

Chargers and Charging Process

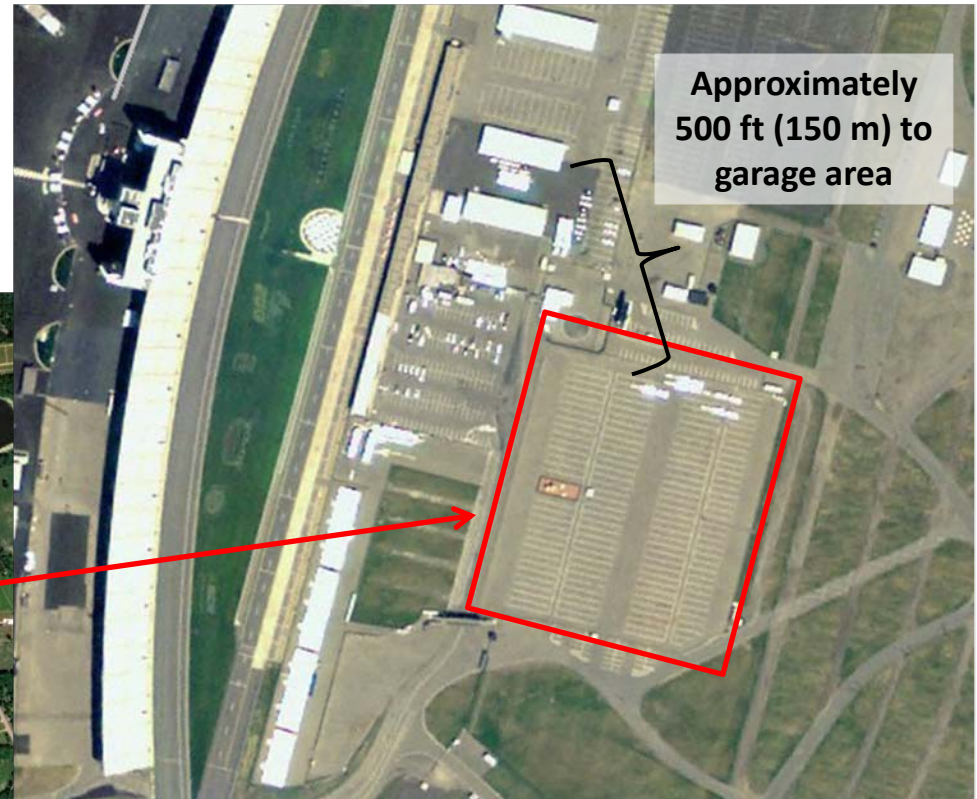
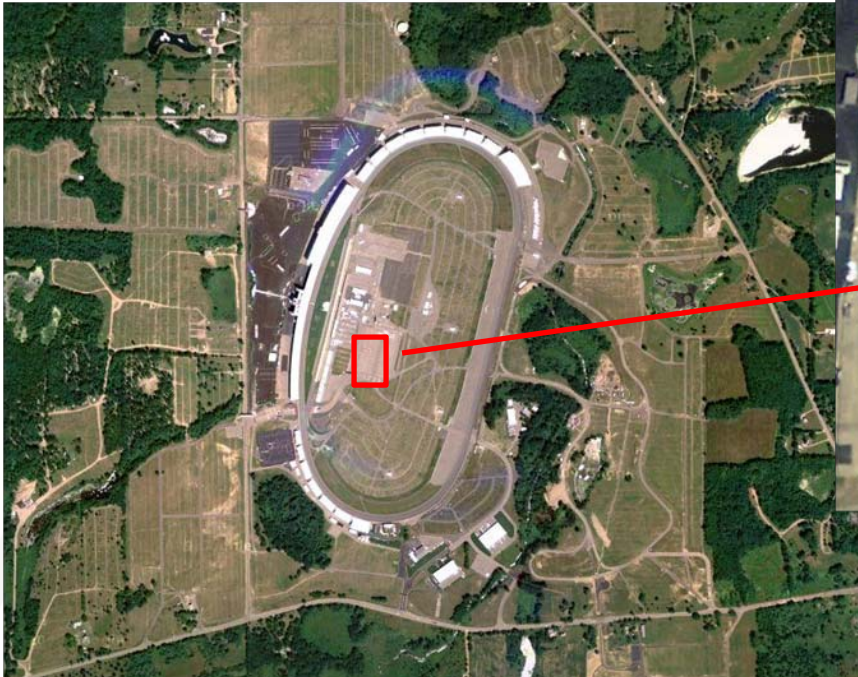
Jody J. Nelson, Sr. Advisor, Energy Storage Technologies

Overview

- Identify the charging area and capabilities
- Change in charger connector specification
- Competition ac outlet configuration
- Event rules for chargers
- Required charger specifications

MIS Charging Area

Location of the charging area will be in the RV park section of the inner track area



Approximately
500 ft (150 m) to
garage area

MIS Charging Area



MIS has the facility to provide 128 RV electrical outlets with sufficient spacing between adjacent electrical outlets



RV Outlets



Two single phase receptacles are available at MIS:

1. Standard 120 V, 60 Hz outlet
 - 15 A continuous
2. NEMA 14-50R
 - 40 A continuous
 - 240 V
 - 3Pole, 4Wire
 - Straight blade
 - Self-grounding

NEMA 14-50 Plug Requirement

Old Requirement:

~~All PIAXP vehicles that need to charge from the electrical grid must use a SAE J1772-compatible charging cord and vehicle receptacle, either Level 1 or Level 2. No charging can take place above J1772 Level 2 rates.~~

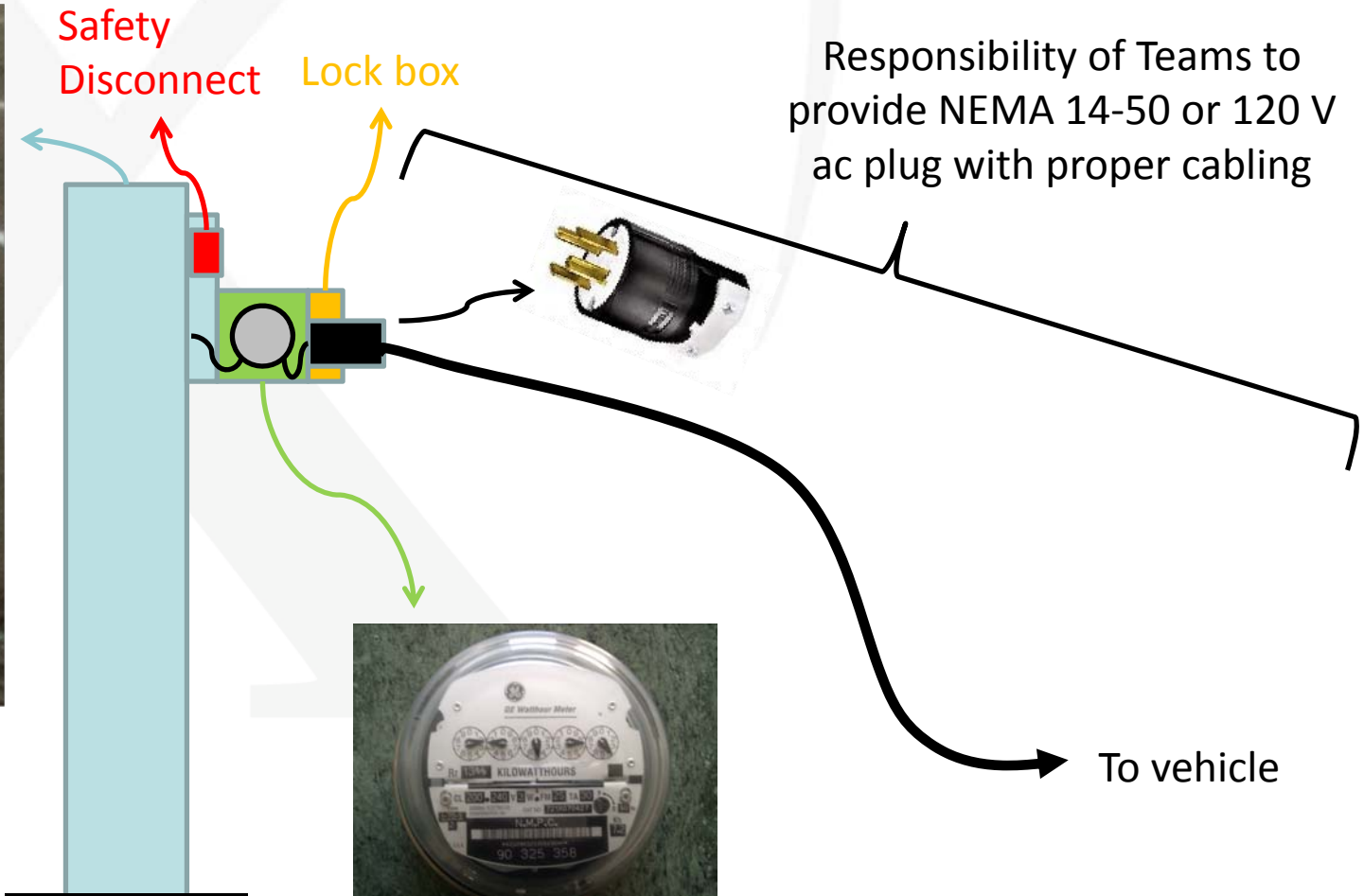
New Requirement:

Teams will no longer be required to meet SAE J1772. However, Teams will be required to provide their own charger with a **NEMA 14-50 plug or standard 120 V, 60 Hz, 15 A plug**. Input voltage and current for the NEMA 14-50 plug will be limited to 240 VAC and 40A continuous.

Competition Configuration



RV Outlet



Safety
Disconnect

Lock box

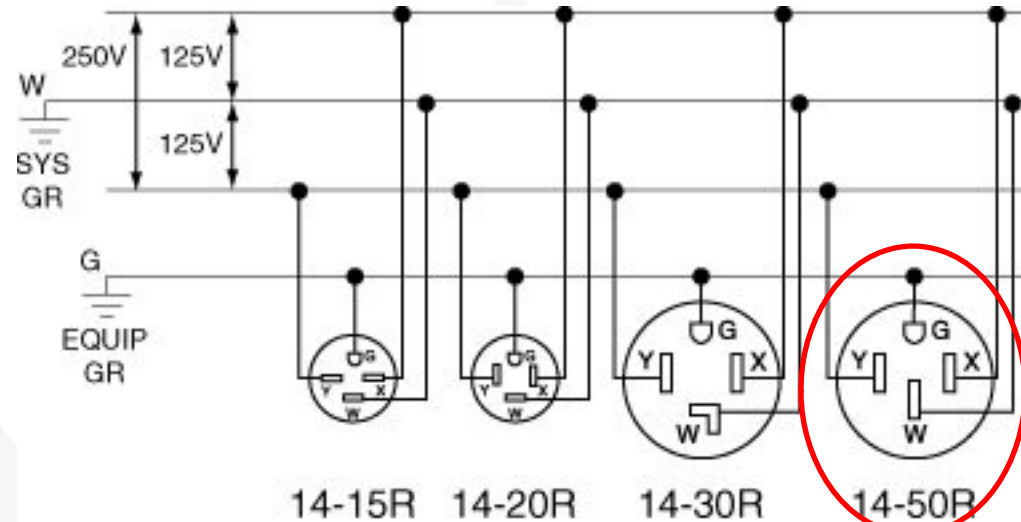
Responsibility of Teams to
provide NEMA 14-50 or 120 V
ac plug with proper cabling



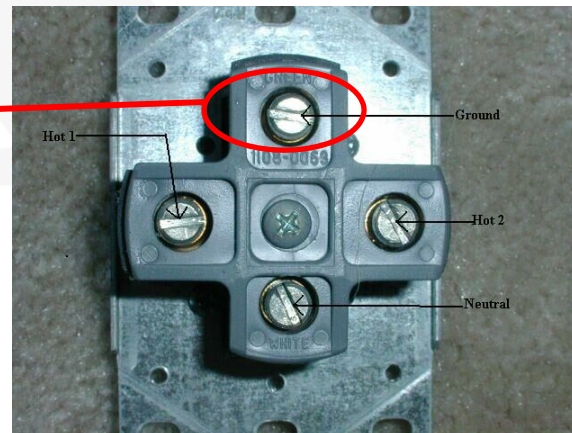
Watt-hour meter

To vehicle

NEMA 14-50 Receptacle



Must be connected to vehicle chassis



Event Charging Rules

- All charging for competition events shall be done at the specific charging area during designated times
- Charging shall be limited to 240 V ac, 40 A continuous for a maximum of 10-12 hours; consider we have limited time for charging
- No work can be done on any competing vehicle while it is charging
- All charging energy will be measured and will be attributed to each vehicle's energy consumption for an event stage — the only exception will be during the Shakedown event

Event Charging Rules, continued

- No opportunity charging from the grid or other external sources will be allowed during race stages
- Teams are responsible that their charger works with meter and MIS equipment (circuit breaker/GFCI)
- The entire electrical propulsion system shall be completely isolated from the battery pack while charging from the grid (with the exception of the battery box ventilation system):
 - A separate charging switch may be used for this function, provided the voltage rating equals or exceeds that of the actual system
 - The Manual Isolation Switch may be used, provided it isolates the battery pack and charger from the rest of the system

Charger General Requirements

- Competition organizers reserve the right to disapprove the use of any charger if they believe it poses a safety risk
- Traction battery chargers shall be production units with proper certification
- The charger must be properly connected to earth ground and the vehicle chassis and have a ground-fault interrupter circuit (GFI)
- The charger shall be fused on supply circuits to the charger and the vehicle

Charger General Requirements, continued

- Charger, including cables, must be weatherproof; expect rainy conditions during the events
- The cable shall not exceed 25 feet in length, but long enough to properly connect to the ac source
- Cable must be appropriately sized to comprehend the full range of the electrical source – assume continuous current based on the peak rating

Charger General Requirements, continued

- Charger must be capable of safely charging unattended overnight
- When the batteries are fully charged, the charge current shall be automatically interrupted or reduced to a safe level
- For NiMH, Li and other advanced batteries, charging equipment must work with the BMS and monitor the voltage
- Chargers must have clearly labeled and accessible on/off switch and overnight Team contact info
- Total harmonic distortion (THD) shall be below 10%

Other Resources

For the US:

SAE J1772 – Electric Vehicle Conductive Charge Coupler

For Europe:

IEC 61851 – Electric vehicle conductive charging system

Summary

- Dedicated charging area – charging can only be performed there
- NEMA 14-50 and standard 120 V/15 A receptacle will be available at MIS for charging
- Charging is limited to 240 Vac, 40 A continuous
- Watt-hr meter will be used for judged events
- Charging system must have proper safety features to monitor battery during charging and to ensure safety at all times – competition organizers have the right to refuse a charger deemed unsafe