



# City of Placentia – Development Services

## Electric Vehicle Charging System Guidelines for Residential Buildings

### ***What are the different types of Electric Vehicle (EV) Chargers?***

There are 2 basic types of EV chargers for home use: **Level 1 and Level 2.**

**Level 1 Chargers** are smaller units that plug directly into a standard 120 volt receptacle outlet. These chargers typically take longer to recharge the vehicle. If the receptacle outlet being used to plug-in the Level 1 Charger is existing, there is no requirement to secure a permit from the Building and Safety Division. If you will be installing a new 120 volt receptacle outlet for the charger, you will need to obtain a permit (you will not need to provide any plans or electrical load calculations).

**Level 2 Chargers** require a 240 volt electrical circuit and charges the vehicle battery much faster than a Level 1 Charger. Level 2 Charger installation requires an electrical permit and inspections of the installation. In order to obtain the permit you will need to provide some basic information to show that your existing electrical service can handle the added load.

### ***What information do I need to provide in order to obtain the permit?***

In most cases, you or your contractor simply need to fill in the blanks on this document, attach the manufacturer's installation instructions and charger specifications and submit it to the Building and Safety Division along with a permit application for review and permit issuance. Once the permit is issued, the installation may begin. When the installation is complete, an inspection of the work must be scheduled with the Building Inspector. Please note that someone will need to be present to allow the inspector access to the location of the electrical meter and the EV charger.

### ***Installing a Level 2 EV charging system***

This will often require changes to the building's electrical wiring. Before installing the EV charging equipment and the associated wiring, contact your EV manufacturer for the electrical requirements for the unit to be installed in your home. When installing your EV charger, be sure to use an Electrical Contractor (C-10 classification) with a current state license and insurance. The contractor should follow the installation instructions for the EV charger manufacturer and the requirements of the California Electrical Code.

### ***Why is Southern California Edison (SCE) concerned about your EV charger location?***

Though an individual Level 2 EV charger may have a negligible impact on the utility electric system, the combined effect of several chargers in the same neighborhood could result in overloads on the utility secondary wires and transformers. It is important that SCE be notified of any Level 2 charger installations to ensure that utility electrical system components are adequately sized to maintain high levels of service reliability.

## LEVEL 2 ELECTRIC VEHICLE CHARGER – SERVICE LOAD CALCULATION

**INSTRUCTIONS:** Review the list of electrical loads in the table below and check all that exist in your home (including the proposed Level 2 charger). For each item checked, fill in the corresponding “Watts Used.” Add up all the numbers in the “Watts Used” column and write that number in the “Total General Load” box. Next, proceed to complete the calculation as instructed to obtain the “TOTAL SERVICE LOAD.” Go to the page 3 to determine if your existing electric service will accommodate the new loads.\*\*

*\*Use name plate rating in watts or calculate as (Ampere rating of circuit x 240 volts = watts)*

*\*\* (Loads shown are rough estimates; actual loads may vary; for a more precise analysis, use the nameplate ratings for appliances and other loads and consult with a trained electrical professional.)*

Check All Applicable Loads	Description of Load	Typical Usage	Watts Used
<b>GENERAL LIGHTING AND RECPTACLE OUTLET CIRCUITS</b>			
✓	Multiply the sq.ft. of the house x 3	3 watts/sq.ft.	
<b>KITCHEN CIRCUITS</b>			
✓	Kitchen Circuits	3,000 watts	3,000
	Electric Oven	2,000 watts	
	Electric Stove Top	5,000 watts	
	Microwave	1,500 watts	
	Garbage Disposal Under Kitchen Sink	1,000 watts	
	Automatic Dishwasher	3,500 watts	
	Garbage Compactor	1,000 watts	
	Instantaneous Hot Water at Sink	1,500 watts	
<b>LAUNDRY CIRCUIT</b>			
✓	Laundry Circuit	1,500 watts	1,500
	Electric Clothes Dryer	4,500 watts	
<b>HEATING AND AIR CONDITIONING CIRCUITS</b>			
	Central Heating (gas) and Cooling (A/C)	6,000 watts	
	Window Mounted A/C	1,000 Watts	
	Whole-house or Attic Fan	500 watts	
	Central Electric Furnace	8,000 watts	
	Evaporative Cooler	500 watts	
<b>OTHER ELECTRICAL LOADS</b>			
	Electric Water Heater (Storage Type)	4,000 watts	
	Electric Tankless Water Heater	4,000 watts	
	Swimming Pool or Spa	4,000 watts	
	Other:	_____ watts	
	Other:	_____ watts	
<b>ELECTRIC VEHICLE CHARGER CIRCUIT</b>			
	Level 2 EV Charger Wattage Rating*		
<b>(Add up all of the watts for the loads you have checked ✓) Total General Load →</b>			
<b>First 10,000 Watts of Total General Load at 100%</b>			10,000
<b>Remainder of Total General Load at 40%</b>			
<b>(Add first 10,000 Watts to remainder of Total General Load at 40%) TOTAL SERVICE LOAD</b>			

**Table based on CEC 220.83 (A), 230.42, and Annex D.**

✓ Check the appropriate line	Total Watts Used (from previous page)	Minimum Required Size of Existing Service Panel (Main Service Breaker Size)	Identify the Size of the Existing Main Service Breaker (Amps) <sup>†</sup>
	Up to 24,000	100 amps	
	24,001 to 30,000	125 amps	
	30,001 to 36,000	150 amps	
	36,001 to 48,000	200 amps	
	48,001 to 54,000	225 amps	

<sup>†</sup>Please note that the size of your **existing** electrical service **MUST** be equal or larger than the Minimum Required Size or a new, larger electrical service panel will need to be installed in order to satisfy the electrical load demand of the EV charger.

**Is a larger electrical service panel required? No**  **Yes**  **Size (amps)**

### CONDUIT AND WIRE SIZES AND TYPES

This table illustrates the type and size of wire and conduit to be used for various Electric Charger circuits.

Size of EV Charger Circuit Breaker	Required Minimum Size of the Conductors (THHN Wire)	Conduit Type and Size <sup>‡</sup>		
		Electrical Metallic Tubing (EMT)	Rigid Nonmetallic Conduit Schedule 40 (RNC)	Flexible Metal Conduit (FMC)
20 amp	#12	1/2"	1/2"	1/2"
30 amp	#10	1/2"	1/2"	1/2"
40 amp	#8	1/2"	1/2"	1/2"
50 amp	#6	3/4"	3/4"	3/4"
60 amp	#6	3/4"	3/4"	3/4"
70 amp	#4	3/4"	3/4"	3/4"

<sup>‡</sup>Based on 4 wires in the conduit (2-current carrying conductors, 1-grounded conductor/1-equipment ground (not needed if using EMT), 1-neutral)).

As an alternate, Nonmetal Sheathed Cable (aka: Romex Cable or NMC) may be used if it is protected from physical damage by placing the cable inside a wall cavity or attic space which is separated from the occupied space by drywall or plywood.

The table below illustrates the required supports for various types of electrical conduit or cable.

Conduit Support	Electrical Metallic Tubing (EMT)	Rigid Nonmetallic Conduit Schedule 40 (RNC)	Flexible Metal Conduit (FMC)	Nonmetallic Sheathed Cable (NMC)
Conduit Support Intervals	10'	3'	4-1/2'	4-1/2'
Maximum Distance from Box to Conduit Support	3'	3'	1'	1'

In addition to the above noted requirements, the California Electrical Code contains many other provisions that may be applicable to the installation of a new electrical circuit. Installers are cautioned to be aware of all applicable requirements before beginning the installation.

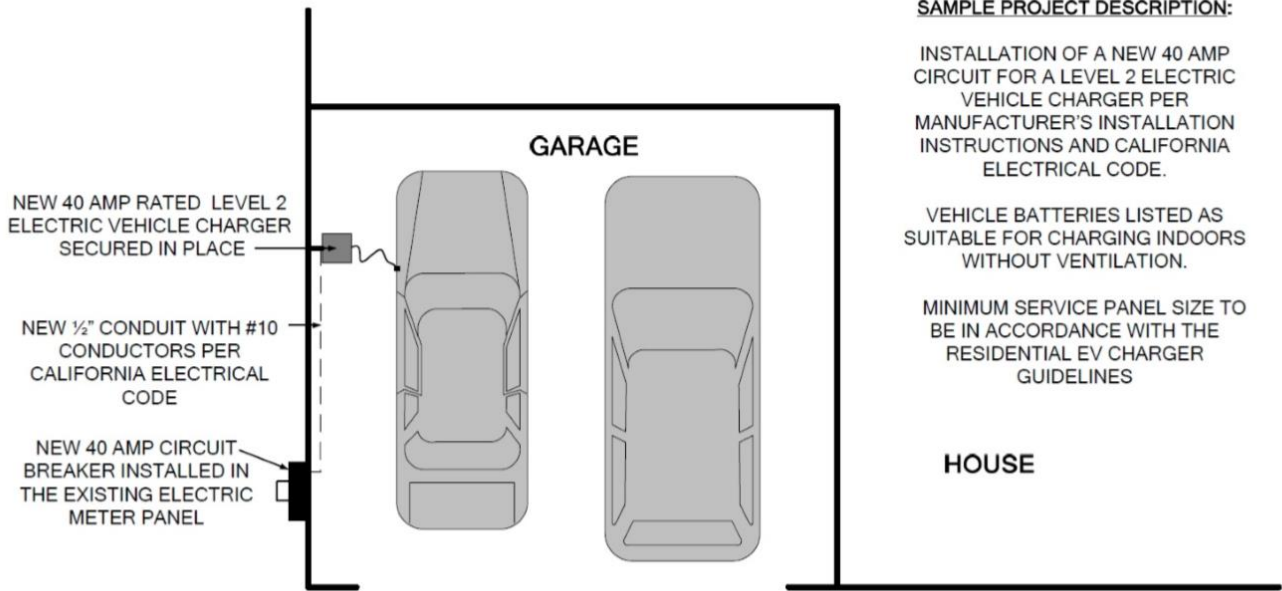
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**GENERAL INSTALLATION GUIDELINES FOR LEVEL 2 RESIDENTIAL EV CHARGERS**

- 1. GENERAL REQUIREMENTS** - All Electrical Vehicle Charging Systems shall comply with the applicable sections of the California Electrical Code, including Article 625.
- 2. EQUIPMENT HEIGHT** – The coupling means of the Electric Vehicle Supply Equipment shall be stored at a height of 18 – 48 inches above the finished floor (CEC Art. 625.29 (B)).
- 3. LISTED EQUIPMENT** – All Electric Vehicle Supply Equipment shall be listed by a national recognized testing laboratory.
- 4. FASTENED IN PLACE** – Level 2 Electric Vehicle Supply Equipment must be permanently connected and fastened in place in accordance with the manufacturer’s installation instructions (CEC Art. 625.13).
- 5. PROTECTION FROM PHYSICAL DAMAGE** – Electrical Vehicle Supply Equipment shall be protected against vehicle impact damage when located in the path of a vehicle. In order to avoid the installation of a substantial pipe bollard as an equipment guard, locate the Electrical Vehicle Supply Equipment on a garage side wall, out of vehicular path. See sample drawing on next page. (CEC Art. 110.27 (B)).
- 6. IF MORE THAN 60 AMPS** – When EV charging equipment is rated at more than 60 amps, the disconnect means shall be provided and installed in a readily accessible location and shall be capable of being locked on the open position (CEC Art. 625.23).

For additional information on preparing your home for electric vehicle charging, refer to Southern California Edison’s **“THE ELECTRICIANS GUIDE: Installing Electric Vehicle Charging Stations at Single-Family Homes”**

**SAMPLE ELECTRICAL PLAN FOR LEVEL 2 ELECTRIC VEHICLE CHARGER CIRCUIT INSTALLATION**



**SAMPLE PROJECT DESCRIPTION:**

INSTALLATION OF A NEW 40 AMP CIRCUIT FOR A LEVEL 2 ELECTRIC VEHICLE CHARGER PER MANUFACTURER'S INSTALLATION INSTRUCTIONS AND CALIFORNIA ELECTRICAL CODE.

VEHICLE BATTERIES LISTED AS SUITABLE FOR CHARGING INDOORS WITHOUT VENTILATION.

MINIMUM SERVICE PANEL SIZE TO BE IN ACCORDANCE WITH THE RESIDENTIAL EV CHARGER GUIDELINES