NISSAN GROUP
OF NORTH AMERICA

EVSE Evaluation
Non-Compliant Chargers

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Zero Emission Technology Development

March 20, 2019

Executive Summary

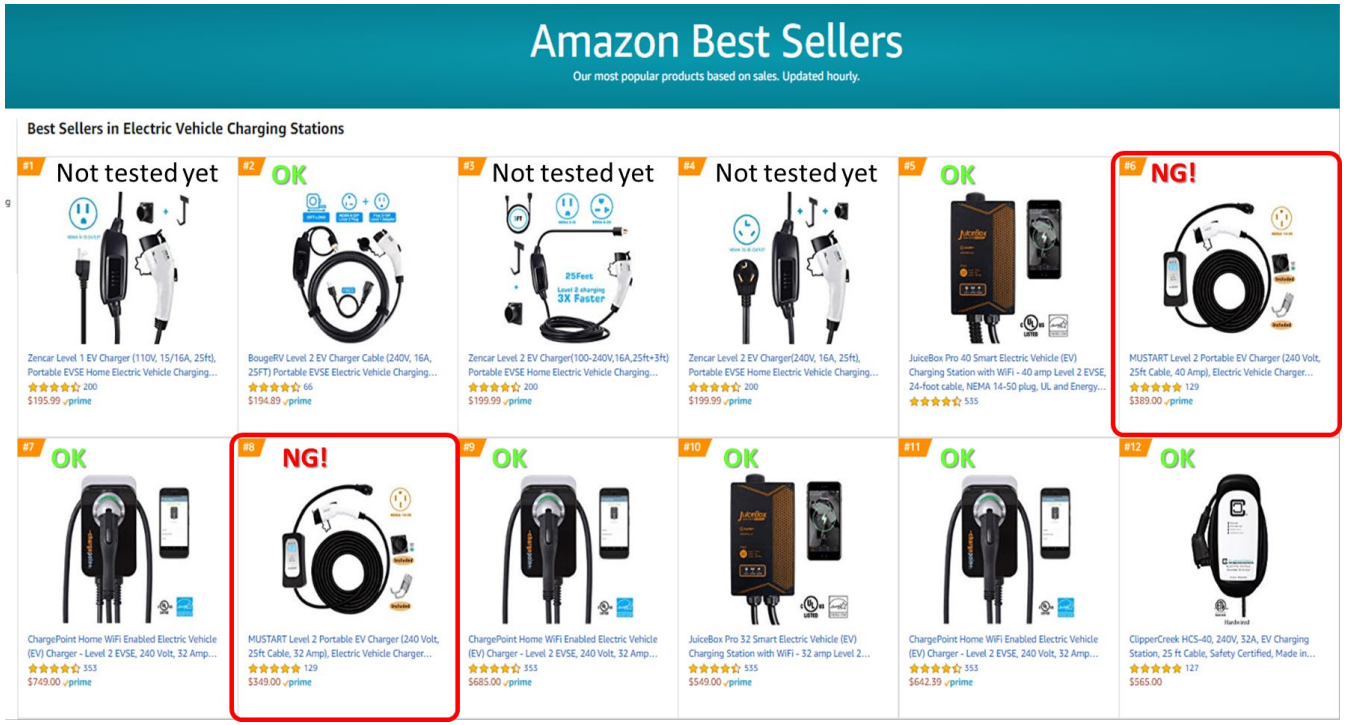
- **Background**
  - Charging infrastructure products are validated on a regular basis to ensure compatibility with Nissan charging platforms
  - Products with significant growth and popularity via online retailers are tested
  - Goal is to ensure safe, reliable operation for Nissan customers

- **Key Points**
  - Several EVSEs tested have been found to violate SAE J1772 & UL safety standards
  - One particular EVSE (MUSTART) has a "fake" CE (Europe) and TUV Rhineland test lab certification mark
  - Risk: customer exposure to high voltage and electric shock

- **Recommendations**
  - Work with industry partners to remove non-certified devices from the market
  - Bring awareness to retailers – should only sell products that are NRTL certified in North America.

Testing Methodology

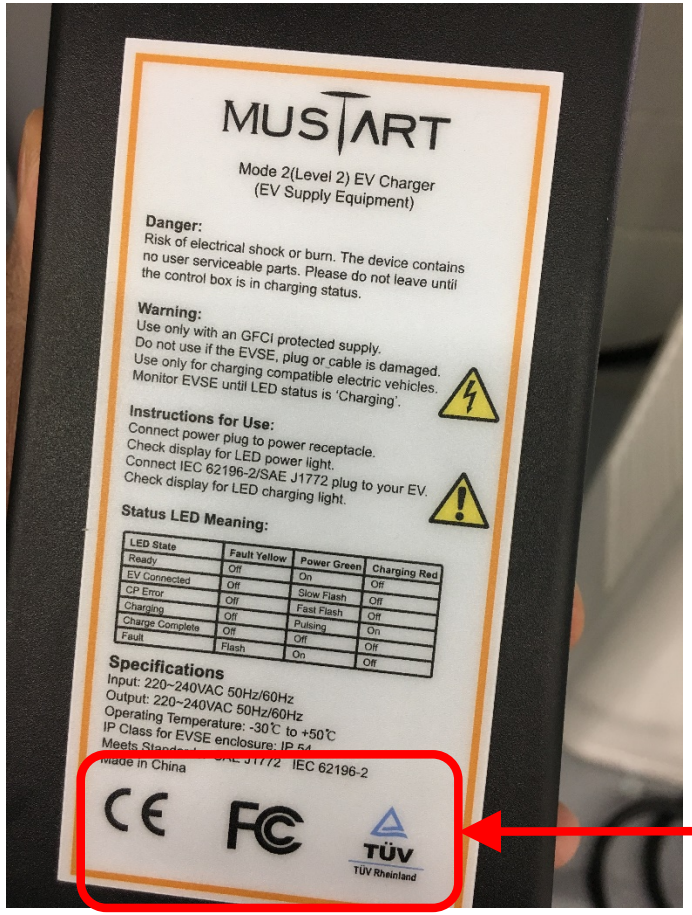
- Previously performed compliance testing on more than 30 L2 EVSEs sold at traditional retailers
- Expanded validation activity to include commonly purchased EVSE on Amazon
- MUSTART EVSE found to be non-compliant with **National Electric Code**



- **NG = Not UL compliant. Product does not have fundamental CCID function short to ground protection**
- **Electric shock risk if conductors are damaged or submerged in water.**
- **Believed to have "fake" CE (Europe) certification mark and "fake" TUV Rhineland mark**

MUSTART EVSE

- Product was found to be Non-Compliant with UL requirements
  - Device DOES NOT have CCID function **<u>at all</u>**.
- CE, TUV Rhineland, FCC marks appear to be fake.
  - TUV Rhineland & FCC have no record of testing this device.



Fake certification marks?

UL 2231-2 Test Method

UL2231-2: Expected Results and Test Setup

- Section 23: System Operational Test Requirements
  - ✓ 23.1.2 A CCID shall act to interrupt the circuit when the current reaches or exceeds the threshold current specified in 23.2 within the time specified in 23.3
  - ✓ 23.2 CCID5 threshold 4-6mA rms @60 Hz; CCID20 threshold 15-20mA rms @60 Hz
  - ✓ 23.3 For Current values of I that equal or exceed the maximum permitted trip threshold:*

    Where T is expressed in seconds and I is expressed in mA.

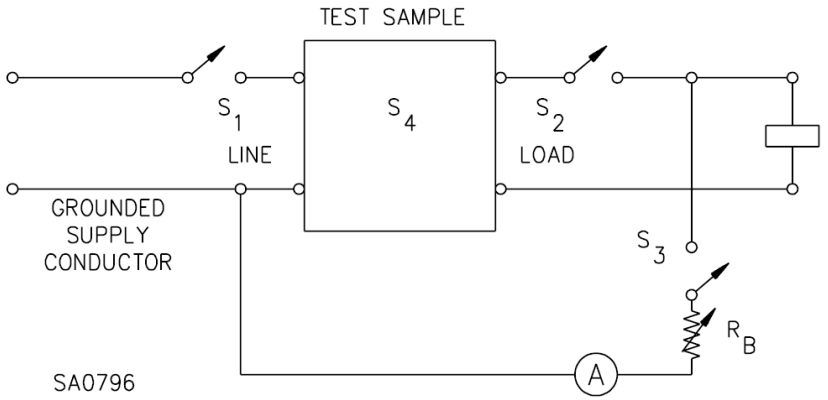
    $T = (20/I)^{(1.43)}$

    **T is not required to be less than 20ms*

- 23.4 High-resistance ground fault test

  To Determine compliance with provisions 23.1-23.3 a device intended for use on a ground system shall be connected as shown in Figure 10 and tested as described in 23.4.2-23.4.4 in the sequence described in Table 8

Figure 10
High-resistance ground-fault test circuit



The sum of R_B and the resistance of meter A shall not be less than 500 ohms

Table 7
Modes of operation

	Precondition of circuit[a]	Action that starts ground-fault current
A	Switch S1 closed Switch S2 closed Switch S3 closed Switch S4 open	Switch S4 shall be moved (1) in one continuous motion to its extreme position, and (2) to the position at which current just starts, and the operating handle held in that position.
B	Switch S1 open Switch S2 closed Switch S3 closed Switch S4 closed	Switch S1 shall be closed
C	Switch S1 closed Switch S2 open Switch S3 closed Switch S4 closed	Switch S2 shall be closed
D	Switch S1 closed Switch S2 closed Switch S3 open Switch S4 closed	Switch S3 shall be closed[b]

Test Method Used

Nissan Recommendation

- Strong recommendation that retailers such as Amazon **only** sell EVSE products that have NRTL listing

NRTL Listing is requirement of National Electric Code
NEC requires any charging station installed in US to be NRTL certified. Installing a non-certified device can be extremely costly and could force retailer into litigation.

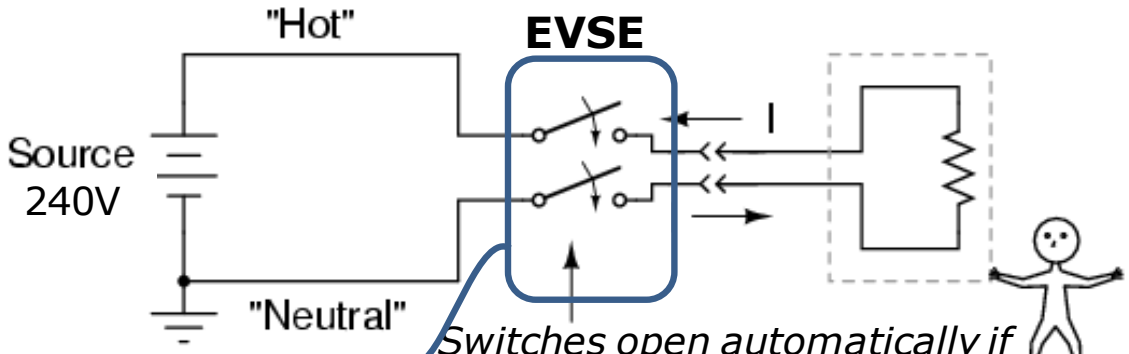
Electric Vehicle Safety is of utmost importance to Automakers
Critical to ensure the full system (EVSE & Vehicle) is compliant with all safety standards

Most consumers are not aware of these requirements
- Nearly impossible for customers to know which devices are safe
- Rely on reputable retailers to sell a product that is inherently safe
  - Most retailers (Home Depot, Lowe's) will not sell an electrical product without NRTL certification

Appendix

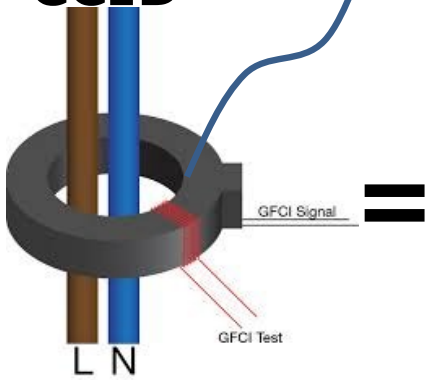
Further Details

- Safety is primary concern in development of Electric Vehicle Supply Equipment (EVSE)
- Key safety circuit is the Charge Circuit Interrupting Device (CCID)
  - CCID is a personnel protection system for EVSEs that reduce risk of electric shock
  - CCID is very similar to Ground Fault Interrupters (GFCI) found inside today's homes
- If CCID is missing or non-functional, no safety protection against electric shock is provided



Switches open automatically if the difference between the two currents is more than the CCID threshold (i.e., ~5mA or ~20 mA)

CCID



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Example: Nationally Recognized test lab marks

- Compliant to National Electric Code
- Thoroughly tested products to all safety standards
- Active governance to find "fakes"

Use Caution when purchasing with these marks: