EV PRIMER
BASIC INFORMATION
(Range, Speeds, Terrain)

With gasoline approaching $3/gal, we have been swamped with Catalog requests, calculations, and more. So we want to provide basic information to help you determine if an EV can meet your requirements.

Basic rules of thumb for conversions are:

Horsepower

1. *Electric motors are rated at their point of maximum efficiency; they may be capable of 2-4 times their continuous rating but only for a few minutes (acceleration or hill climbing). Internal combustion engines are rated at the peak hp. For example, the FB1-4001A motor is rated as 30 hp continuous at 144V and 100 hp peak. The 5 minute rating of the FB1-4001A motor is 48 hp at 144V.*

2. *6-8 hp is required for each 1000 lbs of vehicle weight after conversion. This is the continuous rating of the motor. So a 3000 lb conversion requires a motor that is rated at approximately 20 hp. More hp is required for higher speeds, heavier vehicles, and steeper terrains.*

3. *The available horsepower of a motor increases with voltage; for example, the FB1-4001A motor is rated at 18 hp continuous at 72V but is rated at 30 hp continuous at 144V. As the voltage is increased the rpm increases. Hp is a function of rpm x torque.*

4. *Although electric motors are rated as "continuous", the motor can run at less hp. If only 10 hp is required for the speed then the motor runs at that reduced load. This is the function of the motor controller.*

5. *Operating continuously above the rated hp will eventually overheat and damage the motor. A motor that is rated at 150 amps can run at 300 amps for a short time (minutes), but longer periods can easily damage the motor. Do not buy an undersize motor for your vehicle for your application – it will not last long. Current is what overheats components.*

6. *Highway speeds require greater hp. The hp required at 70 mph is 4 times the hp required at 35 mph. That means the current required is 4 times also; which means less range.*

Batteries (lead Acid)

1. *It takes 15-20 lbs of lead to get 1 mile in range. So if you want to do 40 miles, it will probably require 800 lbs of batteries.*

2. *Approximately 1/3 of the converted weight should be batteries.*

3. *Batteries weigh approximately 60- 75 lbs each. You can have a 12V, 8V, or 6V battery pack. It is all about space. You may only have space for 15 batteries.*

4. *Batteries are approximately 7 inches wide x 11 inches long x 12 inches high. See www.Trojanbattery.com for actual dimensions.*

5. *Most on-road EVs use battery packs equal to or greater than 96V to get reasonable performance.*

6. *Increasing the voltage decreases the current (amperage) for the same hp. In addition, batteries have more capacity at lower amperages.*

7. *Cranking amps is a meaningless number for EVs. EVs use deep cycle batteries; the most important number is the number of minutes the battery can discharge 75 amps continuously. The 30XHS (12V) is rated at 57 minutes at 75 amps output; the T-145 (6V) is rated at 145 minutes at 75 amps output. Almost three times as much energy when you have the same pack voltage.*

8. *There is much press about Lithium Ion and Nickel Metal Hydride batteries. These batteries cost 10-20 times the cost of lead acid batteries. This high cost makes them unaffordable for most individuals; consequently, we do not sell them. If you want information on them, please contact the manufacturers.*

Batteries (Lithium Ion & NiMH)

1. These batteries are not in production yet; therefore, the cost is high. A typical lithium battery pack is approximately $20,000+. A NiMH pack is Higher. This changes the economic advantages of EVs significantly.

Controllers

1. *The most popular Curtis controllers are the 1221C-7401 (72-120V 400A) and the 1231C-8601 (96-144V 500A). The 1231 can provide 50% more peak hp.*

2. *Basically, there are no DC regen controllers.*

Transmissions

1. Automatic transmissions are not typically used in EVs. The problems is that they shift to the next gear at approximately 2000 -2500 rpm. The electric motor is typically most efficient at 4000 - 5500 rpm. If the motor operates at 2000 rpm, it is very inefficient (60%). So it generates a lot of heat(40%). At lower rpm, the internal fan of the motor is not capable of removing the excess heat than that is generated.

Cost

1. *Higher voltages (more hp) cost more money. A 96V system is approximately $4000-$4500. A 144V system is approximately $5500- $6000. Neither price includes batteries. Batteries are typically $100- $150 each.*

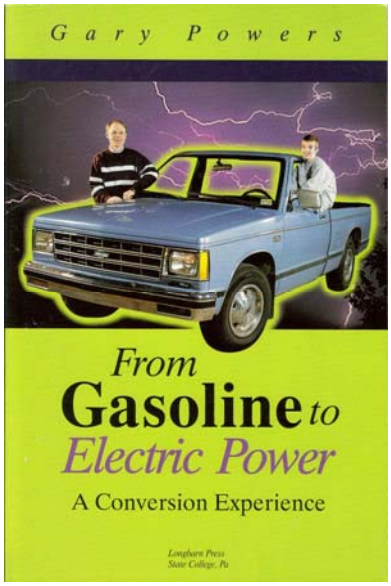
2. *AC systems operate at higher voltages (180-300V) and typically cost 2-3 times the cost of a DC system. Very little difference (~10%) in efficiency. The major benefit is regen - if you have hills.*

EV conversion of cars are acceptable for commutes of less than 40 miles because they requires 800 lbs of batteries. The question then is ***"Does your vehicle have the space and payload***

capacity to locate those batteries?" *Basically you want a car that weighs less than 2600 lbs before conversion. So mid-size and large vehicles will yield less than acceptable performance.*

Light-weight trucks (S-10, Ranger, etc) have a greater payload capacity and more space, so they can accommodate 1200-1400 lbs of batteries. Therefore, they have a greater range. Large trucks, SUVs, and 4WDs are <u>not</u> good candidates for EVs because 30 hp continuous 100 hp peak cannot match the 300 hp engines typically required.

For specific information on doing a conversion, you can buy-----



114 Pages with 24 Pictures

Only $10 with Free Shipping in U.S.A. - Just call

Available only thru EVA !

We design systems to meet your specific requirements (vehicle, range, speed, terrain, etc.) Why buy more than you need? Why buy a system that won't meet your requirements?

We design systems for different applications (industrial vehicles, stage productions, parade vehicles, electric boats, tuk-tuks in Thailand, electric cars, electric trucks, and more). We recently designed and provided components for a 150 Ton rail vehicle that moved ingots of steel. ***Yes 150 Tons****!* ***Engineered systems*** *- is what we do!*

As you start to look at Electric as an alternative - the most basic questions are ***"What components do I need?*** *and* ***"How much do they cost?'***

<u>A 144V System Cost Breakdown</u>

This is just one system – one of the more expensive systems because it provides greater acceleration. We provide this system to assist you in understanding typical components and their

cost. We break down each system to its components so that the customer can understand exactly what is required. If you do not understand a component, feel free to ask about its function and why we think it is important.

The FB1 motor and the 1231 controller have been the most popular EV components for conversions. They are reasonable cost, good reliability, excellent performance. These components can drive a car to 70 mph!

144V SYSTEM FOR CARS

ELECTRIC VEHICLES OF AMERICA, INC.
11 EAGLE TRACE P.O. BOX 2037
WOLFEBORO, NH 03894
(603) 569-2100
FAX (603) 569-2900
EVAmerica@aol.com

144 V SYSTEM - CAR PACKAGE
USING 12V BATTERIES

QTY	DESCRIPTION	UNIT PRICE	TOTAL PRICE
	DRIVE SYSTEM		
1	FB1-4001A Advanced DC Motor	$1,475.00	$1,475.00
	with dual shaft		
1	1231C-8601 Curtis Controller	$1,495.00	$1,495.00
	(96-144 V) 500 Amp Limit		
1	Aluminum Plate/ heat sink compound/12v fan	$50.00	$50.00
1	PB-6 Curtis Potbox	$90.00	$90.00
2	Albright Contactors SW-200	$150.00	$300.00
1	Adaptor Plate with Spacers (2)	$400.00	$400.00
	Manual Transmission - Clutchless		
1	Motor Coupling (Stainless Steel)	$325.00	$325.00
	Manual Transmission - Clutchless		
	BATTERY SYSTEM		
1	Zivan NG3 Charger 2800 watts	$980.00	$980.00
	230VAC input 144VDC output		
24	Battery Terminal Protective Covers	$1.50	$36.00
	(Red & Black)		
1	2/0 Cable package - 25 ft Black, 25 ft Red,	$300.00	$300.00
	Heavy Duty Lugs (40). Heat Shrink (5 ft)		
	INSTRUMENTATION		
1	60-160 V Voltmeter	$65.00	$65.00
1	0-400 Amp Ammeter	$65.00	$65.00
1	50 mV Shunt	$30.00	$30.00
	POWER BRAKES		
1	Vacuum Pump (12V)	$225.00	$225.00
1	Vacuum Switch	$135.00	$135.00
1	In-line Fuseholders	$5.00	$5.00
	SAFETY		
1	Littelfuse L25S-400	$55.00	$55.00
1	Littelfuse holder	$25.00	$25.00
1	Pair Anderson connectors SBX-350	$64.00	$64.00
1	Fuseholder (4) - Control Board	$15.00	$15.00
1	First Inertia Switch - Auto Shutoff (12V Sys)	$45.00	$45.00
	of Power System upon Impact		
	TECHNICAL ASSISTANCE		
A/R	EVA calculations		N/C
1	Safety First" Technical paper		N/C
1	Safety First" Video		N/C
1	EVA Installation Manual		N/C
	Includes schematics, drawings, etc.		
1	S-10 Conversion Video		N/C
A/R	On-Line Assistance @ EVAmerica@aol.com		N/C
	1 year Subscription to EVAmerica		NC

	SUBTOTAL		**$6,180.00**
	EVAmerica Coupons - Package		($120.00)

	TOTAL (Shipping - not included)		**$6,060.00**
	New Hampshire has no Sales Tax!		
	This saves people in some states - hundreds of dollars!		

Options Include:

	OPTIONAL EV COMPONENTS		
	TO REPLACE OR SUPPLEMENT ABOVE		
	DRIVE SYSTEM		
1	203-06-4001A Advanced Dc Motor	$1,275.00	$1,275.00
	with dual shaft		
1	Motor Mount Assembly (RWD)	$170.00	$170.00
	BATTERY SYSTEM		
12	Trojan T-875 Battery (8V)	$108.00	$1,296.00
	INSTRUMENTATION		
1	0-500A Ammeter	$65.00	$65.00
	POWER BRAKES		
1	Vacuum Gauge (Initial Set-up)	$15.00	$15.00
	SAFETY		
1	Zivan DC-DC Converter	$500.00	$500.00
	144 VDC Input 14VDC Output		
	Recommended for headlights, etc.		
1	Pair Anderson connectors SB-50	$20.00	$20.00
1	Pair Anderson connectors SB-50	$20.00	$20.00
14	Ft - 1 1/2 inch clear vinyl hose	$1.50	$21.00
	for 2/0 cable protection		
10	Insulated Metal Clamps for Vinyl Hose	$1.00	$10.00

The above quotation is provided to help you identify the components <u>required</u> for a complete installation. Naturally, some items can be postponed or deleted based on your specific application.

<u>Lower Cost Systems</u>

For people looking to decrease the cost even further, look at the Optional 203-06-4001A motor and Curtis 1221C-7401 Controller. These options can save you almost $700! And will work well with most cars; trucks do require the FB1 motor for the additional torque.

For people looking for an in-town commuter, we have a package for $3000 using a smaller motor, lower voltage, less batteries. Lower cost - Less performance. But still an EV capable of 45 mph!

<u>EVA Advantage</u>

We will be glad to provide engineering calculations based on your vehicle in order to help you select the best components for your application (range, speed, terrain, etc).

*One major advantage of buying from EVA is our **<u>Installation Manual and Videos</u>**. The Installation manual is a 1 inch note book describing the installation of each component, schematics, manufacturers drawings, and more. The DVD includes a 10 minute "Safety First" video and a 50 minute S-10 conversion video. This information is not sold but is available for a $300 deposit toward the system. The deposit is non-refundable. So this is for the individual who is committed to do an EV conversion.*

Do not hesitate to email EVAmerica@aol.com or call us at (603) 569-2100, if you have any questions.

Bob Batson
Registered Professional Engineer
EVAmerica@aol.com
www.EV-America.com
****

"Meeting the needs of Electric Transportation"

Electric Vehicles of America, Inc. (EVA)
Tel# 603-569-2100
Fax# 603-569-2900
P.O. Box 2037
Wolfeboro, NH 03894-4223
****

"Why buy a component when you can buy a system?"

That is the advantage of an EVA Drive System Package. "
****

Authorized Dealer for Advanced DC Motors,
Curtis and Alltrax Controllers,
Albright Contactors,
Zivan Chargers,
and other EV component manufacturers.
Free catalog.
Industrial motors and controllers
Components for Electric cars, trucks,
motorcycles, boats, and more.
****

EVA - " Customer Service is No. 1! "

EV Primer - 144V System

Spring 2007