

## Level 1 Charging

Level 1 equipment provides charging through a 120 volt (V), alternating-current (AC) plug and requires a dedicated circuit. Generally speaking, Level 1 charging refers to the use of a standard household outlet.

Level 1 charging equipment is standard on vehicles and therefore is portable and does not require the installation of charging equipment. On one end of the provided cord is a standard, three-prong household plug. On the other end is a connector, which plugs into the vehicle.

Depending on the battery technology used in the vehicle, Level 1 charging generally takes 8 to 12 hours to completely charge a fully depleted battery. The most common place for Level 1 charging is at the vehicle owner's home and is typically conducted overnight. The biggest advantage to Level 1 is that you can find service almost anywhere in the US and since the charging current is about the same as a standard blow dryer, it won't put too much of a burden on your existing electrical service. Obviously, the biggest disadvantage is the length of time it takes to recharge a vehicle.



Level	Input Voltage VAC	Input Current Amps	Input Power kW	Phase	Standard Outlet
1	120	$\leq 16$	$\leq 2$	single	NEMA 5-15R, Standard 110v outlet in US



## Cost Range

\$0 (free with all current PEVs) to \$950 (non-commercial units)



## Level 2 Charging

Level 2 equipment offers charging through a 240V, AC plug and requires installation of home charging or public charging equipment. These units require a dedicated 40 amp circuit.

Level 2 charging equipment is compatible with all electric vehicles and plug-in electric hybrid vehicles. Level 2 chargers have a cord that plugs directly into the vehicle in the same connector location used for Level 1 equipment.

Depending on the battery technology used in the vehicle, Level 2 charging generally takes 4 to 6 hours to completely charge a fully depleted battery. Level 2 chargers are commonly found in residential settings, public parking areas, places of employment and commercial settings. The disadvantage of charging something faster is managing the heat that is produced in the battery through the charging process. Although today's EVs are built to manage this heat (using liquid cooling/fans), heat typically shortens battery life.



Level	Input Voltage VAC	Input Current Amps	Input Power kW	Phase	Standard Outlet
2	208 / 240	$\leq 80$	$\leq 20$	single	SAE J1772/3



## Cost Range

\$495 to \$2,200 (non-commercial units)

\$200 to \$500 labor, depending on complexity of installation



## DC Fast Charging - Level 2

DC Fast Charging equipment, charges through a 480V, direct-current (DC) plug. This option can charge a fully depleted battery up to 80% full in less than twenty minutes.

DC Fast Charging equipment is not compatible with all vehicles, and the charge itself is not accepted by all vehicles. There is currently no industry standard for this level of charging, however, DC Fast Chargers are being deployed across the United States in public or commercial settings. Only the Mitsubishi "i" and Nissan LEAF can accept a CHAdeMO DC Fast Charge, however, the Tesla Model S uses a unique DC Fast Charging system, available only to Tesla models.

Other vehicles, such as the Chevy Volt cannot accept this level of charge (the Chevy Spark EV and BMW i3 will use the DC Combo Fast Charging system in early 2014). Charge time depends on the battery type and chemistry, as charging this fast makes a HUGE amount heat that has to be disposed of quickly. DC Fast Charging is perfect for fleets, anyone traveling cross-country trips, and emergency charging in case of evacuation.



Level	Input Voltage VAC	Input Current Amps	Input Power kW	Phase	Standard Outlet
3	480	$\geq 125$	$\geq 50$	three	Direct Current charge in US/Japan. *

\* SAE DC Combo agreed upon Sep 2012. CHAdeMO is the Japanese standard supported by Nissan & Mitsubishi.

*DC Fast Charging Level 1 is under discussion at the SAE Standards group.*

*AC Level 3 and DC Level 3 Charging are still being researched and have not been defined, nor are there any available chargers in testing.*

## Making it Easy to Understand

- Level 1 - a 5/8 inch standard garden hose
- Level 2 - a 3/4 inch garden hose - not much bigger, but lots more flow
- DC Fast Charging - a 3 inch Fire Hose with a big red truck behind it!

## Cost Range

\$15,000+ (all are commercial units)

labor substantially higher than Level 2!

