

# **SAE Medium/Heavy Duty Task Force Update**

**Includes:**

**J3068 - Handheld 3-phase AC**

**J3105 - Overhead DC**

**Barber Motorsports Museum**

**Birmingham, Alabama 35094 USA**

**Rodney McGee**

**Chairman**

**SAE Medium/Heavy Duty Task Force**

**Tuesday, March 28, 2017 (Truck/Bus)**

**Wednesday/Thursday, March 29-30, 2017 (IWC)**

## Current Documents Under Development

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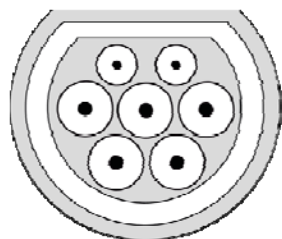
- **EV Power Transfer using Three-phase Capable Coupler (J3068)**
  - Three-phase AC for usage with on-board or integrated chargers
  - Co-leads Jim McLaughlin and Lennart Balgård
- **EV Power Transfer using Overhead Coupler (J3105)**
  - Overhead DC charging
  - Led by Mark Kosowski
- **Wireless charging**
  - Not in this SAE TEVHYB13 MD/HD Task Force
  - Covered by sub-group as part of J2954 effort
  - Aims for 250kW power level (vs 22kW)

## J3068 Overview

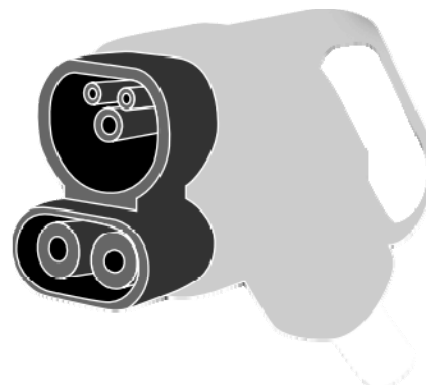
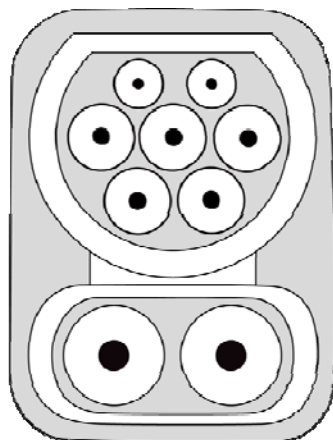
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- EVSE
  - Must be evaluated to UL-2594, UL-2231
- Cordset / Coupler
  - Must be evaluated to UL-2251
  - Directly refers to IEC mechanical drawings
    - AC --- 62196-2 Sheets 2-II f and 2-II e
    - AC+DC --- 62196-3 Sheet 3-IV a and 3-IV c
- Power levels and voltage
  - Voltages
    - USA 208/120Y & 480/277Y VAC
    - Canada 208/120Y & 600/347Y VAC
  - Power example
    - 16A 480VAC 3 $\phi$  = 11kW
    - 80A 480VAC 3 $\phi$  = 65kW
    - 160A 480VAC 3 $\phi$  = 133kW
    - 160A 600VAC 3 $\phi$  = 166kW

# SAE J3068



Inlet Configurations	Description	Utilizable Nominal Input Voltages
J3068 AC <sub>6</sub>	AC only	VAC <sub>nom</sub> 208/120Y, 480/277Y, 600/347Y
J3068 AC <sub>6</sub> /DC <sub>8</sub>	AC on 6mm pins DC on 8mm pins	VAC <sub>nom</sub> 208/120Y, 480/277Y, 600/347Y VDC 1000 max
J3068 DC <sub>8</sub>	DC on 8mm pins only	VDC 1000 max



Note: Other configurations are not currently discussed in the document

## J3068 News and Updates

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- Meetings and documents
  - Next meeting in early April
  - Expect a topic to follow mid-April
  - Move the document towards it's ballot this year
- Prototype demonstration project
  - Start planning for interoperability testing
  - Ensure availability of tested / listed components to build J3068 systems for North American market

# J3068 News and Updates



# Joining the Task Force (TEVHYB13)

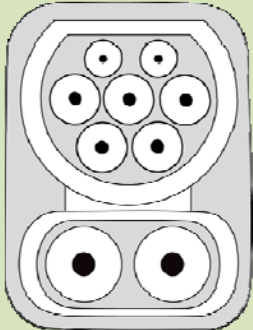


- **Two documents are being developed under the SAE Medium and Heavy Duty Vehicle Conductive Charging Task Force**
  - EV Power Transfer using Overhead Coupler (J3105)
  - EV Power Transfer using Three-phase Capable Coupler (J3068)
- **Download the form to join the task force**
  - <http://bit.ly/sae-join>
  - Return to SAE Staff:
    - Pat Ebejer pebejer@sae.org

## Questions?

# APTA load-out for handheld manual

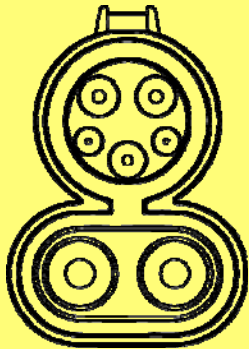
## Specified Default



SAE J3068 Combo Inlet

- ✓ Three-phase AC (using 6mm pins)
- ✓ Single-phase AC (including 277 VAC for example)
- ✓ DC charging using SAE 2847/2
- X Could limit usage of passenger car infrastructure

## Optional Alternative

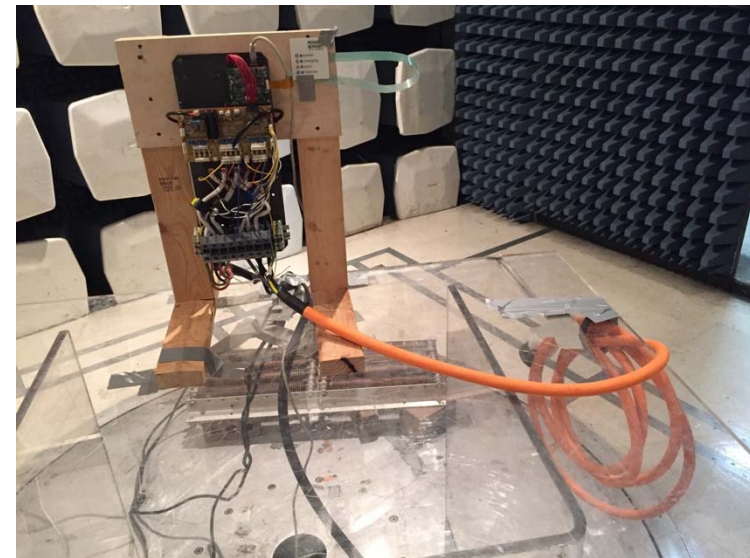


SAE J1772 Combo Inlet

- ✓ Single-phase AC (using 3.6mm pins)
- ✓ Offers direct reuse of passenger car EVSE
- ✓ DC charging using SAE 2847/2
- X Limited AC power; No three-phase; No mandatory AC lock

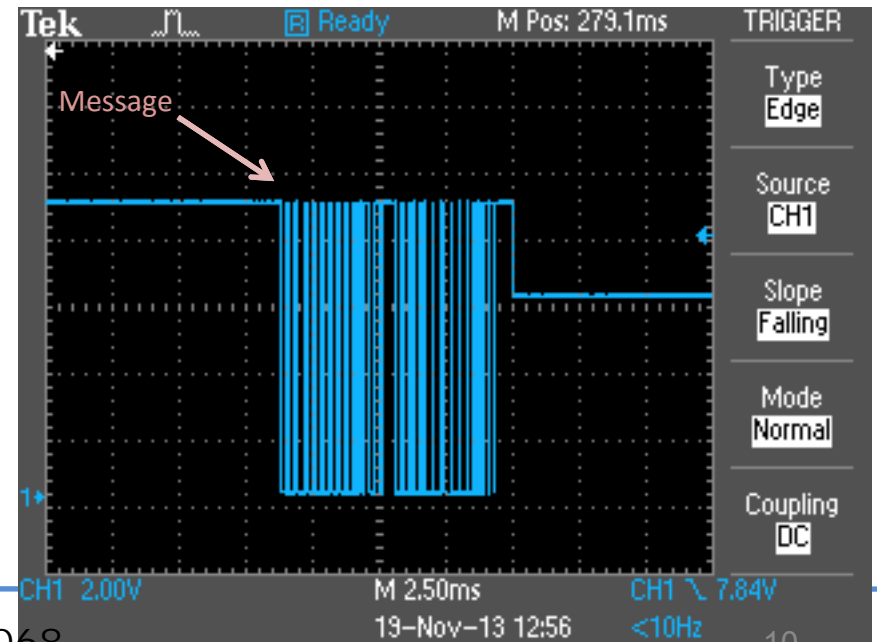
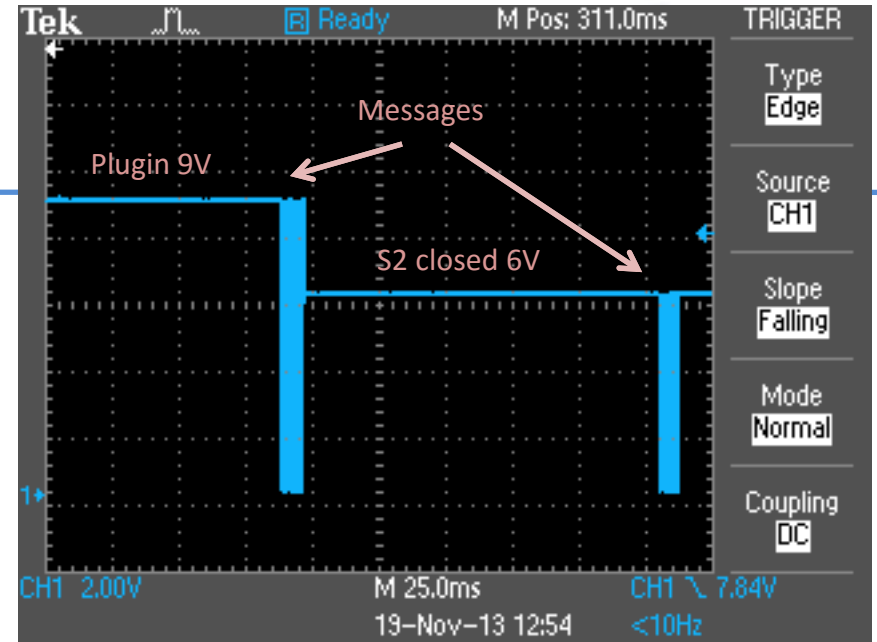
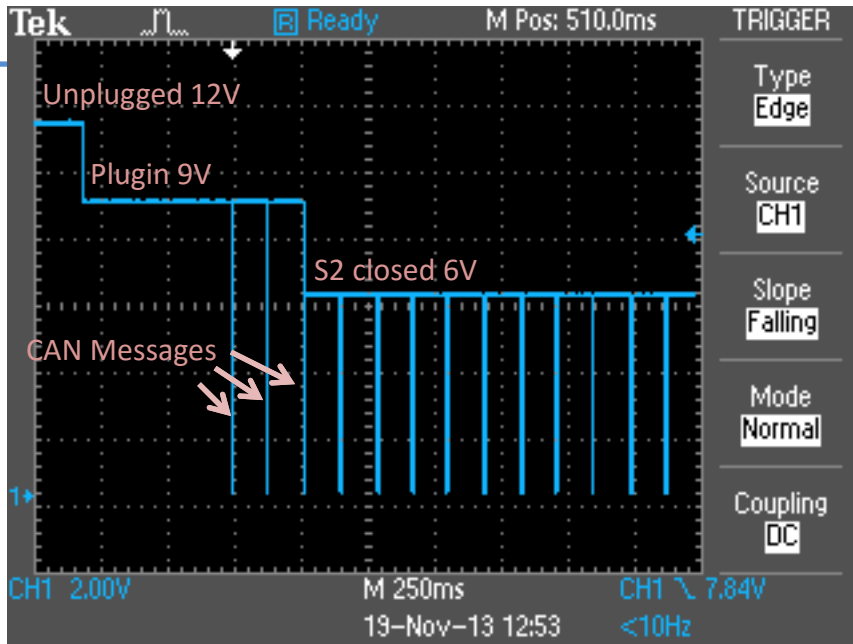


# J3068 at NREL



- Testing at NREL for J3068
- Energy Systems Integration Facility (ESIF) at the U.S. Department of Energy's National Renewable Energy Laboratory in Golden, CO
- Transpower school bus
- Type-2 three-phase AC inlet
- Integrated motor inverter/charger (EPC Power)
- Bus can charge/discharge into grid up to 70kW
- Test with AC EVSE shown on right (shown case-less during EMI testing)

# Digital CP Waveforms



- The bit width at 20Kbs is that same as the positive pulse width of a 5% duty cycle PWM
- Uses TI LIN 2.2 transceiver and any microcontroller with a serial UART paired
- EVSE uses same voltage sensing for safety features
- Functional over entire range of allowed capacitance and inductance for J1772 Control Pilot
- Reception of every message not required for correct operation; noise tolerant

## LIN over Control Pilot

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- Digital replacement for the PWM part of the control pilot
- Electrically compatible with PLC
- Keeping the same voltage levels (12V,9V,6V)
  - Verification of Equipment Grounding Continuity
  - Verification of Vehicle Connection
- Allows communication of basic supply parameters
  - Beyond the PWM 6A-80A supply limit
  - Supply voltage (208,240,480,600) {L1,L2,L3,N}
  - Supply current (0-250A)
- Standardized in IEC-61851-1 Edition 3 Annex D
- Extra hardware
  - Some passives
  - Extremely low-cost transceiver ~\$1

# Single-wire LIN/CAN Bus?

- SAE J2411(CAN variant) and LIN bus are single ended unshielded systems and good fits for use on the control pilot
- J2411 is used by Telsa for superchargers; but isn't ideal to implement ground verification required by UL-2594 (not 12/9/6V state compatible)
- LIN-CP as currently described in J3068 and does not push single-wire baseband technology past established typical operation

	SAE J2411 33.3+ kbit/s	LIN Bus 2.2 20 kbit/s	Control Pilot Environment
Max Capacitance	13700 pF	10000pF	5500pF
Max Nodes	~32	~64	2
Max Length	60m	40m	Typically < ~7.5m Could be longer
Net Resistance	270-4596 ohms	~1000ohms	733/469 ohms

# J3105 Approved Requirements



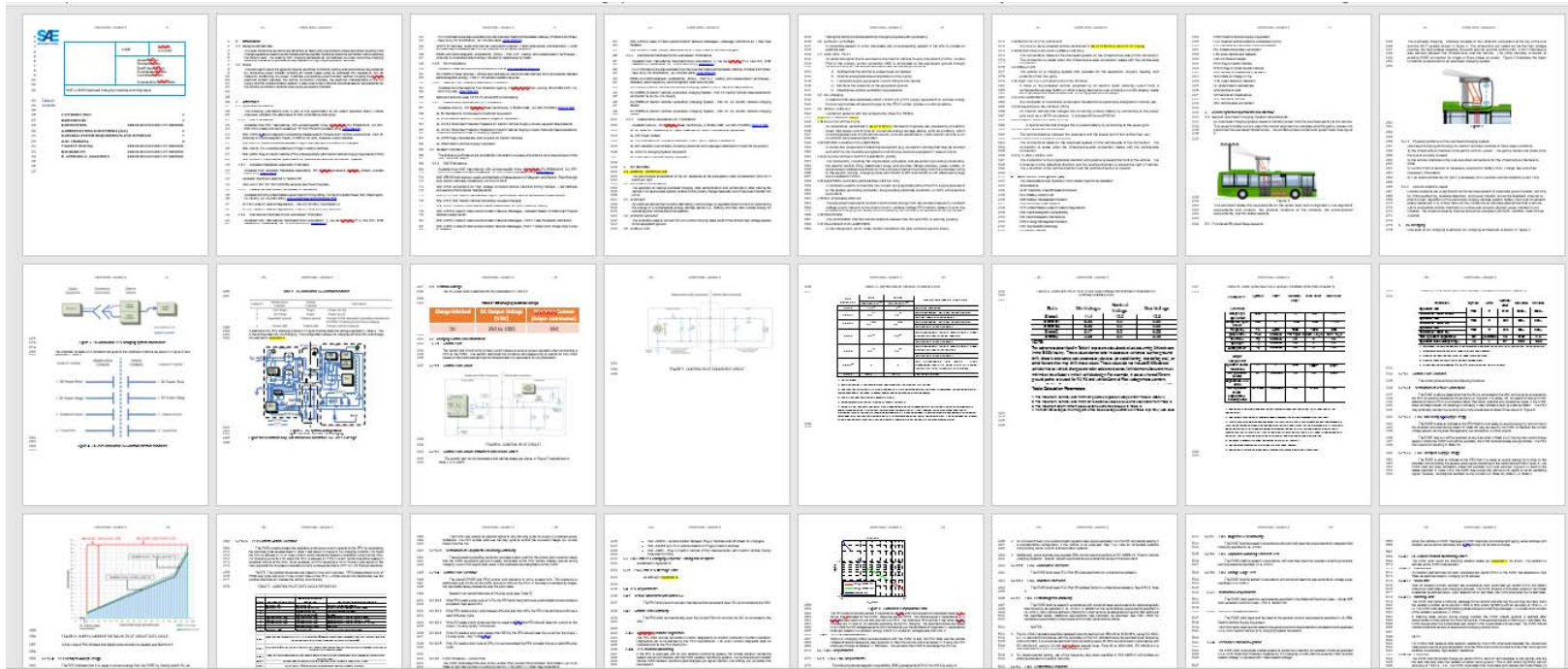
Item	J-3105 Requirements
Power Configuration	DC
Mating Apparatus Mounting Location	overhead
Loss Of Power Self Return	yes
Number of Contacts	Earth, Plus, Neg, Pilot
Pantograph Type	top-down
Pantograph mounting	Infrastructure side
Buy America Reasonably Expected	yes
Minimal Acceptable Lateral Tolerance (in)	24
Minimal Acceptable Longitudinal Tolerance (in)	18
Stopping Reference	Center Line of Front Door
Connection Point on the Roof	Near Front
Snow Handling	yes
HV Touch Safe While Not Charging	yes
HV Touch Safe While Charging	yes
Communication Protocol	J1772 CCS Variant
Compensation for Kneeling	yes
Operational Temperature	-40C to +45C
Wind tolerance	Absolutely
Connection Noise	Low
Connection Sequence	Pilot and PE first, then HV contacts

# Overhead Charging Requirements

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- **Two Power Levels are being considered-**
    - Level 1: 250 to 1000 V up to 600 A
    - Level 2: 250 to 1000 V up to 1500 A
    - Level 1 and Level 2 need to be compatible
  - **Study has occurred to finalize the position on the bus roof**
  - **Connection geometry is being considered**
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# J3105 Document Status



Currently, ~57 pages long Includes references, and basic requirements

TIR planned to be complete in the 4<sup>th</sup> Quarter 2017