia. It is the same way with the electric motor, there is no huge mass of inertia. That is how the clutchless design works.

**2. Downshifting takes 1-2 seconds longer** because the speeds have to match. I usually downshift only at a stop sign coming off a highway. Remember you shift an EV very infrequently. Usually only 2nd and 3rd gear are used.

The synchros in the transmission make it smooth. Some people have suggested that the synchros wear out quickly, but some of our clutchless customers have more than 30,000 miles total on their vehicles. .

Once we asked someone on the West Coast (1) why they thought a clutch was required and (2) how that myth got started. He stated that a clutch was required on the old voltage switching and resistance controllers in order to allow one to park without banging the others cars. This problem was solved with PWM controllers.

Our S-15 truck used a clutchless design and aluminum wheels - it has great range because we eliminated about 70 lbs in rotational weight. Using the rule of thumb above - this represents about 1000 lbs of vehicle weight. WOW! That is about a 20 % decrease in rolling resistance - better than low rolling resistance tires!

As always, we just want to give the facts.

**Bob Batson P.E.**  
[Engineering@EVAmerica.com](mailto:Engineering@EVAmerica.com)  
[www.EVAmerica.com](http://www.EVAmerica.com)

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***"Meeting the needs of Electric Transportation"***

Electric Vehicles of America, Inc. (EVA)  
Tel# 603-569-2100  
Fax# 603-569-2115  
615 Center Street P.O. Box 2037  
Wolfeboro, NH 03894-4223