

ACAP

Austin Competency Analysis Profile
Automotive Technician

Conducted
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Preface

Austin Community College's Workforce Education Office of Curriculum and Competency-Based Instruction would like to express our sincere appreciation to our business, industry, labor, and community partners who donated their time and expertise toward the identification and validation of competencies in the following Austin Competency Analysis Profile.

Introduction

The ACAP (Austin Competency Analysis profile) initiative comes out of the Workforce Education Office of Curriculum and Competency-Based Instruction of Austin Community College. This initiative is ACC's primary source for Competency-Based Curriculum development, providing a connection between our Workforce programs and the needs of business and industry.

The ACAP is a process for analyzing an occupation to develop curriculum. The product is a competency list, employability skills, and academic skill levels that have been developed and validated by subject matter experts who perform the occupation. This list will be used to develop our Workforce Education programs to address the needs of business and industry by equipping our students with skills required in a workplace environment.

A CAP Process Overview

What are Austin Competency Analysis Profiles (ACAPs)?

Austin Competency Analysis Profiles (ACAPs) are competency lists for workforce education programs verified by expert workers, or Subject Matter Experts. These lists evolve from a well-established job analysis process involving business, industry, labor, and community agency representatives from throughout the Austin area.

How is an Austin Competency Analysis Profile used?

Each ACAP identifies the occupational, academic, and employability skills (or competencies) needed to enter a given occupation or occupational area. The ACAP not only lists the competencies but also clusters those competencies into broader units and details the knowledge, skills, and attitudes (competency builders) needed to perform each competency.

Within the competency list are two levels of items: core and advancing. Core items, which are essential for entry-level employment, are required to be taught. Advancing items are those needed to advance in a given occupation, and are designated by a superscripted “a”. If core competencies or competency builders are present in an “advancing” unit, then they are designated with a superscripted “c”.

Educational institutions may add as many units, competencies, and/or competency builders as desired to reflect local employment needs, trends, and specialties. Local advisory committees are actively involved in the identification and verification of additional items. Faculty members formulate their courses of study using the varied contents of the ACAP. Faculty also monitor gains using many forms of assessment.

Occupational Competencies

The following Occupational Competencies have been identified and verified by a panel of subject matter experts currently employed in the field of Automotive Technician. This panel of experts has determined that these skills will adequately prepare students for *entry level* positions in this field. The *Competencies* are grouped into units. *Competency Builders* are included to help identify the knowledge, skills and attitudes students need to perform each competency. These *Competencies* and *Competency Builders* are designed to be the basis for curriculum development to ensure business and industry input that is relative and meaningful to the workplace. These *Competencies* are intended to include all basic, necessary skills for this occupational area, but may be supplemented with additional competencies as faculty and advisory committee members see the need to do so.

Key Terms:

Competency—an observable and measurable behavior that has a definite beginning and end; can be performed within a limited amount of time; consists of two or more competency builders; and leads to a product, service, or decision.

Competency Builders—the skills, knowledge, and attitudes (written in measurable terms) needed to perform a given competency.

Entry Level—position of employment that requires no previous experience, but may require some training and/or specific skills, knowledge, or attitudes.

ACAP: Automotive Technician

Unit 1:	Engine Repair
Unit 2:	Automatic Transmission and Transaxle
Unit 3:	Manual Drive Train and Axles
Unit 4:	Suspension and Steering
Unit 5:	Brakes
Unit 6:	Electrical/Electronic Systems
Unit 7:	Heating and Air Conditioning
Unit 8:	Engine Performance
Unit 9:	Safety
Unit 10:	Customer Service

Sources:

www.natef.org
DACUM

NOTE: All tasks have a Priority designation if they are tasks from the NATEF standards. NATEF standards recognize program content requirements vary by program type and regional employment needs. Therefore, flexibility has been built into the NATEF task list by assigning each task a priority number. The priority number simply indicates the minimum percentage of those tasks, by area, that a program must include in their curriculum in order to be certified in that area.

- Ninety-five percent (95%) of Priority 1 (P-1) items must be taught in the curriculum.
- Eighty percent (80%) of Priority 2 (P-2) items must be taught in the curriculum.
- Fifty percent (50%) of the Priority 3 (P-3) items must be taught in the curriculum.

The ACAP does not necessarily represent all NATEF standards tasks. Tasks without priority designations have been added by the subject matter experts (SMEs). A superscripted ‘a’ designates the task as an advanced competency builder that the SMEs indicated should be introduced, but not mastered by students going into entry level positions.

Unit 1 Engine Repair

Competency 1.1 Perform general mechanical engine diagnosis to determine necessary action

Competency Builders:

- | | | |
|-------|-----|--|
| 1.1.1 | P-1 | Verify and interpret engine concern by duplicating customer complaint |
| 1.1.2 | P-1 | Perform engine vacuum tests |
| 1.1.3 | P-1 | Perform cylinder power balance tests |
| 1.1.4 | P-1 | Perform cylinder compression tests |
| 1.1.5 | P-1 | Perform cylinder leakage tests |
| 1.1.6 | P-2 | Inspect engine assembly for fuel, oil, coolant, fluid contamination and other leaks |
| 1.1.7 | P-3 | Diagnose engine noises and vibrations |
| 1.1.8 | P-3 | Diagnose the cause of excessive oil consumption, unusual engine exhaust color and odor |
| 1.1.9 | P-1 | Perform oil pressure tests to determine necessary action |

Competency 1.2 Remove and reinstall (R & R) engine

Competency Builders:

- | | | |
|-------|-----|----------------------------|
| 1.2.1 | | Prepare engine for removal |
| 1.2.2 | P-3 | Remove engine |
| 1.2.3 | P-3 | Reinstall engine |

Competency 1.3 Inspect and repair cylinder head and valve train

Competency Builders:

- 1.3.1 P-1 Adjust valves (mechanical or hydraulic lifters)
- 1.3.2 P-1 Inspect and replace timing belt(s), overhead camdrive sprockets, and tensioners; check belt tension; adjust as necessary
- 1.3.3 P-1 Verify camshaft(s) timing according to manufacturer's specifications and procedure
- 1.3.4 P-2 Remove cylinder head(s); visually inspect cylinder head(s) for cracks; check gasket surface areas for warpage and leakage
- 1.3.5 P-2 Install cylinder heads and gaskets; tighten according to manufacturer's specifications and procedures
- 1.3.6 P-2 Inspect valve spring retainers, locks, and valve grooves
- 1.3.7 P-2 Resurface valves; perform necessary action
- 1.3.8 P-2 Resurface valve seats; perform necessary action
- 1.3.9 P-2 Check valve spring assembled height and valve stem height; service valve and spring assemblies as needed
- 1.3.10 P-2 Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear bending, crack, looseness, and blocked oil passages (orifices); perform necessary action
- 1.3.11 P-2 Inspect hydraulic or mechanical lifters; replace as needed
- 1.3.12 P-2 Inspect camshaft drives (including gear wear and backlash, sprocket and chain wear); replace as necessary
- 1.3.13 P-3 Inspect and test valve springs for squareness, pressure, and free height comparison; replace as needed
- 1.3.14 P-3 Replace valve stem seals
- 1.3.15 P-3 Inspect valve guides for wear; check valve guide height and stem-to-guide clearance; recondition or replace as needed
- 1.3.16 P-3 Check valve face-to-seat contact and valve seat concentricity (runout); service seats and valves as needed
- 1.3.17 P-3 Inspect camshaft for runout, journal wear and lobe wear
- 1.3.18 P-3 Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment and determine necessary action

Competency 1.4 Inspect and repair engine block assembly

Competency Builders:

- 1.4.1 P-1 Inspect internal and external threads and restore as needed
- 1.4.2 P-1 Prime engine lubrication system
- 1.4.3 P-2 Inspect and replace pans, covers, gaskets, and seals
- 1.4.4 P-1 Deglaze cylinder walls
- 1.4.5 Clean cylinder walls
- 1.4.6 P-2 Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage to determine necessary action
- 1.4.7 P-2 Inspect and measure cylinder walls for damage and wear to determine necessary action

- 1.4.8 P-2 Inspect and measure main and connecting rod bearings for damage, clearance, and end play to determine necessary action (includes the proper selection of bearings)
- 1.4.9 P-2 Inspect, measure, and service pistons and pins to determine necessary action
- 1.4.10 P-2 Inspect, measure, and install piston rings
- 1.4.11 P-2 Reassemble engine components using correct gaskets and sealants
- 1.4.12 P-3 Remove cylinder wall ridges
- 1.4.13 P-3 Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action
- 1.4.14 P-3 Inspect crankshaft for surface cracks and journal damage; check oil passage condition; measure journal wear; determine necessary action
- 1.4.15 P-3 Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; inspect rod alignment and bearing bore condition
- 1.4.16 P-3 Inspect, repair or replace crankshaft vibration damper (harmonic balancer)
- 1.4.17 P-3 Inspect auxiliary (balance, intermediate, idler, counterbalance or silencer shaft(s); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time
- 1.4.18 P-3 Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action

Competency 1.5 Inspect and repair cooling systems

Competency Builders:

- 1.5.1 P-1 Perform cooling system, cap, and recovery system tests (pressure, combustion leakage, and temperature); determine necessary action
- 1.5.2 P-1 Inspect, replace, and adjust drive belts, tensioners, and pulleys
- 1.5.3 P-1 Test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required
- 1.5.4 P-2 Inspect and replace engine cooling and heater system hoses
- 1.5.5 P-2 Inspect, test, and replace thermostat housing
- 1.5.6 P-2 Inspect, test, remove, and replace water pump
- 1.5.7 P-2 Remove and replace radiator
- 1.5.8 P-2 Inspect, and test fan(s) (electrical or mechanical), fan clutch, fan shroud, and air dams
- 1.5.9 p-2^a Inspect, test, and replace oil temperature and pressure switches and sensors (advanced skill)
- 1.5.10 P-3 Inspect auxiliary oil coolers; replace as needed

Unit 2 Automatic Transmission and Transaxle

Competency 2.1 Diagnose general transmission and transaxle

Competency Builders:

- 2.1.1 P-1 Identify and interpret transmission concern; assure proper engine operation; determine necessary action

- 2.1.2 P-1 Diagnose unusual fluid usage, level, and condition concerns; determine necessary action
- 2.1.3 P-1 Perform pressure tests; determine necessary action
- 2.1.4 P-1 Diagnose mechanical, hydraulic, vacuum control system concerns; determine necessary action
- 2.1.5 ^a Diagnose electronic systems (advanced skill)
- 2.1.6 P-2 Perform lock-up converter system tests; determine necessary action
- 2.1.7 P-3 Diagnose noise and vibration concern; determine necessary action

Competency 2.2 Maintain and adjust transmission and transaxle

Competency Builders:

- 2.2.1 P-1 Inspect, adjust or replace throttle (TV) linkages or cables, check gear select indicator (as applicable)
- 2.2.2 P-1 Service transmission; perform visual inspection; replace fluids and filters

Competency 2.3 Repair in-vehicle transmission and transaxle

Competency Builders:

- 2.3.1 P-1 Inspect, leak test, flush, and replace cooler, lines, and fittings
- 2.3.2 P-1 ^a Inspect and test, adjust, repair or replace transmission related electrical and electronic components (includes computers, solenoids, sensors, relays, switches, and harnesses) (advanced skill)
- 2.3.3 P-2 Inspect and replace external seals and gaskets
- 2.3.4 P-3 Inspect, adjust or replace (as applicable) vacuum modulator
- 2.3.5 Inspect and repair or replace lines and hoses
- 2.3.6 P-3 Inspect extension housing, bushings and seals; perform necessary action
- 2.3.7 P-3 Inspect and replace speedometer drive gear, driven gear, vehicle speed sensor (VSS), and retainers
- 2.3.8 P-3 Inspect, replace, and align powertrain mounts

Competency 2.4 Repair off-vehicle transmission and transaxle

Competency Builders:

- 2.4.1 P-1 Disassemble, clean, and inspect transmission/transaxle
- 2.4.2 P-1 Assemble transmission/transaxle
- 2.4.3 P-2 Remove and reinstall transmission and torque converter (rear-wheel drive)
- 2.4.4 P-2 Remove and reinstall transaxle and torque converter assembly
- 2.4.5 P-2 Inspect, measure, clean, and replace valve body (includes surfaces and bores, springs, valves, sleeves, retainers, brackets, check-balls, screens, spacers, and gaskets), and torque valve body bolts
- 2.4.6 P-3 Inspect servo bore, piston, seals, pin, spring, and retainers; determine necessary action
- 2.4.7 P-3 Inspect accumulator bore, piston, seals, spring, and retainer; determine necessary action
- 2.4.8 P-3 Inspect, repair, and replace governor assembly

Competency 2.5 Repair oil pump and converter

Competency Builders:

- 2.5.1 P-1 Check torque converter and transmission cooling system for contamination
- 2.5.2 P-2 Inspect converter flex plate, attaching parts, pilot, pump drive, and seal areas
- 2.5.3 P-2 Measure torque converter endplay and check for interference; check stator clutch
- 2.5.4 P-3 Inspect, measure, and replace oil pump assembly and components

Competency 2.6 Repair gear train, shafts, bushings, and case

Competency Builders:

- 2.6.1 P-1 Measure endplay or preload; determine necessary action
- 2.6.2 P-2 Inspect, measure, and replace thrust washers and bearings
- 2.6.3 P-2 Inspect oil delivery seal rings, ring grooves, and sealing surface areas
- 2.6.4 P-2 Inspect bushings; replace as needed
- 2.6.5 P-2 Inspect and measure planetary gear assembly (includes sun, ring gear, thrust washers, planetary gears, and carrier assembly); replace as needed
- 2.6.6 P-2 Inspect case bores, passages, bushings, vents, and mating surfaces; determine necessary action
- 2.6.7 P-2 Inspect transaxle drive, link chains, sprockets, gears, bearings, and bushings; perform necessary action
- 2.6.8 P-2 Inspect, measure, repair or replace transaxle final drive components
- 2.6.9 P-3 Inspect and reinstall parking pawl, shaft, spring, and retainer; determine necessary action

Competency 2.7 Repair friction and reaction units

Competency Builders:

- 2.7.1 P-1 Measure clutch pack clearance; adjust as needed
- 2.7.2 P-1 Air test operation of clutch and servo assemblies
- 2.7.3 P-2 Inspect clutch drum, piston, check-balls, springs, retainers, seals, and friction and pressure plates; replace as needed
- 2.7.4 P-2 Inspect roller and sprag clutch, races, rollers, sprags, springs, cages, and retainers; replace as needed
- 2.7.5 P-3 Inspect bands and drums; adjust or replace as needed

Unit 3 Manual Drive Train and Axles

Competency 3.1 Diagnose and repair clutch

Competency Builders:

- 3.1.1 P-1 Diagnose clutch noise, binding, slippage, pulsation, and chatter to determine necessary action
- 3.1.2 P-1 Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform necessary action

- 3.1.3 P-1 Inspect hydraulic clutch slave and master cylinders, lines, and hoses; perform necessary action
- 3.1.4 P-1 Inspect release (throw-out) bearing, lever, and pivot; perform necessary action
- 3.1.5 P-1 Inspect and replace clutch pressure plates assembly and clutch disc
- 3.1.6 P-1 Inspect, remove or replace crankshaft pilot bearing or bushing (as applicable)
- 3.1.7 P-1 Inspect flywheel and ring gear for wear and cracks, measure runout; determine necessary action
- 3.1.8 P-3 Inspect engine block, clutch (bell) housing, and transmission/transaxle case mating surfaces; determine necessary action
- 3.1.9 P-3 Measure flywheel-to-block runout and crankshaft endplay; determine necessary action

Competency 3.2 Diagnose and repair transmission/transaxle

Competency Builders:

- 3.2.1 P-1 Measure endplay or preload (shim or spacer selection procedure) on transmission/transaxle shafts; perform necessary action
- 3.2.2 P-1 Inspect, test, and replace transmission/transaxle sensors and switches
- 3.2.3 P-2 Remove and reinstall transmission/transaxle
- 3.2.4 P-2 Disassemble, clean, and reassemble transmission/transaxle components
- 3.2.5 P-2 Inspect and replace gaskets, seals, and sealants; inspect sealing surfaces
- 3.2.6 P-2 Inspect, adjust, and reinstall shift cover, forks, levers, grommets, shafts, sleeves, detent mechanism, interlocks, and springs
- 3.2.7 P-2 Inspect and reinstall synchronizer hub, sleeve, keys (inserts), springs and blocking rings
- 3.2.8 P-2 Inspect and reinstall speedometer drive gear, driven gear, vehicle speed sensor (VSS), and retainers
- 3.2.9 P-2 Remove, inspect, measure, adjust, and reinstall transaxle final drive pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case assembly
- 3.2.10 P-3 Inspect transmission/transaxle case, extension housing, case mating surfaces bores, bushings, and vents; perform necessary action
- 3.2.11 P-3 Diagnose noise, hard shifting, jumping out of gear, and fluid leakage concerns; determine necessary action
- 3.2.12 P-3 Inspect, adjust, and reinstall shift linkages, brackets, bushings, cables, pivots, and levers
- 3.2.13 P-3 Inspect and reinstall powertrain mounts
- 3.2.14 P-3 Remove and replace transaxle final drive
- 3.2.15 P-3 Diagnose transaxle final drive assembly noise and vibration concerns; determine necessary action
- 3.2.16 P-3 Inspect lubrication devices (oil pump or slingers); perform necessary action

Competency 3.3 Diagnose and repair drive shaft and half shaft, universal and constant-velocity (CV) joint

Competency Builders:

- 3.3.1 P-1 Inspect, service, and replace shafts, yokes, boots, and CV joints
- 3.3.2 P-2 Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action
- 3.3.3 P-2 Diagnose universal joint noise and vibration concerns and perform necessary action
- 3.3.4 P-2 Replace front wheel drive (FWD) front wheel bearing
- 3.3.5 P-3 Inspect, service, and replace shaft center support bearings
- 3.3.6 P-3 Check shaft balance; measure shaft runout; measure and adjust driveline angles

Competency 3.4 Assemble ring and pinion gears and differential case

Competency Builders:

- 3.4.1 P-1 Measure and adjust drive pinion bearing preload
- 3.4.2 P-1 Check ring and pinion tooth contact patterns; perform necessary action
- 3.4.3 P-2 Diagnose noise and vibration concerns; determine necessary action
- 3.4.4 P-2 Diagnose fluid leakage concerns; determine necessary action
- 3.4.5 P-2 Inspect and replace companion flange and pinion seal; measure companion flange runout
- 3.4.6 P-2 Inspect ring gear and measure runout; determine necessary action
- 3.4.7 P-2 Remove, inspect, and reinstall drive pinion and ring gear, spacers, sleeves, and bearings
- 3.4.8 P-2 Measure and adjust drive pinion depth
- 3.4.9 P-2 Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types)
- 3.4.10 P-2 Disassemble, inspect, measure, and adjust or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case
- 3.4.11 P-2 Reassemble and reinstall differential case assembly; measure runout; determine necessary action

Competency 3.5 Repair limited slip differential

Competency Builders:

- 3.5.1 P-2 Inspect and flush differential housing; refill with correct lubricant
- 3.5.2 P-3 Diagnose noise, slippage, and chatter concerns; determine necessary action
- 3.5.3 P-3 Inspect and reinstall clutch (cone or plate) components
- 3.5.4 P-3 Measure rotating torque; determine necessary action

Competency 3.6 Repair rear drive axle shaft

Competency Builders:

- 3.6.1 P-1 Remove and replace drive axle shafts
- 3.6.2 P-2 Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine necessary action
- 3.6.3 P-2 Inspect and replace drive axle shaft seals, bearings, and retainers
- 3.6.4 P-2 Measure drive axle flange runout and shaft endplay; determine necessary action
- 3.6.5 P-3 Inspect and replace drive axle shaft wheel studs

Competency 3.7 Diagnose and repair four-wheel drive/all-wheel drive component

Competency Builders:

- 3.7.1 P-3 Diagnose noise, vibration, and unusual steering concerns; determine necessary action
- 3.7.2 P-3 Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets
- 3.7.3 P-3 Remove and reinstall transfer case
- 3.7.4 P-3 Disassemble, service, and reassemble transfer case and components
- 3.7.5 P-3 Inspect front-wheel bearings and locking hubs; perform necessary action
- 3.7.6 P-3 Check drive assembly seals and vents; check lube level
- 3.7.7 P-3 Diagnose, test, adjust, and replace electrical/electronic components of four-wheel drive systems

Unit 4 Suspension and Steering

Competency 4.1 Diagnose and repair steering systems

Competency Builders:

- 4.1.1 P-1 Disable and enable supplemental restraint system (SRS) in accordance with manufacturer's procedures
- 4.1.2 P-1 Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil in accordance with manufacturer's procedures
- 4.1.3 P-1 Inspect power steering fluid levels and condition
- 4.1.4 P-1 Remove, inspect, replace, and adjust power steering pump belt
- 4.1.5 P-2 Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action
- 4.1.6 P-2 Remove and replace manual or power rack and pinion steering gear; inspect mounting bushings and brackets
- 4.1.7 P-2 Inspect and replace manual or power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots
- 4.1.8 P-2 Flush, fill, and bleed power steering system
- 4.1.9 P-2 Diagnose power steering fluid leakage; determine necessary action
- 4.1.10 P-2 Inspect and replace power steering hoses and fittings
- 4.1.11 P-2 Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps

- 4.1.12 P-3 Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action
- 4.1.13 P-3 Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and fluid leakage concerns; determine necessary action
- 4.1.14 P-3 Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and fluid leakage concerns; determine necessary action
- 4.1.15 P-3 Adjust manual or power non-rack and pinion worm bearing preload and sector lash
- 4.1.16 P-3 Disassemble, inspect, perform necessary action and reassemble rack and pinion steering gear
- 4.1.17 P-3 Adjust manual or power rack and pinion steering gear
- 4.1.18 P-3 Remove, inspect, and replace power steering pump, mounts, seals, and gaskets
- 4.1.19 P-3 Remove, inspect, and replace power steering pump pulley; check alignment
- 4.1.20 P-3 Inspect and replace pitman arm, relay (centerlink/ intermediate) rod, idler arm and mountings, and steering linkage damper
- 4.1.21 P-3 Recognize components of electronically controlled steering systems; determine necessary action

Competency 4.2 Diagnose and repair front suspension

Competency Builders:

- 4.2.1 P-1 Diagnose short and long arm suspension system noises, body sway, and uneven riding height concerns; determine necessary action
- 4.2.2 P-1 Diagnose MacPherson strut suspension system noises, body sway, and uneven riding height concerns; determine necessary action
- 4.2.3 P-1 Remove, inspect, and install MacPherson strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount
- 4.2.4 P-2 Remove, inspect, and install upper and lower control arms, bushings, shafts, and rebound bumpers
- 4.2.5 P-2 Remove, inspect, install, and adjust strut (compression/tension) rods and bushings
- 4.2.6 P-2 Remove, inspect, and install upper and lower ball joints on short and long arm suspension systems
- 4.2.7 P-2 Remove, inspect, and install steering knuckle assemblies
- 4.2.8 P-2 Remove, inspect, and install short and long arm suspension system coil springs and spring insulators
- 4.2.9 P-2 Lubricate suspension and steering systems
- 4.2.10 P-3 Remove, inspect, install, and adjust suspension system torsion bars; inspect mounts
- 4.2.11 P-3 Remove, inspect, and install stabilizer bar bushings, brackets, and links

Competency 4.3 Repair rear suspension

Competency Builders:

- 4.3.1 P-2 Remove, inspect, and install coil springs and spring insulators
- 4.3.2 P-2 Remove, inspect, and install transverse links, control arms, bushings, and mounts
- 4.3.3 P-2 Remove, inspect, and install MacPherson strut cartridge or assembly, strut coil spring, and insulators (silencers)
- 4.3.4 P-3 Remove, inspect, and install leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts

Competency 4.4 Perform miscellaneous service

Competency Builders:

- 4.4.1 P-1 Inspect, remove, and replace shock absorbers
- 4.4.2 P-1 Remove, inspect, and service or replace front and rear wheel bearings
- 4.4.3 P-2^a Diagnose, inspect, adjust, repair or replace components of electronically controlled suspension systems (advanced skill)

Competency 4.5 Diagnose, adjust and repair wheel alignment

Competency Builders:

- 4.5.1 P-1 Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary action
- 4.5.2 P-1 Perform prealignment inspection; perform necessary action
- 4.5.3 P-1 Measure vehicle riding height; determine necessary action
- 4.5.4 P-1 Check and adjust front and rear wheel camber; perform necessary action
- 4.5.5 P-1 Check and adjust caster; perform necessary action
- 4.5.6 P-1 Check and adjust front wheel toe; adjust as needed
- 4.5.7 P-1 Center steering wheel
- 4.5.8 P-2 Check toe-out-on-turns (turning radius); determine necessary action
- 4.5.9 P-2 Check SAI (steering axis inclination) and included angle; determine necessary action
- 4.5.10 P-2 Check and adjust rear wheel toe
- 4.5.11 P-2 Check rear wheel thrust angle; determine necessary action
- 4.5.12 P-2 Check for front wheel setback; determine necessary action
- 4.5.13 P-3 Check front cradle (sub-frame) alignment; determine necessary action

Competency 4.6 Diagnose and repair wheel and tire

Competency Builders:

- 4.6.1 P-1 Diagnose tire wear patterns; determine necessary action
- 4.6.2 P-1 Inspect tires; check and adjust air pressure
- 4.6.3 P-1 Rotate tires according to manufacturer's recommendations
- 4.6.4 P-1 Balance wheel and tire assembly (static and dynamic)
- 4.6.5 P-1 Reinstall wheel; torque lug nuts

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| 4.6.6 | P-2 | Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action |
| 4.6.7 | P-2 | Measure wheel, tire, axle, and hub runout; determine necessary action |
| 4.6.8 | P-2 | Diagnose tire pull (lead) problem; determine necessary action |
| 4.6.9 | P-2 | Dismount, inspect, repair, and remount tire on wheel |

Unit 5 Brakes

Competency 5.1 Diagnose and repair hydraulic system

Competency Builders:

- | | | |
|--------|-----|---|
| 5.1.1 | P-1 | Remove, bench bleed, and reinstall master cylinder |
| 5.1.2 | P-1 | Diagnose poor stopping, pulling or dragging concerns caused by problems in the hydraulic system; determine necessary action |
| 5.1.3 | P-1 | Select, handle, store, and install brake fluids to proper level |
| 5.1.4 | P-1 | Bleed (manual, pressure, vacuum or surge) brake system |
| 5.1.5 | P-2 | Measure and adjust pedal height |
| 5.1.6 | P-2 | Check master cylinder for internal and external leaks and proper operation; determine necessary action |
| 5.1.7 | P-2 | Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports; determine necessary action |
| 5.1.8 | P-2 | Fabricate and install brake lines (double flare and ISO types); replace hoses, fittings, and supports as needed |
| 5.1.9 | P-3 | Inspect, test, and replace metering (hold-off), proportioning (balance), pressure differential, and combination valves |
| 5.1.10 | P-3 | Inspect, test, replace, and adjust height (load) sensing proportioning valve |
| 5.1.11 | P-3 | Inspect, test, and replace components of brake warning light system |
| 5.1.12 | P-3 | Flush hydraulic system |

Competency 5.2 Diagnose and repair drum brake

Competency Builders:

- | | | |
|-------|-----|--|
| 5.2.1 | P-1 | Diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action |
| 5.2.2 | P-1 | Remove, clean (using proper safety procedures), inspect, and measure brake drums; service or replace as needed |
| 5.2.3 | P-1 | Pre-adjust brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings |
| 5.2.4 | P-1 | Install wheel, torque lug nuts, and make final checks and adjustments |
| 5.2.5 | P-2 | Mount brake drum on lathe; machine braking surface |
| 5.2.6 | P-2 | Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble |
| 5.2.7 | P-2 | Remove, inspect, and install wheel cylinders |

Competency 5.3 Diagnose and repair disc brake

Competency Builders:

- 5.3.1 P-1 Diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action
- 5.3.2 P-1 Remove caliper assembly from mountings; clean and inspect for leaks and damage to caliper housing; determine necessary action
- 5.3.3 P-1 Clean and inspect caliper mounting and slides for wear and damage; determine necessary action
- 5.3.4 P-1 Remove, clean, and inspect pads and retaining hardware; determine necessary action
- 5.3.5 P-1 Disassemble and clean caliper assembly; inspect parts for wear, rust, scoring, and damage; replace seal, boot, and damaged or worn parts
- 5.3.6 P-1 Reassemble, lubricate, and reinstall caliper, pads, and related hardware; seat pads, and inspect for leaks
- 5.3.7 P-1 Clean, inspect, and measure rotor with a dial indicator and a micrometer; follow manufacturer's recommendation in determining need to machine or replace
- 5.3.8 P-1 Refinish rotor according to manufacturer's recommendations
- 5.3.9 P-1 Install wheel, torque lug nuts, and make final checks and adjustments
- 5.3.10 P-2 Remove and replace rotor
- 5.3.11 P-3 Adjust calipers with integrated parking brake system

Competency 5.4 Diagnose and repair power assist units

Competency Builders:

- 5.4.1 P-2 Test pedal free travel with and without engine running; check power assist operation
- 5.4.2 P-2 Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster
- 5.4.3 P-2 Inspect the vacuum-type power booster unit for vacuum leaks; inspect the check valve for proper operation; determine necessary action
- 5.4.4 P-3 Inspect and test hydro-boost system and accumulator for leaks and proper operation; determine necessary action

Competency 5.5 Perform miscellaneous diagnosis and repair

Competency Builders:

- 5.5.1 P-1 Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action
- 5.5.2 P-1 Remove, clean, inspect, repack, and install wheel bearings and replace seals; install hub and adjust wheel bearings
- 5.5.3 P-1 Check parking brake operation; adjust as needed
- 5.5.4 P-1 Check operation of brake stop light system; adjust and service as needed
- 5.5.5 P-1 Replace wheel bearing and race
- 5.5.6 P-2 Check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, and replace as needed

5.5.7 P-3 Check operation of parking brake indicator light system

Competency 5.6 Diagnose and repair anti-lock brake system

Competency Builders:

- 5.6.1 P-1 Diagnose anti-lock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determine necessary action
- 5.6.2 P-2 Inspect and test anti-lock brake system (ABS) components; determine necessary action
- 5.6.3 P-2 Diagnose poor stopping, wheel lock-up, abnormal pedal feel or pulsation and noise concerns caused by the anti-lock brake system (ABS); determine necessary action
- 5.6.4 P-2 Depressurize high-pressure components of the anti-lock brake system (ABS)
- 5.6.5 P-2 Bleed the anti-lock brake system's (ABS) front and rear hydraulic circuits
- 5.6.6 P-2 Service, test, and adjust anti-lock brake system (ABS) speed sensors
- 5.6.7 P-3 Remove and install anti-lock brake system (ABS) electrical/electronic and hydraulic components
- 5.6.8 P-3 Diagnose anti-lock brake system (ABS) braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.)

Unit 6 Electrical/Electronic Systems

Competency 6.1 Diagnose general electrical systems

Competency Builders:

- 6.1.1 P-1 Use wiring diagrams during diagnosis of electrical circuit problems identifying wiring diagram symbols
- 6.1.2 P-1 Check voltage and voltage drop in electrical/electronic circuits using a digital multimeter (DMM) to determine necessary action
- 6.1.3 P-1 Check current flow in electrical/electronic circuits and components using an ammeter to determine necessary action
- 6.1.4 P-1 Check continuity and resistance in electrical/electronic circuits and components with an ohmmeter to determine necessary action
- 6.1.5 P-1 Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits to determine necessary action
- 6.1.6 P-1 Measure and diagnose the cause(s) of abnormal key-off battery drain to determine necessary action
- 6.1.7 P-1 Inspect and test fusible links, circuit breakers, and fuses to determine necessary action
- 6.1.8 P-1 Inspect and test switches, connectors, relays, and wires of electrical/electronic circuits and perform necessary action
- 6.1.9 P-1 Repair wiring harnesses and connectors
- 6.1.10 P-1 Perform solder repair of electrical wiring
- 6.1.11 P-2 Check electrical circuits with a test light to determine necessary action
- 6.1.12 P-2 Check electrical circuits using jumper wires to determine necessary action

Competency 6.2 Diagnose and service battery

Competency Builders:

- 6.2.1 P-1 Perform battery state-of-charge test to determine needed service
- 6.2.2 P-1 Perform battery capacity test to determine needed service
- 6.2.3 P-1 Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed
- 6.2.4 P-1 Start a vehicle using jumper cables and a battery or auxiliary power supply according to manufacturers recommended specifications
- 6.2.5 P-2 Maintain or restore electronic memory functions
- 6.2.6 P-2 Inspect, clean, fill, and replace battery
- 6.2.7 P-2 Perform slow/fast battery charge

Competency 6.3 Diagnose and repair starting system

Competency Builders:

- 6.3.1 P-1 Perform starter current draw tests to determine necessary action
- 6.3.2 P-1 Perform starter circuit voltage drop tests to determine necessary action
- 6.3.3 P-2 Inspect and test starter relays and solenoids; replace as needed
- 6.3.4 P-2 Remove and install starter
- 6.3.5 P-2 Inspect and test switches, connectors, and wires of starter control circuits; perform necessary action
- 6.3.6 P-3 Perform starter bench tests; determine necessary action
- 6.3.7 P-3 Disassemble, clean, inspect, and test starter components; replace as needed

Competency 6.4 Diagnose and repair charging system

Competency Builders:

- 6.4.1 P-1 Perform charging system output test to determine necessary action
- 6.4.2 P-1 Diagnose charging system for the cause of undercharge, no-charge, and overcharge conditions
- 6.4.3 P-1 Perform charging circuit voltage drop tests; determine necessary action
- 6.4.4 P-1 Inspect and adjust alternator (generator) drive belts; replace as needed
- 6.4.5 P-2 Inspect and test voltage regulator/regulating circuit; perform necessary action
- 6.4.6 P-2 Remove, inspect, and install alternator (generator)
- 6.4.7 P-3 Disassemble alternator (generator), identify, clean, inspect, and test components; determine necessary action

Competency 6.5 Diagnose and repair lighting systems

Competency Builders:

- 6.5.1 P-2 Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action
- 6.5.2 P-2 Inspect, replace, and aim headlights and bulbs
- 6.5.3 P-2 Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action

Competency 6.6 Diagnose and repair gauges, warning devices, and driver information systems

Competency Builders:

- 6.6.1 P-1 Diagnose the cause of incorrect operation of warning devices and other driver information systems; determine necessary action
- 6.6.2 P-2 Inspect and test gauges and gauge sending units for cause of intermittent, high, low, or no gauge readings; determine necessary action
- 6.6.3 P-3 Inspect and test connectors, wires, and printed circuit boards of gauge circuits; determine necessary action
- 6.6.4 P-3 Inspect and test sensors, connectors, and wires of electronic instrument circuits; determine necessary action

Competency 6.7 Diagnose and repair horn and wiper/washer

Competency Builders:

- 6.7.1 P-3 Diagnose incorrect horn operation; perform necessary action
- 6.7.2 P-3 Diagnose incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action
- 6.7.3 P-3 Diagnose incorrect windshield washer operation; perform necessary action

Competency 6.8 Diagnose and repair accessories

Competency Builders:

- 6.8.1 P-2 Diagnose incorrect operation of motor-driven accessory circuits to determine necessary action
- 6.8.2 P-2 Diagnose supplemental restraint system (SRS) concerns to determine necessary action. (Note: follow manufacturer’s safety procedures to prevent accidental deployment)
- 6.8.3 P-3 Diagnose incorrect heated glass operation to determine necessary action
- 6.8.4 P-3 Diagnose incorrect electric lock operation to determine necessary action
- 6.8.5 P-3 Diagnose incorrect operation of cruise control systems; repair as needed
- 6.8.6 P-3 Diagnose radio static and weak, intermittent, or no radio reception to determine necessary action

Unit 7 Heating and Air Conditioning

Competency 7.1 Diagnose and repair A/C system

Competency Builders:

- 7.1.1 Use gauges to determine operating conditions of the AC system to evaluate system performance
- 7.1.2 P-1 Identify refrigerant type; conduct a performance test of the A/C system to determine necessary action
- 7.1.3 P-1 Leak test A/C system; determine necessary action
- 7.1.4 P-2 Diagnose unusual operating noises in the A/C system; determine necessary action

- 7.1.5 P-2 Inspect the condition of discharged oil; determine necessary action
- 7.1.6 P-2 Select oil type; measure, and add oil to the A/C system as needed

Competency 7.2 Diagnose and repair refrigeration system component

Competency Builders:

- 7.2.1 P-1 Inspect A/C condenser for airflow restrictions; perform necessary action
- 7.2.2 P-2 Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and PCM) to interrupt system operation; determine necessary action
- 7.2.3 P-2 Inspect A/C compressor drive belts; replace and adjust as needed
- 7.2.4 P-2 Inspect, test, and replace A/C compressor clutch components or assembly
- 7.2.5 P-2 Remove and replace A/C compressor and mountings
- 7.2.6 P-2 Remove and inspect A/C system mufflers, hoses, lines, fittings, o-rings, seals, and service valves; perform necessary action
- 7.2.7 P-2 Remove and install receiver/drier or accumulator/drier
- 7.2.8 P-2 Remove and install expansion valve or orifice (expansion) tube
- 7.2.9 P-3 Determine need for A/C system filter; perform necessary action
- 7.2.10 P-3 Inspect evaporator housing water drain; perform necessary action

Competency 7.3 Diagnose and repair heating, ventilation, and engine cooling systems

Competency Builders:

- 7.3.1 P-1 Perform cooling system, cap, and recovery system tests (pressure, combustion leakage, and temperature); determine necessary action
- 7.3.2 P-1 Inspect engine cooling and heater system hoses and belts; perform necessary action
- 7.3.3 P-1 Inspect, test, and replace thermostat housing
- 7.3.4 P-1 Determine coolant condition; drain and recover coolant
- 7.3.5 P-1 Flush system; refill system with recommended coolant; bleed system
- 7.3.6 P-1 Inspect and test fan, fan clutch (electrical and mechanical), fan shroud, and air dams; perform necessary action
- 7.3.7 P-1 Inspect and test electrical fan control system and circuits
- 7.3.8 P-2 Diagnose temperature control problems in the heater/ventilation system; determine necessary action
- 7.3.9 P-2 Inspect and test heater control valve(s); perform necessary action

Competency 7.4 Diagnose and repair operating systems and related controls

Competency Builders:

- 7.4.1 P-2 Diagnose failures in the electrical controls of heating, ventilation, and A/C (HVAC) systems to determine necessary action
- 7.4.2 P-2 Inspect and test A/C-heater blower, motors, resistors, switches, relays, wiring, and protection devices; perform necessary action
- 7.4.3 P-2 Diagnose failures in the vacuum and mechanical components and controls of the heating, ventilation, and A/C (HVAC) system to determine necessary action
- 7.4.4 P-3 Test A/C compressor load cut-off systems to determine necessary action

- 7.4.5 P-3 Inspect and test A/C-heater control panel assembly to determine necessary action
- 7.4.6 P-3 Inspect and test A/C-heater control cables and linkages; perform necessary action
- 7.4.7 P-3 Inspect and test A/C-heater ducts, doors, hoses, and outlets; perform necessary action
- 7.4.8 P-3 Check operation of automatic and semi-automatic heating, ventilation, and air-conditioning (HVAC) control systems to determine necessary action

Competency 7.5 Recover, recycle and handle refrigerant

Competency Builders:

- 7.5.1 P-1 Verify correct operation and maintenance of refrigerant handling equipment
- 7.5.2 P-1 Identify (by label application or use of a refrigerant identifier) and recover A/C system refrigerant
- 7.5.3 P-1 Recycle refrigerant
- 7.5.4 P-1 Label and store refrigerant
- 7.5.5 P-1 Test recycled refrigerant for non-condensable gases
- 7.5.6 P-1 Evacuate and charge A/C system
- 7.5.7 Obtain certification to service and repair AC systems

Unit 8 Engine Performance

Competency 8.1 Diagnose general engine performance

Competency Builders:

- 8.1.1 P-1 Interpret and verify concern to determine necessary action
- 8.1.2 P-1 Perform engine absolute (vacuum/boost) manifold pressure tests to determine necessary action
- 8.1.3 P-1 Perform cylinder power balance test to determine necessary action
- 8.1.4 P-1 Perform cylinder compression test to determine necessary action
- 8.1.5 P-1 Perform cylinder leakage test; determine necessary action
- 8.1.6 P-1 Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns with an oscilloscope and engine diagnostic equipment; determine necessary action
- 8.1.7 P-1 Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action
- 8.1.8 P-2 Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action
- 8.1.9 P-2 Diagnose unusual engine noise or vibration concerns; determine necessary action
- 8.1.10 P-2 Diagnose unusual exhaust color, odor, and sound; determine necessary action

Competency 8.2 Diagnose and repair computerized engine controls

Competency Builders:

- 8.2.1 P-1 Retrieve and record stored OBD I diagnostic trouble codes; clear codes

- 8.2.2 P-1 Diagnose the causes of emissions or drivability concerns resulting from failure of computerized engine controls with stored diagnostic trouble codes
- 8.2.3 P-1 Diagnose emissions or drivability concerns resulting from failure of computerized engine controls with no stored diagnostic trouble codes; determine necessary action
- 8.2.4 P-1 Obtain and interpret digital multimeter (DMM) readings
- 8.2.5 P-1 Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals)
- 8.2.6 P-1 Inspect and test power and ground circuits and connections; service or replace as needed
- 8.2.7 P-2 Inspect and test computerized engine control system sensors; powertrain control module (PCM), actuators, and circuits; perform necessary action
- 8.2.8 P-2 Practice recommended precautions when handling static sensitive devices
- 8.2.9 P-2 Diagnose drivability and emissions problems resulting from failures of interrelated systems (such as cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM-installed accessories, and similar systems) to determine necessary action
- 8.2.10 P-3 Retrieve and record stored OBD II diagnostic trouble codes; clear codes
- 8.2.11 P-3 Access and use electronic service information (ESI)

Competency 8.3 Diagnose and repair ignition system

Competency Builders:

- 8.3.1 Use oscilloscope and other test equipment
- 8.3.2 P-1 Diagnose no-starting, drivability, and emissions concerns on vehicles with electronic ignition (EI/DIS) (distributorless) systems; determine necessary action
- 8.3.3 P-1 Diagnose no-starting, drivability, and emissions concerns on vehicles with distributor ignition (DI) systems; determine necessary action
- 8.3.4 P-1 Check and adjust (where applicable) ignition system timing and timing advance/retard
- 8.3.5 P-2 Inspect and test ignition primary circuit wiring and components; perform necessary action
- 8.3.6 P-2 Inspect and test ignition system secondary circuit wiring and components; perform necessary action
- 8.3.7 P-2 Inspect and test ignition coil(s); perform necessary action
- 8.3.8 P-2 Inspect and test ignition system pick-up sensor or triggering devices; perform necessary action
- 8.3.9 P-2 Inspect and test ignition control module; perform necessary action
- 8.3.10 P-3 Inspect and test distributor; perform necessary action

Competency 8.4 Diagnose and repair fuel, air induction, and exhaust systems

Competency Builders:

- 8.4.1 P-1 Identify probable causes of hot or cold no-starting, hard starting, poor drivability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with injection-type fuel systems; determine necessary action
- 8.4.2 P-1 Replace fuel filters
- 8.4.3 P-1 Inspect and test fuel pressure regulation system and components of injection-type fuel systems; perform necessary action
- 8.4.4 P-1 Perform exhaust system back-pressure test; determine necessary action
- 8.4.5 P-2 Inspect fuel tank and fuel cap, fuel lines, fittings, and hoses; perform necessary action
- 8.4.6 P-2 Check fuel for contaminants and quality; determine necessary action
- 8.4.7 P-2 Inspect and test mechanical and electrical fuel pumps and pump control systems; perform necessary action
- 8.4.8 P-2 Remove, service, and install throttle body; adjust related linkages
- 8.4.9 P-2 Inspect, test, and clean fuel injectors
- 8.4.10 P-2 Inspect throttle body mounting plates, air induction and filtration system, intake manifold, and gaskets; perform necessary action
- 8.4.11 P-2 Check idle speed and fuel mixture
- 8.4.12 P-2 Remove, inspect, and test vacuum and electrical circuits, components and connections of fuel system; perform necessary action
- 8.4.13 P-2 Inspect exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action
- 8.4.14 P-3 Identify probable cause of hot or cold no-starting, hard starting, poor drivability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with carburetor-type fuel systems to determine necessary action
- 8.4.15 P-3 Inspect and test cold enrichment system and components; perform necessary action
- 8.4.16 P-3 Adjust idle speed and fuel mixture
- 8.4.17 P-3 Test the operation of turbocharger/supercharger systems; determine necessary action

Competency 8.5 Diagnose and repair emissions control systems

Competency Builders:

- 8.5.1 P-1 Diagnose oil leaks, emissions, and drivability problems resulting from failure of the positive crankcase ventilation (PCV) system; determine necessary action
- 8.5.2 P-1 Diagnose emissions and drivability problems caused by failure of the exhaust gas recirculation (EGR) system; determine necessary action

- 8.5.3 P-2 Inspect and test positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action
- 8.5.4 P-2 Inspect and test valve, valve manifold, and exhaust passages of exhaust gas recirculation (EGR) systems; perform necessary action
- 8.5.5 P-2 Inspect and test vacuum/pressure controls, filters, and hoses of exhaust gas recirculation (EGR) systems; perform necessary action
- 8.5.6 P-2 Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action
- 8.5.7 P-2 Diagnose emissions and drivability problems resulting from failure of the secondary air injection and catalytic converter systems; determine necessary action
- 8.5.8 P-2 Inspect and test mechanical components of secondary air injection systems; perform necessary action
- 8.5.9 P-2 Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action
- 8.5.10 P-2 Inspect and test components of catalytic converter systems; perform necessary action
- 8.5.11 P-2 Diagnose emissions and drivability problems resulting from failure of evaporative emissions control system; determine necessary action
- 8.5.12 P-2 Inspect and test components and hoses of evaporative emissions control system; perform necessary action
- 8.5.13 P-3 Diagnose emissions and drivability problems resulting from failure of the intake air temperature control system; determine necessary action
- 8.5.14 P-3 Inspect and test components of intake air temperature control system; perform necessary action
- 8.5.15 P-3 Diagnose emissions and drivability problems resulting from failure of early fuel evaporation control system; determine necessary action
- 8.5.16 P-3 Inspect and test components of early fuel evaporation control system; perform necessary action

Competency 8.6 Perform miscellaneous engine related services

Competency Builders:

- 8.6.1 P-1 Adjust valves on engines with mechanical or hydraulic lifters
- 8.6.2 P-1 Verify correct camshaft timing; determine necessary action
- 8.6.3 P-1 Verify engine operating temperature; determine necessary action
- 8.6.4 P-1 Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action
- 8.6.5 P-1 Inspect and test thermostat, by-pass, and housing; perform necessary action
- 8.6.6 P-2 Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action

Unit 9 Safety

Competency 9.1 Maintain a safe work environment

Competency Builders:

- 9.1.1 Keep area clean
- 9.1.2 Wear proper safety equipment
- 9.1.3 Maintain tools and equipment
- 9.1.4 Drive safely

Competency 9.2 Handle hazardous material correctly

Competency Builders:

- 9.2.1 Properly dispose of all hazardous waste material
- 9.2.2 Observe all state/local/federal OSHA regulations
- 9.2.3 Identify chemical product hazards

Unit 10 Customer Service

Competency 10.1 Verify customer complaint

Competency Builders:

- 10.1.1 Perform visual inspection
- 10.1.2 Conduct road test
- 10.1.3 Attempt to duplicate complaint
- 10.1.4 Perform auditory inspection
- 10.1.5 Confirm the complaint

Competency 10.2 Diagnose complaint/condition/problem

Competency Builders:

- 10.2.1 Consult proper information resources (internet, manuals, TSB—technical service bulletins, etc.)
- 10.2.2 Select the diagnostic equipment needed
- 10.2.3 Set up diagnostic equipment
- 10.2.4 Perform diagnostic procedure
- 10.2.5 Record results of diagnostic procedure

Employability Competencies

Employability Competencies are underlying skills, including work habits and ethics, essential to the workplace and personal growth. SCANS (Secretary’s Commission on Achieving Necessary Skills) are the basis for these competencies and are included in all programs based on an ACAP (Austin Competency Analysis Profile). These skills are taught with the intention of providing the student with a well-rounded understanding of workplace expectations in areas not specific to a particular occupation, in an attempt to develop a valuable employee.

ACAP: Automotive Technician

Unit 1:	Resources
Unit 2:	Interpersonal
Unit 3:	Information
Unit 4:	Systems
Unit 5:	Technology
Unit 6:	Basic Skills
Unit 7:	Thinking Skills
Unit 8:	Personal Qualities

Competency 1.1 Manage time effectively

Competency Builders:

- 1.1.1 Select relevant, goal-related activities
- 1.1.2 Rank activities in order of importance
- 1.1.3 Allocate time to activities
- 1.1.4 Identify tasks to be completed
- 1.1.5 Develop and follow an effective, workable schedule based on accurate estimates of such things as importance of tasks, time to complete tasks, time available for completion, and task deadlines, without wasting time
- 1.1.6 Identify possible impact of schedules on other activities
- 1.1.7 Evaluate and adjust a schedule

Competency 1.2 Manage money effectively

Competency Builders:

- 1.2.1 Prepare or use budgets including making cost and revenue forecasts
- 1.2.2 Record details to track budget performance
- 1.2.3 Adjust budget appropriately when needed
- 1.2.4 Allocate money to include accurately preparing and using a budget according to a consistent and orderly accounting method
- 1.2.5 Calculate future budgetary needs based on projected costs and revenues
- 1.2.6 Track the extent to which actual costs and revenues differ from the estimated budget, and take appropriate and effective action

Competency 1.3 Manage material and facility resources effectively

Competency Builders:

- 1.3.1 Store resources such as materials, supplies, parts, equipment, space or final products in an order that makes the best use of them
- 1.3.2 Allocate materials and facility resources to include carefully planning the steps involved in the acquisition, storage, and distribution of resources
- 1.3.3 Acquire, transport, and store material and facility resources safely and efficiently
- 1.3.4 Maintain material and facility resources in good condition
- 1.3.5 Distribute material and resources to the end user

Competency 1.4 Manage human resources efficiently

Competency Builders:

- 1.4.1 Assess people's knowledge, skills and potential
- 1.4.2 Identify present and future work load
- 1.4.3 Match individual talents and workload effectively

Unit 2: Interpersonal Skills

Competency 2.1 Participate as a member of a team

Competency Builders:

- 2.1.1 Work cooperatively with others
- 2.1.2 Contribute to group with ideas, suggestions, and efforts
- 2.1.3 Complete personal share of tasks necessary to complete a project
- 2.1.4 Encourage team members by listening and responding appropriately to their contributions
- 2.1.5 Build on individual team members' strengths
- 2.1.6 Resolve differences for the benefit of the team
- 2.1.7 Take personal responsibility for accomplishing goals
- 2.1.8 Challenge existing procedures, policies, or authorities responsibly

Competency 2.2 Teach others

Competency Builders:

- 2.2.1 Coach or otherwise teach others to apply related concepts and theories to tasks
- 2.2.2 Convey job information to allow others to see its applicability and relevance to tasks
- 2.2.3 Identify training needs of others
- 2.2.4 Assess performance of others
- 2.2.3 Provide feedback on others' performance in a constructive manner
- 2.2.4 Provide solutions to observed problems.

Competency 2.3 Serve clients/customers

Competency Builders

- 2.3.1 Identify customers/clients expectations through surveys, questions, body language, or expressions
- 2.3.2 Communicate and work with clients/customers to satisfy their expectations
- 2.3.3 Listen actively to customers to avoid misunderstanding and to identify needs
- 2.3.4 Provide alternatives to clients/customers to satisfy their expectations.
- 2.3.5 Provide services and goods in a timely, positive manner
- 2.3.6 Obtain additional resources to satisfy client needs efficiently

Competency 2.4 Exercise leadership

Competency Builders:

- 2.4.1 Communicate thoughts, feelings, and ideas to justify a position
- 2.4.2 Motivate and/or convince individuals or groups through encouragement or persuasion
- 2.4.3 Challenge existing procedures, policies or authorities responsibly
- 2.4.4 Use rules/values followed by others

- 2.4.5 Justify a position logically and appropriately
- 2.4.6 Consider minority viewpoints in making decisions or taking action

Competency 2.5 Negotiate to arrive at a decision

Competency Builders:

- 2.5.1 Achieve agreement through exchanging specific resources or resolving divergent interests
- 2.5.2 Research opposition and the history of the conflict
- 2.5.3 Set realistic, obtainable goals
- 2.5.4 Present facts and arguments
- 2.5.5 Listen to and reflect upon what has been said
- 2.5.6 Clarify problems and resolve conflicts
- 2.5.7 Propose and examine possible options
- 2.5.8 Make reasonable compromises

Competency 2.6 Work with cultural diversity

Competency Builders:

- 2.6.1 Work with men and women, and a variety of ethnic, social and educational backgrounds
- 2.6.2 Compare one's own culture and that of others
- 2.6.3 Respect the rights of others while helping them make cultural adjustments when necessary
- 2.6.4 Base impression upon individual performance, not stereotypes
- 2.6.5 Understand concerns of members of other ethnic and gender groups

Unit 3: Information

Competency 3.1 Acquire and evaluate information

Competency Builders:

- 3.1.1 Pose analytic questions to determine specific information needs
- 3.1.2 Select appropriate information sources
- 3.1.3 Determine when new information must be created and do so
- 3.1.4 Evaluate data for relevance and accuracy

Competency 3.2 Organize and maintain information

Competency Builders:

- 3.2.1 Organize a variety of information forms or sources in a systemic fashion
- 3.2.2 Maintain written or other forms of information to keep up-to-date information available in a systemic fashion
- 3.2.3 Organize information from computer, visual, oral and physical sources in readily accessible formats, such as computerized data bases, spreadsheets, microfiche, video disks, paper files, etc.

- 3.2.4 Transform data into different formats in order to organize them by the application of various methods such as sorting, classifying, or more formal methods

Competency 3.3 Interpret and communicate information

Competency Builders

- 3.3.1 Select information to be communicated
- 3.3.2 Identify best methods to present information (e.g., overheads, handouts, etc.)
- 3.3.3 Communicate results to others in desired format
- 3.3.4 Convey information to others through a variety of means including oral, written, graphic, pictorial or multi-media methods

Competency 3.4 Process information using computer

Competency Builders

- 3.4.1 Acquire information from the internet and other computer based resources
- 3.4.2 Organize information, using spreadsheets, word processor, and data bases effectively
- 3.4.3 Analyze information to identify trends, make projections, etc.
- 3.4.4 Enter, modify, retrieve, store and verify data and other information in a computer
- 3.4.5 Choose format for display (e.g., line graphs, bar graphs, tables, pie charts, narrative)
- 3.4.6 Convey information into the chosen format
- 3.4.7 Communicate information using e-mail, list serves, word processor, or other computer based communication functions

Unit 4: Systems

Competency 4.1 Apply appropriate techniques to function within social, organizational, and technological systems to attain goals effectively and ethically

Competency Builders:

- 4.1.1 Identify dynamics and components of social, organizational and technological systems
- 4.1.2 Recognize acceptable behavior and attitudes within social, organizational and technological systems
- 4.1.3 Communicate through acceptable methods to interact with social, organizational, and technological systems effectively, efficiently, and ethically
- 4.1.4 Recognize how a system's structures relate to goals
- 4.1.5 Recognize the right of people to ask for information and where to get resources

Competency 4.2 Monitor and correct performance of a system

Competency Builders

- 4.2.1 Distinguish trends
- 4.2.2 Predict impact of actions on system operations
- 4.2.3 Diagnose deviations in the function of a system/organization
- 4.2.4 Correct performance through necessary action
- 4.2.5 Detect deviations from systems intended purpose
- 4.2.6 Troubleshoot the system
- 4.2.7 Make changes to the system to rectify system function and to ensure quality of product

Competency 4.3 Improve and design systems

Competency Builders

- 4.3.1 Make suggestions to modify or improve existing products or services
- 4.3.2 Implement approved improvements in systems
- 4.3.3 Evaluate the benefits of the improvements
- 4.3.4 Develop/recommend new or alternative system designs based on relevant feedback
- 4.3.5 Communicate the results of the evaluations

Unit 5: Technology

Competency 5.1 Select appropriate technology

Competency Builders

- 5.1.1 Determine the desired results or outcomes and applicable restraints
- 5.1.2 Visualize the necessary methods and applicable technology
- 5.1.3 Evaluate specifications
- 5.1.2 Judge which procedures, tools, machines or programs will produce the desired results

Competency 5.2 Apply technology to task

Competency Builders:

- 5.2.1 Set up tools such as machines, computers, and programming systems, using proper procedures, to get desired results
- 5.2.2 Analyze how different parts of machines interact and how machines interact with broader production systems
- 5.2.3 Install machines including computers
- 5.2.4 Interpret machine output accurately
- 5.2.5 Detect errors from program output

Competency 5.3 Maintain and troubleshoot technology

Competency Builders

- 5.3.1 Prevent problems in machines, computers, and other technologies
- 5.3.2 Identify problems in machines, computers and other technologies
- 5.3.3 Perform routine maintenance and service of machines, computers, and other technologies
- 5.3.4 Detect more serious problems
- 5.3.5 Generate workable solutions to correct deviations
- 5.3.6 Recognize need for additional help

Unit 6: Basic Skills

Competency 6.1 Read written information in prose and documents, such as manuals, graphs, and schedules with understanding

Competency Builders

- 6.1.1 Determine the main idea or essential message
- 6.1.2 Identify relevant details, facts, and specifications
- 6.1.3 Infer or locate the meaning of unknown or technical vocabulary
- 6.1.4 Judge the accuracy, appropriateness, style, and plausibility of reports, proposals, or theories of other writers

Competency 6.2 Communicate thoughts, ideas, information, and messages in writing

Competency Builders

- 6.2.1 Record information completely and accurately
- 6.2.2 Compose and create documents such as letters, directions, manuals, reports, proposals, graphs, and flow charts
- 6.2.3 Use language, style, organization and format appropriate to the subject matter, purpose, and audience
- 6.2.3 Include supporting documentation where appropriate
- 6.2.4 Attend to level of detail
- 6.2.5 Check, edit, and revise for correct information, appropriate emphasis, form, grammar, spelling, and punctuation

Competency 6.3 Perform arithmetic computations and concepts with appropriate technology and/or paper and pencil to solve simple work problems

Competency Builders

- 6.3.1 Perform basic computations
- 6.3.2 Use basic numerical concepts such as whole numbers and percentages in practical situations
- 6.3.3 Make reasonable estimates of arithmetic results without a calculator

- 6.3.4 Use tables, graphs, diagrams, and charts to obtain or convey quantitative information

Competency 6.4 Perform mathematics in a variety of techniques to approach practical problems appropriately

Competency Builders

- 6.4.1 Choose appropriate technique to solve problem
6.4.2 Use quantitative data to construct logical explanations for real world situations
6.4.3 Express mathematical ideas and concepts orally and in writing
6.4.4 Predict an event considering the role of chance in the occurrence

Competency 6.5 Listen and react appropriately to verbal messages

Competency Builders

- 6.5.1 Receive, attend to, interpret, and respond to verbal messages appropriately
6.5.2 Receive, attend to, interpret, and respond to other cues such as body language appropriately
6.5.3 Listen to comprehend, learn, critically evaluate, appreciate, or support the speaker

Competency 6.6 Deliver oral messages appropriately to listeners

Competency Builders

- 6.6.1 Organize ideas and communicate orally as appropriate for the situation and listeners
6.6.2 Participate in conversation, discussion, and group presentations
6.6.3 Select an appropriate medium for conveying a message
6.6.4 Use verbal language and other cues, such as body language, in a way appropriate in style, tone, and level of complexity to the audience and the occasion
6.6.5 Speak clearly and communicate a message
6.6.6 Respond to listener feedback in a way that indicates understanding
6.6.7 Ask questions when needed

Unit 7: Thinking Skills

Competency 7.1 Generate new ideas using creative thinking

Competency Builders

- 7.1.1 Change or reshape goals using nonlinear or unusual connections
7.1.2 Imagine new ideas by combining ideas or information in new ways
7.1.3 Connect seemingly unrelated ideas
7.1.4 Reshape goals in ways that reveal new possibilities

Competency 7.2 Make decisions

Competency Builders

- 7.2.1 Specify goals and constraints
- 7.2.2 Generate alternatives
- 7.2.3 Consider risks
- 7.2.4 Evaluate and choose best alternatives
- 7.2.5 Analyze how personal, family, and social factors influence decisions, behaviors, and lifestyles
- 7.2.6 Utilize a decision-making process to develop future career goals

Competency 7.3 Apply problem solving skills appropriate to situation

Competency Builder

- 7.3.1 Recognize a problem exists (i.e., that there is a discrepancy between what is and what should be)
- 7.3.2 Identify possible reasons for the problem
- 7.3.3 Devise and implement a plan of action to resolve the problem
- 7.3.4 Evaluate and monitor progress
- 7.3.5 Revise the plan as indicated by the findings
- 7.3.6 Communicate in both oral and written language while working with others to identify/resolve problems
- 7.3.7 Reason inductively and deductively to solve problems
- 7.3.8 Select and apply problem-solving methods

Competency 7.4 See things in the mind's eye

Competency Builders

- 7.4.1 Organize and process symbols, pictures, graphs, objects or other information to visualize actual representation (such as a building from blueprints)
- 7.4.2 Visualize possible options
- 7.4.3 Communicate visualized options verbally

Competency 7.5 Apply learning strategies to support life-long learning

Competency Builders

- 7.5.1 Apply and adapt existing and new knowledge and skills, using learning techniques, in both familiar and changing situations
- 7.5.2 Evaluate learning style (visual, aural, etc.) to make proper selection of learning techniques
- 7.5.3 Identify various learning techniques including formal learning strategies (note taking or clustering items that share some characteristics) and informal learning strategies (awareness of unidentified false assumptions that may lead to faulty conclusions)
- 7.5.4 Make decisions/plans concerning school to work training and future educational needs using relevant resources

Competency 7.6 Apply reasoning to finding solutions or draw conclusions

Competency Builders

- 7.6.1 Discover a rule or principle underlying the relationship between two or more objects
- 7.6.2 Extract rules or principles from a set of objects or a written text
- 7.6.3 Apply principles to solve problems
- 7.6.4 Draw conclusion from available information using logic
- 7.6.5 Apply rules and principles to a new situation
- 7.6.6 Determine which conclusion is correct when given a set of facts and conclusions
- 7.6.7 Evaluate alternatives and assess consequences to achieve personal and social goals

Unit 8: Personal Qualities

Competency 8.1 Act responsibly

Competency Builders

- 8.1.1 Persevere toward goal attainment with a high level of effort
- 8.1.2 Set high standards in order to become excellent at doing tasks by setting high standards, paying attention to details, working well and displaying a high level of concentration even when assigned an unpleasant task
- 8.1.3 Display a high standard of attendance, punctuality, enthusiasm, vitality, and optimism in approaching and completing tasks

Competency 8.2 Exhibit effective self-esteem

Competency Builders

- 8.2.1 Maintain a positive view of self and believe in own self-worth
- 8.2.2 Identify own skill and abilities possessed
- 8.2.3 Recognize own emotional capacity and needs
- 8.2.4 Identify/Apply effective ways to handle emotional capacity and needs
- 8.2.5 Recognize own impression on others

Competency 8.3 Employ appropriate social skills

Competency Builders

- 8.3.1 Demonstrate understanding, friendliness, adaptability, empathy and politeness in new and on-going group settings
- 8.3.2 Assert self in familiar and unfamiliar social situations
- 8.3.3 Relate well to others
- 8.3.4 Respond appropriately as the situation requires
- 8.3.5 Take an interest in what others say and do

Competency 8.4 Manage self

Competency Builders

- 8.4.1 Assess own knowledge, skills, and abilities accurately
- 8.4.2 Set well-defined and realistic personal goals
- 8.4.3 Monitor progress toward goal attainment
- 8.4.4 Motivate self through goal achievement
- 8.4.5 Exhibit self-control and respond to feedback unemotionally and nondefensively
- 8.4.6 Initiate action

Competency 8.5 Apply integrity and honesty to all matters

Competency Builders

- 8.5.1 Recognize situations when faced with making a decision or exhibiting behavior that may break with commonly held personal or societal values
- 8.5.2 Understand the impact of violating these beliefs and codes on an organization, self, and others
- 8.5.3 Choose an ethical course of action

WorkKeys Process Overview

Developed by American College Testing (ACT), the purpose of the Job Profiling process is to identify the level of applied academic skills that, according to business and industry, students must master to qualify for and be successful in their occupation of choice. The results of Job Profile “leveling” can help teachers to better target instruction toward their students’ needs.

The WorkKeys component, developed by ACT, measures students’ applied academic skills. These academic skills include Applied Mathematics, Locating Information, Reading for Information, Listening, Writing, Teamwork, Observation, and Applied Technology. It is determined during the profile which skills apply to the specific job or occupational area.

The ACAP (Austin Competency Analysis Profile) includes the skills described below. A fourth skill may be identified and included if the subject matter experts agree that it is necessary for entry into the position.

- *Applied Mathematics* measures students’ ability to analyze, set-up, and solve math problems typically found in the workplace.
- *Locating Information* measures students’ ability to use graphic documents to insert, extract, and apply information (includes charts, graphs, tables, forms, blueprints, maps, and instrument gauges).
- *Reading for Information* measures students’ ability to read and understand work-related reading materials (text only—does not including charts, graphs, tables, forms, blueprints, maps, or instrument gauges).

Each WorkKeys assessment is further broken down into four to five levels of achievement, with higher numbers indicating higher achievement in the assessed skill. For each academic skill, the Job Profiling process identifies the level required for successful entry into an occupational area as identified by subject matter experts.

ACT WorkKeys Skill Levels

<u>Skill Area and Rank</u>	<u>Entry Level</u>	<u>Performance Level</u>
1) Reading for Information	5	6
2) Locating Information	5	6
3) Applied Mathematics	4	5

Entry Level

Refers to the requirements necessary for someone entering into the occupation (without previous on-the-job experience).

Performance Level

Refers to the level at which an employee would need to function effectively having gained on-the-job knowledge.

Skill Ranking

Refers to the criticality of the skill to the performance of the occupation with the most critical skill indicated with one (1) and higher numbers indicating lower criticality.

Levels of WorkKeys Defined

The skills needed to achieve each level for WorkKeys academic skills identified in this profile are as follows:

Reading for Information

Reading for Information measures skill in reading and understanding work-related reading materials. There are five levels of complexity, 3 through 7, with Level 3 being the least complex and Level 7 the most complex. Although Level 3 is the least complex, it still represents a level of reading skill well above “no skill at all.” The levels build on each other, each incorporating the skills at the preceding levels.

Level 3

- Identify uncomplicated key concepts and simple details.
- Recognize the proper placement of a step in a sequence of events, or the proper time to perform a task.
- Identify the meaning of words that are defined within a passage.
- Identify the meaning of simple words that are not defined within a passage.
- Recognize the application of instructions, from a passage to situations that are described in the passage.

Level 4

- Identify details that are more subtle than those in Level 3.
- Recognize the application of more complex instructions, some of which involve several steps, to described situations.
- Recognize cause-effect relationships.

Level 5

- Understand the paraphrased definition of specialized words or phrases (jargon or technical terms) defined in these reading materials
- Use jargon or technical terms appropriately in describing situations stated in these reading materials
- Understand the meaning of acronyms defined in these reading materials (an acronym is a work or collection of letters which stands for a longer phrase, such as HMO to mean Health Maintenance Organization).
- Figure out which definition of a word with multiple meanings is appropriate in the context of these reading materials.

- Apply information given in these reading materials to situations that are not directly described, but similar.
- Apply instructions or procedures with a number of steps to described situations. These instructions may include conditional (if X happens, then you should do Y).

Level 6

- Recognize the application of jargon or technical terms to new situations.
- Recognize the application of complex instructions to new situations.
- Recognize the less-common meaning of a word with multiple meanings from context.
- Generalize from a passage to situations not described in the passage.
- Identify implied details.
- Explain the rationale behind a procedure, policy, or communication.
- Generalize from a passage to a somewhat similar situation.

Level 7

- Recognize the definitions of difficult, uncommon jargon or technical terms from context.
- Generalize from a passage to situations neither described in nor completely similar to those in a passage.

Locating Information

Locating Information measures skill in using information taken from workplace graphics such as diagrams, blueprints, floor plans, tables, forms, graphs, charts, and instrument gauges. There are four levels of complexity, 3 through 6, with Level 3 being the least complex and Level 6 the most complex. The levels build on each other, each incorporating the skills at the preceding levels.

Level 3

- Find one or two pieces of information in elementary workplace graphics, such as simple order forms, bar graphs, tables, flowcharts, and floor plans.
- Fill in one or two pieces of information that are missing from elementary workplace graphics.

Level 4

- Find several pieces of information in these type of graphics.
- Summarize and/or compare information and trends in a single graphic.
- Summarize and/or compare information and trends among more than one workplace graphic, such as a bar chart and a table showing related information.

Level 5

- Summarize and/or compare information and trends in single graphic.
- Summarize and/or compare information and trends among more than one graphic, such as a bar chart and a table showing related information.

Level 6

- Make decisions, draw conclusions, and/or apply information to new situations using several related and complex workplace graphics that contain a great amount of information or have challenging presentations (e.g., very detailed graphs, charts, tables, forms, maps, blueprints, diagrams).

Applied Mathematics

Applied Mathematics measures skill in applying mathematical reasoning to work-related problems. There are five levels of complexity, 3 through 7, with Level 3 being the least complex and Level 7 the most complex. The levels build on each other, each incorporating the skills at the preceding levels.

Level 3

- Perform basic mathematical operations (addition, subtraction, multiplication, and division) and conversions from one form to another, using whole numbers, fractions, decimals, or percentages.
- Translate simple verbal problems into mathematical equations.
- Directly apply logical information provided to solve problems, including those with measurements and dollars and cents.

Level 4

- Perform one or two mathematical operations (such as addition, subtraction, or multiplication) on several positive or negative numbers. (Division of negative numbers is not covered until Level 5.)
- Add commonly known fractions, decimals, or percentages (e.g., $\frac{1}{2}$, .75, 25%) or add three fractions that share a common denominator.
- Calculate averages, simple ratios, proportions, and rates, using whole numbers and decimals.
- Reorder verbal information before performing calculations.
- Read simple charts or graphs to obtain information needed to solve a problem.

Level 5

- Look up and calculate single-step conversions within English or non-English measurement systems (e.g., converting ounces to pounds or centimeters to meters) or between measurement systems (e.g., converting centimeters to inches).
- Make calculations using mixed unit (e.g., hours and minutes).
- Determine what information, calculations, and unit conversions are needed to find a solution.

Level 6

- Set up problems and do several steps of calculations or conversions.
- Calculate using negative numbers, fractions, ratios, percentages, or mixed numbers (e.g., $12 \frac{1}{8}$).
- Transpose a formula before calculating (e.g., $8X = 20 \Rightarrow X = 20/8$).
- Look up and use two formulas to change from one unit to another unit within the same system of measurement (e.g., 1 cup = 8 fl oz, 1 quart = 4 cups).
- Find mistakes in calculations, such as those required in lower levels.
- Determine the best deal and perform a further calculation with the result.

Level 7

- Solve problems requiring multiple steps of logic and calculation.
- Solve problems involving more than one unknown, nonlinear functions (e.g., rate of change), and applications of basic statistical concepts (e.g., error of measurement).
- Locate errors in multiple-step calculations.
- Solve problems with unusual content or format, or with incomplete or implicit information

Glossary

ACAP—*Austin Competency Analysis Profile*--a well-established job analysis process unique to Austin Community College involving business, industry, labor, and community agency representatives from throughout the Austin area.

Advanced Competencies—The occupation and academic competencies needed to advance in a given occupation.

Competency—an observable and measurable behavior that has a definite beginning and end; can be performed within a limited amount of time; consists of two or more competency builders; and leads to a product, service, or decision.

Competency Builders—The skills, knowledge, and attitudes (written in measurable terms) needed to perform a given competency.

Core Competencies—The essential occupational and academic competencies needed to enter and remain in a given occupation.

Employability Competencies—Underlying skills, abilities, and knowledge as they relate to work ethics, work habits, and personal growth and development.

Entry Level—refers to the requirements necessary for someone entering into the occupation (without previous on the job experience).

Performance Level—refers to the level at which an employee would need to function effectively having gained on-the-job knowledge.

Skill Ranking—Refers to the criticality of the WorkKeys skill to the performance of the occupation with one (1) indicating the most critical skill.

SME—*Subject Matter Expert*—incumbent worker in a given occupation that is knowledgeable about the job.

Target Job Titles—titles that may be assigned to the types of jobs aligned with an ACAP. Possible titles of jobs for which students would qualify with certificates or degrees in the programs based on an ACAP.

WorkKeys Skills—Eight skills, defined by ACT, referring to underlying, academic skills as they relate to the workplace. The skills include *Applied Mathematics, Applied Technology, Locating Information, Reading for Information, Observation, Teamwork, Listening, and Writing*. Each skill has a very specific definition and levels of each skill can be aligned with specific abilities defined at each level. WorkKeys skills are the basis for an occupational analysis system developed by ACT. The WorkKeys analysis is the final part of the overall ACAP report. All ACAPs include *Reading for Information, Locating Information, and Applied Mathematics*. A fourth skill may be included in the profile if the subject matter experts identify a need for it.