COMPETENCY-BASED OCCUPATIONAL FRAMEWORK FOR REGISTERED APPRENTICESHIP

Transit Bus Technician

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For more information, contact:

Diana Elliott, PhD, Senior Research Associate, Urban Institute: delliott@urban.org

Robert Lerman, PhD, Institute Fellow, Urban Institute: rlerman@urban.org

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The nonprofit Urban Institute is dedicated to elevating the debate on social and economic policy. For nearly five decades, Urban scholars have conducted research and offered evidence-based solutions that improve lives and strengthen communities across a rapidly urbanizing world. Their objective research helps expand opportunities for all, reduce hardship among the most vulnerable, and strengthen the effectiveness of the public sector.

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Daniel Aasen
Metro Transit, Minneapolis, MN

Russell Anderson
Santa Clara Valley Transportation Authority

Norman Blessant
Utah Transit Authority

Frank Boice
Niagara Frontier Transportation Authority

David Burke
Transit Authority of River City

Levil Calico
Dallas Area Rapid Transit

Eric Darby
Alameda and Contra Costa (AC) Transit

John Dembick
Niagara Frontier Transportation Authority

Dale Feudale
New Jersey Transit

George Fields
Greater Cleveland Regional Transit Authority

Mark Fitzgerald
Metropolitan Atlanta Rapid Transit Authority

Norm Gartner
Southeastern Pennsylvania Transportation Authority

Steve Johnson
San Diego Metropolitan Transit System

Michael Joyce
Metro Transit, Minneapolis, MN

Victoria Learn
Indianapolis Public Transportation Corporation

Tom Loproto
Santa Clara valley Transportation Authority

George Martin
Southeastern Pennsylvania Transportation Authority

Joseph Morton
Nashville Metropolitan Transit Authority

David Olmeda
San Mateo County Transit District

Joshua Palachek
San Diego Metropolitan Transit System

Orlando Riley
New Jersey Transit

Landon Rowser
Utah Transit Authority

Terry Saubernick
RTS Regional Transit, Rochester, NY

Dwight Sammy
Indianapolis Public Transportation Corporation

James Souza
Alameda and Contra Costa (AC) Transit

Jeff Stambaugh
King County Metro Transit

Tim Vick
Nashville Metropolitan Transit Authority

Bernie Walkowsky
Cambria County Transit, Johnstown, PA

Danielle Wallace
King County Metro Transit

Gary Williams
AMTRAN, Altoona, PA

Rudy Chavez
San Mateo County Transit District

Greg Gaulin
RTS Regional Transit, Rochester, NY

John Murdock
Metropolitan Atlanta Rapid Transit Authority

Phil Scherer
Kansas City Area Transportation Authority

Eric Cunningham
Greater Cleveland Regional Transit Authority

Mike Hubbell
Dallas Area Rapid Transit

Wayne Nunley
Transit Authority of River City

Tom Seymour
Kansas City Area Transportation Authority

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Competency-Based Occupational Frameworks

The Urban Institute, under contract by the U.S. Department of Labor, has worked with employers, subject matter experts, labor unions, trade associations, credentialing organizations and academics to develop Competency-Based Occupational Frameworks (CBOF) for Registered Apprenticeship programs. These frameworks defined the **purpose** of an occupation, the **job functions** that are carried out to fulfill that purpose, the **competencies** that enable the apprentice to execute those job functions well, and the **performance criteria** that define the specific knowledge, skills and personal attributes associated with high performance in the workplace. This organizational hierarchy – Job Purpose – Job Functions – Competencies – Performance Criteria – is designed to illustrate that performing work well requires more than just acquiring discrete knowledge elements or developing a series of manual skills. To perform a job well, the employee must be able to assimilate knowledge and skills learned in various settings, recall and apply that information to the present situation, and carry out work activities using sound professional judgement, demonstrating an appropriate attitude or disposition, and achieving a level of speed and accuracy necessary to meet the employer's business need.

The table below compares the terminology of Functional Analysis with that of traditional Occupational Task Analysis to illustrate the important similarities and differences. While both identify the key technical elements of an occupation, Functional Analysis includes the identification of behaviors, attributes and characteristics of workers necessary to meet an employer's expectations.

Framework Terminology	Traditional Task Analysis Terminology
Job Function – the work activities that are carried out to fulfill the job purpose	Job Duties – roles and responsibilities associated with an occupation
Competency – the actions an individual takes and the attitudes he/she displays to complete those activities	Task – a unit of work or set of activities needed to produce some result
Performance Criteria – the specific knowledge, skills, dispositions, attributes, speed and accuracy associated with meeting the employer's expectations	Sub Task – the independent actions taken to perform a unit of work or a work activity

Although designed for use in competency-based apprenticeship, these Competency-Based Occupational Frameworks also support time-based apprenticeship by defining more clearly and precisely what an apprentice is expected to learn and do during the allocated time-period.

CBOFs are comprehensive to encompass the full range of jobs that may be performed by individuals in the same occupation. As employers or sponsors develop their individual apprenticeship programs, they can extract from or add to the framework to meet their unique organizational needs.

Components of the Competency-Based Occupational Framework

Occupational Overview: This section of the framework provides a description of the occupation including its purpose, the setting in which the job is performed and unique features of the occupation.

Work Process Schedule: This section includes the job functions and competencies that would likely be included in an apprenticeship sponsor's application for registration. These frameworks provide a point of reference that has already been vetted by industry leaders so sponsors can develop new programs knowing that they will meet or exceed the consensus expectations of peers. Sponsors maintain the ability to customize their programs to meet their unique needs, but omission of a significant number of job functions or competencies should raise questions about whether or not the program has correctly identified the occupation of interest.

Cross-cutting Competencies: These competencies are common among all workers, and focus on the underlying knowledge, attitudes, personal attributes and interpersonal skills that are important regardless of the occupation. That said, while these competencies are important to all occupations, the relative importance of some versus others may change from one occupation to the next. These relative differences are illustrated in this part of the CBOF and can be used to design pre-apprenticeship programs or design effective screening tools when recruiting apprentices to the program.

Detailed Job Function Analysis: This portion of the framework includes considerable detail and is designed to support curriculum designers and trainers in developing and administering the program. There is considerable detail in this section, which may be confusing to those seeking a more succinct, higher-level view of the program. For this reason, we recommend that the Work Process Schedule be the focus of program planning activities, leaving the detailed job function analysis sections to instructional designers as they engage in their development work.

a. Related Technical Instruction: Under each job function appears a list of foundational knowledge, skills, tools and technologies that would likely be taught in the classroom to enable the apprentice's on-the-job training safety and success.

b. Performance Criteria: Under each competency, we provide recommended performance criteria that could be used to differentiate between minimally, moderately and highly competent apprentices. These performance criteria are generally skills-based rather than knowledge-based, but may also include dispositional and behavioral competencies.

Using the Competency-Based Occupational Framework to Develop a Registered Apprenticeship Program

When developing a registered apprenticeship program, the Work Process Schedule included in this CBOF provides an overview of the job functions and competencies an expert peer group deemed to be important to this occupation. The Work Process Schedule in this document can be used directly, or modified and used to describe your program content and design as part of your registration application.

When designing the curriculum to support the apprenticeship program – including on the job training and related technical instruction – the more detailed information in Section 5 could be helpful. These more detailed job function documents include recommendations for the key knowledge and skill elements that might be included in the classroom instruction designed to support a given job function, and the performance criteria provided under each competency could be helpful to trainers and mentors in evaluating apprentice performance and insuring inter-rater reliability when multiple mentors are involved.

Transit Bus Technician Occupational Overview

Occupational Purpose and Context

Diagnose, adjust, repair, maintain, and overhaul buses and bus equipment. Typically works in municipal transit repair shops as an employee. Other occupations include working for a vendor/supplier, a private bus company, or as an independent contractor.

Potential Job Titles

Service Technician, Bus Technician, Transit Technician, Bus Mechanic, or Transit Mechanic.

Attitudes and Behaviors

Technicians must have an aptitude for understanding mechanical, electrical/electronic, pneumatic and hydraulic systems, maintaining those systems through preventive and predictive actions, diagnosing faults within those systems, and repairing those faults. Technicians must also have manual and finger dexterity, hearing sensitivity, auditory attention, and physical strength and flexibility. Technicians must also be detail oriented and precise, have strong inductive and deductive reasoning and problem solving skills, exhibit strong perceptual skills and problem sensitivity and the ability to communicate technical information orally and in writing. Must have good attendance record and experience working with others.

Apprenticeship Prerequisites

May be required to pass drug testing or other tests administered by the transit agency.

Occupational Pathways

Career pathways include transitioning to positions within a transit agency such as maintenance superintendent, maintenance manager, instructor, parts manager, warranty manager, or other transportation management positions within the organization. Other pathways include working outside the agency for private bus companies in maintenance/management positions, or for suppliers/vendors as service representatives, technicians, and product/sales representatives.

Certifications, Licensure and Other Credential Requirements

CREDENTIAL	Offered By	Before, During or After Apprenticeship
Transit Bus Certification tests	Automotive Service Excellence (ASE)	Before, During, or After
Air conditioning refrigeration test	Several organizations offer this. See list here: https://www.epa.gov/mvac/section-609-technician-training-and-certification-programs	Before, During, or After
Commercial Driver's License (CDL) test	See various state requirements.	Before, During, or After

Job Functions

JOB FUNCTIONS		Core or Optional
1.	Demonstrates mastery of fundamental skills	Core
2.	Maintains, diagnoses, and repairs electrical and electronic systems	Core
3.	Maintains, diagnoses, and repairs brake and air systems	Core
4.	Maintains, diagnoses, and repairs propulsion systems	Core
5.	Maintains, diagnoses, and repairs transmission and drivetrain systems	Core
6.	Maintains, diagnoses, and repairs steering and suspension systems	Core
7.	Maintains, diagnoses, and repairs heating, ventilation, and air conditioning (HVAC) systems	Core
8.	Maintains, diagnoses, and repairs body and chassis equipment and systems	Core
9.	Conducts preventive maintenance inspections	Core
10.	Maintains, diagnoses, and repairs articulated bus systems	Optional

Stackable Programs

This occupational framework is designed to link to the following additional framework(s) as part of a career laddering pathway.

Stackable Programs		Base or Higher Level	Stacks on top of
1.		Base Program	
2.			
3.			

Options and Specializations

The following options and specializations have been identified for this occupation. The Work Process Schedule and individual job function outlines indicate which job functions and competencies were deemed by industry advisors to be optional. Work Process Schedules for Specializations are included at the end of this document.

Options and Specializations	Option	Specialization
N/A		

Levels

Industry advisors have indicated that individuals in this occupation may function at different levels, based on the nature of their work, the amount of time spent in an apprenticeship, the level of skills or knowledge mastery, the degree of independence in performing the job or supervisory/management responsibilities.

Level	Distinguishing Features	Added Competencies	Added Time Requirements
N/A			

Work Process Schedule

Job Functions and Competencies

WORK PROCESS SCHEDULE Transit Bus Technician		ONET Code: 49-3031 RAPIDS Code: 2073CB
JOB TITLE:		
LEVEL:	**SPECIALIZATION:**	
STACKABLE PROGRAM ___yes _____no **BASE OCCUPATION NAME:**		
Company Contact: Name		
Address:	**Phone**	**Email**
Apprenticeship Type: **_____Competency-Based** **_____Time-Based _____Hybrid**	**Prerequisites**	

JOB FUNCTION 1: Demonstrates mastery of fundamental skills

Competencies	Core or Optional	RTI	OJT
A. Follows safe procedures	Core		
B. Correctly applies hand tools, power tools, and fasteners	Core		
C. Demonstrates basic rigging and hoisting ability	Core		
D. Demonstrates ability to apply basic industrial mathematics	Core		
E. Demonstrates basic mechanical ability	Core		
F. Demonstrates basic hydraulic and pneumatic ability	Core		
G. Demonstrates basic electrical and electronic ability	Core		
H. Demonstrates basic welding precautions	Core		

I. Demonstrates basic vehicle towing	Core		
JOB FUNCTION 2: Maintains and repairs low voltage electrical and electronic systems			
Competencies	Core or Optional	RTI	OJT
A. Follows safe procedures	Core		
B. Performs general electrical/electronic diagnosis	Core		
C. Performs battery diagnosis and repair	Core		
D. Performs starting system diagnosis and repair	Core		
E. Performs charging system diagnosis and repair	Core		
F. Performs lighting systems diagnosis and repair	Core		
G. Performs gauge and warning device diagnosis and repair	Core		
H. Diagnoses and repairs related electrical/electronic systems	Core		
I. Maintains, diagnoses, and repairs data communications systems (CAN, J1939, J 1708, etc.)	Core		
J. Maintains, diagnoses, and repairs multiplex systems	Core		
K. Maintains, diagnoses, and repairs fire suppression/ detection systems	Core		
L. Maintains, diagnoses, and repairs (electronic) signage systems	Core		
M. Maintains, diagnoses, and repairs fare collection equipment	Core		
N. Maintains, diagnoses, and repairs radio communications systems	Core		
O. Maintains, diagnoses, and repairs automatic stop announcement systems	Core		
P. Maintains, diagnoses, and repairs video surveillance equipment	Optional		
Q. Maintains, diagnoses, and repairs automatic passenger counters	Optional		
R. Maintains, diagnoses, and repairs wireless communication systems	Optional		
JOB FUNCTION 3: Maintains and repairs brake and air systems			

Competencies	Core or Optional	RTI	OJT
A. Follows safe procedures	Core		
B. Maintains, diagnoses, and repairs air supply and service systems	Core		
C. Maintains, diagnoses, and repairs mechanical/foundation disc and drum brakes	Core		
D. Maintains, diagnoses, and repairs parking brakes	Core		
E. Maintains, diagnoses, and repairs wheel bearings	Core		

JOB FUNCTION 4: Maintains, diagnoses, and repairs propulsion systems

Competencies	Core or Optional	RTI	OJT
A. Follows safe procedures	Core		
B. Maintains, diagnoses, and repairs internal combustion (IC) bus engines (note: applies generally to diesel, CNG and gasoline engines – see unique competencies below for each propulsion type)	Core		
C. Maintains, diagnoses, and repairs items specific to diesel engines	Core		
D. Maintains, diagnoses, and repairs items specific to gasoline engines	Optional		
E. Maintains, diagnoses, and repairs items specific to CNG engines and related systems	Optional		
F. Maintains, diagnoses, and repairs items specific to hybrid propulsion systems	Optional		
G. Maintains, diagnoses, and repairs items specific to electric propulsion systems	Optional		
H. Maintains, diagnoses, and repairs items specific to fuel cell propulsion systems	Optional		
I. Overhaul of engine	Optional		

JOB FUNCTION 5: Maintains, diagnoses, and repairs automatic transmissions and drivetrains

Competencies	Core or Optional	RTI	OJT
A. Follows safe procedures	Core		

B. Maintains, diagnoses, and repairs automatic transmissions	Core		
C. Maintains, diagnoses, and repairs drive shafts and universal joints	Core		
D. Maintains, diagnoses, and repairs drive axles	Core		
E. Overhaul of transmission	Optional		
JOB FUNCTION 6: Maintains, diagnoses, and repairs steering and suspension systems			
Competencies	Core or Optional	RTI	OJT
A. Follows safe procedures	Core		
B. Maintains, diagnoses, and repairs steering systems	Core		
C. Maintains, diagnoses, and repairs independent front suspensions	Core		
D. Maintains, diagnoses, and repairs straight/I-beam axles	Core		
E. Maintains, diagnoses, and repairs rear suspensions	Core		
F. Diagnoses, adjusts, and repairs wheel alignment	Core		
G. Maintains, diagnoses, and repairs wheels and tires	Core		
JOB FUNCTION 7: Maintains, diagnoses, and repairs heating, ventilation and air conditioning (HVAC) systems			
Competencies	Core or Optional	RTI	OJT
A. Follows safe procedures	Core		
B. Performs basic HVAC system verifications and testing	Core		
C. Maintains, diagnoses, and repairs a/c system and related components	Core		
D. Maintains, diagnoses, and repairs heating and engine cooling systems	Core		
E. Maintains, diagnoses, and repairs HVAC operating systems and related controls	Core		
JOB FUNCTION 8: Maintains, diagnoses, and repairs body and chassis equipment and systems			
Competencies	Core or Optional	RTI	OJT
A. Follows safe procedures	Core		

B. Maintains, diagnoses, and repairs operator and passenger seating	Core		
C. Maintains, diagnoses, and repairs stanchions, grab rails and modesty panels	Core		
D. Maintains, diagnoses, and repairs windows	Core		
E. Maintains, diagnoses, and repairs door systems	Core		
F. Maintains, diagnoses, and repairs flooring, paneling and roof hatches	Core		
G. Maintains, diagnoses, and repairs wheelchair lifts, ramps and restraints	Core		
H. Maintains, diagnoses, and repairs passenger signaling (stop request) systems	Core		
I. Inspects and repairs frame/chassis members	Core		
J. Welding	Optional		
K. Collision repair and paint refinishing	Optional		
JOB FUNCTION 9: Conducts preventive maintenance inspections			
Competencies	Core or Optional	RTI	OJT
A. Follows safe procedures	Core		
B. Inspects engine systems	Core		
C. Inspects body interior and exterior	Core		
D. Inspects electrical/electronic systems	Core		
E. Inspects frame and chassis	Core		
F. Conducts road test	Core		
JOB FUNCTION 10: Maintains, diagnoses, and repairs articulated bus systems			
Competencies	Core or Optional	RTI	OJT
A. Follows safe procedures	Optional		
B. Maintains, diagnoses, and repairs mechanical components of the articulation joint	Optional		
C. Maintains, diagnoses, and repairs hydraulic components of the articulation joint	Optional		

D.	Maintains, diagnoses, and repairs the electronic control system	Optional		
E.	Maintains, diagnoses, and repairs articulation bellows	Optional		

Specialization

Type of Specialization: _____

JOB FUNCTION 1:		
Competencies	RTI	OJT
JOB FUNCTION 2:		
Competencies	RTI	OJT
JOB FUNCTION 3:		
Competencies	RTI	OJT

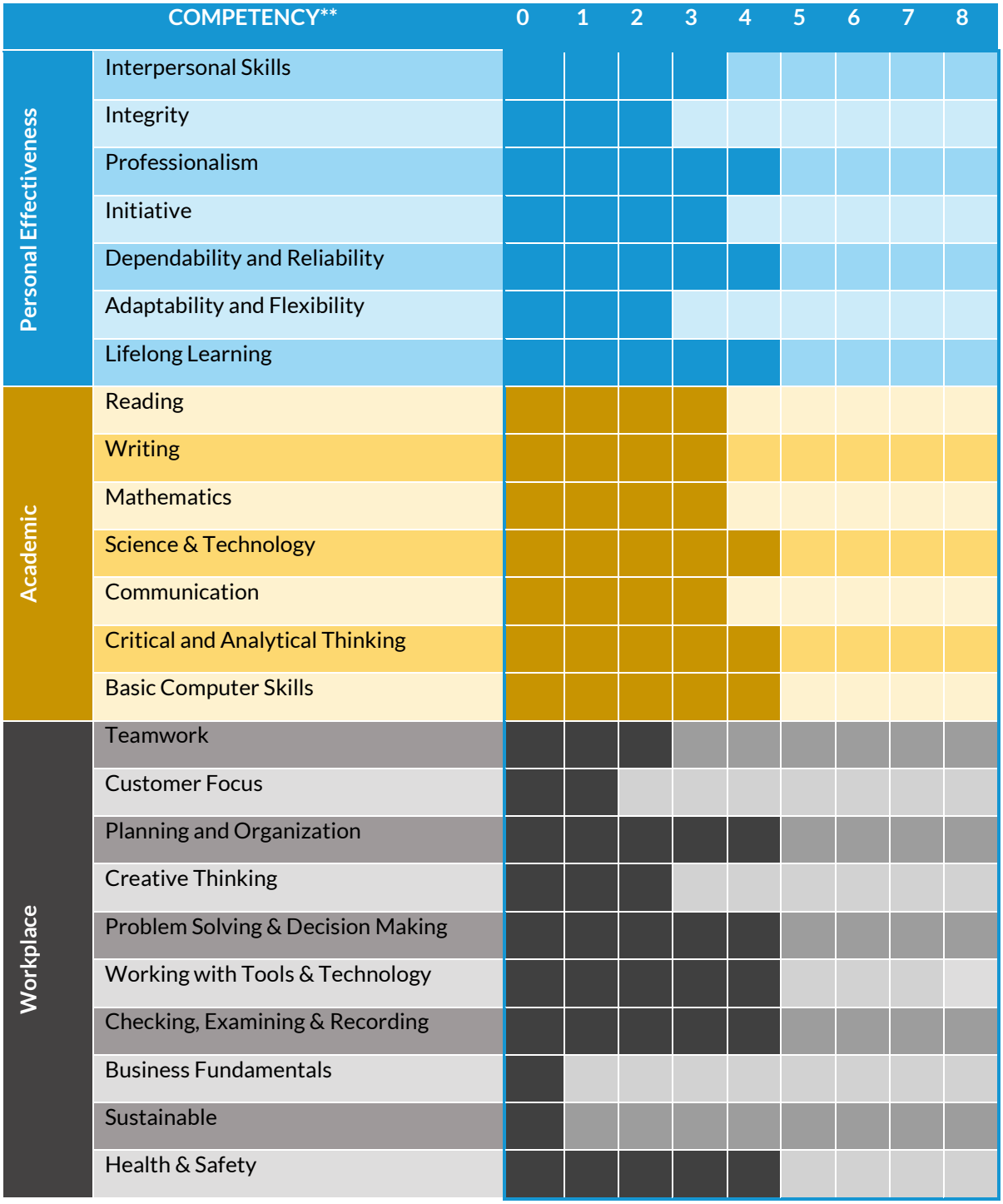
JOB FUNCTION 4:		
Competencies	RTI	OJT
JOB FUNCTION 5:		
Competencies	RTI	OJT

Related Technical Instruction Plan

COURSE NAME	**Course Number**
	Hours
LEARNING OBJECTIVES	
COURSE NAME	Course Number
	Hours
LEARNING OBJECTIVES	
COURSE NAME	Course Number
	Hours
LEARNING OBJECTIVES	
COURSE NAME	Course Number
	Hours

LEARNING OBJECTIVES	
COURSE NAME	Course Number
	Hours
LEARNING OBJECTIVES	

Cross-Cutting Competencies



**Cross-cutting competencies are defined in the Competency Model Clearinghouse:

https://www.careeronestop.org/CompetencyModel/competency-models/building-blocks-model.aspx

Cross-Cutting Competencies identify transferable skills – sometimes called "soft skills" or "employability skills" – that are important for workplace success, regardless of a person's occupation. Still, the relative importance of specific cross-cutting competencies differs from occupation to occupation. The Cross-Cutting Competencies table, above, provides information about which of these competencies is most important to be successful in a particular occupation. This information can be useful to employers or intermediaries in screening and selecting candidates for apprenticeship programs, or to pre-apprenticeship providers that seek to prepare individuals for successful entry into an apprenticeship program.

The names of the cross-cutting competencies come from the U.S. Department of Labor's Competency Model Clearinghouse and definitions for each can be viewed at https://www.careeronestop.org/CompetencyModel/competency-models/building-blocks-model.aspx

The scoring system utilized to evaluate the level of competency required in each cross cutting skill aligns with the recommendations of the Lumina Foundation's Connecting Credentials Framework. The framework can be found at: http://connectingcredentials.org/wp-content/uploads/2015/05/ConnectingCredentials-4-29-30.pdf

DETAILED JOB FUNCTIONS

JOB FUNCTION 1: Demonstrates mastery of fundamental skills

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Basic work safety protocols, habits and procedures • Basic mechanical, hydraulic and pneumatic principals • Basic electrical and electronic principals • Routine maintenance protocols and schedules • Basic automotive, transportation and bus technology terminology • Basic hand and power tools and their application • Basic fasteners and applications • Use of appropriate technical reference manuals to research bus equipment types, usage and specifications • Procedures to safely and properly lift and hoist buses and heavy bus equipment • Safe use and disposal of bio/hazardous waste • Advantages and disadvantages of different lubricant types	• Effectively communicate in English both verbally and written at a minimum 8th grade level; perform at 8th grade math level; have basic mechanical aptitude • Visual acuity; normal or corrected visual ability sufficient for vehicle observation and assessment • Physical endurance and mobility; remain continuously on task for several hours while standing, sitting, moving, lifting, bending and/or working in awkward positions; maneuver in small spaces; full range of notion; manual and finger dexterity; hand-eye coordination • Gross and fine motor skills sufficient to repair and operate equipment including vehicle operation • Olfactory senses (smell) sufficient for assessment of abnormal conditions of bus operation • Basic industrial math skills including fractions, metrics, decimals, angles, circles, volume, area, ratio, speed and measurement of all the above • Safely and correctly use basic hand, power and electrical tools and testing equipment • Critical thinking ability • Interpersonal abilities to interact with supervisors and fellow employees from a variety of backgrounds	• Basic hand tools including screw driver sets, wrench sets, ratchet/socket sets, torque wrench, punches and awls, hammers, plier sets, riveters and rivets, bolt cutters, wire brushes, hex (allen) keys, punch sets, chisel sets, files and rasps, cutters and snipes, scraping tools, utility knives, levels, caulk guns, and staple guns • Basic power tools • Basic diagnostic equipment (such as laptop, related software/hardware, interfaces, cables) • Digital volt ohm meter • Basic measurement tools and instruments including calipers, ruler, tape measure, dial indicator, thread pitch gauge, micrometer, straight edge, feeler gauge, angle gauge, dial caliper, offset gauge, spring tension gauge, depth gauge, belt tension gauge, etc. • Torque wrenches • Pressure test equipment; air pressure gauges • Tachometer • Pyrometer (temp gun), analog thermometer and digital thermometer • Tap and die sets • Seal installers and pullers; U-joint pullers and presses • Gasket sealant • Drain pan • Belt tension gauge

	• Professional attitude and demeanor; professional appearance and maintenance of physical and mental health; emotional stability • Ability to focus and concentrate on diagnostic, repair, and maintenance tasks requiring electrical and mechanical skills • Ability to locate and use service/parts manuals, troubleshoot guides and other technical reference materials • Ability to read and interpret hydraulic, pneumatic, electrical, and mechanical schematics • Basic skills in the operation of a computer in a Microsoft Windows environment • Ability to maintain reliable and timely attendance	• Heating and cutting equipment to remove hardware • Air compressor • Jacks, jack stands, lifts, forklifts, and cranes

Competency A: Follows safe procedures	Core or Optional
PERFORMANCE CRITERIA	
1. Properly lifts heavy objects	Core
2. Properly handles chemicals, hazards, and bloodborne pathogens	Core
3. Wears proper attire and personal protective equipment (PPE)	Core
4. Utilizes Safety Data Sheet (SDS) when handling chemicals	Core
5. Properly stores, dispenses, transports and disposes of waste materials	Core
6. Properly applies fall protection	Core
7. Properly protects against high voltage and amperage hazards - lockout/tagout procedures	Core
8. Keep safe work environment and safe housekeeping practices free of slip, trip and fall situations	Core
9. Properly works in confined spaces	Core

Competency B: Correctly applies hand tools, power tools, and fasteners	Core or Optional
PERFORMANCE CRITERIA	
1. Demonstrates tool hazards and safety	Core
2. Correctly uses hand and power tools (including cordless tools)	Core
3. Correctly uses pneumatic tools	Core
4. Applies correct fasteners - SAE standard and metric	Core
5. Applies correct fastener locking device(s)	Core
6. Applies correct fastener torque and tension	Core
7. Correctly forms and cuts fastener threads	Core
Competency C: Demonstrates basic rigging and hoisting ability	**Core or Optional**
PERFORMANCE CRITERIA	
1. Locates safe jacking points on a vehicle	Core
2. Demonstrates safe hoisting and jacking procedures	Core
3. Demonstrates safe hoisting and jacking procedures relative to each vehicle section on articulated vehicles (if applicable)	Core
4. Positioning/moving vehicles in a shop environment, including lifts, hoists, and pits	Core
Competency D: Demonstrates ability to apply basic industrial mathematics	**Core or Optional**
PERFORMANCE CRITERIA	
1. Adds and subtracts numbers	Core
2. Multiplies and divides numbers	Core
3. Applies fractions, percents, decimals, proportions, and angles	Core
4. Demonstrates understanding of metric system	Core
5. Demonstrates understanding of formulas	Core

Competency E: Demonstrates basic mechanical ability	Core or Optional
PERFORMANCE CRITERIA	
1. Demonstrate working knowledge and identification of power transmission such as gears, sprockets, chains, tensioners, belts, pulleys, and ratios	Core
2. Demonstrate working knowledge and identification of power translation such as cams and cam followers, linkages, and springs	Core
3. Demonstrate working knowledge and identification of friction reduction such as bushings and bearings	Core
4. Demonstrate working knowledge and identification of fasteners such as screws, nuts and bolts, pins, rings, clips, and couplings	Core
5. Demonstrate working knowledge of levers, wheel and axle, inclined plane, and wedge	Core
Competency F: Demonstrates basic hydraulic and pneumatic ability	**Core or Optional**
PERFORMANCE CRITERIA	
1. Demonstrate working knowledge of hydraulic principals	Core
2. Identifies common bus hydraulic applications	Core
3. Troubleshoot basic hydraulic faults	Core
4. Demonstrate working knowledge of pneumatic principals	Core
5. Identifies common bus pneumatic applications	Core
6. Troubleshoot basic pneumatic faults	Core
7. Ability to read hydraulic and pneumatic schematics	Core
Competency G: Demonstrates basic electrical and electronic ability	**Core or Optional**
PERFORMANCE CRITERIA	
1. Read basic electrical schematics and related symbols	Core
2. Demonstrates basic understanding of electricity and relationship between voltage, resistance and current	Core
3. Demonstrates basic understanding of direct current voltage and alternating current voltage	Core
4. Demonstrates basic understanding of conductors and non-conductors	Core
5. Demonstrates basic understanding of series and parallel circuits	Core
6. Demonstrates basic understanding of DC and AC motors	Core

7. Demonstrates basic understanding of electrical measurement and use of electrical meters	
Competency H: Demonstrates basic welding precautions	**Core or Optional**
PERFORMANCE CRITERIA	
1. **Demonstrate safe procedures to avoid primary and secondary electrical shocks**	Core
2. Demonstrate safe procedures to minimize overexposure to welding fumes and gases	Core
3. Correctly uses personal protective equipment (PPE) to avoid injuries from burns and exposure to arc rays	Core
4. Demonstrate ability to safeguard all onboard electrical and electronic equipment during the welding process	Core
Competency I: Demonstrates basic vehicle towing	**Core or Optional**
PERFORMANCE CRITERIA	
1. Identifies all equipment needed to tow a bus from the front and rear	Core
2. Correctly and safely connects tow vehicle to front and rear of bus (Note: may need to obtain proper towing endorsements based on state requirements)	Core

JOB FUNCTION 2: Maintains and repairs low voltage electrical and electronic systems

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Knowledge and understanding identified in Job Function 1 • Electrical theory including the application of protons, neutrons and electrons • Electricity fundamentals: volts, amperes, ohms and watts • Application of Direct Current (DC) and Alternating Current (AC) in vehicles • Mathematical relationship between voltage (E), current (I) and resistance (R) in an electrical circuit (Ohms Law) • Purpose of electrical conductors and insulators • Electrical circuits and wiring • Role of relays and switches in electrical circuits • Battery and charging systems • Electronic fundamentals • Evolution, purpose, and application of electronics in modern vehicles • Analog and digital electronics • Electronic components and circuits • Different types of electronic data communication protocols • Personal computer and laptop fundamentals including the latest version of Windows • Multiplex systems • Voltage drops and Kirchhoff's Law	• Those skills identified in Job Function 1 • Read electrical and ladder logic schematics • Soldering • Stripping and crimping wiring and making terminal connections including pin removal and installation • Use electrical/electronic tools and testing equipment	• Tools identified in Job Function 1: Demonstrates Mastery of Fundamental Skills • Digital multimeter (DMM) • Graphing multimeter (GMM) • Oscilloscope • Megger meter • Milliohm meter • Laptop computer with diagnostic software package and handheld diagnostic reader. • Wire stripping and crimping tool • Battery testing equipment • Battery post cleaner/brush • Battery charging equipment • Carbon pile load tester

Competency A: Follows safe procedures	Core or Optional
PERFORMANCE CRITERIA	
1. Performance Standards identified in Job Function 1, Competency 1a	Core

2. Utilizes shock protection tools and equipment when required	Core
3. Properly use test equipment to confirm an electrically safe work condition	Core
4. Plans electrical jobs in advance of performing the work to insure safe working conditions	Core
5. Properly performs lock-out, tag-out procedures	Core
6. Proper use and knowledge of specific high voltage PPE, including 1,000 volt gloves and fire protective clothing	Core
Competency B: Performs general electrical/electronic diagnosis	**Core or Optional**
PERFORMANCE CRITERIA	
1. Verify operator complaint, reproduce the condition (including intermittent problems), and/or road test vehicle; determine necessary action	Core
2. Check continuity in electrical/electronic circuits using appropriate test equipment	Core
3. Check applied voltages, circuit voltages, and voltage drops in electrical/ electronic circuits using a digital multimeter (DMM), or a graphing multimeter (GMM)	Core
4. Check current flow in electrical/electronic circuits and components using an ammeter, DMM, clamp-on ammeter, or GMM	Core
5. Check electronic circuit waveforms using an oscilloscope; interpret readings and determine needed repairs	Core
6. Check resistance in electrical/electronic circuits and components using an ohmmeter, DMM or GMM	Core
7. Locate shorts, grounds and opens in electrical/electronic circuits	Core
8. Diagnose battery drain problems with the master/key switch off	Core
9. Inspect and test fusible links, circuit breakers, solid-state current limiters and fuses; replace as required	Core
10. Inspect and test spike suppression diodes/resistors and capacitors; replace as required	Core
11. Inspect and test relays and solenoids; replace as required	Core
12. Read and interpret electrical schematic diagrams and symbols	Core
13. Remove, replace, and adjust electrical/electronic switches, sensors, and other electrical/electronic components	Core
14. Demonstrate proper care and handling of electrical/electronic components	Core

Competency C: Performs battery diagnosis and repair	Core or Optional
PERFORMANCE CRITERIA	
1. Perform battery tests (load and capacitance); determine needed repairs	Core
2. Determine battery state of charge by measuring terminal post voltage using a DMM	Core
3. Inspect, clean, and service battery, cables, terminal connections and disconnects; replace as required	Core
4. Inspect, clean and repair battery boxes, mounts and hold downs; replace as required	Core
5. Charge battery(s), using slow or fast charge method as appropriate	Core
6. Jump-start a transit bus using jumper cables and a booster battery or auxiliary power	Core
7. Identify different battery types	Core
Competency D: Performs starting system diagnosis and repair	**Core or Optional**
PERFORMANCE CRITERIA	
1. Perform starter circuit voltage drop tests and current draw; determine needed repairs	Core
2. Inspect and test components of the starter control circuit (key switch, push button and/or magnetic switch and wires); replace as required	Core
3. Inspect and test starter relays and solenoids/switches; replace as required	Core
4. Remove and replace starter; inspect flywheel ring gear or flex plate	Core
5. Inspect, clean, repair or replace cranking circuit battery cables and connectors	Core
6. Differentiate among electrical, multiplex or mechanical problems that cause a slow cranking, no cranking, extended cranking or cranking noise conditions	Core
Competency E: Performs charging system diagnosis and repair	**Core or Optional**
PERFORMANCE CRITERIA	
1. Diagnose the cause of a no-charge, low-charge, or overcharge condition and source voltage; determine needed repairs	Core
2. Inspect and adjust alternator drive belts/gears, pulleys, fans, mounting brackets, and tensioners; replace as required	Core
3. Perform charging system output tests (12-volt and 24-volt); determine needed repairs	Core

4. Perform charging circuit voltage drop tests; determine needed repairs	Core
5. Test, adjust or replace voltage regulator	Core
6. Maintain, remove, and replace alternator	Core
7. Inspect, repair or replace charging circuit connectors and wires	Core
8. Check battery equalizer output, check wiring and mounting; determine needed repairs	Core
9. Beltless alternator - verify operation	Core
10. Verify operation of charging system circuit monitor; determine needed repairs	Core
Competency F: Performs lighting system diagnosis and repair	**Core or Optional**
PERFORMANCE CRITERIA	
1. Diagnose the cause of brighter than normal, intermittent, dim, or no headlight and daytime running light (DRL) operation	Core
2. Test, aim, and replace headlights	Core
3. Test headlight and dimmer switches, wires, connectors, terminals, sockets, relays and control components; repair or replace as required	Core
4. Inspect, test and repair parking, clearance and taillight circuit switches, bulbs, sockets, connectors, terminals, relays, wires and light-emitting diodes (LEDs); replace as required	Core
5. Inspect, test and repair dash light circuit switches, bulbs, sockets, connectors, terminals, wires and printed circuits; replace as required	Core
6. Inspect, test and repair interior and exterior light circuit switches, bulbs, sockets, connectors, terminals, ballasts and wires; replace as required. Including Multiplex controlled LEDs	Core
7. Inspect and test stoplight circuit switches, bulbs, sockets, connectors, terminals, relays, control components and wires; repair or replace as required	Core
8. Diagnose the cause of turn signal and hazard flasher light system malfunctions; determine needed repairs	Core
9. Inspect and test turn signal and hazard circuit flashers, switches, bulbs, sockets, connectors, terminals, relays, wires and LEDs; repair or replace as required	Core
10. Inspect, test and adjust backup light and warning devices, circuit switches, bulbs, sockets, connectors, terminals and wires; repair or replace as required	Core

Competency G: Performs gauge and warning device diagnosis and repair	Core or Optional
PERFORMANCE CRITERIA	
1. Diagnose the cause of intermittent, high, low or no gauge readings; determine needed repairs	Core
2. Diagnose the cause of control area network (CAN) driven gauge malfunctions; determine needed repairs	Core
3. Inspect, test and adjust gauge circuit sending units, sensors, gauges, connectors, terminals and wires; repair or replace as required	Core
4. Inspect and test warning device (lights and audible) circuit sending units, sensors, bulbs, audible component, sockets, connectors, terminals, wires and printed circuits/control modules; repair or replace as required	Core
5. Inspect and test electronic speedometer and odometer systems; replace as required; verify proper calibration for vehicle application	Core
6. Inspect, test and diagnose multi-functional displays and instrument clusters	Core
Competency H: Diagnoses and repairs related electrical/electronic systems	**Core or Optional**
PERFORMANCE CRITERIA	
1. **Inspect and test horns, horn circuit relays, switches, connectors, terminals and wires; repair or replace as required**	Core
2. Diagnose the cause of constant, intermittent or no wiper operation; diagnose the cause of wiper speed control and/or park problems	Core
3. Inspect and test wiper motor, resistors, park switch, relays, switches, connectors, terminals and wires; repair or replace as required	Core
4. Inspect and test windshield washer motor or pump/relay assembly, switches, connectors, terminals and wires; repair or replace as required	Core
5. Inspect and test side view mirror motors, heater circuit grids, relays, switches, connectors, terminals and wires; repair or replace as required	Core
6. Inspect and test HVAC electrical components, including A/C clutches, motors, drivers, resistors, relays, switches, controls, connectors, terminals, and wires; repair or replace as required	Core
7. Inspect and test engine cooling fan electrical control components; replace as required	Core

Competency I: Maintains, diagnoses, and repairs data communications systems (CAN, J1939, J1708, etc.)	Core or Optional
PERFORMANCE CRITERIA	
1. Inspect, test, and diagnose data communication backbone	Core
2. Repair and replace data communication cables, connectors and terminals per manufacturer standards	Core
3. Inspect, test, diagnose, and repair/replace data communication gateway modules	Core
4. Inspect, test, diagnose, verify, and repair/replace vehicle telematics	Core
Competency J: Maintains, diagnoses, and repairs multiplex systems	**Core or Optional**
PERFORMANCE CRITERIA	
1. Inspect, test, and diagnose multiplex specific data communication cables, connectors, terminals per manufacturer standards	Core
2. Read and interpret ladder logic diagrams	Core
3. Using a laptop computer, establish communication with a multiplex control system. Verify that the needed ladder logic inputs are active to control an individual/specific ladder logic output	Core
4. Diagnose and repair computer communication multiplex systems; determine needed repairs	Core
5. Interpret LEDs for diagnostic purposes	Core
6. Upload/download system programs	Core

Competency K: Maintains, diagnoses, and repairs fire suppression/detection systems	Core or Optional
PERFORMANCE CRITERIA	
1. Identify location and purpose of various detectors and sensors	Core
2. Inspect, diagnose and repair inspect electronic control system	Core
3. Proper testing of system and connection procedure (simulator)	Core
4. Inspect, repair and replace heat sensors	Core
5. Inspect, repair and replace fire dispersing hoses and hardware	Core
6. Inspect, repair and replace cabling, resistors, and connectors	Core
7. Identify location and purpose of various detectors and sensors	Core
8. Inspect, diagnose and repair and replace optical detectors, thermal detectors and end of line device	Core
9. Inspect, diagnose and repair interfaces with the I/O control system	Core
10. Inspect and replace fire suppression agent, bottle and activation device	Core
11. Perform distribution restriction blowdown test, replace caps	Core
Competency L: Maintains, diagnoses, and repairs (electronic) signage systems	**Core or Optional**
PERFORMANCE CRITERIA	
1. Inspect functionality of the destination sign system	Core
2. Inspect, test, remove, and replace circuit boards and hardware	Core
3. Inspect, test, remove, and replace driver display	Core
4. Inspect, test, remove, and replace wiring and connectors	Core
5. Update destination sign program and firmware	Core
6. Diagnose malfunctions using LEDs	Core
7. Use of static straps during repairs	Core

Competency M: Maintains, diagnoses, and repairs fare collection equipment	Core or Optional
PERFORMANCE CRITERIA	
1. Inspect functionality trim units	Core
2. Inspect functionality of circuit boards	Core
3. Check and replenish fare card stock if equipped	Core
4. Inspect functionality of the fare collection system	Core
5. Verify communication between farebox and control unit	Core
6. Log into farebox using correct log-in procedure	Core
7. Identify fault codes, initiate additional diagnostic procedures, and make repairs as needed	Core
8. Inspect functionality of passenger display, transfer issue mechanism, coin bypass mechanism and magnetic card swipe reader and smart card processor if equipped	Core
Competency N: Maintains, diagnoses, and repairs radio communications systems	**Core or Optional**
PERFORMANCE CRITERIA	
1. Perform mechanical inspection of microphone, amplifier, radio, vehicle-mounted controls, speakers, emergency alarms, information signs, antennae, GPS equipment and any other equipment related to the vehicle communication systems and repair as required	Core
2. Perform electrical inspection of wiring (chafed or cut insulation, loose crimps or worn or corroded lugs, loose terminals, heat fatigue, connectors for damage), relay contacts for burns/pitting or other deformities), and fuses for burned, separated or otherwise damaged elements and repair as required	Core
3. Perform an operational (functional) check of the PA Announcement System including microphone, push-to-talk control, interior speakers, and exterior speaker(s)	Core
Competency O: Maintains, diagnoses, and repairs automatic stop announcement systems	**Core or Optional**
PERFORMANCE CRITERIA	
1. Perform an operational (functional) check of the Automatic Stop Request System including stock activation devices (switches), visual display unit(s), audio equipment and announcement messages, dash indicators, and door controls to extinguish visual displays and audio announcements; repair as required	Core

Competency P: Maintains, diagnoses, and repairs video surveillance equipment	Core or Optional
PERFORMANCE CRITERIA	
1. Perform an operational (functional) check of video surveillance equipment; clean cameras and lenses, inspect cameras and mounting devices for proper angle positioning, check the recording systems for proper connectivity and cleanliness, and check functionality of system firmware and software and update as needed; repair as required	Optional
Competency Q: Maintains, diagnoses, and repairs automatic passenger counters	**Core or Optional**
PERFORMANCE CRITERIA	
1. Perform an operational (functional) check of Automatic Passenger Counters including sensors and equipment to detect passenger boarding and alighting, power supply, signal processing equipment, sensor interface, and data transmission equipment; repair as required	Optional
Competency R: Maintains, diagnoses, and repairs wireless communication systems	**Core or Optional**
PERFORMANCE CRITERIA	
1. Perform an operational (functional) check of Wireless Communication Systems including modems, antennas, antenna cables, power supply, signal processing equipment, and data transmission equipment; repair as required	Optional

JOB FUNCTION 3: Maintains and repairs brake and air systems

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Knowledge and understanding identified in Job Function 1 • Knowledge and understanding identified in Job Function 2 • Identification and function of basic brake system components • Environmental issues related to working with solvents and cleaning equipment • Brake-related electrical and pneumatic schematics • Brake system types - drum (S-Cam, wedge) and disc • Lubricants and lubrication • Braking system failures • Road tests procedures • Wheel bearing components and failures • Anti-lock brakes (ABS) and automatic traction control (ATC) operation • Understanding of the shoe lining to include the scribe line and friction codes of the lining • Electronic stroke sensing system • Brake performance testing procedures using appropriate test equipment per applicable federal and/or state requirements • Performing brake repairs in accordance with recommended APTA procedures	• Skills identified in Job Function 1 • Skills identified in Job Function 2 • Ability to use air/brake tools and testing equipment.	• Tools identified in Job Function 1 • Tools identified in Job Function 2 • Pneumatic gauges • Lathe to machine drums and rotors • Diagnostic reader (laptop computer with appropriate software) • Tools for cutting lines, attaching fittings, etc. • Torque wrenches, torque multipliers, measuring tools, and decel meters

Competency A: Follows safe procedures	Core or Optional
PERFORMANCE CRITERIA	
1. **Performance Standards identified in Job Function 1**	Core
2. **Demonstrates proper use of spring parking brake (release and cage)**	Core
3. **Knowledge of de-energizing spring brake chambers**	Core
4. **Protection against brake dust**	Core
Competency B: Maintains, diagnoses, and repairs air supply and service systems	**Core or Optional**
PERFORMANCE CRITERIA	
1. **Diagnose poor stopping, pulling, grabbing, dragging, and air leak (static and applied) problems, caused by supply and service system malfunctions; determine needed repairs**	Core
2. **Check air system build-up and recovery time; determine needed repairs**	Core
3. **Drain air reservoir tanks; check for oil, water and foreign material; determine needed repairs**	Core
4. **Inspect, adjust, align or replace air compressor drive belts, pulleys, tensioners, drive gears and couplings**	Core
5. **Inspect, repair or replace air compressor, air cleaner, oil and coolant lines and fittings**	Core
6. **Inspect, test, adjust or replace system pressure controls (governor/relief valve), unloader assembly valves, pressure protection valves and filters**	Core
7. **Inspect, repair or replace air system lines, hoses, fittings and couplings.**	Core
8. **Inspect, test, clean or replace air tank relief (pop-off) valves, one-way check valves, drain cocks, automatic drain (spitter) valves, heaters, wiring and connectors**	Core
9. **Inspect, clean, repair or replace air drier systems, filters, valves, heaters, wiring and connectors**	Core
10. **Inspect, test, adjust, repair or replace brake application (foot/treadle) valve, fittings, and mounts; check and adjust brake pedal free play**	Core
11. **Inspect, test, clean, or replace two-way (double) check valves and anti-compounding valves**	Core
12. **Inspect, test, repair or replace stop and parking brake light circuit switches, wiring and connectors**	Core
13. **Inspect, test, repair or replace brake relay valve and quick-release valves**	Core

14. Inspect, test, repair or replace interlock system solenoid valves, regulator valves, pressure switches and related components	Core
15. Inspect, test and replace inversion/emergency (spring) brake control valve(s) and emergency brake release system	Core
16. Inspect, test, repair or replace low-pressure warning devices	Core
17. Inspect, test and replace air pressure gauges, lines and fittings	Core
18. Inspect, test and replace parking brake override valve	Core
19. Inspect, test, repair or replace towing circuit components	Core
20. Perform antilock brake system (ABS) warning lamp start-up test; determine needed repairs; diagnose hard fault codes/diagnostic trouble codes (DTCs) using scan tool, PC computer, or LEDs; determine needed repairs	Core
21. Diagnose poor stopping and lockup problems on ABS; determine needed repairs	Core
22. Test, adjust or replace ABS wheel speed sensors and tone/exciter rings	Core
23. Test and replace ABS, electronic control units (ECUs) and modulator valves; test, repair and replace wiring and connectors	Core
24. Verify proper operation of auxiliary (transmission retarder, driveline, exhaust, and engine) braking systems	Core
Competency C: Maintains, diagnoses, and repairs mechanical/foundation disc and drum brakes	**Core or Optional**
PERFORMANCE CRITERIA	
1. Diagnose poor stopping, brake noise, premature wear, pulling, grabbing or dragging complaints caused by foundation brake, slack adjuster and brake chamber problems; determine needed repairs	Core
2. Perform deceleration tests on service and parking brake systems	Core
3. Inspect, test, adjust, repair or replace service brake chambers, diaphragm, clamp, spring, pushrod, clevis and mounting brackets	Core
4. Inspect, test, adjust, repair or replace automatic slack adjusters	Core
5. Inspect or replace cams, rollers, shafts, bushings, seals, spacers and retainers	Core
6. Inspect, or replace brake spider, shields, anchor pins, bushings and springs	Core
7. Inspect, clean, rebuild or replace, and adjust air disc brake caliper assemblies	Core
8. Inspect brake shoes, linings, or pads; determine needed repairs	Core
9. Inspect brake drums or rotors; determine needed repairs	Core
10. Resurface brake drums and linings; resurface rotors	Core

Competency D: Maintains, diagnoses, and repairs parking brakes	Core or Optional
PERFORMANCE CRITERIA	
1. Inspect or replace parking brake chamber; dispose of removed chambers in accordance with local regulations	Core
2. Inspect, test or replace parking (spring) brake valves, lines, hoses and fittings	Core
3. Manually release and cage parking (spring) brakes	Core
Competency E: Maintains, diagnoses, and repairs wheel bearings	**Core or Optional**
PERFORMANCE CRITERIA	
1. Remove and replace axle hub and wheel assembly	Core
2. Clean, inspect, lubricate or replace wheel bearing assemblies; replace seals and wear rings	Core
3. Adjust axle wheel bearings in accordance with manufacturer's procedures	Core
4. Inspect or replace extended service (sealed, close-tolerance and unitized) bearing assemblies; perform initial installation in accordance with manufacturer's procedures	Core
5. Replace seals and O-rings on planetary axle assemblies; adjust axle endplay	Core

JOB FUNCTION 4: Maintains, diagnoses, and repairs propulsion systems

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
General • Knowledge and understanding identified in Job Function 1 • Knowledge and understanding identified in Job Function 2 • SAE, CAN and other data communication protocols • Importance of conducting all diagnostic tests according to manufacturer's specifications • Purpose of warning lights and audible alarms **Internal Combustion Engines** • Principals of internal engine design and operation • Engine electronic control systems • Engine types and sub system components • Fluid types (oils, coolants, etc.) and viscosity • Starting and charging systems • Differences between sensors and sending units • Effects of exhaust back pressure • Fastener torque procedure for cylinder heads • Engine lubrication, oil pump operating pressure and relief valve operation • Theory of exhaust emissions and ways to reduce emissions through engine and exhaust after-treatment means • Function and operation of vibration dampeners • Effects of low or high fuel pressure on engine performance • Conditions that would activate engine protection systems • Conditions that would cause abnormal engine/drive train vibrations • Interface between the engine and bus manufacturer specific devices (e.g., fire suppression)	• Skills identified in Job Function 1 • Skills identified in Job Function 2 • Identification of propulsion components • Removal and replacement of propulsion components • Conduct all diagnostic tests according to manufacturer's specifications • Use diagnostic software per each propulsion system OEM, BAE, Allison, Proterra, etc.	**General** • Tools identified in Job Function 1 • Tools identified in Job Function 2 • Manufacturer provided tools and diagnostic software • Listening tools to detect noises and harmonics • Infrared temperature gauge • Antifreeze test kit (to determine conditioner concentration levels) • Spectrometer (to check antifreeze concentration levels) **Internal Combustion Engines** • PH strips for testing coolant • Fuel gauge, vacuum gauge, pressure gauge/mercury manometer • Specialized fuel system test equipment • Gear removal and installation tools • Injector height gauges • Exhaust back pressure test equipment **Diesel Engines** • Hydrometer and/or refractometer **CNG Engines** • Methane leak detection equipment **Hybrid Propulsion** • Hi-pot tester/megger • Isolation tester • Digital multimeter with adequate capabilities (1000 V, auto ranging, Cat 3 or 4) • OEM specific test equipment, breakout box, etc **Electric Propulsion** • (Same as Hybrid Propulsion) **Fuel Cell Propulsion** • To be determined (Technology not yet fully developed for transit applications)

• OEM specific alarm stages and shut down features • Operation of variable ratio/geometry turbo chargers • Procedures needed to rebuild internal combustion engines and related components **Diesel Engines** • Principals and properties of diesel fuels and auto ignition • Differences and applications of distributor and in-line type injection pumps and mechanical unit injectors; understand Common Rail system applications • Exhaust emissions specific to diesel engines and related emissions reduction equipment including exhaust gas recirculation (EGR), oxidation catalysts, diesel particulate filters, selective catalytic reduction (SCR), and related subsystems **CNG Engines** • Principals and properties of gaseous fuel • Effects of various pressure levels • Federal, state, local codes and regulations; NFPA codes; building codes • Mercaptan (odor agent) and what it's used for • Exhaust emissions specific to CNG engines and related emissions reduction equipment including oxidation catalysts and EGR • Primary and secondary ignition systems and related components • Unique CNG engine tune-up procedures **Hybrid Propulsion** • Difference between series and parallel hybrid systems • Regenerative braking and dissipation of excess power • Purpose and function of hybrid cooling system • Purpose and function of high-voltage isolation and how it is implemented including high voltage shut down procedures		**Fire Detection and Suppression** • OEM specific test kits

• Exhaust emissions specific to hybrid propulsion and related emissions reduction equipment • Understand ESS (energy storage system) unique to each hybrid propulsion system including overhaul and repair • Understand inverter testing and repair **Battery Electric Propulsion** • Various types of batteries and energy storage devices • Various types of battery and energy storage charging equipment and procedures • Various types of battery propulsion equipment • Understand cooling loops unique to all electric propulsion • Understanding of charging the bus utilizing depot charging and fast charging **Fire Detection and Suppression** • Understands fire detection and suppression systems, manual and automatic deployment, purpose of various detectors and sensors, extinguishing agents, and OEM specific alarm stages and shut down features		

Competency A: Follows safe procedures	Core or Optional
PERFORMANCE CRITERIA	
General	Core
1. Performance Standards identified in Job Function 1	Core
2. Applies lock-out/tag-out procedures	Core
Diesel Propulsion	Core
3. Identify high pressure and low pressure within fuel system	Core
4. Demonstrate use of specialized PPE for working on high pressure fuel systems	Core
CNG Propulsion	Core
5. Identify location and purpose of various detectors and sensors	Core

6. CNG cylinder and Fuel System inspection	Core
Hybrid/Electric Propulsion	Core
7. Fulfills local high-voltage electrical safety certification requirements (if applicable)	Core
8. Works safely with high-voltage orange cables	Core
9. Demonstrate use of specialized tools for high-voltage testing	Core
10. Demonstrate use of insulated tools in safe condition to work on high-voltage equipment and wiring	Core
11. Demonstrate use of specialized PPE for working on hybrids/electric propulsion vehicles	Core
12. Demonstrate use of fall protection and other equipment for roof access	Core
13. Demonstrate use of shepherd's hook/hot stick and follows other safety requirements for two-person jobs	Core
14. Demonstrate ability to correctly enter a battery tub/enclosure	Core
15. Correctly follows procedures for washing electric propulsion systems	Core
Fuel Cell Propulsion	Core
16. To be determined (Technology not yet fully developed for transit applications)	Core
Fire Detection and Suppression	Core
17. Verify that a bus alarm and safety features have been programmed correctly	Core
Competency B: Maintains, diagnoses, and repairs internal combustion (IC) bus engines (note: applies generally to diesel, CNG and gasoline engines – see unique competencies below for each propulsion type)	**Core or Optional**
PERFORMANCE CRITERIA	
General IC Engine Diagnosis	Core
1. Verify the complaint, and road test vehicle; review operator service request and past maintenance documents (if available); determine further diagnosis	Core
2. Inspect engine assembly and engine compartment for fuel, oil, coolant, exhaust, or other leaks; determine needed repairs	Core
3. Inspect engine compartment wiring harness, connectors, seals, and locks; check for proper routing and terminal/connector condition; determine needed repairs	Core
4. Listen for and diagnose engine noises; determine needed repairs	Core
5. Check engine exhaust emissions, odor, smoke color, opacity (density) and quantity; determine needed repairs	Core

6. Perform air intake system restriction and leakage tests; determine needed repairs	Core
7. Perform intake manifold pressure tests; determine needed repairs	Core
8. Perform exhaust backpressure and temperature tests; determine needed repairs	Core
9. Perform crankcase pressure test; determine needed repairs	Core
10. Diagnose no cranking, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed repairs	Core
11. Diagnose surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems; determine needed repairs	Core
12. Isolate and diagnose engine related vibration problems; check engine mounts; determine needed repairs	Core
13. Check cooling system for temperature protection level, contamination, coolant type and level, temperature, pressure, supplemental coolant additive (SCA) concentration, filtration, and fan operation; determine needed repairs	Core
14. Check lubrication system for contamination, oil level, quality, temperature, pressure, filtration, and oil consumption; determine needed repairs	Core
15. Check, record, and clear electronic diagnostic codes; monitor electronic data; determine needed repairs	Core
16. Perform visual inspection for physical damage and missing, modified, or tampered components; determine needed repairs	Core
17. Research applicable vehicle and service information, service precautions, and technical service bulletins; determine needed actions	Core
IC Engine Fuel System Diagnosis and Repair - Mechanical Components	Core
18. Inspect, repair or replace fuel tanks, vents, cap(s), mounts, valves, screens, crossover system, supply and return lines, and fittings	Core
19. Inspect, adjust, repair or replace mechanical engine throttle and controls	Core
20. Inspect, test, repair or replace fuel injection nozzles	Core
21. Inspect, test, adjust, repair or replace engine fuel shut-off devices and controls, including engine protection shut-down devices, circuits and sensors	Core
IC Engine Fuel System Diagnosis and Repair - Electronic Components	Core
22. Inspect and test for missing, modified, or damaged, engine control components and programmed parameters (factory and customer)	Core
23. Interpret diagnostic scan tool data to determine program parameters (factory and customer) and engine control system condition	Core
24. Establish relative importance and accuracy of displayed data	Core
25. Determine if the control system problem is electrical/electronic or mechanical	Core

26. Determine appropriate electronic engine control diagnostic procedures based on vehicle data, operational complaint, and utilize relevant service information and diagnostic tools	Core
27. Perform digital multimeter tests on circuits	Core
28. Test input sensors/circuits using displayed data	Core
29. Test output actuators/circuits using displayed data	Core
30. Test and confirm operation of electrical/electronic circuits not displayed on diagnostic tools	Core
31. Diagnose performance complaints caused by non-engine electronic control system problems	Core
32. Determine root cause of current, multiple, and repeated failures	Core
IC Engine Cylinder Head and Valve Train Diagnosis and Repair	Core
33. Remove, inspect, disassemble, and clean cylinder head assembly(s)	Core
34. Inspect threaded holes, studs, and bolts for serviceability; service or replace as needed	Core
35. Measure cylinder head-to-deck thickness, and check mating surfaces for warpage and surface finish; inspect for cracks and damage; check condition of passages; inspect core and gallery plugs; service as needed	Core
36. Inspect valves, guides, seats, springs, retainers, rotators, locks and seals; determine serviceability and needed repairs	Core
37. Inspect, reinstall or replace injector sleeves and seals; pressure test to verify repair (if applicable); measure injector tip or nozzle protrusion where specified by manufacturer	Core
38. Inspect, reinstall or replace valve bridges (crossheads) and guides; adjust bridges (cross-heads)	Core
39. Clean components; reassemble, check, and install cylinder head assembly as specified by the manufacturer	Core
40. Inspect, measure, reinstall, or replace pushrods, rocker arms, rocker arm shafts, and supports for wear, bending, cracks, looseness, and blocked oil passages. Visually inspect for wear and correct routing	Core
41. Inspect, install, and adjust cam followers	Core
42. Adjust valve clearances and injector settings	Core
43. Inspect, measure, and reinstall or replace overhead camshaft and bearings; measure and adjust endplay and backlash	Core
IC Engine Lubrication and Cooling Systems Diagnosis and Repair	Core
44. Verify engine oil pressure and check operation of pressure sensor, pressure gauge, and sending unit	Core
45. Inspect measure, repair or replace oil pump, drives, pipes, and screens	Core

46. **Inspect, repair or replace oil pressure regulator valve(s), by-pass valve(s), and filters**	Core
47. **Inspect, clean, test, reinstall or replace oil cooler, by-pass valve, oil thermostat, lines and hoses**	Core
48. **Inspect turbocharger lubrication system (if applicable); repair or replace as needed**	Core
49. **Change oil and filter, verify oil level and condition.**	Core
50. **Inspect, reinstall or replace drive belts, pulleys and tensioners; adjust drive belts and check alignment**	Core
51. **Verify coolant temperature, and check operation of temperature and level sensors, temperature gauge, and sending unit**	Core
52. **Inspect and replace cooling system thermostat(s), by-passes, housing(s), and seals**	Core
53. **Flush and refill cooling system; bleed air from system; recover coolant**	Core
54. **Inspect, repair or replace coolant conditioner/filter, check valves, lines, shutoff valves, and fittings**	Core
55. **Inspect, repair, or replace water pump, housing, hoses, idler pulley and drives**	Core
56. **Inspect radiator, pressure cap, and tank(s); determine needed service**	Core
57. **Inspect, repair, or replace fan hub, fan, and fan clutch; inspect mechanical, hydraulic, and electronic fan controls, fan thermostat, and fan shroud**	Core
58. **Pressure test cooling system and radiator cap; determine needed repairs**	Core
IC Engine Air Induction and Exhaust Systems Diagnosis and Repair	Core
59. **Inspect, service or replace air induction piping, air cleaner, and element; check for air restriction or contamination**	Core
60. **Inspect, test, and replace turbocharger, wastegate, and wastegate controls (if applicable)**	Core
61. **Inspect and replace intake manifold and gaskets; test temperature and pressure sensors; check connections**	Core
62. **Inspect, test, clean, repair or replace aftercooler or charge-air cooler and piping system (if applicable)**	Core
63. **Inspect, repair or replace exhaust manifold, gaskets, piping, mufflers, insulation/heat shield and mounting hardware; inspect, replace, or repair exhaust after treatment devices**	Core
64. **Inspect, repair or replace preheater/inlet air heater, starting aids, and controls**	Core
65. **Inspect, test, service, and replace EGR system components; including EGR valve, variable ratio/geometry turbocharger, cooler, piping, filter, electronic sensors, controls, system air pressure solenoids, and wiring (if applicable)**	Core
66. **Inspect and repair exhaust brake system (if applicable)**	Core

67. Determine root cause of current, multiple, and repeated failures	Core
IC Engine Block Diagnosis, Repair and Overhaul	Core
68. Remove, inspect, service, and reinstall pans, covers, breathers, gaskets, seals, and wear rings	Core
69. Disassemble, clean, and inspect engine block for cracks; check mating surfaces for damage or warpage and surface finish; check deck height; check condition of passages, core, and gallery plugs; inspect threaded holes, studs, dowel pins and bolts for serviceability; service, reinstall or replace as needed	Core
70. Inspect cylinder sleeve counterbore and lower bore; check bore distortion; determine needed service	Core
71. Inspect and measure cylinder walls or liners for wear and damage; determine needed service	Core
72. Replace/reinstall cylinder liners and seals; check and adjust liner heights	Core
73. Inspect in-block camshaft bearings for wear and damage; replace as needed	Core
74. Inspect measure, reinstall or replace in-block camshaft; measure and adjust end play; inspect, reinstall or replace, and adjust cam followers (if applicable)	Core
75. Clean and inspect crankshaft and journals for surface cracks and damage; check condition of oil passages; check passage plugs; measure journal diameters; check mounting surfaces; determine needed service	Core
76. Inspect, reinstall or replace main bearings; check cap fit and bearing clearances; check and correct crankshaft endplay	Core
77. Inspect, reinstall, and time the drive gear train (check timing sensors, gear wear and back-lash of crankshaft, camshaft, balance shaft, auxiliary drive, and idler gears); service shafts, bushings, and bearings	Core
78. Clean, inspect measure, reinstall or replace pistons, pins, and retainers	Core
79. Measure piston-to-cylinder wall clearances	Core
80. Check ring-to-groove clearances and end gaps; install piston rings	Core
81. Identify piston, connecting rod bearing, and main bearing wear patterns that indicate connecting rod and crankshaft alignment or bearing bore problems; check bearing bore and bushing condition; determine needed repairs	Core
82. Assemble pistons and connecting rods and install in block; check piston height; replace rod bearings and check clearances; check condition, position, and clearance of piston cooling jets (nozzles - if applicable)	Core
83. Inspect and measure crankshaft vibration damper; determine needed repairs	Core
84. Inspect, install, and align flywheel housing	Core
85. Inspect flywheel or flexplate (including ring gear) and mounting surfaces for cracks, wear, and runout; determine needed repairs	Core

Competency C: Maintains, diagnoses, and repairs items specific to diesel engines	Core or Optional
PERFORMANCE CRITERIA	
Diesel Fuel System Diagnosis and Repair - Mechanical Components	Core
1. Inspect, clean, test, repair or replace fuel transfer pump, lift pump, drives, screens, fuel/water separators/indicators, filters, heaters, coolers, ECM cooling plates, and mounting hardware	Core
2. Check fuel system for air and temperature; determine needed repairs; prime and bleed fuel system; check, repair or replace primer pump	Core
3. Inspect, test, repair or replace low/high pressure systems (check valves, pressure regulator valves and restrictive fittings)	Core
4. Perform on-engine inspections, tests, adjustments, and time, or replace and time, distributor type injection pumps	Core
5. Perform on-engine inspections, tests, and adjustments, or replace mechanical unit injectors	Core
6. Inspect, adjust, repair or replace smoke limiters (air/fuel ratio controls)	Core
7. Inspect, reinstall or replace high-pressure injection lines, fittings, seals, and mounting hardware	Core
8. Inspect and test high pressure fuel system (common rail) including pump, relief valve, and injectors	Core
Diesel Fuel System Diagnosis and Repair - Electronic Components	Core
9. Same as IC Engine Fuel System Diagnosis and Repair - Electronic Components	Core
Diesel Engine Air Induction and Exhaust Diagnosis	Core
10. Properly diagnose engine performance issues due to boost pressure, pressure test the air induction system, charge air cooler and bellows and perform exhaust restriction testing	Core
11. Perform emission related diagnostics per troubleshooting manuals, pull ECM images and perform regeneration to evaluate emissions after treatment regeneration times/temperatures	Core
12. Isolate failed components (diesel oxidation catalyst [DOC], diesel particulate filter [DPF] or selective catalytic reduction [SCR]) using laptop diagnostics	Core
13. Perform bi-lateral functions to test/diagnose Diesel Exhaust Fluid (DEF) system failures	Core
14. Same as IC Engine Air Induction and Exhaust Systems Diagnosis and Repair	Core

Competency D: Maintains, diagnoses, and repairs items specific to gasoline engines	Core or Optional
PERFORMANCE CRITERIA	
1. Inspect and replace spark plugs and ignition wires	Optional
2. Inspect and diagnose primary and secondary ignition systems	Optional
3. Diagnose and replace mass air flow sensors, throttle actuators, pressure density switches, cam and crank sensors, throttle valves, and other gasoline related engine parts	Optional
4. Perform gasoline fuel supply and fuel return system tests; check fuel for contamination; quality/type/grade, and consumption; determine needed repairs	Optional

Competency E: Maintains, diagnoses, and repairs items specific to CNG engines and related systems	Core or Optional
PERFORMANCE CRITERIA	
General	Optional
1. Perform gaseous fuel delivery system tests; check fuel for contamination, quality/type/grade, and consumption; determine needed repairs	Optional
2. Use detection equipment to locate leaks	Optional
3. Inspect and replace spark plugs and ignition wires	Optional
4. Inspect and diagnose primary and secondary ignition systems	Optional
5. Diagnose and replace mass air flow sensors, throttle actuators, pressure density switches, cam and crank sensors, throttle valves, and other CNG related engine parts	Optional
CNG Fuel Storage Cylinders and related components	Optional
6. Perform system inspections (annually, and after low clearance accidents)	Optional
7. Inspect cylinder mountings for security, gouges, rubs, etc.; inspect lines and fittings; inspect for UV damage using tool; inspect all pressure relief devices/tank isolation valves; inspect high pressure regulator; and inspect routing of vent lines	Optional
8. Use OEM specifications to evaluate and measure fuel storage tank scratches and gauges	Optional
CNG Fuel Distribution Systems	Optional
9. Demonstrates the ability to correctly fabricate/bend replacement lines with proper fittings (Swagelock)	Optional

Competency F: Maintains, diagnoses, and repairs items specific to hybrid propulsion systems	Core or Optional
PERFORMANCE CRITERIA	
Energy Storage System (ESS)	Optional
1. Use a laptop to identify ESS faults	Optional
2. Inspect, maintain and repair: ESS cooling system, control system (internal to ESS), disconnect features (shunt disconnects), mechanical enclosure, isolation system, and cables in the ESS	Optional
3. Inspect, repair, overhaul, and rebuild ESS	Optional
4. Diagnose and repair ESS end of life condition	Optional
Power Inverter/Power Electronics	Optional
5. Use a laptop to identify Power Inverter/Power Electronics faults	Optional
6. Inspect, maintain and repair: inverter and related control system, high-voltage cables, DC-to-DC converter, cooling system, and communication between components	Optional
7. Diagnoses and repair High Voltage Interlock Loop (HVIL) problems	Optional
8. Diagnoses and repair ESS problems associated with fuses, relays, contactors, and wiring	Optional
Power Generation	Optional
9. Use a laptop to identify Power Generation faults	Optional
10. Inspect and maintain generator/motor	Optional
11. Use OEM schematics to determine fault in propulsion system	Optional
High-Voltage Cables	Optional
12. Inspect and maintain shielded and non-shielded cables	Optional
13. Inspect and test for opens, shorts, and EMI problems	Optional
14. Uses DVOM and MEGGER to diagnose/test cables, terminal ends and connections	Optional
Electric Drive/Traction Motor	Optional
15. Inspect, maintain and repair: AC induction motors, wheel motors (if present), regenerative braking function, cooling system and cables	Optional
16. Diagnoses and repair speed sensors, temp sensors, associated with the Drive/Traction Motor	Optional
17. Diagnoses and repair Drive/Traction Motor including stator problems	Optional
18. Pressure check drive when applicable	Optional

Data Communication Networks	Optional
19. Verify communication between components on data network	Optional
20. Inspect, maintain and repair: terminating resistors, gateways, interface with engine control module or unit (ECM/ECU), shielded and non-shielded data cables, shielded and non-shielded data cables	Optional
21. Diagnose and repair the High Voltage Interlock Loop (HVIL)	Optional
22. Verify integrity of control area network (CAN) and other applicable networks	Optional
23. Inspect and repair terminals and connector used on CAN and other applicable networks	Optional
24. Diagnoses CAN and other applicable network errors and faults	Optional
Competency G: Maintains, diagnoses, and repairs items specific to electric propulsion systems	**Core or Optional**
PERFORMANCE CRITERIA	
Energy Storage System (ESS)	Optional
1. Diagnoses and repair ESS end of life condition	Optional
2. Diagnoses and repair ESS problems associated with fuses, relays, contactors, and wiring	Optional
Electric Drivetrain	Optional
3. Inspect, maintain and repair: AC induction motors, wheel motors (if present), regenerative braking function, cooling system and cables	Optional
Facility and Wayside Chargers (to be determined)	Optional
Competency H: Maintains, diagnoses, and repairs items specific to fuel cell propulsion systems	**Core or Optional**
PERFORMANCE CRITERIA	
1. To be determined (technology not yet fully developed for transit applications)	Optional
Competency I: Overhaul of engine	**Core or Optional**
PERFORMANCE CRITERIA	
1. Overhaul engine	Optional

JOB FUNCTION 5: Maintains, diagnoses, and repairs automatic transmissions and drivetrains

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Knowledge and understanding identified in Job Function 1 • Knowledge and understanding identified in Job Function 2 • Identification and function of basic transmission and drivetrain system components • Principals of fluid and mechanical drive systems • Importance of maintaining transmission fluid at correct level; detecting problems through sight, sound and smell • Causes and consequences of drive shaft vibrations • Application of different seal types • Importance of drive line clearances, alignment angles, gear tooth contact patterns • Effects of vibrations in transmission and differential • Role of data communication between the drivetrain and other vehicle components	• Skills identified in Job Function 1 • Skills identified in Job Function 2	• Tools identified in Job Function 1 • Tools identified in Job Function 2 • Fluid flushing equipment • Axle puller, angle gauges, dial indicators, micrometers, protrusion gauges, gear tooth pattern contact indicator paste • Seal removal and installation with proper drivers/special tools as indicated by manuals.

Competency A: Follows safe procedures	**Core or Optional**
PERFORMANCE CRITERIA	
1. Performance Standards identified in Job Function 1	Core
2. Uses manufacturers or approved lifting/support/removal devices for proper weight ratings and component being removed/installed	Core
Competency B: Maintains, diagnoses, and repairs automatic transmissions	**Core or Optional**
PERFORMANCE CRITERIA	
1. Diagnose noise, vibration, and shifting problems; determine needed repairs	Core
2. Check transmission fluid level; check dipstick calibration; diagnose fluid usage, leaks, and condition; determine needed repairs	Core

3. **Perform transmission pressure tests; determine needed repairs**	Core
4. **Perform stall tests; determine needed repairs**	Core
5. **Perform lock-up converter system tests; determine needed repairs**	Core
6. **Diagnose mechanical control systems; determine needed repairs**	Core
7. **Replace fluid and internal/external filter(s)**	Core
8. **Inspect, test, adjust, and/or replace retarder controls, valves, air lines, sensors, and components**	Core
9. **Inspect and replace external seals and gaskets**	Core
10. **Inspect, test, flush, transmission, transmission cooler and lines; inspect breathers, filters, and fittings; service as required**	Core
11. **Inspect, test, reinstall or replace internal or external vehicle speed sensors**	Core
12. **Inspect and test transmission temperature circuit for accuracy; determine needed repairs**	Core
13. **Inspect, test, diagnose, adjust, repair, or replace electrical/electronic components including the transmission control module (TCM), electronic modulators, solenoids, sensors, relays, switches, lights, fuses/breakers, wiring and connectors**	Core
14. **Inspect, replace, and align drivetrain mounts**	Core
15. **Remove and replace transmission; inspect flex plate**	Core
16. **Inspect engine block, flywheel housing, and transmission mating surfaces; check runout; check engine-to-transmission mounting adapters; determine needed repairs**	Core
17. **Inspect, test, repair, or replace electronic shift selectors, switches, displays and indicators, and wiring harnesses**	Core
18. **Diagnose automatic transmission and retarder problems using appropriate diagnostic tools and software, procedures, and service information/flow charts; perform TCM flash programming/updates; check and record diagnostic trouble codes; clear codes; interpret digital multimeter (DMM) readings**	Core
19. **Diagnose automatic transmission problems caused by data link/bus interfaces with the transmission control module (TCM); identify electrical interference problems; determine needed repairs**	Core
20. **Inspect, adjust, service, repair, or replace power take-off assemblies and controls**	Core

Competency C: Maintains, diagnoses, and repairs drive shafts and universal joints	Core or Optional
PERFORMANCE CRITERIA	
1. Diagnose drive shaft and universal joint noise and vibration problems; determine cause of failure and needed repairs	Core
2. Inspect, service, or replace driveshaft, slip joints, yokes, drive flanges, universal joints, and vibration dampers; phase drive shaft yokes	Core
3. Measure driveline angles; determine needed adjustments	Core
Competency D: Maintains, diagnoses, and repairs drive axles	**Core or Optional**
PERFORMANCE CRITERIA	
1. Diagnose rear axle drive unit noise, vibration, and overheating problems; determine needed repairs	Core
2. Check and repair fluid leaks; inspect and replace rear axle drive unit cover plates, gaskets, breathers, magnetic plugs, and pinion seals	Core
3. Check rear axle drive unit fluid level and condition; determine needed service; add proper type of lubricant	Core
4. Remove and replace differential carrier assembly, check ring and pinion backlash, inspect rear axle housing mating surfaces; determine needed repairs	Core
5. Remove, inspect, and replace axle shafts	Core
6. Remove and replace rear wheel hub assembly; inspect ABS tone/exciter ring and wheel speed sensor; determine needed repairs	Core
7. Diagnose wheel bearing noises and damage; determine needed repairs. Demonstrate wheel bearing preload adjustment	Core
8. Clean, inspect, lubricate, and replace wheel bearing cones and races (cups); clean and inspect locking plates and nuts; replace seals, wear rings, and axle flange gasket; adjust rear wheel bearings	Core
9. Inspect, adjust, repair, or replace planetary axle assemblies including case, idler pinion, pins, gears, thrust washers, shims, seals, cover, and springs	Core
Competency E: Overhaul of transmission	**Core or Optional**
PERFORMANCE CRITERIA	
1. Overhaul transmission	Optional

JOB FUNCTION 6: Maintains, diagnoses, and repairs steering and suspension systems

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Knowledge and understanding identified in Job Function 1 • Knowledge and understanding identified in Job Function 2 • Basics of steering and suspension operation and alignment • Identification of steering and suspension components • Steering Axis Inclination (SAI) and King Pin Inclination (KPI) • Alignment angles including caster, camber, toe and toe out on turns (Ackerman angle) • Basic hydraulic system principles • Different tire wear patterns and how they occur • Radial and lateral runout • Steering shaft configurations including tilt, telescopic and u-joint phasing • Proper ride height and its effect on bus operation • OSHA and DOT requirements related to tire maintenance • Different types of steering control links (boomerang, differential lever, strut) • Gear/miter box operation • Function of valves and air flow through suspension system • Power steering and hydraulic system circuit tests • Problems associated with under filling, overfilling, contamination, and improper hydraulic fluid • Suspension airbag safety • Relationship of wheel stops and steering box pressure relief valves • Correlation between the kneeling and interlock systems; ADA requirements for kneeling system	• Skills identified in Job Function 1 • Skills identified in Job Function 2 • Understanding of geometry as it relates to steering angles and alignment	• Tools identified in Job Function 1 • Tools identified in Job Function 2 • Steering wheel puller, ball joint press, king pin press, pitman arm puller, tie rod puller/separator, and bushing reamer tool • Alignment equipment and tools

Competency A: Follows safe procedures	Core or Optional
PERFORMANCE CRITERIA	
1. Performance Standards identified in Job Function 1	Core
Competency B: Maintains, diagnoses, and repairs steering systems	**Core or Optional**
PERFORMANCE CRITERIA	
1. Diagnose steering column (tilt, telescoping, or fixed) shaft noise, looseness, and binding problems; determine needed repairs	Core
2. Inspect and replace steering shaft U-joint(s), slip joint(s), bearings, bushings, and seals; phase steering shaft U-joints	Core
3. Diagnose power steering system noises, steering binding, uneven turning effort, looseness, hard steering, overheating, fluid leakage, and fluid aeration problems; determine needed repairs	Core
4. Inspect power steering fluid level and condition; determine fluid type and needed service	Core
5. Purge air from the power steering system	Core
6. Perform power steering system pressure and flow tests; determine needed repairs	Core
7. Inspect, service, or replace power steering reservoir including filter, seals, and gaskets	Core
8. Inspect, adjust, align, or replace power steering pump belt(s), pulley(s), and tensioner(s)	Core
9. Inspect power steering pump drive gear and coupling; replace as required	Core
10. Inspect, adjust, or repair, power steering pump, diverter valves, mountings, and brackets; replace as required	Core
11. Inspect power steering system cooler, lines, hoses, and fittings; replace as required	Core
12. Inspect, and adjust integral-type power steering gear; replace as required	Core
13. Inspect and replace pitman arm; center steering linkage	Core
14. Inspect, adjust/service, or replace drag link/center link, tie rods and tie rod ends; position adjusting sleeves, clamps, and retainers	Core
15. Inspect idler arm; replace as required	Core
16. Inspect steering arm and tie rods; replace as required	Core

17. Check and adjust steering linkage or wheel stops (axle stops)	Core
18. Check and adjust steering gear poppet/relief valves	Core
19. Diagnose problems in the articulation system electronic controls, and mechanical and hydraulic components; determine needed repairs	Core
Competency C: Maintains, diagnoses, and repairs independent front suspensions	**Core or Optional**
PERFORMANCE CRITERIA	
1. Diagnose front suspension system noises, looseness, body sway, and rough ride; determine needed repairs	Core
2. Inspect upper and lower control arms, strut rods/radius arms, bushings, shafts, and rebound/jounce bumpers on short and long arm (SLA) suspension systems; replace as required	Core
3. Inspect upper and lower ball joints and/or kingpins; replace as required	Core
4. Inspect steering knuckle/spindle assemblies; replace as required	Core
5. Measure and adjust ride height	Core
6. Inspect front suspension system air bags; replace as required	Core
7. Inspect operation of kneeling system; perform necessary repairs	Core
8. Inspect stabilizer bar (sway bar) bushings, brackets, and links; replace as required	Core
9. Inspect shock absorbers, bushings, brackets, and mounts; replace as required	Core
10. Check and adjust steer axle wheel bearings, replace as needed	Core
Competency D: Maintains, diagnoses, and repairs straight/I-beam axles	**Core or Optional**
PERFORMANCE CRITERIA	
1. Diagnose front suspension system noises, looseness, body sway, and rough ride; determine needed repairs	Core
2. Inspect front axle, U-bolts, and nuts; service or replace as required	Core
3. Inspect, kingpins, steering knuckle bushings, locks, bearings, shims, seals, and covers; service or replace as required	Core
4. Inspect shock absorbers, bushings, brackets, and mounts; replace as required	Core
5. Inspect front suspension air bags; replace as required	Core
6. Measure vehicle ride height; determine needed adjustments or repairs	Core

7. Inspect, repair, and/or replace radius rods, lateral/torque rods, stabilizer bar (sway bar), bushings, brackets, and mounts, and air/walking beams; adjust as necessary	Core
8. Check and adjust steer axle wheel bearings, replace as needed	Core
9. Inspect operation of kneeling system; perform necessary repairs	Core
Competency E: Maintains, diagnoses, and repairs rear suspensions	**Core or Optional**
PERFORMANCE CRITERIA	
1. Diagnose suspension system noises, looseness, rough ride, and body sway problems; determine needed repairs	Core
2. Inspect rear axle housing, U-bolts, and nuts; service or replace as required	Core
3. Inspect shock absorbers, bushings, brackets, and mounts; replace as required	Core
4. Measure vehicle ride height; determine needed adjustments or repairs	Core
5. Inspect and adjust rear axle aligning devices such as radius rods, lateral rods, torque rods, stabilizer bars, and related bushings, mounts, shims, and links; replace as required	Core
6. Inspect, test, adjust, or repair air suspension pressure regulator, pressure protection valve(s), height control valve(s), lines, hoses, and fittings; replace as required	Core
7. Inspect, test, or repair, air bags, mounting plates, suspension arms, and bushings; replace as required	Core
8. Check and adjust drive axle wheel bearings replace as needed	Core
Competency F: Diagnoses, adjusts, and repairs wheel alignment	**Core or Optional**
PERFORMANCE CRITERIA	
1. Diagnose vehicle wandering, pulling, shimmy, bump steer, and steering effort problems; determine needed adjustments or repairs	Core
2. Check and adjust camber; determine needed repairs	Core
3. Check and adjust caster; determine needed repairs	Core
4. Check SAI (steering axis inclination)/KPI (kingpin inclination) and included angle; determine needed repairs	Core
5. Check and adjust toe	Core
6. Diagnose toe-out-on-turn (Ackerman angle) problems; determine needed repairs	Core
7. Check rear axle alignment (thrustline/centerline) and tracking; adjust or determine needed repairs	Core

Competency G: Maintains, diagnoses, and repairs wheels and tires	Core or Optional
PERFORMANCE CRITERIA	
1. Diagnose tire wear patterns; determine needed repairs	Core
2. Inspect, repair, or replace tires, valve stems, and caps; check and adjust air pressure	Core
3. Diagnose wheel/tire vibration and shimmy problems; determine needed repairs	Core
4. Inspect and replace wheels (rims), wheel spacers, studs, and nuts	Core
5. Measure wheel and tire radial and lateral run out; determine needed repairs	Core
6. Balance wheel and tire assembly	Core
7. Measure tire diameter and/or circumference; match tires and rims	Core

JOB FUNCTION 7: Maintains, diagnoses, and repairs heating, ventilation, and air conditioning (HVAC) systems

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Knowledge and understanding identified in Job Function 1 • Knowledge and understanding identified in Job Function 2 • Principals of vehicle heating, ventilation and air conditioning • Identify HVAC system components and understand their role in heating, ventilation and air conditioning • Characteristics and properties of refrigerants, including identification, application, handling and storage • Federal (EPA) requirements for handling, shipping, and storing refrigerants; environmental impact, and need for recovery machines • Difference between recycling, recovering and reclaiming • Various electrical and mechanical protection devices for different HVAC systems • Various connections/interface between HVAC and bus multiplexing and data communication systems	• Skills identified in Job Function 1 • Skills identified in Job Function 2 • Ability to obtain EPA 609 (and possibly 608) Certification (Note: some agencies require technicians to first reach journey level status before being able to obtain this certification) • Ability to solder different metals • Ability to cut, fit, swag, bend, and flare aluminum and copper tubing	• Tools identified in Job Function 1 • Tools identified in Job Function 2 • Analyzer or static gauge (to identify refrigerant types) • Electronic sniffer tool • Manifold gauge set and single gauges for EPR (engine pressure ratio) and oil pressure • Refrigerant recycle/recovery/reclaim machine (RRR machine) • Strobe/tachometer (to check fan and compressor speed) • Anemometer (air speed or flow) • Psychrometer (humidity) • Soldering equipment

Competency A: Follows safe procedures	Core or Optional
PERFORMANCE CRITERIA	
1. Performance Standards identified in Job Function 1	Core
2. Follows all EPA requirements for handling, labeling and storing refrigerant and storage containers	Core
3. Demonstrate ability to safely use recycle/recovery equipment	Core
4. Fire safety and MSDS as applies to soldering repairs	Core

Competency B: Performs basic HVAC system verifications and testing	Core or Optional
PERFORMANCE CRITERIA	
1. Verify the need for service or repair of HVAC systems based on operating noises; determine appropriate action	Core
2. Verify the need of service or repair of HVAC systems based on sight, odor, and other conditions; determine appropriate action	Core
3. Identify HVAC system components and refrigerant type (R-22, R-134a, R-407c); conduct performance tests; determine appropriate action	Core
4. Use a data reader/computer to determine fault codes and perform system tests; check and adjust system parameters; clear fault codes	Core
Competency C: Maintains, diagnoses, and repairs A/C system and related components	**Core or Optional**
PERFORMANCE CRITERIA	
NOTE: The following competencies should be accomplished in accordance with published EPA and appropriate SAE "J" standards for R-22, R-134a, R-407c, and EPA approved refrigerant blends. Service must be performed by EPA certified technicians.	Core
A/C System—General	Core
1. Diagnose the cause of A/C system temperature control problems; determine needed repairs	Core
2. Identify A/C refrigerant type; check for contamination; determine appropriate action	Core
3. Diagnose the cause of A/C system problems indicated by pressure gauge readings and sight glass/moisture indicator conditions (where applicable); determine needed service or repairs	Core
4. Diagnose the cause of A/C system problems indicated by sight, audible, odor, and touch conditions; determine needed repairs	Core
5. Perform A/C system leak test; determine needed repairs	Core
6. Evacuate A/C system using appropriate equipment	Core
7. Remove contaminants from the A/C system	Core
8. Test recycled refrigerant for non-condensable gases	Core
9. Label and store refrigerant	Core
10. Charge A/C system with refrigerant	Core
11. Identify A/C system lubricant type needed for system application	Core
12. Maintain and verify correct operation of certified equipment	Core

Compressor and Clutch	Core
13. Diagnose A/C system problems that cause protection devices (pressure, thermal, and electronic) to interrupt system operation; determine needed repairs	Core
14. Inspect and test A/C system pressure, thermal, and electronic protection devices and connections; replace as required	Core
15. Inspect and adjust A/C compressor drives, belts, pulleys, and tensioners; replace as required	Core
16. Inspect, test, and service A/C compressor clutch components and clutch assembly; replace as required	Core
17. Check and correct A/C compressor lubricant level and condition	Core
18. Inspect, test, and replace A/C compressor	Core
19. Inspect and repair A/C compressor mountings and hardware; replace as required	Core
20. Check operation of A/C compressor unloaders; adjust as required	Core
Evaporator, Condenser, and Related Components	Core
21. Adjust A/C system lubricant level after replacement of system components	Core
22. Inspect and repair A/C system hoses, lines, filters, fittings, and seals; replace as required	Core
23. Check air flow through A/C condensers and evaporators; correct as required	Core
24. Inspect and test A/C system condenser and mountings; replace as required	Core
25. Inspect receiver and filter-drier; replace as required	Core
26. Inspect and test refrigerant solenoid, expansion valve(s), and evaporator pressure regulators; check placement of thermal bulb (capillary tube); replace as required	Core
27. Inspect and test evaporator core; replace as required	Core
28. Inspect, clean, and repair evaporator housing and water drain; inspect and service or replace evaporator air filter	Core
29. Identify and inspect A/C system service valves and connections; repair as required	Core
30. Diagnose cause of A/C system failures which result in refrigerant loss from the high-pressure relief device	Core
Solder, Brazing, and Torch use	Core
31. Proper torch set up and use. Fire prevention and or other component damage. MSDS and PPE	Core
32. Identify different metal compounds	Core

33. Identify the correct filler metal, flux and temperature needed for repair	Core
34. Job preparation functions (clean, correct solder, heat, flux, cool down, clean and coat)	Core
Competency D: Maintains, diagnoses, and repairs heating and engine cooling systems	**Core or Optional**
PERFORMANCE CRITERIA	
1. Diagnose the cause of outlet air temperature control problems in the HVAC system; determine needed repairs	Core
2. Diagnose window fogging problems; determine needed repairs	Core
3. Perform engine cooling system tests for leaks, protection level, contamination, coolant level, temperature, and conditioner concentration; determine needed repairs	Core
4. Inspect engine cooling and heating system hoses, lines, and clamps; replace as required	Core
5. Inspect and test radiator, pressure relief devices, and coolant recovery system (surge tank); determine needed repairs	Core
6. Inspect water pump and drive system; determine needed repairs	Core
7. Inspect and test thermostats, by-passes, housings, and seals; determined needed repairs	Core
8. Flush and refill cooling system; bleed air from system	Core
9. Inspect and test fan, fan drives, controls, and fan shroud; repair or replace as required	Core
10. Inspect and test heating system coolant control valve(s) and manual shut-off valves; replace as required	Core
11. Inspect and flush driver's heater and/or defroster cores; replace as required	Core
12. Perform heating system tests to include coolant flow and booster pump(s) operation	Core
13. Inspect, test, and diagnose heater/defroster and defogger system problems; check blowers, fans, resistors, switches, relay/modules, sensors, wiring, and protection devices; repair or replace as required	Core
14. Inspect, test and diagnose service heating, ventilating, and defrosting control panel assemblies, cables, and linkages; repair or replace as required	Core
15. Inspect, test, and diagnose heating, ventilating, and defrosting control switches, hoses, and solenoid valves; repair or replace as required	Core
16. Inspect, test, and adjust heating, ventilating, and defrosting ducts, filters, doors, cables, linkages, hoses, and outlets; repair or replace as required	Core
17. Test, diagnose, and service fuel-fired auxiliary heater system	Core

Competency E: Maintains, diagnoses, and repairs HVAC operating systems and related controls	Core or Optional
PERFORMANCE CRITERIA	
Electrical Systems	Core
1. Diagnose the cause of failures in HVAC electrical control systems; determine needed repairs	Core
2. Inspect and test HVAC defroster blower motors, resistors, switches, relays, modules, wiring, and protection devices; repair or replace as required	Core
3. Inspect and test HVAC compressor clutch relays, modules, wiring, sensors, switches, di-odes, and protection devices; repair or replace as required	Core
4. Inspect and test HVAC-related electronic engine control systems; determine needed repairs	Core
5. Inspect and test HVAC evaporator/heater and condenser fan motors, motor drivers (alternating current and direct current), relays, modules, switches, sensors, wiring, and protection devices; repair or replace as required	Core
6. Inspect and test HVAC system electrical control panel assemblies; repair or replace as required	Core
Constant/Automatic Temperature Control Systems	Core
7. Diagnose constant/automatic temperature control system problems; determine needed repairs	Core
8. Inspect and test climate control temperature sensors; repair or replace as required	Core
9. Inspect, test, and adjust heater coolant valve and controls; repair or replace as required	Core
10. Inspect and test solenoids and switches; repair or replace as required	Core
11. Inspect and test constant/automatic temperature control panels; repair or replace as required	Core
12. Inspect and test constant/automatic temperature control microprocessor (climate control computer/programmer); repair or replace as required	Core
13. Connect data reader/computer to determine fault codes and perform system tests; check and adjust system parameters; clear fault codes	Core

JOB FUNCTION 8: Maintains, diagnoses, and repairs body and chassis equipment and systems

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Knowledge and understanding identified in Job Function 1 • Knowledge and understanding identified in Job Function 2 • ADA accessibility requirements	• Skills identified in Job Function 1 • Welding (optional)	• Tools identified in Job Function 1 • Tools identified in Job Function 2 • Auto body tools including dual action sander, slide hammer, auto body hammer and dolly set, auto body sanding blocks, body filler spreader and putty knives and dent pullers • Welding equipment (mig welder, spot welder – optional) • Grinder and cut-off wheel; Plasma cutter

Competency A: Follows safe procedures	**Core or Optional**
PERFORMANCE CRITERIA	
1. Performance standards identified in Job Function 1	Core
Competency B: Maintains, diagnoses, and repairs operator and passenger seating	**Core or Optional**
PERFORMANCE CRITERIA	
1. Remove and replace operator seat and passenger seat	Core
2. Repair operator seat and passenger seat	Core
Competency C: Maintains, diagnoses, and repairs stanchions, grab rails, and modesty panels	**Core or Optional**
PERFORMANCE CRITERIA	
1. Remove and replace stanchions, grab rails/straps and modesty panel	Core
2. Repair stanchions, grab rails and modesty panels	Core

Competency D: Maintains, diagnoses, and repairs windows	Core or Optional
PERFORMANCE CRITERIA	
1. Remove and replace passenger windows and related seals	Core
2. Remove and replace front/rear windshield	Core
Competency E: Maintains, diagnoses, and repairs door systems	**Core or Optional**
PERFORMANCE CRITERIA	
1. Remove and replace passenger doors	Core
2. Adjust doors	Core
3. Diagnose and repair common door faults	Core
4. Remove and replace door controls	Core
5. Diagnose and repair common door control faults	Core
6. Remove and replace operator door/barrier	Core
7. Adjust operator door/barrier	Core
8. Diagnose and repair common operator door/barrier faults	Core
9. Remove and replace door motor(s)	Core
10. Diagnose and repair common door motor faults	Core
Competency F: Maintains, diagnoses, and repairs flooring, paneling, and roof hatches	**Core or Optional**
PERFORMANCE CRITERIA	
1. Remove and replace flooring	Core
2. Remove and replace paneling	Core
3. Remove and replace roof hatch	Core
4. Repair flooring	Core
5. Repair paneling	Core
6. Repair roof hatches	Core

Competency G: Maintains, diagnoses, and repairs wheelchair lifts, ramps, and restraints	Core or Optional
PERFORMANCE CRITERIA	
1. Remove and replace wheelchair lift	Core
2. Remove and replace wheelchair ramp	Core
3. Adjust wheelchair lift	Core
4. Adjust wheelchair ramp	Core
5. Diagnose and repair common wheelchair lift faults	Core
6. Diagnose and repair common wheelchair lift control faults	Core
7. Remove and replace wheelchair restraints	Core
8. Adjust wheelchair restraints	Core
Competency H: Maintains, diagnoses, and repairs passenger signaling (stop request) systems	**Core or Optional**
PERFORMANCE CRITERIA	
1. Remove and replace stop request system components	Core
2. Adjust stop request pull cords and push buttons	Core
3. Diagnose and repair common stop request system component faults	Core
Competency I: Inspects and repairs frame/chassis members	**Core or Optional**
PERFORMANCE CRITERIA	
1. Inspect frame and frame members for cracks, breaks, distortion, elongated holes, looseness, and damage; determine needed repairs	Core
2. Inspect, install, or repair cradle and cradle mounts, brackets, and crossmembers in accordance with manufacturers' recommended procedures	Core
3. Inspect bulkheads for cracks and rust; determine needed repairs	Core
Competency J: Welding	**Core or Optional**
PERFORMANCE CRITERIA	
1. Use welding, cutting and heating equipment to carry out frame and chassis repairs	Optional
2. Obtain American Welding Society (AWS) Certified Welder certification	Optional

Competency K: Collision repair and paint refinishing	Core or Optional
PERFORMANCE CRITERIA	
1. Straighten collision damaged sheet metal	Optional
2. Refinish body parts using appropriate paint and coatings	Optional
3. Replace non-structural panels and parts	Optional
4. Repair plastic and composite body parts	Optional
5. Repair and replace fixed and moveable glass and related seals	Optional

JOB FUNCTION 9: Conducts preventative maintenance inspections

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Knowledge and understanding identified in Job Function 1 • Knowledge and understanding identified in Job Function 2 • Identification and understanding of bus equipment associated with engine systems, body interior and exterior, electrical/electronic systems, and frame and chassis systems • Agency specific Preventive Maintenance Inspection checksheets available for each bus type • Local, state, and federal regulations • Importance of regularly scheduled vehicle inspections	• Skills identified in Job Function 1 • Skills identified in Job Function 2	• Tools identified in Job Function 1 • Tools identified in Job Function 2 • Pressure and vacuum gauges • Coolant freeze point testing equipment • Coolant pressure testing equipment • Fan speed testing equipment • Belt alignment and tension testing equipment • Battery test equipment • Tire pressure gauge • Exhaust opacity meter • Manufacturer specific diagnostic equipment

Competency A: Follows safe procedures	Core or Optional
PERFORMANCE CRITERIA	
1. Performance standards identified in Job Function 1	Core
2. Understands industry terminology (difference between check, test, inspect)	Core
Competency B: Inspects engine systems	**Core or Optional**
PERFORMANCE CRITERIA	
Engine	Core
1. Check engine operation for unusual noises, vibration, and excessive exhaust smoke	Core
2. Inspect vibration damper	Core
3. Inspect belts, tensioners, belt guards, pulleys and alignment; check and adjust belt tension	Core
4. Check engine compartment for oil, coolant, air, hydraulic fluid, and fuel leaks (Engine Off and Engine Running)	Core

5. Inspect engine mounts for looseness and deterioration	Core
6. Check engine oil pressure, oil level and condition; check dipstick seal	Core
7. Check engine compartment wiring, harnesses, connectors, and seals for damage and proper routing; check engine compartment controls, gauges, and lighting	Core
Fuel System	Core
8. Check fuel tanks, filler neck check valve mountings, lines, vents, and caps	Core
9. Drain water from fuel system	Core
10. Inspect water separator/fuel heater; replace fuel filter(s); prime and bleed fuel system	Core
11. Inspect crankcase ventilation system	Core
12. Inspect diesel emission control systems and components, including exhaust gas recirculation (EGR) and catalytic converter	Core
Air Induction and Exhaust Systems	Core
13. Check engine exhaust system mountings for looseness and damage	Core
14. Check engine exhaust system for leaks, excessive noise, proper routing, and missing or damaged components (heat shields and guards); perform restriction/backpressure tests	Core
15. Check air induction system routing, piping, charge air cooler, hoses, clamps, mountings, and indicators; check for air restrictions and leaks; check operation of cold start aids (heated grid, ether systems)	Core
16. Inspect turbocharger for noise and leaks; check mountings and connections; check wastegate and controls, variable geometry turbo, linkages, and hoses	Core
17. Service or replace air filter(s) as required	Core
Cooling System	Core
18. Check operation of fan control system	Core
19. Inspect radiator for air flow restrictions, leaks, and damage; check mountings	Core
20. Inspect fan assembly and fan shroud	Core
21. Pressure test cooling system and radiator cap	Core
22. Inspect coolant hoses and clamps for leaks, damage, and proper routing	Core
23. Check surge tank; check sight glass for leaks, cracks, and discoloration	Core
24. Identify coolant type; check coolant for contamination, supplemental additive (SCA) levels, and freeze point protection level	Core
25. Service coolant filter/conditioner; check condition of shut-off valve	Core
26. Drain and refill cooling system; bleed air from system; recover coolant and dispose of in accordance with federal, state, and local regulations	Core
27. Inspect water pump for leaks and bearing play	Core

28. Change engine oil and filters; visually check oil for coolant or fuel contamination; inspect and clean magnetic drain plugs; dispose of used oil and/or filters in accordance with federal, state, and local regulations	Core
29. Take an engine oil sample (prior to changing oil)	Core
Competency C: Inspects body interior and exterior	**Core or Optional**
PERFORMANCE CRITERIA	
Instruments and Controls	Core
1. Inspect master control switch and start button; check operation of transmission shift selector	Core
2. Check operation of indicator lights, warning lights and/or alarms	Core
3. Check operation of instruments, gauges, and panel lighting	Core
4. Check operation of fast engine idle and throttle and brake interlock systems	Core
5. Check operation of driver's area defroster, heater, ventilation, and A/C (HVAC) controls	Core
6. Check operation of driver controlled auxiliary systems, i.e. doors, wheelchair lift, kneeling system, and PA system	Core
7. Use a diagnostic tool or the on-board diagnostic system to extract engine, transmission, brake monitoring, and other vehicle diagnostic systems information and codes	Core
Safety Equipment	Core
8. Check operation of horns	Core
9. Check condition of safety equipment including flares, reflective triangles, fire extinguisher, fire suppression system, and all required decals	Core
10. Inspect seat belts and wheelchair restraints	Core
11. Inspect wiper blades and arms	Core
12. Check windshield wiper and washer operation	Core
13. Check for all required vehicle permits, registration, decals, and inspection papers	Core
14. Check operation of emergency exits (roof hatches, windows, door releases, and switches)	Core
15. Check operation of entrance and exit doors, sensitive edges and touch bars: check door opening and closing speeds; check operation of rear door interlock	Core
Hardware	Core
16. Inspect windshield glass for cracks, chips or discoloration; check sun visor operation	Core
17. Check driver's seat condition, operation, mounting, and suspension components	Core
18. Check passenger seat condition, operation, and mountings	Core

19. Check door glass and passenger window operation, condition, and safety stops	Core
20. Inspect steps, flooring, and stanchion bars	Core
21. Inspect all mirror, mountings, brackets, glass, heaters, and motors	Core
22. Inspect and record all observed physical damage	Core
23. Inspect and lubricate door and compartment hinges, latches, strikers, gas struts, linkages, and cables	Core
24. Check operation and condition of accelerator and brake pedals	Core
25. Inspect bicycle rack operation and condition	Core
Heating, Ventilation, and Air Conditioning (HVAC)	Core
26. Inspect A/C condenser and evaporator lines for condition and visible leaks; check filter/drier, receiver tank, slight glasses and mountings	Core
27. Inspect A/C compressor and lines for condition and visible leaks; check clutch and compressor mountings; check sight glass oil level and condition	Core
28. Check operation of condenser and evaporator motors	Core
29. Check A/C system operation	Core
30. Check HVAC air inlet filters and ducts; service as required	Core
31. Check operation of boost pump and coolant control valves	Core
32. Check operation of auxiliary heater system; check for leaks and damage	Core
Competency D: Inspects electrical/electronic systems	**Core or Optional**
PERFORMANCE CRITERIA	
Battery and Starting Systems	Core
1. Inspect battery compartment and doors, trays, slides, covers, and mountings	Core
2. Inspect battery disconnect switch, hold downs, connections, cables, and cable routing; service as required	Core
3. Check and record battery state of charge (open circuit voltage) and battery condition; check electrolyte level (if applicable)	Core
4. Perform battery load and capacitance tests	Core
5. Inspect starter, mounting, connections, cables, and cable routing	Core
6. Engage starter; check for unusual noises, starter drag, and starting difficulty	Core
Charging System	Core
7. Inspect alternator, mountings, wiring and routing	Core
8. Perform alternator current output test	Core

9. Perform alternator voltage output test	Core
10. Check equalizer function, wiring, and mountings	Core
Lighting and Alarm Systems	Core
11. Check operation of all interior lights; service as required	Core
12. Check all exterior lights, lenses, and reflectors; check headlight alignment; service as required	Core
13. Inspect and check operation of exterior warning (back-up, wheel-chair, and kneeler) systems	Core
14. Check operation of passenger stop request chimes and lighting systems	Core
15. Inspect and check operation of destination sign and GPS locater systems	Core
Competency E: Inspects frame and chassis	**Core or Optional**
PERFORMANCE CRITERIA	
Air Brakes (Include hydraulic brake inspections as needed)	Core
1. Check parking brake operation	Core
2. Check and record air governor cut-in and cut-out settings (psi)	Core
3. Check operation of air drier purge valve and heater; service air drier as required	Core
4. Check air system for leaks (brakes released)	Core
5. Check air system for leaks (brakes applied)	Core
6. Test one-way and double-check valves	Core
7. Check low air pressure warning devices and brake pressure switches	Core
8. Check emergency spring brake control valve	Core
9. Test air pressure build-up time	Core
10. Perform antilock brake system (ABS) operational self-test; perform automatic traction control (ATC) operational self-test	Core
11. Inspect air lines couplings and fittings	Core
12. Check brake chambers and air lines for secure mountings, damage, and missing caging plugs and caging bolts	Core
13. Inspect and record brake lining/pad condition and thickness on all axles	Core
14. Check operation and adjustment of front and rear brake automatic slack adjusters on all axles	Core
15. Check condition of foundation brake components and hardware on all axles	Core
16. Lubricate all air brake system component grease fittings	Core

Drivetrain	Core
17. Check transmission case, seals, filter, retarder components, cooler, and cooler lines for cracks and leaks	Core
18. Check transmission wiring, connectors, seals, and harnesses for damage and proper routing	Core
19. Inspect transmission breather	Core
20. Inspect transmission mounts for looseness and deterioration	Core
21. Check transmission oil/fluid level and condition	Core
22. Inspect U-joints, yokes, and drive lines for looseness, damage, and correct phasing	Core
23. Inspect axle housing for cracks and leaks	Core
24. Inspect axle breather	Core
25. Lubricate all drive train grease fittings	Core
26. Check drive axle oil level	Core
27. Change drive axle oil; check and clean magnetic plug	Core
28. Change transmission oil/fluid and filters; check and clean magnetic plug	Core
29. Take transmission oil/fluid sample	Core
Suspension and Steering Systems	Core
30. Check steering wheel operation for free play or binding; check tilt and telescoping operations	Core
31. Check hydraulic and/or power steering pump and hoses for leaks and mounting; check fluid level	Core
32. Change hydraulic and/or power steering fluid and filter	Core
33. Inspect steering gear(s) for leaks and mounting	Core
34. Inspect steering shaft and U-joints for condition and phasing; inspect pinch bolts, splines, Pitman arm-to-steering sector shaft, steering/Ackerman arms, drag link, tie rod ends and wheel stops	Core
35. Check for kingpin and thrust bearing wear	Core
36. Check wheel bearings for looseness and noise	Core
37. Check oil level and condition in all non-drive axle hubs; check for leaks	Core
38. Inspect suspension components (U-bolts, insulators, radius rods, torque rods, walking beams, equalizers, lateral rods, sway bars and links, trunnion bushings, and overload bumpers); retorque U-bolts in accordance with manufacturers' specifications	Core
39. Inspect shock absorbers for leaks and mounting	Core

40. Inspect air suspension components (bags/springs, mounts, arms, hoses, valves, linkage, and fittings) for leaks and damage	Core
41. Check suspension ride height	Core
42. Lubricate all suspension and steering system grease fittings	Core
Tires and Wheels	Core
43. Inspect tires for irregular wear patterns and proper mounting of tires	Core
44. Inspect tires for cuts, cracks, bulges, and sidewall damage	Core
45. Inspect valve caps and stems	Core
46. Measure and record tire tread depth	Core
47. Check and record tire air pressure	Core
48. Check for loose or missing lug nuts; check mounting hardware condition; service as required	Core
49. Retorque lugs/nuts in accordance with manufacturers' specifications	Core
50. Inspect wheels and spacers for cracks or damage	Core
51. Check tire matching (diameter and tread) on dual tire installations	Core
Frame and Under Floor Equipment	Core
52. Check mud flaps and brackets	Core
53. Lubricate articulation joint grease fittings (where applicable)	Core
54. Inspect frame and frame members for cracks and damage	Core
55. Inspect body attaching hardware	Core
56. Inspect wheelchair lift/ramps, cylinders, controls, linkage chains, hardware, sensitive edges, sensors, proximity switches, hoses, and wiring; check fluid level, and lubricate grease fittings	Core
57. Check mounting security of all under floor equipment	Core
Competency F: Conducts road test	**Core or Optional**
PERFORMANCE CRITERIA	
1. Check operation of all instruments, gauges, and lights	Core
2. Check steering wheel for play, binding and centering	Core
3. Check operation of automatic transmission	Core
4. Check road speed limiter	Core
5. Observe exhaust for excessive smoke	Core

6. Test service brakes with regen brake switch off and on, parking brake and interlock	Core
7. Verify engine/exhaust brake or retarder operation	Core
8. Check operation of backup warning	Core
9. Observe any unusual noises	Core
10. After road test check for leaks	Core

JOB FUNCTION 10: Maintains, diagnoses, and repairs articulated bus systems

Related Technical Instruction		
KNOWLEDGE	**SKILLS**	**TOOLS & TECHNOLOGIES**
• Knowledge and understanding identified in Job Function 1 • Knowledge and understanding identified in Job Function 2 • Manufacturer specific anti-jackknifing control systems	• Skills identified in Job Function 1 • Skills identified in Job Function 2	• Tools identified in Job Function 1 • Tools identified in Job Function 2

Competency A: Follows safe procedures	**Core or Optional**
PERFORMANCE CRITERIA	
1. Performance Standards identified in Job Function 1	Optional
2. Applies manufacturer specific safety recommendations regarding articulation joint including turning angles, angles for lifting one vehicle section in relationship to the other, securing lines and harnesses that pass through the joint section, etc.	Optional
Competency B: Maintains, diagnoses, and repairs mechanical components of the articulation joint	**Core or Optional**
PERFORMANCE CRITERIA	
1. Proper inspection of the main bearings	Optional
2. Proper inspection of the welding connections	Optional
Competency C: Maintains, diagnoses, and repairs hydraulic components of the articulation joint	**Core or Optional**
PERFORMANCE CRITERIA	
1. Diagnose common hydraulic component faults	Optional
2. Repair common hydraulic component faults including leaks	Optional
3. Replace hydraulic components	Optional

Competency D: Maintains, diagnoses, and repairs the electronic control system	Core or Optional
PERFORMANCE CRITERIA	
1. Diagnosis and repair the electronic control system based on manual specifications	Optional
2. Diagnosis and repair the anti-jack-knifing control system	Optional
3. Check and diagnosis proximity sensors	Optional
Competency E: Maintains, diagnoses, and repairs articulation bellows	**Core or Optional**
PERFORMANCE CRITERIA	
1. Remove and replace the articulation bellows	Optional

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2100 M Street NW
Washington, DC 20037

www.urban.org