SIL
SERVICE INFORMATION LETTER

Allison Transmission

SUBJECT: H 40/50 EP™ System High Voltage Electrical Safety

MODELS AFFECTED: H 40/50 EP™ System

Introduction:

The purpose of this SIL is to provide additional information about High Voltage (HV) electrical safety for the H 40/50 EP™ System. The H 40/50 EP™ System uses potentially hazardous electrical energy to power the Dual Power Inverter Module (DPIM) and electric motors in the Drive Unit. The Energy Storage System (ESS) stores HV Direct Current (DC) energy while the DPIM converts HV DC to HV Alternating Current (AC) to power the Drive Unit motors. HV DC from the ESS ranges from 432VDC to 780VDC and the DPIM output ranges from -350A to +350A during normal system operation.

All H 40/50 EP™ System components are identified with warning labels or symbols. **DO NOT** attempt to service components containing potentially hazardous electrical energy if you are not trained and qualified to do so. All persons working with potentially hazardous electrical energy should familiarize themselves with safe electrical work practices provided by their employer and with reference to publicly available documentation that can assist a technician in developing the safe electrical work practices required to service the H 40/50 EP™ System HV electrical system.

Sources of publicly available documentation include but are not limited to:

- Occupational Safety and Health Administration (OSHA) 29 CFR 1910 Subpart S
  - *1910.137*: Electrical Protective Equipment
  - *1910.335*: Safeguards for personnel protection
- National Fire Protection Association *(NFPA) 70E*
  - 130.4: Shock Risk Assessment
  - 130.5: Arc Flash Risk Assessment
  - 130.7: Personal and Other Protective Equipment
- Workplace Safety Awareness Council (*WPSAC*)
  - *Arc Flash Handout*

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Please Note: Allison Transmission Service Information Letters are intended for use by professional, trained technicians, not for the "do-it-yourselfer." They are written to inform those technicians of conditions that may occur on some transmission models (or serial numbers ranges) or to provide information that could assist in the proper servicing of a specific Allison transmission. Properly trained technicians have the equipment, tools, safety instructions, and know-how to do a job properly and safely. If a condition is described, do not assume that the Service Information Letter applies to your transmission, or that your transmission has the condition described. Product evolution and information updates are inevitable. Please see your authorized Allison Transmission service dealer or distributor to understand if your particular transmission may benefit from the information contained within the Service Information Letter.

NOTE: This information is provided as a guide only and is deemed accurate based on information available on the date of this publication. Additional hazard and safety requirements at a National, State, or Local level may be different than the information provided here. Allison Transmission is not responsible for creating, reviewing, or enforcing hazard and safety protocols for external facilities.

The phrase "arc flash" is commonly used in discussion about electrical safety and servicing of hybrid and electric vehicles. **Arc flash**, from a WPSAC arc flash handout, is "a phenomenon where a flashover of electric current leaves its intended path and travels through the air from one conductor to another, or to ground. The results are often violent and when a human is in close proximity to the arc flash, serious injury and even death can occur." An **arc flash hazard**, as defined in NFPA 70E-2018, is "a source of possible injury or damage to health associated with the release of energy caused by an electric arc."

To identify an **arc flash hazard**, an evaluation of the equipment must be performed. Based on the evaluation, an arc flash boundary and proper personal protective equipment can be determined. Evaluating the equipment involves determining the energy exposure under various scenarios at a given distance. A mathematical formula can be used to estimate the incident energy exposure for a given scenario. The incident energy for the device can then be used to determine required PPE. The formula for estimating DC incident energy can be found in NFPA 70E-2018 Appendix D.5.1.

[D.5.1]

$$I_{arc} = 0.5 \times I_{bf}$$
$$IE_m = 0.01 \times V_{sys} \times I_{arc} \times T_{arc} / D^2$$

where:
I_{arc} = arcing current amperes
I_{bf} = system bolted fault current amperes
IE_m = estimated dc arc flash incident energy at the maximum power point cal/cm^2
V_{sys} = system voltage volts
T_{arc} = arcing time sec
D = working distance cm

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Figure 1.

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It is important to understand that estimating incident energy with a formula involves input variables that can change depending on the scenario evaluated. In scenarios where the ESS is completely and properly assembled or when performing the electrical disconnect verification procedure, the incident energy can be very low or non-existent. If a technician is working inside the ESS and following Allison Transmission's published electrical safety procedures and recommendations, the incident energy can be very low. If a technician is working inside the ESS and **disregards** Allison Transmission's published electrical safety procedures and recommendations, the incident energy could be much higher.

When following all of Allison Transmission's electrical safety procedures and recommendations published in H 40/50 EP™ System service and troubleshooting manuals to perform the electrical disconnect verification procedure or working inside the ESS, **the estimated incident energy exposure at 40cm (16in) is 0.186 cal/cm^2**. The recommended PPE for this work, as described in H 40/50 EP™ System service and troubleshooting manuals, are Class 0 isolation gloves (red color code, 1,500 VDC max) with leather outer gloves, which are available from Allison Transmission as special tool *J-50090*. No additional PPE for arc flash protection is required as the minimum incident energy level requiring arc-rated flame-resistant PPE is 1.2 cal/cm^2 per NFPA 70E-2018.

If Allison Transmission's electrical safety procedures and recommendations published in H 40/50 EP™ System service and troubleshooting manuals **are not followed**, a scenario may exist in which a higher incident energy may be present when performing the Electrical Disconnect Verification Procedure or working inside the ESS. In a worst case scenario, where a fault between the most positive side and the most negative side of an ESS string exists, with the fuse and sub-pack service connects in place, the estimated incident energy exposure at 45.7cm (18in) would be 2.91 cal/cm^2. In this scenario, additional PPE must be worn. Refer to *Table 130.5(G)* Selection of **Arc-Rated Clothing** and Other PPE When the Incident Energy Analysis Method Is Used in NFPA 70E-2018 and the notes below Table 130.5(G) to determine the proper PPE.

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