

INTERNATIONAL TRANSPORTATION LEARNING CENTER

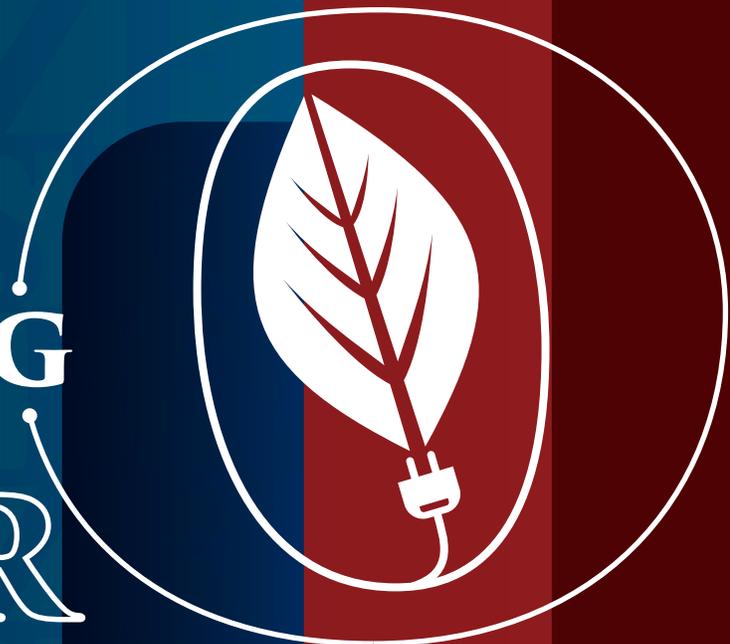
**JOBS
TO MOVE
AMERICA**

**PROVIDING
TRAINING
FOR**

ZER

EMISSION

BUSES:



**RECOMMENDED
EXPANDED
RFP
LANGUAGE**



PREFACE

ABOUT THE ITLC

The International Transportation Learning Center (ITLC) is the only national organization that focuses on workforce development of the frontline workforce in public transportation. The ITLC is a nonprofit organization that works with its partners to develop and support technical training partnerships for today's and tomorrow's front-line work force. The ITLC is dedicated to improving public transportation by committed investment at the national and local levels in frontline technical workers.



ABOUT JMA

Jobs to Move America (JMA) is a strategic policy center that works to transform public spending and corporate behavior using a comprehensive approach that is rooted in racial and economic justice and community organizing. JMA seeks to advance a fair and prosperous economy with good jobs and healthier communities for all.





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INTRO

Research from CALSTART shows that Zero Emission Bus (ZEB) deployment in the US grew 27% in 2021, up to 3,533 buses (on the road and on order).¹ The Infrastructure Investment and Jobs Act provides more than \$5 billion in funding for public transit agencies to adopt low- and no-emissions buses.² Sixteen states and Washington, DC have signed agreements to switch all heavy-duty trucks, vans, and buses over to running on electricity by 2050.^{3,4} This is an investment in public transportation, the environment, and the U.S. economy.

	Fuel Cell Electric Bus (FCEB)	Battery Electric Bus (BEB)	Total ZEBs	Deployed ZEBs
2020	87	2,703	2,790	722
2021	169	3,364	3,533	1,287
Increase ('20 to '21)	82	643	725	565
Growth %	94%	24%	27%	78%

Source: CALSTART. <https://www.sustainable-bus.com/news/zero-emission-buses-usa-2021-calstart/>

¹ Over 3,500 ZE buses on the road or on the order books in the US. CALSTART: «The coming funding will be instrumental in scaling fleets», 2021. <https://www.sustainable-bus.com/news/zero-emission-buses-usa-2021-calstart/>

² Fact Sheet: The Bipartisan Infrastructure Investment and Jobs Act Advances President Biden's Climate Agenda, 2021. <https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-the-bipartisan-infrastructure-investment-and-jobs-act-advances-president-bidens-climate-agenda/>

³ 15 States Will Follow California's Push To Electrify Trucks And Buses, 2021. <https://www.theverge.com/2020/7/14/21324552/electric-trucks-buses-clean-air-zero-emissions-states>

⁴ Northam pledges all new trucks and buses in Va. will be electric, zero-emission by 2050, 2021. <https://wtop.com/virginia/2021/12/northam-pledges-all-new-trucks-and-buses-in-va-will-be-electric-zero-emission-by-2050/>

INTRODUCTION

Dependable, well-maintained ZEBs are only possible with an accompanying investment in human capital. Without this investment, transit technicians will be unable to safely and efficiently maintain and repair these buses and charging infrastructure, and operators will be unable to safely and efficiently operate these new vehicles. Research has proven that quality training for frontline transit workers has a high return on investment – up to 700%.⁵ Recognizing this, the federal government added new requirements for recipients of Bus and Bus Facilities Grants:

- **Fleet Transition Plan:** In awarding grants under this subsection or under subsection (b) for projects related to zero emission vehicles, the Secretary shall require the applicant to submit a zero emission transition plan, which, at a minimum-- (i) demonstrates a long-term fleet management plan with a strategy for how the applicant intends to use the current application and future acquisitions; (ii) addresses the availability of current and future resources to meet costs; (iii) considers policy and legislation impacting technologies; (iv) includes an evaluation of existing and future facilities and their relationship to the technology transition; (v) describes the partnership of the applicant with the utility or alternative fuel provider of the applicant; and (vi) examines the impact of the transition on the applicant’s current workforce by identifying skill gaps, training needs, and retraining needs of the existing workers of the applicant to operate and maintain zero emission vehicles and related infrastructure and avoids the displacement of the existing workforce.”;
- **Workforce Development Training Activities:** 5 percent of grants related to zero emissions vehicles (as defined in subsection (c)(1)) or related infrastructure under subsection (b) or (c) shall be used by recipients to fund workforce development training, as described in section 5314(b)(2) (including registered apprenticeships and other labor-management training programs) under the recipient’s plan to address the impact of the transition to zero emission vehicles on the applicant’s current workforce under subsection (c)(3) (D), unless the recipient certifies a smaller percentage is necessary to carry out that plan.⁶

⁵ International Transportation Learning Center, Transit Partnership Training: Metrics of Success, 2010.

⁶ H.R.3684 - Infrastructure Investment and Jobs Act, Section 30018. <https://www.congress.gov/bill/117th-congress/house-bill/3684/text>

INTRODUCTION

The transit workforce is also understandably concerned regarding the safety of new electrical equipment. Transit workers are demanding training on the safe use of this equipment. As the industry shifts to ZEBs, going from traditional low-voltage bus electrical systems to potentially life-threatening 800-volt ZEB propulsion creates real safety concerns especially when training on these new vehicles is inadequate.

Including maintenance and operations employees closely in the procurement process, such as by having workers provide input into the technical specifications and review of proposals, can help address workers' concerns. Frontline worker input throughout the procurement process helps assure that new buses delivered to the agency will benefit the agency, the riding public, and workers.

Agency Request for Proposals (RFPs), which define procurement requirements, can be used to set standards for the quantity and quality of ZEB training. These RFPs are typically developed using the American Public Transportation Association (APTA) Standard Bus Procurement Guidelines (SBPG) which provides standardized language for bus procurement including terms, conditions, specifications, warranties, and training, as developed through an industry-wide working group process. This Recommended Expanded RFP Language provides additional detailed recommendations on the procurement of training, based on industry input, and can be used to expand on the SPBG. The training can be delivered by the Original Equipment Manufacturers (OEMs) and related vendors/suppliers or by third-parties. Given that Battery Electric Buses (BEBs) are currently the most prevalent zero-emission bus technology in the U.S., this document focuses on assisting agencies in developing RFP training language specific to the procurement of BEBs.

Many agencies may feel inclined to use extended warranties that go beyond the traditional warranty periods for BEBs. However, this leaves agency technicians ill-equipped to perform needed repairs once the warranty period ends and increases an agency's dependency on outsourced work. Agencies lose the ability to control the scheduling, quality and cost of this work when it is performed by others.

INTRODUCTION

As an option, an agency should, therefore, as part of its procurement process, consider requiring OEM training comprehensive to the point where agency technicians are qualified to perform warranty work in-house when the warranty expires. This does not, however, prevent agencies from having OEMs perform warranty repairs if they choose to. A section at the end of this document provides agencies with suggested warranty language to consider as an option. Whether technicians are certified during the warranty period or at the end of the warranty, the goal is that agency repair proficiency be on par with the OEM's expertise, thereby guaranteeing that BEB maintenance work can be performed by agency personnel when the warranty expires.

This document is intended to be used as a starting point for agencies to tailor their training procurement to suit their specific needs. Agencies should consider the expertise that their staff will need to maintain and operate their BEB fleet. The recommended language here was developed as the result of multiple interviews with leadership and staff from transit agencies around the country, as well as discussions with procurement experts at the Federal Transit Administration, independent procurement trainers and representatives from transit labor. The team also conducted a thorough review of a range of RFPs that contained strong language on procuring training for maintenance and operations workers.

The intent of the training defined in this document is to make frontline workers, operators, technicians and related personnel, proficient at their jobs. In many cases, it is not time or cost effective to have the contractor provide training to all affected agency personnel, especially at larger agencies. In these cases, training is provided to a select number of individuals in a train-the-trainer scenario where those individuals train other key agency personnel. The definitions listed below are intended to delineate where training is to be directed with the understanding that the agency is to select the appropriate staff to be trained.



• DEFINITIONS —

CONTRACTOR: (from APTA’s SBPG) The successful Proposer who is awarded a Contract for providing all buses and equipment described in the Contract documents.

OEM: Original Equipment Manufacturer (OEM) is typically the Contractor that builds the bus. In other cases, the OEM is a third-party supplier that produced a particular component or subsystem (e.g., air conditioning supplier, electric propulsion supplier, etc.). Note: In some cases, these third-party OEMs or others may be directed by the Contractor to provide targeted training.

MAINTENANCE PERSONNEL: Anyone designated by the agency to receive maintenance training delivered under the terms of this procurement, which may consist of technicians, instructors, supervisors, managers or a combination thereof with the intent that the training provided to those individuals is ultimately transferred to technicians and others responsible for the maintenance and repair of the buses being delivered.

OPERATIONS PERSONNEL: Anyone designated by the agency to receive operator training delivered under the terms of this procurement, which may consist of operators, instructors, supervisors, managers or a combination thereof with the intent that the training provided to those individuals is ultimately transferred to operators and others responsible for the operation of buses being delivered.

• SPECIFYING TRAINING IN PROCUREMENT LANGUAGE —

As noted, this sample language on technical specifications for training can be adapted by agencies to meet their needs. Agencies may also consider supplementing this language to emphasize the need for proposals to contain training specifications as fully as they do to specifications for equipment. Agencies can encourage proposers to respond to training specifications by, for example, noting that failure to respond to technical specifications for training will result in a proposal being deemed non-responsive or by offering bonus points on the RFP evaluation to proposals that are particularly responsive regarding training specifications.

In addition to using procurement specifications to obtain training for new vehicle familiarization, agencies can also use those specifications to procure refresher and other needed training. For example, agencies with limited in-house training could require OEMs or third-parties to provide more fundamental training on foundational bus systems in addition to the product-specific training covered here.

Instead of including the cost of training as part of its overall bus purchase, agencies could also require OEMs to itemize training costs for evaluation purposes. For example, agencies may require the OEM to distinguish the training it will provide from training the OEM will have component vendors provide. Agencies could also require the OEM to itemize the cost of each training segment provided. Doing so allows the agency to evaluate individual training costs to determine if it is more effective to have a third-party training organization provide the training, rather than the OEM. Third-parties may provide more innovative and engaging training delivery methods.



• SAMPLE TRAINING LANGUAGE —

AGENCY REVIEW OF TRAINING MATERIALS

The Contractor shall provide copies of all lesson plans, detailed instructor guides, student workbooks, manuals, publications, videos, PowerPoints, transparencies, and any other training aids used by instructors 90 days prior to the delivery of the first production bus. The Contractor shall identify the instructor and provide the qualifications of the instructor 90 days prior to the delivery of the first production bus. Dates of the training shall be determined by the Agency in coordination with the Contractor. The Contractor shall inform the Agency of any training support equipment (such as DVD player, personal computer with PowerPoint, projector, etc.) and/or supplies required for the training. The training, including materials, schedule, instructors, and course outlines, shall be approved by the Agency prior to their use.

For each separately ordered group of buses, the Contractor shall provide a program of instruction, instructional materials, and training aids targeted for specific groups of operations and fleet maintenance personnel, as described below. This training shall take place at the Agency.

The Contractor shall make clear which of the trainings included in its proposal will be provided by the Contractor, and which trainings will be provided by a third-party organization such as a component vendor. Contact information for each outside training provider shall be provided. For each segment of training provided (e.g., HVAC, brakes, propulsion, etc.), the Contractor shall itemize costs for each, and then provide a total cost for all training offered. The Agency reserves the right to select all or part of the training offered by the Contractor with costs adjusted accordingly. The Contractor shall indicate the extent to which interactive and engaging learning techniques shall be applied. The Contractor shall indicate which aspects of the training shall be provided in-person, and which through e-learning and distance-based platforms.

The Contractor shall designate a specific individual as the “Principal Training Contact” for the scheduling and accomplishment of the

SAMPLE TRAINING LANGUAGE

Contractor and third-party vendor training. The Contractor shall provide a name, complete mailing address, telephone number, and e-mail address for this person to the Agency no later than 90 days after Notice to Proceed.

OPERATOR TRAINING (PHASE 1 TRAINING)

For each separately ordered group of buses, the Contractor shall provide a minimum of 6 hours of training to Operations Personnel and Maintenance Personnel as designated by the Agency on driving characteristics of the bus; use of all controls, gauges, warning lamps, and driver's seat controls; CDL pre-trip requirements for safe operation; emergency procedures; use of the wheel chair ramp system; and other operational items as required to safely and efficiently operate the bus.

MAINTENANCE TRAINING COURSES

The Contractor shall provide maintenance training utilizing two modules of instruction: General Orientation and Technical Orientation.

- **General Orientation (Phase 1 Training)**

For each separately ordered group of buses the Contractor shall provide an initial orientation for Maintenance Personnel as designated by the Agency. The General Orientation shall be provided at each facility where the buses ordered could be maintained or repaired and shall be provided for each shift. The General Orientation shall be presented on and around the bus. The General Orientation session shall be, at a minimum, 8 hours in duration. The General Orientation shall include, but not be limited to, the following: fluid types; fluid quantities; fluid level checks; inspection and maintenance of fluid types (manual and electronic); fill ports; basic servicing of bus to include PM schedules and all related safety precautions; procedures for charging buses for quick or slow charge and hazards, safety procedures, and Personal Protective Equipment (PPE) related to both types of charging. The General Orientation shall also cover

familiarity of vehicle for safe operation and specific procedures that the Agency could use to train First Responders.

- **Technical Orientation for Each Area of Instruction (Phase 2 Training)**

The Contractor shall provide a structured program of technical training. The number of times each program is delivered depends on the number of Maintenance Personnel to be trained. See Table 1. This program shall be delivered at locations to be specified by the Agency.

The training shall consist of specific and identifiable separate areas of instruction, including at least the following (see Table 1):

- Electrical/Multiplex System
- Energy Storage System (ESS)⁴ and Battery Management System⁵
- Propulsion System Familiarization/ HV⁶ Safety
- On-Board and Off-Board Charging System Equipment
- HVAC System
- Brake and Air Systems
- Steering, Suspension and Axle Systems
- Wheelchair Ramp System
- Entrance & Exit Doors
- Electric Propulsion System Overhaul

⁷ Energy Storage System (ESS): A component or system of components that stores energy and for which its supply of energy is rechargeable by the on-vehicle system (engine/regenerative braking/ generator) or an off-vehicle energy source.

⁸ Battery Management System (BMS): Monitors energy, as well as temperature, cell or module voltages, and total pack voltage. The BMS adjusts the control strategy algorithms to maintain the batteries at uniform state of charge and optimal temperatures.

⁹ High Voltage (HV): Greater than 50 V (AC and DC).



A detailed class shall be provided for each area of instruction listed above and shall include, at a minimum:

1. Component identification and location
2. Diagnosis and repair
3. Safety and warnings
4. Theory of operation
5. Diagnostic software and computer use
6. System maintenance and troubleshooting
7. Agency specific configuration files in digital format
8. PPE and its use specific to BEB systems
9. A list and pricing of all required PPE and special bus-specific tooling

SPECIAL INSTRUCTIONAL MATERIALS AND TRAINING AIDS FOR EACH AREA OF PHASE 2 TRAINING

The Contractor shall supply the following instructional materials for each separately ordered group of buses 90 days before delivery of the first production bus in each group. For all subjects listed in Table 1, the Contractor shall provide two complete sets of:

- electrical and electronic wiring diagrams
- instructor guides and training aids
- overhaul process guide, if applicable
- videos
- PowerPoint and other presentations
- wall chart training aids
- student guides

Training materials shall be sufficient to allow Maintenance Personnel to:

- Identify component function and location within system
- Use diagnostic test equipment to perform troubleshooting procedures
- Be certified by the OEM to perform warranty repairs
- Perform preventive maintenance procedures
- Perform equipment repair

SAMPLE TRAINING LANGUAGE

The Contractor shall supply the following training aids for each separately ordered group of buses 90 days before the delivery of the first production bus in each group, in addition to training aids necessary for the above-listed systems. Pre-production design of each unit shall be subject to the approval by the Agency.

- Air Conditioning System Training Aid Module: a stand-alone, fully operational training aid, representative of the vehicle's air conditioning system, constructed using actual bus parts identical to those being used on the vehicles provided under this contract including but not limited to the following: compressor & clutch assembly, service valves, condenser, condenser fans, receiver tank, filter dryer, expansion valve, evaporator pressure regulator (if applicable), evaporator coil, evaporator fans, heater coil, return air filter, minimal ducting. The unit shall demonstrate the operation of the complete air conditioning system. The unit shall also include all switches, electronic controls, sensors, lights, warning devices, and gauges to indicate all system functions. The unit shall be delivered fully charged with the same refrigerant used on the vehicles provided under this contract. The unit shall be powered by a 3-phase AC motor with sufficient voltage and pulley which simulates the rotational horsepower taken from an engine/electric propulsion system.
- Vehicle Multiplex Module: a fully operational multiplex system with the vehicle to be delivered.
- Air Brake Module: a fully operational air brake system with the vehicle to be delivered.

OEM “TRAIN THE TRAINER” MAINTENANCE TRAINING

The Contractor shall provide a “Train the Trainer” program for each separately ordered group of buses covering all subject areas listed above. The “Train the Trainer” program, intended specifically for Maintenance Instructors, shall be accomplished through instruction led by the

SAMPLE TRAINING LANGUAGE

Contractor, OEM Component Vendor, or third-party as appropriate. This training shall also incorporate the use of the instructional training aids and materials described above.

“Train the Trainer” training is preferably held at the manufacturer’s factory location. All courses shall include transportation, lodging, and meal per diem for (add number of Instructors attending). The training shall be provided in two phases: pre-delivery and post-delivery of buses. The Contractor shall itemize in detail when the training is to be provided by all entities. The “Train the Trainer” program shall accommodate a minimum of (add number of trainers). The “Train the Trainer” program shall include, at a minimum, the subject areas listed above for the technical training.

ELECTRONIC MAINTENANCE INFORMATION

The Contractor shall supply all software information, including source codes for any programmed module or component. Also to be supplied is any special hardware necessary to repair or modify any microprocessors and/or software used in the bus. The Contractor shall supply: complete schematic drawings containing component identification, and the location of the components on the circuit board; circuit descriptions; and theory of operation for all electronic components. The Contractor shall also supply information on programmed array logic (PAL) and any other preprogrammed device. The Contractor shall identify all data it considers as proprietary.

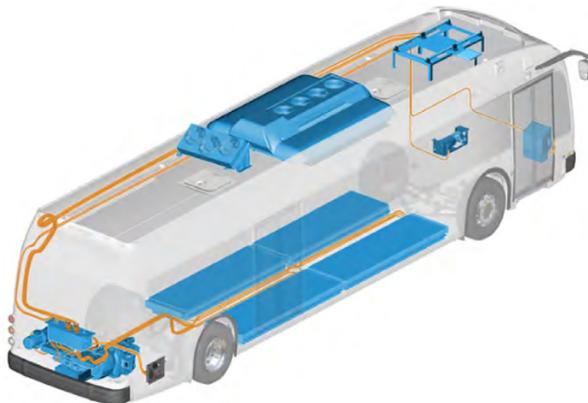




TABLE 1: TRAINING REQUIREMENTS

Note: length of hours for each course has been provided as a minimum. Agencies may need to adjust the hours and insert the number of sessions required to suit their individual needs.

PHASE 1 TRAINING				
Course	Description	Target Audience	Length (Hours)	# of Sessions
Class #1: Operator Orientation	Class shall cover driver familiarity, operation of all vehicle systems including the wheelchair ramp, and CDL pre-trip requirements for the safe operation of Battery Electric powered vehicles. This orientation shall also cover familiarity of vehicle for safe operation and specific procedures that the Agency could use to train First Responders.	Maintenance Personnel and Operations Personnel as designated by the Agency	6	
Class #2: Maintenance General Orientation	Class shall cover fluid types, fluid quantities, fluid level checks inspection and maintenance of fluid types, (manual and electronic), fill ports and basic servicing of bus to include PM schedules and all related safety precautions. procedures for charging buses for quick or slow charge and cover all hazards, safety procedures, and PPE related to both types of charging.	Maintenance Personnel and Operations Personnel as designated by the Agency	8	

SAMPLE TRAINING LANGUAGE

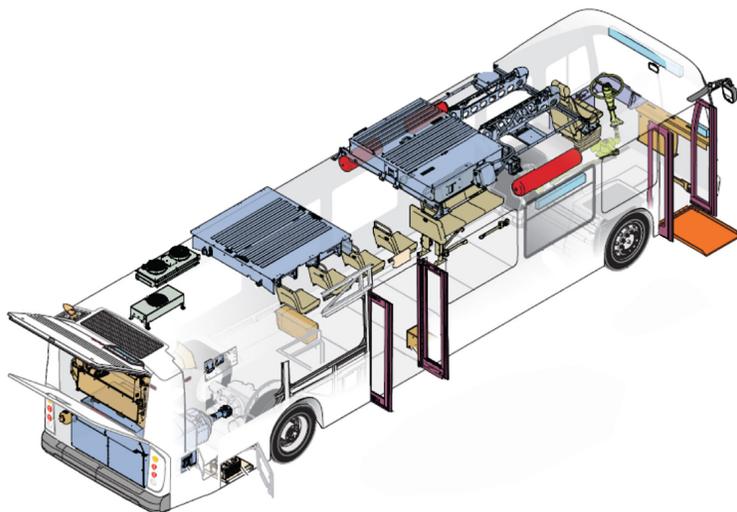
PHASE 2 TRAINING				
Course	Description	Target Audience	Length (Hours)	# of Sessions
Class #3: Electrical and Multiplexing	Class shall cover the non-propulsion electrical system and multiplex system. Class shall cover the inspection, location, troubleshooting/diagnostics, maintenance and repair of over voltage monitor, battery, equalizer, battery maintenance, print reading, multiplex system, ladder logic, wiring color coding, harnesses, connectors, plugs, J1939 communication circuit	Maintenance Personnel as designated by the Agency	24	
Class #4: Energy Storage & Management Systems	Class shall cover the inspection, location, troubleshooting/diagnostics, maintenance (preventive and corrective) and repair of the high voltage energy storage system, battery management system, and any related components, controllers, etc. The class shall provide safety procedures for handling and working with a high voltage system, and power down procedures; general construction and principles of operation and troubleshooting; battery thermal management system, pumps/piping diagnostics, lock-out/tag-out, and assembly and disassembly procedures.	Maintenance Personnel as designated by the Agency	12	

PHASE 2 TRAINING				
Course	Description	Target Audience	Length (Hours)	# of Sessions
Class #5: Propulsion System Familiarization/ HV Safety	Class shall cover fluid types, fluid quantities, fluid level checks inspection and maintenance of fluid types, (manual and electronic), fill ports and basic servicing of bus to include PM schedules and all related safety precautions. procedures for charging buses for quick or slow charge and cover all hazards, safety procedures, and PPE related to both types of charging.	Maintenance Personnel as designated by the Agency	16	
Class #6: Charging System Equipment	Class shall cover the inspection, location, troubleshooting/ diagnostics, maintenance (preventive and corrective) and repair of all aspects of the charging equipment including depot and wayside charging equipment.	Maintenance Personnel as designated by the Agency	8	
Class #7: HVAC System	Class shall cover the inspection, location, troubleshooting/ diagnostics, maintenance (preventive and corrective) and repair of the HVAC system for both the vehicle itself and propulsion system to include: compressor, evaporator/ condenser fans, motor drivers, recovery/recycling refrigerants, system operation, diagnostic software, bus interface electrical and mechanical drawings.	Maintenance Personnel as designated by the Agency	12	

SAMPLE TRAINING LANGUAGE

PHASE 2 TRAINING				
Course	Description	Target Audience	Length (Hours)	# of Sessions
Class #8: Brake and Air Systems	Class shall cover the inspection, location, troubleshooting/ diagnostics, maintenance and repair of air lines, valves, compressor, air dryer, tanks, plumbing diagrams, electrical interface, kneeling system and air suspension, inspection, location, troubleshooting, maintenance and troubleshooting, maintenance and repair of regenerative braking and foundation braking.	Maintenance Personnel as designated by the Agency	16	
Class #9: Steering, Suspension and Axle Systems	Class shall cover the inspection, location, troubleshooting/ diagnostics, maintenance and repair of steering, suspension and axle systems	Maintenance Personnel as designated by the Agency	8	
Class #10: Wheelchair Ramp System	Class shall cover the inspection, location, troubleshooting/ diagnostics, maintenance (preventive and corrective) and repair of the wheelchair ramp system including automatic and manual operation as applicable	Maintenance Personnel as designated by the Agency	4	
Class #11: Entrance & Exit Doors	Class shall cover the inspection, location, troubleshooting/ diagnostics, maintenance (preventive and corrective) and repair of coach assembly, door adjustments, fasteners, repairs, major repairs, windows, seat adjustments, interiors, doors, under-floor heater boxes, etc.	Maintenance Personnel as designated by the Agency	8	

PHASE 2 TRAINING				
Course	Description	Target Audience	Length (Hours)	# of Sessions
Class #12: Electric Propulsion System Overhaul	Class shall cover the inspection, location, troubleshooting/ diagnostics, maintenance (preventive and corrective) and repair of the electric propulsion system including traction motor(s) and other propulsion components that can be overhauled. Training shall include performance testing, bus interface electrical and mechanical drawings, and diagnostic software, general construction and principles of operation, cooling pumps/ piping diagnostics, and vehicle interface and the electronic control system. Assembly and disassembly procedures shall also be provided by the OEM.	Maintenance Personnel as designated by the Agency	40	



SPECIAL TOOLS AND DIAGNOSTIC EQUIPMENT

The Contractor and any OEM component vendors shall provide a list of all required special tooling and diagnostic equipment pertaining to the BEB being procured and related pricing.

The Contractor and any OEM component vendors shall also provide a recommended list of all generic insulated tooling and high-voltage PPE (see Appendix).

Note: Guidance for Insulated tools and PPE for BEBs are attached to this document as an Appendix.

VEHICLE MAINTENANCE TRAINING – WARRANTY (OPTIONAL)

The Contractor shall provide training to a level whereby the Contractor, following all training delivered, certifies that those trained are fully capable of performing all warranty repairs on the BEBs purchased. If the Contractor will not certify agency employees to perform certain warranty repairs as a result of their training, the Contractor shall list the specific repairs and the reason(s) why Agency employees cannot be certified to perform them.

It is understandable that prior to receiving the full complement of training and resulting certification and in cases where Agency employees cannot be certified, the Contractor or affiliated vendor will need to make certain warranty repairs. In those cases, the Agency shall use the warranty repairs as a training exercise if sufficient staffing is available. Before the warranty repairs begin, the Contractor or Component Vendor shall inform the maintenance department when (date and time) the warranty repair(s) will be made, the cause of the need for repair, and the anticipated repair procedures. If a technician or instructor is available, the Agency will send the appropriate staff representative to oversee the repair. During the repair, the Contractor or Component Vendor shall describe all procedures used to facilitate the repair including any safety considerations and use of special tools or procedures. The Contractor

• SAMPLE TRAINING LANGUAGE

or Component Vendor may have available Agency staff (e.g., technician, instructor, supervisor) assist with the repair as part of the training exercise. A copy of the repair order shall be submitted to the Agency immediately following each warranty repair. This option does not prevent the Agency from having OEMs perform warranty repairs if they choose to.



• APPENDIX —

Because of the high voltage, BEBs require insulated tools and unique Personal Protective Equipment (PPE). This equipment is generic in nature and required for any BEB regardless of make/model. As a result, the equipment may not be included in the Contractor’s list of special tools.

Agencies have a choice when it comes to procuring this equipment. Although some do so as part of their bus RFP, most procure the equipment through specialized vendors that offer services that the bus OEMs do not. For example, insulated gloves require testing and replacement at specified intervals. Purchasing these gloves from a third-party vendor may be beneficial because they are better prepared to support this equipment over time.

Regardless of how agencies decide to procure this equipment, this section provides guidance to assist agencies in obtaining this safety-critical equipment. At time of printing, bus transit lacks industry-accepted standards when it comes to high-voltage PPE and tools. NFPA 70E, which applies generally to all workplaces (hospitals, supermarkets, industrial plants, etc.), can be used as a guide to establish safe work practices to protect bus technicians by reducing their exposure to major electrical hazards.

Because NFPA 70E does not specifically apply to BEBs, it is recommended that agencies, as part of their bus RFP, require the Contractor to provide a recommended list of insulated tooling and high-voltage PPE. The following sentence is included in the Special Tools and Diagnostic Equipment section:

The Contractor and any OEM component vendors shall also provide a recommended list of all insulated tooling and high-voltage PPE.

From the Contractor’s recommendations, agencies could inquire as to whether the Contractor offers such equipment and obtain related pricing, and either purchase the equipment as part of the bus RFP or through

specialized vendors. The table below provides guidance pertaining to insulated tools and PPE typically required for BEBs.

INSULATED TOOLS		
Tool	Recommended Quantity	Notes
CAT III rated digital multimeter(s) (rated up to 1000 VDC)	1 for each BEB technician	
Insulated hand tools that follow ASTM F1505-01 and IEC 900 standards and compliance with OSHA 1910.333 (c)(2) and NFPA 70E standards (as recommended by the BEB OEM)	1 set for each BEB technician that could be working on a BEB at any given time	

PERSONAL PROTECTIVE EQUIPMENT		
Tool	Recommended Quantity	Notes
ASTM Class 0 insulated gloves with red label	1 pair, properly sized for each BEB technician	Insulated gloves need to be tested and replaced at specified intervals.
Leather gloves to be worn over ASTM insulated gloves	1 pair, properly sized for each BEB technician	
Insulated EH Rated Safety Shoes	1 pair, properly sized for each BEB technician	
NRR 33 rated ear plugs	Ample supply for each BEB technician that could be working on a BEB at any given time	
NRR 331 rated (overhead) ear muffs	Ample supply for each BEB technician that could be working on a BEB at any given time	Note: Combining NRR 33 rated ear plugs with NRR 31 ear muffs can provide a NRR protection level of 36.

PERSONAL PROTECTIVE EQUIPMENT

Tool	Recommended Quantity	Notes
Arc flash suits	Ample supply for each BEB technician that could be working on a BEB at any given time	
Combination arc flash shield and hardhat	Ample supply for each BEB technician that could be working on a BEB at any given time	
Arc flash hoods	Ample supply for each BEB technician that could be working on a BEB at any given time	Arc flash shield, hardhat and hood may be procured as one integrated item depending on manufacturer and agency preference.
Insulated electrical rescue hook(s) (Sheppard’s Hook) sized for use on BEBs	1 set for each BEB technician that could be working on a BEB at any given time (certain HV operations require a second worker to be available to extricate primary worker in an emergency)	





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