### COMMON ELECTRICAL DISTRIBUTION SYSTEMS

#### 120/240 Volt Single Phase Three Wire System



t . Line one ungrounded conductor colored Black.

+ · Line two ungrounded conductor colored Red.

\*\* Grounded neutral conductor colored White or Gray.

### 120/240 Volt Three Phase Four Wire System (Delta High Leg)



- + A phase ungrounded conductor colored Black.
- †\* B phase ungrounded conductor colored Orange or tagged (High Leg). (Caution - 208V Orange to White)
- t . C phase ungrounded conductor colored Red.
- \*\* Grounded conductor colored White or Gray. (Center tap)

\*\* Grounded conductors are required to be white or gray or three white stripes. See NEC 200.6A.
\* B phase of high leg delta must be Orange or tagged.

+ Ungrounded conductor colors may be other than shown; see local ordinances or specifications.





# How electrical service effects cost

- <u>https://www.peninsulacleanenergy.com/wp-content/uploads/2020/08/PCE\_SCVE-EV-Infrastructure-Cost-Analysis-Report-2019.11.05.pdf</u>
- In the chart in the "Secondary Transformers (customer-owned)" section.
  - So, in that chart, the blue cost is the effect of J1772 level 2 not supporting 277VAC
  - "In particular, attention should be paid to the 300kV load point, which may cause considerable cost escalation as the electrical service would switch from 208V/120V to 480V/277V."
  - Many commercial / urban sites will pay about 50% more for the an AC EVSE without 277VAC

# Typical commercial site with mixed DC and J1772 Level 2 AC charging



\*some DC charging stations support 208/120V but \*typically\* at <=50kW

# Typical communication site with mixed DC and NACS AC Charging



# Why secondary transformers matter \$\$\$

- Dropping the voltage (277VAC -> 208VAC)
  - Increased current 33% for same power
  - Larger conduit
  - Larger wires
- Need a secondary panel board
- Additional grounding requirements
- Because of the additional transformer & panel space
  - Affects the ability to fit charging stations for street parking

## NACS AC Voltage Input support

Specifications

The maximum power rating for the Wall Connector is 20 kW or 80A at 250V AC single-phase power. Your vehicle can charge from 200V to 277V single-phase power.

Description	Specifications
Voltage and Wiring	277V AC single-phase: L1, neutral, and earth
	208V or 240V AC single-phase: L1, L2, and earth
Current	Maximum output: 80A, 72A, 64A, 56A, 48A, 40A, 36A, 32A, 28A, 24A, 20A, 16A, 12A
Frequency	50 to 60 Hz
Cable Length	8.5' (2.6 m) and 24' (7.4 m)
Wall Connector Dimensions	Height: 15.0" (380 mm)
	Width: 6.3" (160 mm)
	Depth: 5.5" (140 mm)
Top Entry Bracket Dimensions	Height: 10.8" (275 mm)
	Width: 15.1 " (130 mm)
	Depth: 2.0" (50 mm)
Weight (including bracket)	20 lb (9 kg)
Operating Temperature	-22°C to 122°C (-30°C to 50°C)
Storage Temperature	-40°F to 185°F (-40°C to 85°C)
Enclosure Rating	Type 3R
Agency Approvals	cULus listed for United States and Canada under file number E354307, FCC Part 15.

Except from Tesla wall box (80A model) Gen2

https://www.tesla.com/sites/default/files/pdf s/wall-connector-eu/tesla-80a-wallconnector-installation-manua-en-v1.pdf



# NACS AC Voltage Input support



**ProMountDuo™ PEDESTAL INSTALLATION GUIDE** 

## **INSTALLATION REQUIREMENTS AND CONFIGURATIONS** (continued)

**CONFIGURATION F:** Required Equipment for a Single-Mount Pedestal with one TESLA<sup>®</sup> EVSE (One EVSE per Pedestal):

- One (1) ClipperCreek ProMountDuo<sup>™</sup> Kit, ClipperCreek part number 0300-00-025.
- One (1) TESLA<sup>®</sup> EVSE, TESLA<sup>®</sup> part number 1050067-01-E.
- One (1) dedicated 208, 240 or 277 V AC branch circuit.\*
- One (1) circuit breaker appropriately sized for the EVSE charging capacity.\*
- Two (2) Live Line conductors that are appropriately sized based on the EVSE power requirements (5 feet of length is adequate).



**CONFIGURATION F** 

Except from Clipper Creek Manual

https://www.clippercreek.com/wp-content/uploads/2018/03/PMD-10T-Installation-Guide\_Version-11\_20171122\_Final.pdf

## NACS AC Voltage Input support

- Since the Model S was released 277VAC support has been there
- This is a good thing ---- this removes the requirement of intermediate customer-owned transformers because many (most) large commercial sites get 480/277Y from the utility this is a cost reduction for AC charging buildout
  - Decrease transformer losses by 2-4% by eliminating secondary transformers at commercial sites
  - 25% increase in power for the same amperage rating over typical 208VAC
  - Decrease I^2R losses for same power level
- Some Telsa Wall boxes (Gen3) don't support 277VAC, but that is specific that product and it's listing
- Lack of 277VAC support is a <u>Disadvantage</u> for J1772