Atlantic Workforce Partnership

Curriculum Standard

AUTOMOTIVE SERVICE TECHNICIAN

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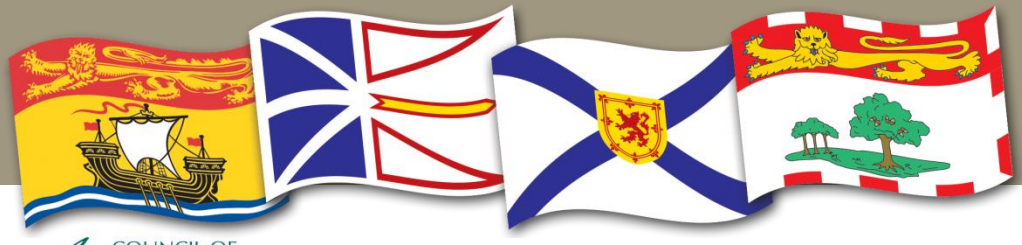
Atlantic Apprenticeship



COUNCIL OF ATLANTIC PREMIERS
CONSEIL DES PREMIERS MINISTRES DE L'ATLANTIQUE

Employment and Social Development Canada
Emploi et Développement social Canada

Atlantic Apprenticeship Curriculum Standard

Automotive Service Technician

Preface

This Atlantic Apprenticeship Curriculum Standard is intended to assist instructional staff in the design and delivery of technical, in-class training in support of the Automotive Service Technician program.

This document contains all the technical training elements required to complete the Automotive Service Technician apprenticeship program and has been developed based on the 2016 Red Seal Occupational Standard (RSOS). The RSOS can be found on the Red Seal website (www.red-seal.ca).

Implementation of this AACS for Apprenticeship training is outlined in the following table.

Level	Implementation Effective
Level 1	2019-2020
Level 2	2020-2021
Level 3	2021-2022
Level 4	2022-2023

** *The above implementation schedule was current at time of printing. Please* ***confirm*** *with Apprenticeship Staff prior to commencing training.*

Granting of credit or permission to challenge level examinations for pre-employment or pre-apprenticeship training for the Automotive Service Technician trade will be based on the content outlined in this standard. Training providers must contact their provincial apprenticeship authority for more information on the process and requirements for determining eligibility for credit towards an apprenticeship program. Programs which have been deemed acceptable by the jurisdictional apprenticeship authority will be identified in transfer credit matrix developed through the Atlantic Apprenticeship Harmonization Project.

Acknowledgements

The development of the Atlantic Apprenticeship Curriculum Standard (AACS) is an initiative of the Atlantic Apprenticeship Council's Atlantic Apprenticeship Harmonization Project (AAHP) through the Atlantic Workforce Partnership and Employment and Social Development Canada.

The Atlantic Apprenticeship Council wishes to acknowledge the contributions of the following industry and instructional representatives on the Atlantic Trade Advisory Committee (ATAC) who participated in the development of this document in May, 2018.

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User Guide

Atlantic Apprenticeship Curriculum Standards (AACS) are developed based on Red Seal Occupational Standards (RSOS), National Occupational Analyses (NOA), Interprovincial Program Guides (IPG), if available, and extensive industry consultation. This document represents the minimum content to be delivered as part of the harmonized Atlantic program for the Automotive Service Technician trade.

The AACS's are deliberately constructed for ease of use and flexibility of structure in order to adapt to all delivery requirements. They detail units of training, unit outcomes and objectives. They do not impose a delivery model or teaching format.

Jurisdictions and/or training providers will select and develop delivery materials and techniques that accommodate a variety of learning styles and delivery patterns. The AACS does not dictate study materials, textbooks or learning activities to be used in delivery.

The document includes a Level Structure to facilitate mobility for apprentices moving from one jurisdiction to another.

Structure

The content of the AACS is divided into units. Unit codes are used as a means of identification and are not intended to convey the order of delivery. It is at the discretion of the training provider to deliver the content in the required logical sequence of delivery within the level. Jurisdictions are free to deliver units one at a time or concurrently within a level, provided all outcomes are met.

The Learning Outcomes describe what the apprentice should know or be able to do at the end of training. Wording of the Learning Outcomes, "Demonstrate knowledge of…" acknowledges the broad spectrum of ways in which knowledge can be assessed (i.e. practical projects, multiple choice testing, presentations, etc.) by instructional staff within the training.

Summative evaluation will be through a multiple-choice Level Examination administered through the jurisdictional Apprenticeship Authority.

User Guide *(continued)*

The 2016 Red Seal Occupational Standard References (RSOS) to AACS Comparison chart outlines the relation between each RSOS sub-task and the AACS units. RSOS References have also been detailed in each unit to highlight the direct link between the unit and relevant sub-tasks in the RSOS.

In the Level Structure section, the document identifies suggested hours in order to provide an indication of the time it should take to cover the material in the unit and is provided as a guide only. Adjustments to the suggested hours for each unit may be required to account for rate of apprentice learning, statutory holidays, storm days, registration and examinations. These suggested hours detailed for each unit will represent both theory and practical training (if relevant) and for consistency will be based on a standard of 30 hours per week of training. The true length of time required to deliver an outcome successfully will depend upon the learning activities and teaching methods used.

There are two types of objectives found in the AACS document: theoretical and practical.

The theoretical objectives represent the material that is to be covered during the technical training in order to convey the required knowledge to the apprentice.

The practical objectives represent the tasks or skills that have been deemed by the Atlantic Trade Advisory Committee as critical for the apprentices to receive exposure to while attending technical training. For example, exposure could be done through instructor demonstration or individual or group performance of the skill or task. Training providers are encouraged to use practical demonstration and opportunities for hands-on learning whenever possible. Practical objectives are not intended to replace the on-the-job training component of the apprentice's program or to mirror or replace the logbook skills that are to be taught and evaluated in the workplace.

Detailed content for each objective has not been developed. Where detail is required for clarity, content has been provided.

Glossary of Terms

These definitions are intended as a guide to how language is used in the document.

ADJUST	To put in good working order; regulate; bring to a proper state or position.
APPLICATION	The use to which something is put and/or the circumstance in which an individual would use it.
CHARACTERISTIC	A feature that helps to identify, tell apart or describe recognizably; a distinguishing mark or trait.
COMPONENT	A part that can be separated from or attached to a system; a segment or unit.
DEFINE	To state the meaning of (a word, phrase, etc.).
DESCRIBE	To give a verbal account of; tell about in detail.
EXPLAIN	To make plain or clear; illustrate; rationalize.
IDENTIFY	To point out or name objectives or types.
INTERPRET	To translate information from observation, charts, tables, graphs and written material.
MAINTAIN	To keep in a condition of good repair or efficiency.
METHOD	A means or manner of doing something that has procedures attached to it.
OPERATE	How an object works; to control or direct the functioning of.
PROCEDURE	A prescribed series of steps taken to accomplish an end.
PURPOSE	The reason for which something exists or is done, made or used.

Glossary of Terms (*continued*)

SERVICE	Routine inspection and replacement of worn or deteriorating parts. An act or business function provided to a customer in the course of an individual's profession (e.g., haircut).
TECHNIQUE	Within a procedure, the manner in which technical skills are applied.
TEST	v. To subject to a procedure that ascertains effectiveness, value, proper function or other quality. n. A way of examining something to determine its characteristics or properties, or to determine whether or not it is working correctly.

Essential Skills Profiles

Through extensive research, the Government of Canada and other national and international agencies have identified and validated key essential skills for the workplace. These skills are used in nearly every job and at different levels of complexity. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Essential Skills Profiles describe how workers in various occupations use each of the key essential skills. They include:

- a brief description of the occupation;
- examples of tasks that illustrate how each essential skill is applied; and,
- complexity ratings that indicate the level of difficulty of the example tasks.

Essential Skills profiles can be found on the Employment and Social Development Canada (ESDC) website at www.esdc.gc.ca/eng/jobs/les/profiles/index.shtml.

The development and improvement of these Essential Skills is inherent throughout the apprenticeship training program as apprentices work towards achieving journeyperson status.

Profile Chart

PERFORMS COMMON OCCUPATIONAL SKILLS			
AST-100 Safety	**AST-105** Tools and Equipment	**AST-110** Fasteners, Tubing, Hoses and Fittings	**AST-115** Hoisting and Lifting
	AST-125 Technical Information	**AST-135** Oxy-Acetylene Heating and Cutting	**AST-140** Gas Metal Arc Welding
AST-180 Vehicle Maintenance Inspection	**AST-185** Pre-Delivery Inspection	**MENT-700** Mentoring I	**AST-335** Motor Vehicle Inspection
DIAGNOSES AND REPAIRS ENGINE AND ENGINE SUPPORT SYSTEMS			
AST-175 Engine Principles	**AST-200** Cooling Systems	**AST-205** Engine Lubrication Systems	**AST-210** Accessory Drive Systems
AST-215 Engine Repair	**AST-305** Gasoline Fuel Delivery and Injection Systems	**AST-310** Gasoline Ignition Systems	**AST-320** Gasoline Emission Control Systems
AST-325 Gasoline Intake and Exhaust Systems	**AST-405** Diesel Fuel Delivery and Injection Systems	**AST-410** Diesel Emission Control Systems	**AST-415** Diesel Intake and Exhaust Systems
DIAGNOSES AND REPAIRS VEHICLE MODULE COMMUNICATION SYSTEMS			
AST-315 Vehicle Networking Systems			
DIAGNOSES AND REPAIRS DRIVE LINE SYSTEMS			
AST-155 Drive Shafts and Axles	**AST-250** Manual Transmissions and Transaxles	**AST-255** Clutches	**AST-260** Final Drive Assemblies
AST-300 Transfer Cases	**AST-435** Automatic Transmissions and Transaxles		
DIAGNOSES AND REPAIRS ELECTRICAL AND COMFORT CONTROL SYSTEMS			
AST-165 Electrical and Electronic Principles	**AST-220** Starting Systems	**AST-225** Charging Systems	**AST-230** Lighting and Wiper Systems
AST-330 Electrical Options and Accessories	**AST-420** Entertainment Systems	**AST-425** Instrumentation and Information Displays	**AST-440** Heating, Ventilation and Air Conditioning Systems

Profile Chart *(continued)*

DIAGNOSES AND REPAIRS STEERING AND SUSPENSION, BRAKING, CONTROL SYSTEMS, TIRES, HUBS AND WHEEL BEARINGS			
AST-130 Tires, Wheels, Hubs and Wheel Bearings	**AST-145** Suspension Systems I	**AST-150** Steering Systems I	**AST-160** Braking Systems I (Non-ABS)
AST-235 Steering Systems II	**AST-240** Suspension Systems II	**AST-245** Braking Systems II	
DIAGNOSES AND REPAIRS RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES AND TRIM			
AST-170 Body Components and Trim	**AST-430** Restraint Systems		
DIAGNOSES AND REPAIRS HYBRID AND ELECTRIC VEHICLES (EV)			
AST-445 Hybrid and Electric Vehicle Systems			

Recommended Atlantic Level Structure

Level 1 - 8 Weeks

Unit Code	Unit Title	Sugg Hrs*	Pg #	Practical Objectives*
AST-100	Safety	9	20	N/A
AST-105	Tools and Equipment	6	23	N/A
AST-110	Fasteners, Tubing, Hoses and Fittings	6	25	N/A
AST-115	Hoisting and Lifting	9	26	N/A
MENT-700	Mentoring I	6	28	N/A
AST-125	Technical Information	3	30	N/A
AST-130	Tires, Wheels, Hubs and Wheel Bearings	12	32	N/A
AST-135	Oxy-Acetylene Heating and Cutting	12	35	Setup, adjust, use and shutdown oxy-acetylene equipment
AST-140	Gas Metal Arc Welding (GMAW)	6	37	Setup, adjust, use and shutdown GMAW equipment
AST-145	Suspension Systems I	12	39	Inspect conventional suspension system to ensure it meets manufacturing specifications
AST-150	Steering Systems I	18	41	Inspect conventional steering system to ensure it meets manufacturing specifications
AST-155	Drive Shafts and Axles	9	43	N/A
AST-160	Braking Systems I (Non-ABS)	36	46	Flaring a line
AST-165	Electrical and Electronic Principles	57	48	1. Test battery 2. Perform a wire/connector repair
AST-170	Body Components and Trim	9	51	N/A
AST-175	Engine Principles	24	54	1. Calculate engine displacement, compression ratios, and horsepower.
AST-180	Vehicle Maintenance Inspection	3	56	Perform vehicle operational checks.
AST-185	Pre-Delivery Inspection	3	57	N/A

Level 2 - 8 Weeks

Unit Code	Unit Title	Sugg Hrs*	Pg #	Practical Objectives*
AST-200	Cooling Systems	12	60	Perform a coolant system pressure test
AST-205	Engine Lubrication Systems	12	63	N/A
AST-210	Accessory Drive Systems	12	65	N/A
AST 215	Engine Repair	42	67	Diagnose mechanical engine problems.
AST-220	Starting Systems	12	69	N/A
AST-225	Charging Systems	12	71	Perform charging system test
AST-230	Lighting and Wiper Systems	18	73	N/A
AST-235	Steering Systems II	12	75	N/A

Unit Code	Unit Title	Sugg Hrs*	Pg #	Practical Objectives*
AST-240	Suspension Systems II	24	77	Perform a wheel alignment
AST-245	Braking Systems II	24	79	N/A
AST-250	Manual Transmissions and Transaxles	36	81	N/A
AST-255	Clutches	6	84	N/A
AST-260	Final Drive Assemblies	18	86	N/A

Level 3 - 7 Weeks

Unit Code	Unit Title	Sugg Hrs*	Pg #	Practical Objectives*
AST-300	Transfer Cases	24	90	N/A
AST-305	Gasoline Fuel Delivery and Injection Systems	24	92	Perform fuel pressure check
AST-310	Gasoline Ignition Systems	24	94	N/A
AST-315	Vehicle Networking Systems	60	97	N/A
AST-320	Gasoline Emission Control Systems	24	100	N/A
AST-325	Gasoline Intake and Exhaust Systems	18	103	N/A
AST-330	Electrical Options and Accessories	30	106	N/A
AST-335	Motor Vehicle Inspection	6	108	N/A

Level 4 - 8 Weeks

Unit Code	Unit Title	Sugg Hrs*	Pg #	Practical Objectives*
MENT-701	Mentoring II	6	112	N/A
AST-405	Diesel Fuel Delivery and Injection Systems	18	114	N/A
AST-410	Diesel Emission Control Systems	18	117	N/A
AST-415	Diesel Intake and Exhaust Systems	6	120	N/A
AST-420	Entertainment Systems	15	122	N/A
AST-425	Instrumentation and Information Displays	15	124	N/A
AST-430	Restraint Systems	24	126	N/A
AST-435	Automatic Transmissions and Transaxles	48	129	N/A
AST-440	Heating, Ventilation and Air Conditioning Systems	30	132	Conduct a performance test of an A/C system
AST-445	Hybrid and Electric Vehicle Systems	30	135	N/A
AST-450	Program Review	30	137	N/A

*__Suggested Hours:__ The time it should take to cover the unit (a guide only).

*__Practical Objectives:__ The tasks/skills apprentices must be exposed to during technical training. An individual or group performance of the task/skill is recommended; if not possible, an instructor demonstration is acceptable. Training Providers should use practical, hands-on learning whenever possible, whether identified in the curriculum as a practical objective or not.

2016 RSOS Sub-Task to AACS Unit Comparison

RSOS Sub-task		AACS Unit	
Task A-1 Performs safety-related functions.			
A-1.01	Maintains safe work environment.	AST-100	Safety
A-1.02	Uses personal protective equipment (PPE) and safety equipment.	AST–100	Safety
Task A-2 Uses tools, equipment and documentation.			
A-2.01	Uses tools and equipment.	AST-105	Tools and Equipment
		AST-135	Oxy-Acetylene Heating and Cutting
		AST-140	Gas Metal Arc Welding (GMAW)
A- 2.02	Uses fasteners, tubing, hoses and fittings.	AST-110	Fasteners, Tubing, Hoses and Fittings
A- 2.03	Uses hoisting and lifting equipment.	AST-115	Hoisting and Lifting
A- 2.04	Uses technical information.	AST-125	Technical Information
Task A-3 Uses communication and mentoring techniques.			
A-3.01	Uses communication techniques.	MENT-700	Mentoring I
A-3.02	Uses mentoring techniques.	MENT-700	Mentoring I
Task B-4—Diagnoses engine systems.			
B-4.01	Diagnoses cooling systems.	AST–200	Cooling Systems
B-4.02	Diagnoses lubricating systems.	AST–205	Engine Lubrication Systems
B- 4.03	Diagnoses engine assembly.	AST-175	Engine Principles
		AST-215	Engine Repair
B-4.04	Diagnoses accessory drive systems.	AST-210	Accessory Drive Systems
Task B-5 – Repairs engine systems.			
B-5.01	Repairs cooling systems.	AST-200	Cooling Systems
B-5.02	Repairs lubricating systems.	AST-205	Engine Lubrication Systems
B-5.03	Repairs engine assembly.	AST-175	Engine Principles
		AST-215	Engine Repair
B-5.04	Repairs accessory drive systems.	AST-210	Accessory Drive Systems
Task B-6 – Diagnoses gasoline engine support systems.			
B-6.01	Diagnoses gasoline fuel delivery and injection systems.	AST–305	Gasoline Fuel Delivery and Injection Systems
B-6.02	Diagnoses gasoline ignition systems.	AST-310	Gasoline Ignition Systems
B-6.03	Diagnoses gasoline intake/exhaust systems.	AST–325	Gasoline Intake and Exhaust Systems
B-6.04	Diagnoses gasoline emission control systems.	AST–320	Gasoline Emission Control Systems
Task B-7 – Repairs gasoline engine support systems.			
B-7.01	Repairs gasoline fuel delivery and injection systems.	AST-305	Gasoline Fuel Delivery and Injection Systems

RSOS Sub-task		AACS Unit	
B-7.02	Repairs gasoline ignition systems.	AST-310	Gasoline Ignition Systems
B-7.03	Repairs gasoline intake / exhaust systems.	AST-325	Gasoline Intake and Exhaust Systems
B-7.04	Repairs gasoline emission control systems.	AST-320	Gasoline Emission Control Systems
Task B-8 – Diagnoses diesel engine support systems.			
B-8.01	Diagnoses diesel fuel delivery and injection systems.	AST-405	Diesel Fuel Delivery and Injection Systems
B-8.02	Diagnoses diesel intake / exhaust systems.	AST-415	Diesel Intake and Exhaust Systems
B-8.03	Diagnoses diesel emission control systems.	AST-410	Diesel Emission Control Systems
Task B-9 – Repairs diesel engine support systems.			
B-9.01	Repairs diesel fuel delivery and injection systems.	AST-405	Diesel Fuel Delivery and Injection Systems
B-9.02	Repairs diesel intake / exhaust systems.	AST-415	Diesel Intake and Exhaust Systems
B-9.03	Repairs diesel emission control systems.	AST-410	Diesel Emission Control Systems
Task C-10 – Diagnoses vehicle networking systems.			
C-10.01	Reads diagnostic trouble codes (DTCs).	AST-315	Vehicle Networking Systems
C-10.02	Monitors data.	AST-315	Vehicle Networking Systems
C-10.03	Interprets test results.	AST-315	Vehicle Networking Systems
C-10.04	Tests system circuitry and components.	AST-315	Vehicle Networking Systems
Task C-11 – Repairs vehicle networking systems.			
C-11.01	Updates component software.	AST-315	Vehicle Networking Systems
C-11.02	Replaces components.	AST-315	Vehicle Networking Systems
C-11.03	Verifies vehicle module communications system repair.	AST-315	Vehicle Networking Systems
Task D-12 – Diagnoses driveline systems.			
D-12.01	Diagnoses drive shafts and axles.	AST-155	Drive Shafts and Axles
D-12.02	Diagnoses manual transmissions / transaxles.	AST-250	Manual Transmissions and Transaxles
D-12.03	Diagnoses automatic transmissions / transaxles.	AST-435	Automatic Transmissions and Transaxles
D-12.04	Diagnoses clutches.	AST-255	Clutches
D-12.05	Diagnoses transfer cases.	AST-300	Transfer Cases
D-12.06	Diagnoses final drive assemblies.	AST-260	Final Drive Assemblies
Task D-13 – Repairs driveline systems.			
D-13.01	Repairs drive shafts and axles.	AST-155	Drive Shafts and Axles

RSOS Sub-task		AACS Unit	
D-13.02	Repairs manual transmissions / transaxles.	AST-250	Manual Transmissions and Transaxles
D-13.03	Repairs automatic transmissions / transaxles.	AST-435	Automatic Transmissions and Transaxles
D-13.04	Repairs clutches.	AST-255	Clutches
D-13.05	Repairs transfer cases.	AST-300	Transfer Cases
D-13.06	Repairs final drive assemblies.	AST-260	Final Drive Assemblies
Task E-14 – Diagnoses electrical systems and components.			
E-14.01	Diagnoses basic wiring and electrical systems.	AST-165	Electrical and Electronic Principles
E-14.02	Diagnoses starting / charging systems and batteries.	AST-165	Electrical and Electronic Principles
		AST-220	Starting Systems
		AST-225	Charging Systems
E-14.03	Diagnoses lighting and wiper systems.	AST-230	Lighting and Wiper Systems
E-14.04	Diagnoses entertainment systems.	AST-420	Entertainment Systems
E-14.05	Diagnoses electrical options.	AST-330	Electrical Options and Accessories
E-14.06	Diagnoses instrumentation and information displays.	AST-425	Instrumentation and Information Displays
E-14.07	Diagnoses electrical accessories.	AST-330	Electrical Options and Accessories
Task E-15 – Repairs electrical systems and components.			
E-15.01	Repairs basic wiring and electrical systems.	AST-165	Electrical and Electric Principles
E-15.02	Repairs starting / charging systems and batteries.	AST-165	Electrical and Electric Principles
		AST-220	Starting Systems
		AST-225	Charging Systems
E-15.03	Repairs lighting and wiper systems.	AST-230	Lighting and Wiper Systems
E-15.04	Repairs entertainment systems.	AST-420	Entertainment Systems
E-15.05	Repairs electrical options.	AST-330	Electrical Options and Accessories
E-15.06	Repairs instrumentation and information displays.	AST-425	Instrumentation and Information Displays
E-15.07	Installs electrical accessories.	AST-330	Electrical Options and Accessories
E-15.08	Repairs electrical accessories.	AST-330	Electrical Options and Accessories
Task E-16 –Diagnoses heating, ventilation and air-conditioning (HVAC) and comfort control systems			
E-16.01	Diagnoses air flow control systems	AST-440	Heating, Ventilation and Air Conditioning Systems
E-16.02	Diagnoses refrigerant systems.	AST-440	Heating, Ventilation and Air Conditioning Systems

RSOS Sub-task		AACS Unit	
E-16.03	Diagnoses heating systems.	AST-440	Heating, Ventilation and Air Conditioning Systems
Task E-17 – Repairs heating, ventilation and air conditioning (HVAC) and comfort control systems			
E-17.01	Repairs air flow control systems.	AST-440	Heating, Ventilation and Air Conditioning Systems
E-17.02	Repairs refrigerant systems.	AST-440	Heating, Ventilation and Air Conditioning Systems
E-17.03	Diagnoses heating systems.	AST-440	Heating, Ventilation and Air Conditioning Systems
Task F-18 – Diagnoses steering and suspension, braking, control systems, tires, wheels, hubs and wheel bearings			
F-18.01	Diagnoses steering, suspension and control systems.	AST-145	Suspension Systems I
		AST-150	Steering Systems I
		AST-240	Suspension Systems II
		AST-235	Steering Systems II
F-18.02	Diagnoses braking and control systems.	AST-160	Braking Systems I (Non-ABS)
		AST-245	Braking Systems II
F-18.03	Diagnoses tires, wheels, hubs and wheel bearings.	AST-130	Tires, Wheels, Hubs and Wheel Bearings
Task F-19 – Repairs steering and suspension, braking, control systems, tires, wheels, hubs and wheel bearings			
F-19.01	Repairs steering, suspension and control systems.	AST-145	Suspension Systems I
		AST-150	Steering Systems I
		AST-240	Suspension Systems II
		AST-235	Steering Systems II
F-19.02	Repairs braking and control systems.	AST-160	Braking Systems I (Non-ABS)
		AST-245	Braking Systems II
F-19.03	Repairs tires, wheels, hubs and wheel bearings.	AST-130	Tires, Wheels, Hubs and Wheel Bearings
Task G-20 – Diagnoses restraint systems, body components, accessories and trim			
G-20.01	Diagnoses restraint systems.	AST-430	Restraint Systems
G-20.02	Diagnoses wind noises, rattles and water leaks.	AST-170	Body Components and Trim
G-20.03	Diagnoses interior and exterior components, accessories and trim.	AST-170	Body Components and Trim
G-20.04	Diagnoses latches, locks and movable glass.	AST-170	Body Components and Trim
Task G-21 – Repairs restraint systems, body components, accessories and trim			
G-21.01	Repairs restraint systems.	AST-430	Restraint Systems
G-21.02	Repairs wind noises, rattles and water leaks.	AST-170	Body Components and Trim
G-21.03	Repairs interior and exterior components, accessories and trim.	AST-170	Body Components and Trim

RSOS Sub-task		AACS Unit	
G-21.04	Repairs latches, locks and movable glass.	AST-170	Body Components and Trim
Task H-22 – Diagnoses hybrid and electric vehicles (EV)			
H-22.01	Implements specific safety protocols for hybrid and EV.	AST-100	Safety
		AST-445	Hybrid and Electric Vehicle Systems
H-22.02	Diagnoses hybrid and EV systems.	AST-445	Hybrid and Electric Vehicle Systems
Task H-23 – Repairs hybrid and EV			
H-23.01	Repairs hybrid vehicle systems.	AST-445	Hybrid and Electric Vehicle Systems
H-23.02	Repairs EV systems.	AST-445	Hybrid and Electric Vehicle Systems

LEVEL 1

Unit Code	Title	Suggested Hours	Page Number
AST-100	Safety	9	20
AST-105	Tools and Equipment	6	23
AST-110	Fasteners, Tubing, Hoses and Fittings	6	25
AST-115	Hoisting and Lifting	9	26
MENT-700	Mentoring I	6	28
AST-125	Technical Information	3	30
AST-130	Tires, Wheels, Hubs and Wheel Bearings	12	32
AST-135	Oxy-Acetylene Heating and Cutting	12	35
AST-140	Gas Metal Arc Welding (GMAW)	6	37
AST-145	Suspension Systems I	12	39
AST-150	Steering Systems I	18	41
AST-155	Drive Shafts and Axles	9	43
AST-160	Braking Systems I (Non-ABS)	36	46
AST-165	Electrical and Electronic Principles	57	48
AST-170	Body Components and Trim	9	51
AST-175	Engine Principles	24	54
AST-180	Vehicle Maintenance Inspection	3	56
AST-185	Pre-Delivery Inspection	3	57

AST-100 Safety

Learning Outcomes:

- Demonstrate knowledge of safe work practices.
- Demonstrate knowledge of regulatory requirements pertaining to workplace safety.
- Demonstrate knowledge of personal protective equipment, their applications, limitations and procedures for use.
- Demonstrate knowledge of safety equipment, their applications and procedures for use.
- Demonstrate knowledge of handling refrigerant.
- Demonstrate knowledge of safety protocols for hybrid and electric vehicles (EV) systems.

2016 Red Seal Occupational Standard Reference:

1.01 Maintains safe work environment.
1.02 Uses personal protective equipment (PPE) and safety equipment.
17.02 Repairs refrigerant systems (safety awareness).
22.01 Implements specific safety protocols for hybrid and EV (safety awareness).

Suggested Hours:

9 Hours

Objectives and Content:

Theoretical Objectives

1. Describe safe work practices to maintain a safe work environment.
    i) personal
    ii) shop/facility
        - fire
        - explosion
        - gases
    iii) environmental awareness
    iv) vehicle
        - refrigerant systems
        - restraint systems

- high voltage systems (hybrid and EV systems)
- high pressure fuel systems

2. Identify and describe jurisdictional safety regulations to maintain a safe work environment.
   i) Occupational Health and Safety (OHS)
      - right of refusal
      - reportable incidents
   ii) Workplace Hazardous Material Information System (WHMIS)/Globally Harmonized System (GHS)

3. Identify components of WHMIS/GHS.
   i) safety data sheets
   ii) labels
   iii) training

4. Identify and describe jurisdictional requirements for handling and disposing of hazardous materials.
   i) supplemental restraint system components
   ii) batteries
   iii) automotive fluids and chemicals
   iv) cleaning fluids and chemicals

5. Identify types of PPE, and describe their applications, limitations and procedures for use.
   i) work boots
   ii) ear protection
   iii) eye protection
   iv) face shields
   v) insulating gloves
   vi) fire resistant clothing
   vii) breathing apparatus

6. Describe the care and maintenance of PPE.

7. Identify types of safety equipment, and describe their applications.
   i) jack stands
   ii) exhaust ventilation fans
   iii) fire extinguishers
   iv) lock-out devices

v) respirators

8. Describe the care and maintenance of safety equipment.

Practical Objectives

N/A

AST-105 Tools and Equipment

Learning Outcomes:

- Demonstrate knowledge of hand and power tools, their applications, maintenance and procedures for use.
- Demonstrate knowledge of measuring and testing devices, their applications, maintenance and procedures for use.
- Demonstrate knowledge of shop tools and equipment, their applications, maintenance and procedures for use.
- Demonstrate knowledge of welding, cutting and heating equipment and their applications.

2016 Red Seal Occupational Standard Reference:

2.01 Uses tools and equipment.

Suggested Hours:

6 Hours

Objectives and Content:

Theoretical Objectives

1. Identify types of hand tools, and describe their applications and procedures for use.

2. Describe the procedures used to store and maintain hand tools.

3. Identify types of power tools, and describe their applications and procedures for use.
   i) electric
   ii) pneumatic
   iii) hydraulic

4. Describe the procedures used to store and maintain power tools.

5. Describe safe operating procedures for hand and power tools.

6. Identify types of measuring and testing devices, and describe their applications and procedures for use.
   i) micrometers
   ii) vernier callipers
   iii) pressure gauges
   iv) torque wrenches

7. Identify types of scan tools and digital multimeters (DMM), and describe their applications.

8. Describe the procedures used to store and maintain measuring and testing devices.

9. Identify types of shop tools and equipment, and describe their applications and procedures for use.
   i) brake lathe
   ii) tire changing machine
   iii) wheel balancer
   v) battery chargers
   vi) vices
   vii) presses

10. Describe the procedures used to store and maintain shop tools and equipment.

11. Identify types of welding, cutting and heating equipment, and describe their applications.
   i) oxy-acetylene heating and cutting
   ii) gas metal arc welding (GMAW)
   iii) metal inert gas welding (MIG)
   iv) shielded metal arc welding (SMAW)

Practical Objectives

N/A

AST-110 Fasteners, Tubing, Hoses and Fittings

Learning Outcomes:

- Demonstrate knowledge of fasteners, tubing, hoses and fittings, their applications and procedures for use.

2016 Red Seal Occupational Standard Reference:

2.02 Uses fasteners, tubing, hoses and fittings.

Suggested Hours:

6 Hours

Objectives and Content:

Theoretical Objectives

1. Identify types of fasteners, and describe their characteristics, applications and procedures for use.

2. Identify types of tubing and hoses, and describe their applications and procedures for use.

3. Identify types of fittings and flares, and describe their applications and procedures for use.

Practical Objectives

N/A

AST-115 Hoisting and Lifting

Learning Outcomes:

- Demonstrate knowledge of vehicle hoisting and lifting equipment, their applications and procedures for use.
- Demonstrate knowledge of shop lifting equipment, their applications and procedures for use.

2016 Red Seal Occupational Standard Reference:

2.03 Uses hoisting and lifting equipment.

Suggested Hours:

9 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to hoisting and lifting.
   i) occupational health and safety (OHS) regulations
   ii) safe work practices

2. Identify types vehicle hoisting and lifting equipment and accessories and describe their applications and procedures for use.
   i) chain falls
   ii) overhead cranes
   iii) hydraulic jacks
   iv) engine hoists
   v) vehicle hoists
   vi) jack stands

3. Describe the procedures for use of vehicle hoisting and lifting equipment.

4. Describe the procedures used to inspect, store and maintain hoisting and lifting equipment.

Practical Objectives

N/A

MENT-700 Mentoring I

Learning Outcomes:

- Demonstrate knowledge of effective communication practices as a learner.
- Demonstrate knowledge of strategies for learning skills in the workplace.

Red Seal Occupational Standard Reference:

3.01 Uses communication techniques
3.02 Uses Mentoring Techniques

Suggested Hours:

6 hours

Learning Objectives:

1. Describe the importance of one's own individual experiences.
2. Identify behaviours that demonstrate positive learning experiences.
3. Identify the benefits of workplace mentoring for the apprentice, mentor, and employer.
4. Identify the partners involved in apprenticeship training.
5. Describe the shared responsibilities for workplace learning in apprenticeship.
6. Identify different learning needs and strategies to address challenges or barriers in the workplace.
   i) learning disabilities
   ii) language
   iii) underrepresentation
7. Identify the components that create a positive and inclusive workplace culture.
   i) workplace characteristics
   ii) individual behaviours

8. Identify various learning styles and determine one's own learning preferences.

9. Explain how learning preferences impact learning new skills.

10. Identify different learning strategies to meet individual learning needs.

11. Describe the importance of adapting to a variety of teaching and learning methods in the workplace.

12. Identify techniques for effective communication as a learner.
    i) verbal and non-verbal
    ii) active listening

13. Identify and describe personal responsibilities and attitudes that contribute to on-the-job success.
    i) self advocating
    ii) asking questions
    iii) accepting constructive feedback
    iv) working safely
    v) employing time management techniques and being punctual

AST-125 Technical Information

Learning Outcomes:

- Demonstrate knowledge of trade documents and their use.
- Demonstrate knowledge of preparing and interpreting trade documents.

2016 Red Seal Occupational Standard Reference:

2.04 Uses technical information.

Suggested Hours:

3 Hours

Objectives and Content:

Theoretical Objectives

1. Locate and interpret identification codes found on the vehicle and vehicle components.
   - i) vehicle identification number (VIN)
   - ii) component identification codes
   - iii) diagnostic indicators

2. Identify and interpret types of trade documents.
   - i) repair orders
   - ii) estimates
   - iii) history
   - iv) preventative maintenance reports and schedules
   - v) work orders
   - vi) schematics and service information
   - vii) technical service bulletins (TSB)
   - viii) industry standard labour guides
   - ix) pre-delivery inspection reports

3. Describe the procedures used to prepare and complete documentation.
   - i) work orders
   - ii) estimates

iii) pre-delivery inspection reports
iv) preventative maintenance reports

Practical Objectives

N/A

AST-130 Tires, Wheels, Hubs and Wheel Bearings

Learning Outcomes:

- Demonstrate knowledge of tires, wheels, hubs, wheel bearings, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose tires, wheels, hubs and wheel bearings.
- Demonstrate knowledge of the procedures used to repair tires, wheels, hubs and wheel bearings.

2016 Red Seal Occupational Standard Reference:

18.03 Diagnoses tires, wheels, hubs and wheel bearings.
19.03 Repairs tires, wheels, hubs, and wheel bearings.

Suggested Hours:

12 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to tires, wheels, hubs and wheel bearings.
   i) tire inflation
   ii) mounting
   iii) pinch points
   iv) lifting and support procedures

2. Identify types of tires, and describe their construction.
   i) snow
   ii) run flats
   iii) radials
   iv) bias
   v) passenger
   vi) light truck

3. Interpret tire codes and sidewall markings.

4. Describe the importance of tire rotation, balance and pressure.

5. Identify types of wheels, and describe their components and construction.
   i) steel
   ii) alloy
   iii) offset
   iv) drop zone
   v) deep flange
   vi) hub surface

6. Identify types of hubs and bearing assemblies, and describe their components and operation.
   i) pressed in
   ii) integral
   iii) tapered roller

7. Identify types of tire pressure monitoring systems, and describe their applications.
   i) passive
   ii) active

8. Identify types of lubricants, and describe their applications and procedures for use.

9. Describe the relationship between the steering, suspension system and wheel assemblies.

10. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
    i) diagnostic
       - measuring tools
       - pressure gauges
       - chassis ears
       - stethoscopes
       - vibration analyzers
       - Tire Pressure Monitoring Systems (TPMS) equipment
    ii) repair

- hand tools
- air tools
- scan tools
- wheel balancers
- tire changing machines
- tire pressure monitoring tools
- presses
- pullers
- tire inflation cage

11. Describe the procedures used to diagnose tires, wheels, hubs and wheel bearings.
    i) verify concern
    ii) perform sensory inspection
    iii) retrieve diagnostic codes
    iv) access service information
    v) conduct tests and measurements
    vi) isolate problem and identify root cause

12. Describe the procedures used to remove and reinstall tires, wheels, hubs and wheel bearings.

13. Describe the procedures to repair and replace tires, wheels, hubs and wheel bearings.

14. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-135 Oxy-Acetylene Heating and Cutting

Learning Outcomes:

- Demonstrate knowledge of oxy-acetylene heating and cutting equipment, accessories and their applications.
- Demonstrate knowledge of the procedures to heat and cut using oxy-acetylene.

2016 Red Seal Occupational Standard Reference:

2.01 Uses tools and equipment.

Suggested Hours:

12 Hours

Objectives and Content:

Theoretical Objectives

1. Define and explain terminology associated with oxy-acetylene heating and cutting equipment.

2. Identify safety considerations pertaining to oxy-acetylene heating and cutting.
   i) personal
   ii) shop/facility
   iii) equipment

3. Identify oxy-acetylene heating and cutting equipment and accessories, and describe their applications.

4. Describe the procedures used to set-up, adjust and shut-down oxy-acetylene equipment.

5. Describe the procedures used to inspect, store and maintain oxy-acetylene equipment.

6. Describe the procedures used to heat and cut using oxy-acetylene.

Practical Objectives

1. Setup, adjust, use and shutdown oxy-acetylene equipment.

AST-140 Gas Metal Arc Welding (GMAW)

Learning Outcomes:

- Demonstrate knowledge of gas metal arc welding (GMAW) equipment, accessories and applications.
- Demonstrate knowledge of the procedures used to weld using GMAW equipment.

2016 Red Seal Occupational Standard Reference:

2.01 Uses tools and equipment.

Suggested Hours:

6 Hours

Objectives and Content:

Theoretical Objectives

1. Define and explain terminology associated with gas metal arc welding (GMAW) welding.

2. Identify safety considerations pertaining to GMAW.
   i) personal
   ii) shop/facility
   iii) equipment

3. Identify types of GMAW processes, and describe their applications.

4. Identify GMAW welding equipment and accessories, and describe their applications.

5. Describe the procedures used to set-up, adjust and shut-down GMAW equipment.

6. Describe the procedures used to inspect, maintain and store GMAW equipment.

7. Describe the procedures used to weld using GMAW equipment.

8. Describe weld defects, their causes and the procedures used to prevent and correct them.

Practical Objectives

1. Setup, adjust, use and shutdown GMAW equipment.

AST-145 Suspension Systems I

Learning Outcomes:

- Demonstrate knowledge of conventional suspension systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair conventional suspension systems.

2016 Red Seal Occupational Standard Reference:

18.01 Diagnoses steering, suspension and control systems.
19.01 Repairs steering, suspension and control systems.

Suggested Hours:

12 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to conventional suspension systems.
   i) loaded components
      - ball joints
      - springs

2. Identify types of conventional suspension systems, and describe their components and operation.
   i) MacPherson strut
   ii) leaf spring
   iii) independent
   iv) monobeam
   v) electronic

3. Identify types of springs, and describe their purpose and operation.
   i) coil
   ii) leaf
   iii) torsion bar

iv) air

4. Identify types of dampers, and describe their components and operation.
   i) struts
   ii) shocks

5. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.

6. Describe the procedures used to diagnose conventional suspension systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

7. Describe the procedures used to repair conventional suspension systems.

8. Describe the procedures used to remove and reinstall conventional suspension system components.

9. Describe the procedures used to adjust, repair and/or replace conventional suspension system components.

10. Describe the procedures used to verify the repair.

Practical Objectives

1. Inspect conventional suspension system to ensure it meets manufacturing specifications.

AST-150 Steering Systems I

Learning Outcomes:

- Demonstrate knowledge of conventional steering systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair conventional steering systems.

2016 Red Seal Occupational Standard Reference:

18.01 Diagnoses steering, suspension and control systems.
19.01 Repairs steering, suspension and control systems.

Suggested Hours:

18 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to conventional steering systems.
   i) accidental deployment of passive restraints
      - air bags
      - clock springs
   ii) collapsible columns

2. Identify types of conventional steering columns, and describe their components and operation.
   i) tilt
   ii) telescopic
   iii) collapsible

3. Identify types of steering systems, and describe their components and operation.
   i) rack-and-pinion
   ii) recirculating ball (steering box)

4. Introduce steering geometry.

5. Identify types of conventional steering assist systems, and describe their components and operation.
   i) electric
   ii) hydraulic

6. Identify types of power steering pumps, and describe their components and operation.

7. Identify types of fluids, lubricants, fasteners, tubing, hoses, gaskets and seals, and describe their applications.

8. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.

9. Describe the procedures used to disarm passive restraints.

10. Describe the procedures used to diagnose conventional steering systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

11. Describe the procedures used to remove and reinstall conventional steering system components.

12. Describe the procedures used to adjust, repair and replace conventional steering system components.

13. Describe the procedures used to verify the repair.

Practical Objectives

1. Inspect conventional steering system to ensure it meets manufacturing specifications.

AST-155 Drive Shafts and Axles

Learning Outcomes:

- Demonstrate knowledge of drive shafts and axles, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair drive shafts and axles.

2016 Red Seal Occupational Standard Reference:

12.01 Diagnoses drive shafts and axles.
13.01 Repairs drive shafts and axles.

Suggested Hours:

9 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to drive shafts and axles.
   i) exposed rotating parts
   ii) pinch points
   iii) lifting and support procedures

2. Identify types of drive shafts, and describe their composition.
   i) 1-piece
   ii) 2-piece
   iii) steel/aluminum

3. Identify types of drive shaft components, and describe their purpose and operation.
   i) slip yokes and flanges
   ii) flex joints
   iii) single cardan joints
   iv) double cardan joints
   v) support bearing

vi) viscous coupling
vii) constant velocity joints

4. Identify types of axles, and describe their components and operation.
   i) half shafts
   ii) floating
   iii) semi-floating

5. Describe axle disconnects, locking hubs and their purpose.

6. Describe the importance of multiple piece drive shaft phasing, indexing and driveline angles.

7. Identify types of lubricants, fasteners, gaskets, seals and sealants, and describe their applications.

8. Identify diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - electronic vibration analyzers
      - inclinometers
      - dial indicators
      - scan tools
   ii) repair
      - pullers
      - presses

9. Describe the procedures used to diagnose drive shafts and axle systems.
   i) verify concern
   ii) preform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) measure drive line angles
   vii) isolate problem and identify root cause

10. Describe the procedures used to adjust, repair and/or replace drive shafts and axles and their related components.

11. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-160 Braking Systems I (Non-ABS)

Learning Outcomes:

- Demonstrate knowledge of braking systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair braking systems.

2016 Red Seal Occupational Standard Reference:

18.02 Diagnoses braking and control systems.
19.02 Repairs braking and control systems.

Suggested Hours:

36 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to braking systems.
   i) hydraulic pressure
   ii) airborne contaminants

2. Explain hydraulic principles related to braking systems.
   i) Pascal's law

3. Identify types of braking systems, and describe their components and operation.
   i) hydraulic
   ii) electric
   iii) park brake

4. Identify types of power assists, and describe their components and operation.
   i) vacuum
   ii) hydraulic
   iii) electric

5. Identify types of brake fluids, and describe their applications and procedures for use.

6. Identify types of fittings, flaring, tubing and hoses, and describe their applications and procedures for use.

7. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.

8. Describe the procedures used to diagnose braking systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

9. Describe the procedures used to flush and bleed hydraulic brakes.

10. Describe the procedures used to measure and machine components.

11. Describe the procedures used to adjust, repair and/or replace braking system components.

12. Describe the procedures used to verify the repair.

Practical Objectives

1. Flaring a line.

AST-165 Electrical and Electronic Principles

Learning Outcomes:

- Demonstrate knowledge of basic electrical and electronic principles.
- Demonstrate knowledge of batteries, their characteristics and procedures to replace.
- Demonstrate knowledge of electrical circuits, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair electrical circuits and components.

2016 Red Seal Occupational Standard Reference:

14.01 Diagnoses basic wiring and electrical systems.
14.02 Diagnoses starting / charging systems and batteries (batteries only).
15.01 Repairs basic wiring and electrical systems.
15.02 Repairs starting / charging systems and batteries (batteries only).

Suggested Hours:

57 Hours

Objectives and Content:

Theoretical Objectives

1. Interpret diagnostic flow charts and schematics.

2. Explain basic electrical theory.
   i) conventional theory
   ii) electron theory
   iii) Ohm's Law
   iv) Watt's Law
   v) magnetism
   vi) induced voltages

3. Explain basic computer operation.
   i) inputs
   ii) processing

iii) outputs

4. Describe the application of Ohm's Law to electrical circuits.
   i) series circuit
   ii) parallel circuit
   iii) series-parallel circuits

5. Identify types of batteries, and describe their characteristics.

6. Identify types of tools and equipment used to test batteries, and describe their applications and procedures for use.

7. Describe the procedures used to test and/or charge batteries.

8. Identify types of wire, and describe their characteristics, composition and applications.

9. Identify types of electrical components, and describe their purpose and operation.
   i) circuit protection
   ii) control devices
   iii) load devices

10. Identify types of electronic components, and describe their purpose and operation.
   i) diodes
   ii) transistors
   iii) resistors
   iv) integrated circuits

11. Identify types of tools and equipment used to diagnose and repair electrical circuits and components, and describe their applications and procedures for use.
   i) diagnostic
      - digital multi-meters (DMM)s
      - scan tools
      - circuit testers
      - battery testers
   ii) repair
      - soldering equipment

12. Identify electrical circuit problems.
    i) open
    ii) shorts to voltage
    iii) shorts to ground

13. Describe the procedures used to diagnose circuits and components.
    i) verify concern
    ii) perform inspection
    iii) retrieve diagnostic codes
    iv) access service information
    v) conduct tests and measurements
    vi) isolate problem and identify root cause

14. Identify methods of wire repair, and describe their associated procedures.
    i) splicing
    ii) terminal replacement
    iii) soldering
    iv) crimping

15 Describe the procedures used to repair circuits and components.

16. Describe the procedures used to verify the repair.

Practical Objectives

1. Test battery.
2. Perform a wire/connector repair.

AST-170 Body Components and Trim

Learning Outcomes:

- Demonstrate knowledge of body components and trim and their applications.
- Demonstrate knowledge of the procedures used to diagnose and repair body components and trim.

2016 Red Seal Occupational Standard Reference:

20.02 Diagnoses wind noises, rattles and water leaks.
20.03 Diagnoses interior and exterior components, accessories and trim.
20.04 Diagnoses latches, locks and movable glass.
21.02 Repairs wind noises, rattles, and water leaks.
21.03 Repairs interior and exterior components, accessories and trim.
21.04 Repairs latches, locks and movable glass.

Suggested Hours:

9 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations related to body components and trim.
   i) restraint components
   ii) pinch points
   iii) handling of glass

2. Identify body components and accessories, and describe their purpose and operation.
   i) interior
      - doors
      - seats
      - dashes
   ii) exterior
      - bumpers
      - mirrors

- add-on accessories
- mounts
- hitches and secondary safety attachment devices

3. Identify flaws related to interior and exterior components, accessories and trim.
   i) fit
   ii) finish
   iii) form
   iv) function

4. Identify types of latches, locks and movable glass, and their applications.

5. Explain the principles of basic aerodynamics related to body design.

6. Identify types and sources of noise, vibration and harshness (NVH).
   i) chuckles
   ii) rattles
   iii) knocks and whines
   iv) offensive noises

7. Identify materials used to dampen or interrupt vibration.
   i) tapes
   ii) adhesives
   iii) insulators

8. Identify types and sources of wind and water leaks and their causes.
   i) missing sealant and adhesive
   ii) loose fasteners
   iii) panel misalignment
   iv) incorrect clearances
   v) exterior accessories

9. Identify types of seals, adhesives, sealing materials and fasteners, and describe their applications and procedures for use.

10. Identify diagnostic and repair tools and equipment, and describe their applications and procedures for use.

11. Describe the procedures used to diagnose body components and trim.
   i) verify concern

ii) perform sensory inspection
iii) retrieve diagnostic codes
iv) access service information
v) conduct tests and measurements
vi) isolate problem and identify root cause

12. Describe the procedures used to repair wind noises, rattles and water leaks.

13. Describe the procedures used to adjust, repair or replace interior and exterior components, accessories and trim.

14. Describe the procedures used to repair latches, locks and movable glass.

15. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-175 Engine Principles

Learning Outcomes:

- Demonstrate knowledge of engine theory.
- Demonstrate knowledge of engine assemblies, their components and operation.

2016 Red Seal Occupational Standard Reference:

4.03 Diagnose Engine Assembly (engine theory)
5.03 Repairs Engine Assembly (engine theory)

Suggested Hours:

24 Hours

Objectives and Content:

Theoretical Objectives

1. Define and explain terminology associated with engines.

2. Explain internal combustion principles.

3. Identify types of engine classifications, and describe their construction.
   - i) fuel
     - diesel
     - gasoline
     - alternate fuels
   - ii) two-stroke and four- stroke
   - iii) cooling systems
     - air
     - liquid

4. Identify types of engine configurations, and describe their construction.
   - i) inline
   - ii) rotary
   - iii) opposed
   - iv) V

5. Identify types of valve train configurations, and describe their construction.
   i) push rod
   ii) overhead cam
   iii) multi-valve
   iv) solenoid operated valve

6. Describe variable valve control systems.

7. Identify engine assembly components, and describe their design, purpose and operation.
   i) crankshafts
   ii) camshafts
   iii) bearings
   iv) pistons and rings
   v) engine block
   vi) cylinder head assemblies
   vii) gaskets
   viii) variable valve actuators

8. Describe engine displacement, compression ratios, horsepower and torque.

9. Identify related components and describe their relationship to engine assembly.
   i) engine oil coolers
   ii) lines
   iii) hoses
   iv) pulleys

Practical Objectives

1. Calculate engine displacement, compression ratios, and horsepower.

AST-180 Vehicle Maintenance Inspection

Learning Outcomes:

- Demonstrate knowledge of vehicle maintenance inspections and their purpose.
- Demonstrate knowledge of the procedures used to perform vehicle maintenance inspections.

2016 Red Seal Occupational Standard Reference:

N/A

Suggested Hours:

3 Hours

Objectives and Content:

Theoretical Objectives

1. Describe the importance of regular vehicle maintenance inspections.

2. Identify vehicle components and accessories requiring operational checks.
   i) brakes
   ii) tires
   iii) lights and wipers
   iv) steering linkage
   v) belts and filters
   vi) exhaust

3. Identify lubricants and fluids requiring service checks.

4. Identify tools and equipment used to perform vehicle maintenance inspections.

5. Describe the procedures used to perform vehicle maintenance inspections.

Practical Objectives

1. Perform vehicle operational checks.

AST-185 Pre-Delivery Inspection

Learning Outcomes:

- Demonstrate knowledge of the procedures used to perform pre-delivery inspections.

2016 Red Seal Occupational Standard Reference:

N/A

Suggested Hours:

3 Hours

Objectives and Content:

Theoretical Objectives

1. Explain the purpose of a pre-delivery inspection.

2. Identify pre-delivery inspection procedures and requirements.

3. Describe the procedures used to perform pre-delivery inspections.

Practical Objectives

N/A

LEVEL 2

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AST-200 Cooling Systems

Learning Outcomes:

- Demonstrate knowledge of cooling systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair cooling systems.

2016 Red Seal Occupational Standard Reference:

4.01 Diagnoses cooling systems.
5.01 Repairs cooling systems.

Suggested Hours:

12 Hours

Objectives and Content:

Theoretical Objectives

1. Identify types of cooling systems, and describe their purpose, characteristics and applications.
   i) liquid
   ii) air cooled

2. Identify cooling system components, and describe their purpose and operation.
   i) radiators
   ii) hoses
   iii) thermostats
   iv) water pumps

3. Identify warning systems and indicators, and describe their purpose and operation.
   i) lights
   ii) gauges
   iii) audible

4. Identify types of fan systems, and describe their components and operation.
   i) mechanical
   ii) electric
   iii) hydraulic

5. Identify related systems, and describe their relationship to cooling systems.
   i) heating, ventilation and air conditioning (HVAC)
   ii) coolers and auxiliary coolers
   iii) coolant heaters

6. Identify types of coolants and chemical additives, and describe their characteristics and applications.

7. Describe the procedures used to bleed, flush and dispose of coolants according to jurisdictional regulations.

8. Identify types of hoses, tubing, belts, gaskets, seals and sealants, and describe their applications.

9. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - pressure testers
      - coolant strength testers
      - infrared temperature guns
      - scan tools
   ii) repair
      - automated refill devices
      - tension gauges

10. Describe the procedures used to diagnose and repair cooling systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

11. Describe the procedures used to remove and reinstall cooling system components.

12. Describe the procedures used repair cooling systems.

13. Describe the procedures used to verify the repair.

Practical Objectives

1. Perform a coolant system pressure test.

AST-205 Engine Lubrication Systems

Learning Outcomes:

- Demonstrate knowledge of engine lubrication systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair engine lubrication systems.

2016 Red Seal Occupational Standard Reference:

4.02 Diagnoses lubricating systems.
5.02 Repairs lubricating systems.

Suggested Hours:

12 Hours

Objectives and Content:

Theoretical Objectives

1. Identify types of engine lubricants, and describe their characteristics and applications.
   i) grades and classifications
   ii) synthetics
   iii) additives

2. Identify types of oil pumps, and describe their purpose and operation.
   i) rotor
   ii) vane
   iii) gear

3. Identify types of oil coolers, and describe their purpose and operation.
   i) oil-to-air
   ii) oil-to-coolant

4. Identify types of hoses, tubing, gaskets, seals and sealants and describe their applications.

5. Describe oil flow, filtration and pressure regulation.

6. Identify types of warning systems and indicators, and describe their purpose and operation.
   i) lights
   ii) gauges
   iii) audible

7. Identify testing procedures for checking oil contaminants.

8. Identify lubrication requirements related to superchargers and turbochargers.

9. Identify related systems and describe the relationship to lubrication systems.
   i) engine assembly
   ii) galleries and clearances

10. Describe the procedures used to diagnose engine lubrication systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

11. Describe the procedures used to repair engine lubrication systems.

12. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-210 Accessory Drive Systems

Learning Outcomes:

- Demonstrate knowledge of accessory drive systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair accessory drive systems.

2016 Red Seal Occupational Standard Reference:

4.04 Diagnoses accessory drive systems.
5.04 Repairs accessory drive systems.

Suggested Hours:

12 Hours

Objectives and Content:

Theoretical Objectives

1. Identify types of accessory drive systems, and describe their components and operation.
   i) belt tension/tensioners
   ii) belts
   iii) drives
      - electric
      - hydraulic
      - gear
      - pulley

2. Identify related components, and describe their relationship to accessory drive systems.
   i) water pumps
   ii) alternators
   iii) AC compressors
   iv) power steering pumps
   v) supercharger

3. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - pyrometer
      - laser alignment
      - straight edges
      - electronic vibration analyzers
      - stethoscopes
   ii) repair
      - tension relief devices
      - pullers
      - belt installers

4. Describe the procedures used to diagnose and repair accessory drive systems and components.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

5. Describe the procedures used to reinstall and adjust accessory drive systems and their components.

6. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-215 Engine Repair

Learning Outcomes:

- Demonstrate knowledge of the procedures to diagnose and repair engines.

2016 Red Seal Occupational Standard Reference:

4.03 Diagnoses engine assembly.
5.03 Repairs engine assembly.

Suggested Hours:

42 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to engine repair.

2. Identify types and sources of engine problems.
   i) low power
   ii) smoke
   iii) oil consumption
   iv) fluid contamination
   v) rough running
   vi) internal/external leaks
   vii) noises
   viii) vibrations

3. Identify types of engine mounts, and describe their construction and applications.

4. Identify types of fasteners, gaskets, seals and sealants, and describe their applications and procedures for use.

5. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - vacuum gauges
      - compression gauges
      - straight edges
      - stethoscopes
      - scan tools
      - plastic precision clearance gauges
   ii) repair
      - torque angle gauge

6. Describe the procedures used to diagnose engine problems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

7. Describe the procedures used to remove, repair and reassemble engines.

8. Describe the procedures used to adjust, repair and/or replace engine components.

9. Describe the procedures used to verify the repair.

Practical Objectives

1. Diagnose mechanical engine problems.

AST-220 Starting Systems

Learning Outcomes:

- Demonstrate knowledge of starting systems, their components and operation.
- Demonstrate knowledge of the procedures to diagnose and repair starting systems.

2016 Red Seal Occupational Standard Reference:

14.02 Diagnoses starting/charging system and batteries.
15.02 Repairs starting/charging system and batteries.

Suggested Hours:

12 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to starting systems.
   i) battery explosions
   ii) corrosive materials
   iii) high voltage

2. Identify types of starting systems, and describe their components and operation.

3. Identify types of control systems, and describe their components and operation.
   i) anti-theft/immobilizer
   ii) safety interlock devices

4. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.

5. Describe the procedures used to diagnose starting systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes

iv) access service information
v) conduct tests and measurements
vi) isolate problem and identify root cause

6. Describe the procedures used to remove and reinstall starting system components.

7. Describe the procedures used to adjust, repair and/or replace starting system components.

8. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-225 Charging Systems

Learning Outcomes:

- Demonstrate knowledge of charging systems, their components and operation.
- Demonstrate knowledge of the procedures to diagnose and repair charging systems.

2016 Red Seal Occupational Standard Reference:

14.02 Diagnoses starting/charging system and batteries.
15.02 Repairs starting/charging system and batteries.

Suggested Hours:

12 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to charging systems.

2. Identify types of charging systems, and describe their components and operation.

3. Identify types of control systems, and describe their components and operation.

4. Identify warning indicators.

5. Describe the relationship of charging system to the vehicle networking system.

6. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.

7. Describe the procedures used to diagnose charging systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes

iv) access service information
v) conduct tests and measurements
vi) isolate problem and identify root cause

8. Describe the procedures used to remove and reinstall charging system components.

9. Describe the procedures used to adjust, repair and/or replace charging system components.

10. Describe the procedures used to verify the repair.

Practical Objectives

1. Perform a charging system test.

AST-230 Lighting and Wiper Systems

Learning Outcomes:

- Demonstrate knowledge of lighting and wiper systems, their components and operation.
- Demonstrate knowledge of the procedures to diagnose and repair lighting and wiper systems.

2016 Red Seal Occupational Standard Reference:

14.03 Diagnoses lighting and wiper systems.
15.03 Repairs lighting and wiper systems.

Suggested Hours:

18 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to lighting and wiper systems.
   i) lamps (high intensity discharge (HID))
   ii) pinch points

2. Identify jurisdictional requirements pertaining to lighting and wiper systems.

3. Identify types of lighting systems, and describe their components and operation.
   i) electrically-controlled
   ii) electronically-controlled

4. Identify types of wiper systems, and describe their components and operation.
   i) electrically-controlled
   ii) electronically-controlled

5. Describe the relationship of lighting and wiper systems to the vehicle networking system.

6. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
    i) diagnostic
        - digital multimeters
        - scan tools
        - circuit testers
    ii) repair
        - reprogramming equipment

7. Describe the procedures used to diagnose lighting and wiper systems.
    i) verify concern
    ii) perform sensory inspection
    iii) retrieve diagnostic codes
    iv) access service information
    v) conduct tests and measurements
    vi) isolate problem and identify root cause

8. Describe the procedures used to remove and reinstall lighting and wiper system components.

9. Describe the procedures used to adjust, repair and/or replace lighting and wiper system components.

10. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-235 Steering Systems II

Learning Outcomes:

- Demonstrate knowledge of electronically-controlled steering systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair electronically-controlled steering systems.
- Demonstrate knowledge of wheel alignment and steering geometry.

2016 Red Seal Occupational Standard Reference:

18.01 Diagnoses steering, suspension and control systems.
19.01 Repairs steering, suspension and control systems.

Suggested Hours:

12 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to electronically-controlled steering systems.
   i) accidental deployment of passive restraints
      - air bags
      - clock springs
   ii) collapsible columns

2. Identify types of electronic control steering systems, and describe their components and operation.

3. Identify related systems, and describe their relationship to steering systems.
   i) lane departures
   ii) park-assist
   iii) collision avoidance

4. Identify types of variable-assist steering systems, and describe their components and operation.

5. Describe steering geometry.
   i) alignment angles
   ii) Ackerman principle

6. Describe the procedures used to diagnose and perform wheel alignment.

7. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.

8. Describe the procedures used to diagnose electronically-controlled steering systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iii) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

9. Describe the procedures used to remove and reinstall electronically-controlled steering system components.

10. Describe the procedures used to adjust, repair and/or replace electronically-controlled steering system components.

11. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-240 Suspension Systems II

Learning Outcomes:

- Demonstrate knowledge of wheel alignment and suspension geometry.
- Demonstrate knowledge of electronically-controlled suspension systems, their components and operation.
- Demonstrate knowledge of the procedures used to repair wheel alignments and electronically-controlled suspension systems.
- Demonstrate knowledge of the procedures used to diagnose and perform wheel alignments.

AST 2016 Red Seal Occupational Standard Reference:

18.01 Diagnoses steering, suspension and control systems.
19.01 Repairs steering, suspension and control systems.

Suggested Hours:

24 Hours

Objectives and Content:

Theoretical Objectives

1. Identify types of electronically-controlled suspension systems, and describe their components and operation.
   i) ride control
   ii) height control

2. Describe suspension geometry.
   i) alignment angles
   ii) Ackerman principle

3. Describe the procedures used to diagnose electronically-controlled suspension systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes

iv) access service information
v) conduct tests and measurements
vi) isolate problem and identify root cause

4. Describe the procedures used to diagnose wheel alignment.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes

5. Describe the procedures used to remove and reinstall electronically-controlled suspension systems components.

6. Describe the procedures used to adjust, repair and/or replace electronically-controlled suspension systems components.

7. Describe the procedures used to perform wheel alignment

8. Describe the procedures used to reset steering sensors.

9. Describe the procedures used to verify the repair.

Practical Objectives

1. Perform a wheel alignment.

AST-245 Braking Systems II

Learning Outcomes:

- Demonstrate knowledge of anti-lock braking systems (ABS), their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair anti-lock braking systems (ABS).
- Demonstrate knowledge of the procedures used to diagnose and repair control systems.

2016 Red Seal Occupational Standard Reference:

18.02 Diagnoses braking and control systems.
19.02 Repairs braking and control systems.

Suggested Hours:

24 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to anti-lock braking systems (ABS) and their components.
   i) hydraulic pressure
   ii) airborne contaminants
   iii) high voltage systems

2. Identify types of anti-lock braking systems (ABS), and describe their components and operation.

3. Identify types of braking systems in hybrid and electric vehicles (EV).

4. Identify types of trailer brakes and controls, and describe their components and operation.
   i) surge
   ii) electric

iii) electric-hydraulic

5. Identify types of control systems, and describe their components and operation.
   i) traction control system (TCS)
   ii) anti-lock brake system (ABS)
   iii) stability control
   iv) adaptive cruise control

6. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.

7. Describe the procedures used to diagnose anti-lock braking systems (ABS).
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

8. Describe the procedures used to flush and bleed anti-lock brakes.

9. Describe the procedures used to adjust, repair and/or replace anti-lock braking system (ABS) components.

10. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-250 Manual Transmissions and Transaxles

Learning Outcomes:

- Demonstrate knowledge of manual transmissions and transaxles, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair manual transmissions and transaxles.

2016 Red Seal Occupational Standard Reference:

12.02 Diagnoses manual transmissions and transaxles.
13.02 Repairs manual transmissions and transaxles.

Suggested Hours:

36 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to manual transmissions and transaxles.
   i) exposed rotating parts
   ii) pinch points
   iii) lifting and support procedures

2. Identify types of manual transmissions and transaxles and describe their components and operation.

3. Explain manual transmissions and transaxles power flow.

4. Describe gear ratios, their purpose and calculation.

5. Identify types of lubricants, fasteners, gaskets, seals and sealants, and describe their applications.

6. Identify types of engine and driveline mounts, their construction and applications.

7. Identify related systems, and describe their relationship to manual transmissions and transaxles.
   i) clutches
   ii) flywheels
      - single mass
      - dual mass
   iii) mounts

8. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - chassis ears
      - stethoscopes
      - scan tools
   ii) repair
      - measuring tools
      - presses
      - pullers
      - lifting and support equipment

9. Describe the procedures used to diagnose manual transmissions and transaxles.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

10. Describe the procedures used to remove and reinstall manual transmissions and transaxles.

11. Describe the procedures used to replace engine and driveline mounts.

12. Describe the procedures used to adjust, repair and/or replace manual transmissions and transaxles and their related components.

13. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-255 Clutches

Learning Outcomes:

- Demonstrate knowledge of clutches, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair clutches.

2016 Red Seal Occupational Standard Reference:

12.04 Diagnoses clutches.
13.04 Repairs clutches.

Suggested Hours:

6 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to clutch systems.
   i) airborne contaminants
   ii) pinch points
   iii) exposed rotating parts
   iv) lifting and support procedures

2. Identify types of clutches, and describe their components and operation.

3. Identify types of flywheels, and describe their components and operation.

4. Identify mechanical and hydraulic clutch actuating systems, and describe their components and operation.

5. Identify types of fluids, fasteners, tubing, hoses and seals, and describe their applications.

6. Describe clutch system power flow.

7. Identify related systems, and describe their relationship to clutch systems.
   i) engine
   ii) manual transmission
   iii) drive shaft and axles

8. Identify diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - measuring tools
   ii) repair
      - alignment
      - pullers
      - lifting and support equipment

9. Describe the procedures used to diagnose clutches.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

10. Describe the procedures used to remove and reinstall clutches.

11. Describe the procedures used to adjust, repair and/or replace clutches and flywheels and their related components.

12. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-260 Final Drive Assemblies

Learning Outcomes:

- Demonstrate knowledge of final drive assemblies, their components and applications.
- Demonstrate knowledge of the procedures used to diagnose and repair final drive assemblies.

2016 Red Seal Occupational Standard Reference:

12.06 Diagnoses final drive assemblies.
13.06 Repairs final drive assemblies.

Suggested Hours:

18 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to final drive assemblies.
   i) exposed rotating parts
   ii) pinch points
   iii) lifting and supporting procedures

2. Identify types of final drive assemblies, and describe their components and operation.
   i) locking
   ii) all wheel drive
   iii) integral
   iv) removable
   v) limited slip
   vi) torque distribution

3. Identify related systems, and describe their relationship to final drive assembly.
   i) transmissions
   ii) drivelines

iii) mounts

4. Identify types of control systems, and describe their components and operation.
   i) electronically-controlled/electric
   ii) vacuum
   iii) mechanical

5. Describe final drive assembly power flow.

6. Describe gear ratios, their purpose and calculations.

7. Identify types of lubricants, fasteners, gaskets, seals and sealants, and describe their applications.

8. Identify diagnostic and repair tools and equipment pertaining to final drive assemblies, and describe their applications and procedures for use.
   i) diagnostic
      - scan tools
      - measuring tools
      - chassis ears
   ii) repair
      - presses
      - pullers
      - lifting and support equipment
      - gear marking compound

9. Describe the procedures used to diagnose final drive assembly.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

10. Identify tests used to diagnose final drive assembly.
   i) road test
   ii) sensory inspection
   iii) bearing inspection
   iv) gear tooth patterns
   v) backlash

11. Describe the procedures used to remove and reinstall final drive assemblies.

12. Describe the procedures used to adjust, repair and/or replace final drive assemblies and their related components.

13. Describe the procedures used to verify the repair.

Practical Objectives

N/A

LEVEL 3

Unit Code	Title	Suggested Hours	Page Number
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AST-310	Gasoline Ignition Systems	24	94
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AST-325	Gasoline Intake and Exhaust Systems	18	103
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AST-300 Transfer Cases

Learning Outcomes:

- Demonstrate knowledge of transfer cases, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair transfer cases.

2016 Red Seal Occupational Standard Reference:

12.05 Diagnoses transfer cases.
13.05 Repairs transfer cases.

Suggested Hours:

24 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to transfer cases.
   i) pinch points
   ii) exposed rotating components
   iii) lifting and support procedures

2. Identify types of transfer cases/power transfer unit, and describe their components and operation.
   i) part-time
   ii) full-time
   iii) automatic

3. Identify types of all-wheel drive (AWD) systems, their components and operation.

4. Identify related systems, and describe their relationship to transfer cases.
   i) transmissions
   ii) locking hubs
   iii) axle disconnects

5. Identify types of control systems, and describe their components and operation.
   i) vacuum
   ii) manual
   iii) electronic

6. Describe transfer case power flow.

7. Describe gear ratios, their purpose and calculations.

8. Identify types of lubricants, fasteners, gaskets, seals and sealants, and describe their applications.

9. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.

10. Describe the procedures used to diagnose transfer cases.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

11. Describe the procedures used to remove and reinstall transfer cases.

12. Describe the procedures used to adjust, repair and/or replace transfer cases and their related components.

13. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-305 Gasoline Fuel Delivery and Injection Systems

Learning Outcomes:

- Demonstrate knowledge of gasoline fuel delivery and injection systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair gasoline fuel delivery and injection systems.

2016 Red Seal Occupational Standard Reference:

6.01 Diagnoses gasoline fuel delivery and injection systems.
7.01 Repairs gasoline fuel delivery and injection systems.

Suggested Hours:

24 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety precautions pertaining to gasoline fuel delivery and injection systems.
   i) high pressure
   ii) flammability

2. Identify the types of gasoline fuel delivery and injection systems, and describe their components and operation.
   i) fuel pumps and supply systems
   ii) gasoline direct injection
   iii) port injection systems

3. Identify types of tubing, hoses, gaskets, seals and sealants, and describe their applications.

4. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic

- fuel pressure gauges
- scan tools
- vacuum gauges
- DMMs
- oscilloscope

ii) repair
- fuel transfer and storage equipment
- fuel injector cleaning equipment

5. Describe the procedures used to diagnose and repair gasoline fuel delivery and injection systems, and their components.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

6. Describe the procedures used to remove and reinstall gasoline fuel delivery and injection system components.

7. Describe the procedures used to adjust, calibrate, repair and/or replace gasoline fuel delivery and injection system components.

8. Describe the procedures used to verify the repair.

Practical Objectives

1. Perform fuel pressure check.

AST-310 Gasoline Ignition Systems

Learning Outcomes:

- Demonstrate knowledge of ignition systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair ignition systems.

2016 Red Seal Occupational Standard Reference:

6.02 Diagnoses gasoline ignition systems.
7.02 Repairs gasoline ignition systems.

Suggested Hours:

24 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to ignition systems.
   i) high voltage
   ii) high temperature

2. Identify types of ignition systems, and describe their components and operation.
   i) distributor
   ii) distributor-less

3. Identify the types of ignition circuits, and describe their purpose and operation.
   i) primary
   ii) secondary
   iii) control

4. Identify related systems, and describe their relationship to ignition systems and their components.
   i) fuel
   ii) exhaust
   iii) air intake

iv) engine

5. Identify warning systems and indicators.
   i) check engine light
   ii) driver information centre (DICs)

6. Identify ignition concerns.
   i) hesitation
   ii) misfire
   iii) lag
   iv) timing
   v) detonation
   vi) pre-ignition

7. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - oscilloscopes
      - digital multimeters (DMMs)
      - scan tools
      - spark testers
   ii) repair
      - scan tools
      - gauges
      - timing light

8. Describe the procedures used to diagnose and repair ignition systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

9. Describe the procedures used to remove and reinstall ignition system components.

10. Describe the procedures used to adjust, calibrate, repair and/or replace ignition system components.

11. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-315 Vehicle Networking Systems

Learning Outcomes:

- Demonstrate knowledge of vehicle networking systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair vehicle networking system components.
- Demonstrate knowledge of reprogramming software.

2016 Red Seal Occupational Standard Reference:

10.01 Reads diagnostic trouble codes (DTC).
10.02 Monitors data.
10.03 Interprets test results.
10.04 Tests system circuitry and components.
11.01 Updates component software.
11.02 Replaces components.
11.03 Verifies vehicle modular communication system repair.

Suggested Hours:

60 Hours

Objectives and Content:

Theoretical Objectives

1. Explain basic computer operation and its relationship to vehicle networking systems.

2. Identify on-board diagnostic (OBD) systems, and describe their components and operation.

3. Identify types of network protocols, and describe their purpose.
   i) International Standards Organization (ISO)
   ii) high speed (HS)
   iii) controller area network (CAN)

4. Describe the networking of modules and multiplexing.
   i) wiring designs
   ii) wireless

5. Identify and interpret data.
   i) inputs
   ii) processing
   iii) outputs

6. Identify and interpret diagnostic trouble codes (DTC).

7. Identify the parameters of inputs and outputs, and describe their relationships.

8. Identify methods used to access, transfer and reprogram software, and describe their associated procedures.
   i) CD/DVD
   ii) internet
   iii) scan tool
   iv) programmable read only memory (PROM)

9. Identify types of diagnostic and repair tools and equipment used to diagnose network and electronic circuitry, and describe their applications and procedures for use.
   i) digital multimeters (DMM)
   ii) scopes
   iii) probes
   iv) break out boxes
   v) scan tools

10. Describe the procedures used to diagnose vehicle networking systems and components.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

11. Describe the procedures used to repair and/or replace vehicle networking systems and their components.

12. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-320 Gasoline Emission Control Systems

Learning Outcomes:

- Demonstrate knowledge of emission control systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair emission control systems.

2016 Red Seal Occupational Standard Reference:

6.04 Diagnoses gasoline emission control systems.
7.04 Repairs gasoline emission control systems.

Suggested Hours:

24 Hours

Objectives and Content:

Theoretical Objectives

1. Identify types of on-board diagnostic systems and describe their applications.

2. Identify types of emission gases and how they are formed.
   i) carbon monoxide (CO)
   ii) carbon dioxide (CO_2)
   iii) oxides of nitrogen (NO_X)
   iv) hydro carbon (HC)
   v) oxygen (O_2)

3. Identify emission control systems, and describe their components and operation.
   i) exhaust gas recirculation (EGR)
   ii) evaporative emission control systems (EVAP)
   iii) secondary air injection
   iv) exhaust system
   v) positive crankcase ventilation (PCV)
   vi) induction system
   vii) variable cam-timing (VCT)

viii) engine temperature (thermostat)

4. Identify emission control system monitors, and describe their components and operation.

5. Identify related systems, and describe their relationship to emission control systems.
   i) exhaust
   ii) intake
   iii) fuel

6. Identify warning systems and indicators.
   i) check engine light
   ii) driver information centre (DIC)

7. Identify types of fasteners, tubing, hoses, gaskets, seals and sealants, and describe their applications.

8. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - scan tools
      - smoke generators
      - EVAP leak detectors
      - gas analyzers
      - digital multimeters (DMM)
   ii) repair
      - cleaning and service tools
      - reprogramming equipment

9. Describe the procedures used to diagnose emission control systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

10. Describe the procedures used to repair and service emission control systems.

11. Describe the procedures used to remove and reinstall emission control system components.
12. Describe the procedures used to adjust, repair and/or replace emission control system components.

13. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-325 Gasoline Intake and Exhaust Systems

Learning Outcomes:

- Demonstrate knowledge of gasoline intake and exhaust systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair gasoline intake and exhaust systems.

2016 Red Seal Occupational Standard Reference:

6.03 Diagnoses gasoline intake/exhaust systems.
7.03 Repairs gasoline intake/exhaust systems.

Suggested Hours:

18 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations related to intake and exhaust systems.

2. Identify types of intake air systems, and describe their components and operation.
   i) forced air
   ii) naturally aspirated (NA)

3. Identify the types of exhaust systems, and describe their components and operation.
   i) single
   ii) dual

4. Identify types and sources of intake and exhaust system problems.
   i) leaks
   ii) blockages
   iii) noise
   iv) vibration

5. Identify the types of fasteners, tubing, hoses, gaskets, seals and sealants, and describe their applications.

6. Identify related systems, and describe their relationship to intake and exhaust systems.
   i) emissions
   ii) lubricating
   iii) fuel delivery

7. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - scan tools
      - vacuum gauges
      - exhaust back pressure gauges
      - smoke generators
      - gas analyzers
   ii) repair
      - torches
      - welders
      - timing light

8. Describe the procedures used to diagnose and repair intake and exhaust systems and their components.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

9. Describe the procedures used to remove and reinstall intake and exhaust system components.

10. Describe the procedures used to adjust/calibrate, repair and/or replace intake and exhaust system components.

11. Describe the procedures used to perform oil changes and clean supercharger and turbocharger systems.

12. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-330 Electrical Options and Accessories

Learning Outcomes:

- Demonstrate knowledge of electrical options and accessories, their components and operation
- Demonstrate knowledge of the procedures used to diagnose and repair electrical options and accessories.
- Demonstrate knowledge of the procedures used to install electrical accessories.

2016 Red Seal Occupational Standard Reference:

14.05 Diagnoses electrical options.
14.07 Diagnoses electrical accessories.
15.05 Repairs electrical options.
15.07 Installs electrical accessories.
15.08 Repairs electrical accessories.

Suggested Hours:

30 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to electrical options and accessories.

2. Identify types of electrical options and accessories, and describe their component and operation.
   - i) power options
     - windows
     - mirrors
     - seats
     - door locks
   - ii) theft deterrents
   - iii) remote starter
   - iv) seat heating and/or cooling
   - v) cruise control

3. Describe the relationship of vehicle options to the vehicle networking system.

4. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.

5. Describe the procedures used to diagnose electrical options and accessories.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and root cause

6. Describe the procedures used to install, adjust, calibrate, repair and/or replace electrical options and accessories.

7. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-335 Motor Vehicle Inspection

Learning Outcomes:

- Demonstrate knowledge of jurisdictional motor vehicle inspections and their purpose.
- Demonstrate knowledge of the procedures used to perform provincial motor vehicle inspections.

2016 Red Seal Occupational Standard Reference:

N/A

Suggested Hours:

6 Hours

Objectives and Content:

Theoretical Objectives

1. Explain the purpose of a provincial motor vehicle inspection.

2. Identify individuals and authorities involved with provincial motor vehicle inspections, and explain their role, responsibilities and liabilities.
   i) vehicle owner
   ii) journeyperson
   iii) shop owner
   iv) government

3. Identify jurisdictional requirements pertaining to motor vehicle inspections.
   i) inspection instructions
   ii) specifications and tolerances
   iii) documentation
      - inspection forms
      - rejection stickers
      - inspection stickers

4. Describe the procedures used to perform a provincial motor vehicle inspection.
   i) vehicles
   ii) trailers

Practical Objectives

N/A

LEVEL 4

Unit Code	Unit Title	Suggested Hours	Page Number
MENT-701	Mentoring II	6	112
AST-405	Diesel Fuel Delivery and Injection Systems	18	114
AST-410	Diesel Emission Control Systems	18	117
AST-415	Diesel Intake and Exhaust Systems	6	120
AST-420	Entertainment Systems	15	122
AST-425	Instrumentation and Information Displays	15	124
AST-430	Restraint Systems	24	126
AST-435	Automatic Transmissions and Transaxles	48	129
AST-440	Heating, Ventilation and Air Conditioning Systems	30	132
AST-445	Hybrid and Electric Vehicle Systems	30	135
AST-450	Program Review	30	137

MENT-701 MENTORING II

Learning Outcomes:

- Demonstrate knowledge of effective communication practices as a mentor.
- Demonstrate knowledge of strategies for teaching workplace skills.

Red Seal Occupational Standard Reference:

3.01 Uses communication techniques
3.02 Uses Mentoring Techniques

Suggested Hours:

6 hours

Learning Objectives:

1. Identify the different roles played by a workplace mentor.

2. Identify strategies to create a supportive learning environment.

3. Identify techniques for effective communication as a mentor.

   i) constructive feedback
   ii) active listening
   iii) leading meetings and one-on-one sessions

4. Describe the steps in teaching a skill.

   i) identifying the point of lesson
   ii) linking the lesson
   iii) demonstrating the skill
   iv) providing practice
   v) giving feedback
   vi) assessing skill and progress

5. Identify strategies to assist in teaching a skill while meeting individual learning needs.

i) principles of instruction
ii) coaching skills

6. Explain how to adjust a lesson for various situations.

AST-405 Diesel Fuel Delivery and Injection Systems

Learning Outcomes:

- Demonstrate knowledge of diesel fuel delivery and injection systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair diesel fuel delivery and injection systems.

2016 Red Seal Occupational Standard Reference:

8.01 Diagnoses diesel fuel delivery and injection systems.
9.01 Repairs diesel fuel delivery and injection systems.

Suggested Hours:

18 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to diesel fuel delivery systems.
   i) high pressure fuel
   ii) high injector voltage
   iii) diesel fuel contamination (bacteria)

2. Identify types of diesel fuel delivery and injection systems, and describe their components and operation.
   i) direct injection
   ii) indirect injection
   iii) mechanical
   iv) hydraulic
   v) electronic
   vi) common rail systems

3. Explain hydraulic principles related to diesel fuel injection systems.
   i) Pascal's Law

4. Identify types of tubing, hoses, gaskets, seals and sealants, and describe their applications.

5. Identify the types of starting aids, and describe their purpose and operation.
   i) glow plugs
   ii) intake heaters
   iii) coolant heaters
   iv) fuel heaters

6. Identify methods to test fuel quality, and describe their associated procedures.

7. Identify related systems, and describe their relationship to diesel fuel delivery and injection systems.

8. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - fuel pressure gauges
      - scan tools
      - vacuum gauges
      - digital multimeters (DMM)
      - injector test bench
      - fuel pressure gauges
   ii) repair
      - fuel transfer
      - storage equipment
      - reprogramming equipment

9. Describe the procedures used to diagnose and repair diesel fuel delivery and injection systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

10. Describe the procedures used to remove and reinstall diesel fuel delivery and injection system components.

11. Describe the procedures used to adjust, repair and/or replace diesel fuel delivery and injection system components.

12. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-410 Diesel Emission Control Systems

Learning Outcomes:

- Demonstrate knowledge of diesel emission control systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair diesel emission control systems.

2016 Red Seal Occupational Standard Reference:

8.03 Diagnoses diesel emission control systems.
9.03 Repairs diesel emission control systems.

Suggested Hours:

18 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations related to diesel emission control systems.
   i) corrosive diesel exhaust fluid
   ii) high temperature

2. Identify diesel emissions and how they are formed.
   i) carbon monoxide (CO)
   ii) carbon dioxide (CO^2)
   iii) oxides of nitrogen (NOx)
   iv) hydro carbon (HC)
   v) oxygen (O^2)
   vi) sulfur dioxide ($SO_{2)}$
   vii) particulates

3. Identify warning systems and indicators.
   i) check engine light
   ii) air filter restriction indicator
   iii) water in fuel light

iv) driver information centre

4. Identify diesel emission control systems, and describe their components and operation.
   i) exhaust gas recirculation (EGR)
   ii) evaporative emission control systems (EVAP)
   iii) positive crankcase ventilation (PCV)
   iv) variable cam-timing (VCT)
   v) exhaust emissions
      - selective catalyst reduction (SCR)
      - diesel emission fluid (DEF)
      - diesel oxidation catalyst (DOC)
      - diesel particulate filter (DPF)
      - diesel regeneration process

5. Identify types of fasteners, tubing, hoses, gaskets, seals and sealants, and describe their applications.

6. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - scan tools
      - manometer
      - smoke generators
      - leak detectors
      - digital multimeters (DMM)
      - opacity meter
      - refractometer
   ii) repair
      - reprogramming equipment

7. Describe the procedures used to diagnose diesel emission control systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

8. Describe the procedures used to repair and service emission control systems.

9. Describe the procedures used to remove and reinstall diesel emission control system components.

10. Describe the procedures used to adjust, repair and/or replace diesel emission control system components.

11. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-415 Diesel Intake and Exhaust Systems

Learning Outcomes:

- Demonstrate knowledge of diesel intake and exhaust systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair diesel intake and exhaust systems.

2016 Red Seal Occupational Standard Reference:

8.02 Diagnoses diesel intake/exhaust systems.
9.02 Repairs diesel intake/exhaust systems.

Suggested Hours:

6 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations related to diesel intake and exhaust systems.
   i) extreme temperature
   ii) exhaust fumes

2. Identify types of diesel intake and exhaust systems, and describe their components and operation.
   i) turbocharged
   ii) supercharged

3. Identify types and sources of intake and exhaust system problems.
   i) leaks
   ii) blockages
   iii) noise
   iv) vibration

4. Identify the types of fasteners, tubing, hoses, gaskets, seals and sealants, and describe their applications.

5. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - scan tools
      - vacuum gauges
      - exhaust back pressure gauges
      - smoke generators
      - pyrometers
   ii) repair
      - reprogramming equipment

6. Describe the procedures used to diagnose and repair diesel intake and exhaust systems and their components.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

7. Describe the procedures used to remove and reinstall diesel intake and exhaust system components.

8. Describe the procedures used to adjust, repair and/or replace diesel intake and exhaust system components.

9. Describe the procedures used to perform decarbonization of turbocharger systems.

10. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-420 Entertainment Systems

Learning Outcomes:

- Demonstrate knowledge of entertainment systems their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair entertainment systems.

2016 Red Seal Occupational Standard Reference:

14.04 Diagnoses entertainment systems.
15.04 Repairs entertainment systems.

Suggested Hours:

15 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to entertainment systems.
   i) accidental restraint system deployment
   ii) electro static discharge

2. Identify types of entertainment systems, and describe their components of operation.
   i) audio
   ii) video
   iii) wireless/handsfree/Bluetooth

3. Describe the relationship of the entertainment system to the vehicle networking system.

4. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - digital multimeters (DMM)

- scan tools
- circuit testers

ii) repair
- scan tools
- specialized tools

5. Describe the procedures used to diagnose entertainment systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

6. Describe the procedures used to adjust, repair and/or replace entertainment systems.

7. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-425 Instrumentation and Information Displays

Learning Outcomes:

- Demonstrate knowledge of instrumentation and information displays, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair instrumentation and information displays.

2016 Red Seal Occupational Standard Reference:

14.06 Diagnoses instrumentation and information displays.
15.06 Repairs instrumentation and information displays.

Suggested Hours:

15 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to instrumentation and information displays.
   i) accidental restraint deployment
   ii) electric static discharge

2. Identify jurisdictional requirements pertaining to instrumentation and information displays.
   i) odometer servicing

3. Identify types of instrumentation displays, and describe their components and operation.
   i) gauges
   ii) warning indicators
   iii) digital
   iv) analogue

4. Identify types of information systems, and describe their purpose and operation.
   i) back-up camera
   ii) navigation systems
   iii) driver information centre (DIC)
   iv) heads-up display
   v) adaptive cruise control

5. Describe the relationship of instrumentation and information displays to the vehicle networking system.

6. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - digital multimeters
      - scan tools
      - circuit testers
   ii) repair
      - reprogramming equipment

7. Describe the procedures used to diagnose instrumentation and information displays.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

8. Describe the procedures used to remove and reinstall instrumentation and information displays and their related components.

9. Describe the procedures used to adjust, repair and/or replace instrumentation and information displays and their related components.

10. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-430 Restraint Systems

Learning Outcomes:

- Demonstrate knowledge of restraint systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair restraint systems.

2016 Red Seal Occupational Standard Reference:

20.01 Diagnoses restraint systems.
21.01 Repairs restraint systems.

Suggested Hours:

24 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations related to restraint systems.
   i) handling
   ii) storage
   iii) disposal
   iv) manufacturers' protocols

2. Identify jurisdictional requirements pertaining to restraint systems.
   i) recycle and disposal
   ii) repair
   iii) motor vehicle inspection

3. Identify types of restraint systems, and describe their operation.
   i) active
   ii) passive

4. Identify restraint system components, and describe their purpose and operation.
   i) seatbelts
   ii) steering column (collapsible)

iii) clock spring
iv) occupant classification system (OCS)
v) airbags (pyrotechnic and hybrid)
vi) crash sensor
vii) control modules
viii) safing sensor (accelerometer)
ix) buckles
x) retractors
xi) pre-tensioner systems
xii) seat belt track
xiii) seat belt covers

5. Identify types of restraint system monitoring and warning systems and describe their purpose.
   i) chimes
   ii) lights
   iii) driver information centre (DIC)

6. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - scan tools
      - simulators
      - digital multimeters (DMM)
   ii) repair
      - scan tools

7. Describe the procedures used to diagnose and repair restraint systems.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

8. Describe the procedures to remove and reinstall restraint systems.

9. Describe the procedures to adjust, repair and/or replace restraint systems.

10. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-435 Automatic Transmissions and Transaxles

Learning Outcomes:

- Demonstrate knowledge of automatic transmissions and transaxles, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair automatic transmissions and transaxles.

2016 Red Seal Occupational Standard Reference:

12.03 Diagnoses automatic transmissions/transaxles.
13.03 Repairs automatic transmissions/transaxles.

Suggested Hours:

48 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining to automatic transmissions and transaxles.
   i) exposed rotating parts
   ii) pinch points
   iii) lifting and support procedures

2. Identify types of automatic transmissions and transaxles, and describe their components and operation.

3. Identify types of alternate transmissions and transaxle designs.
   i) constant variable transmission (CVT)
   ii) dual clutch transmission (DCT)

4. Explain hydraulic principles related to automatic transmissions and transaxles.
   i) Pascal's law

5. Explain automatic transmissions and transaxles power flow.

6. Interpret electric and hydraulic schematics.

7. Describe gear ratios, their purpose and perform calculations.

8. Describe gear designs, and explain their purpose and operation.
   i) simple planetary gear set
   ii) compound planetary gear set

9 Identify types of lubricants, fasteners, tubing, hoses, gaskets, seals and sealants, and describe their applications.

10. Identify warning systems and indicators.
   i) driver information centre (DIC)
   ii) instrument panel cluster (IPC)
   iii) check engine light
   iv) transmission control module light

11. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - pressure gauges
      - scan tools
      - reprogramming equipment
      - measuring tools
   ii) repair
      - reprogramming equipment
      - measuring tools
      - presses
      - pullers
      - lifting and support equipment

12. Describe the procedures used to diagnose automatic transmissions and transaxles.
   i) verify concern
   ii) perform sensory inspection
   iii) retrieve diagnostic codes
   iv) access service information
   v) conduct tests and measurements
   vi) isolate problem and identify root cause

13. Describe the procedures used to remove and reinstall automatic transmissions and transaxles.

14. Describe the procedures used to adjust, repair and/or replace automatic transmissions and transaxles and their related components.

15. Describe the procedures used to replace engine and driveline mounts.

16. Describe the procedures used to verify the repair.

Practical Objectives

N/A

AST-440 Heating, Ventilation and Air Conditioning Systems

Learning Outcomes:

- Demonstrate knowledge of air flow control systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair air flow control systems.
- Demonstrate knowledge of refrigerant systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair refrigerant systems.
- Demonstrate knowledge of heating systems, their components and operation.
- Demonstrate knowledge of the procedures used to diagnose and repair heating systems.

2016 Red Seal Occupational Standard Reference:

16.01 Diagnoses air flow control systems.
16.02 Diagnoses refrigerant systems.
16.03 Diagnoses heating systems.
17.01 Repairs air flow systems.
17.02 Repairs refrigerant systems.
17.03 Repairs heating systems.

Suggested Hours:

30 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety considerations pertaining heating, ventilation, and air conditioning (HVAC) systems.
   i) airborne contaminants
   ii) mould spores
   iii) handling of refrigerants
   iv) pinch points

2. Identify jurisdictional requirements pertaining to refrigerants and lubricants.
   i) handling and disposal
   ii) storing and recycling
   iii) heating
   iv) Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) licensing and certification

3. Explain the principles of the refrigeration cycle.

4. Identify air flow control systems, their components and operation.

5. Identify types of refrigerants and lubricants, and describe their applications and procedures for use.

6. Identify refrigerant systems, and describe their components and operation.
   i) orifice tube
   ii) thermal expansion valve

7. Describe refrigerant systems specific to hybrid and electric vehicles.

8. Identify heating systems, and describe their components and operation.

9. Identify related systems, and describe their relationship to HVAC systems.

10. Identify types of fasteners, tubing, hoses, gaskets, seals and sealants, and describe their applications.

11. Identify types of diagnostic and repair tools and equipment, and describe their applications and procedures for use.
   i) diagnostic
      - scan tool
      - manifold gauge set
      - charging station
      - pyrometer
   ii) repair
      - reprogramming equipment

12. Describe the procedures used to identify, recover, recycle, evacuate and recharge refrigerant systems.

13. Describe the procedures used to diagnose HVAC systems.
    i) verify concern
    ii) perform sensory inspection
    iii) retrieve diagnostic codes
    iv) access service information
    v) conduct tests and measurements
    vi) isolate problem and identify root cause

14. Describe the procedures used to remove and reinstall air flow control system components.

15. Describe the procedures used to repair air flow control systems.

16. Describe the procedures used to remove and reinstall refrigerant system components.

17. Describe the procedures used to repair refrigerant systems.

18. Describe the procedures used to remove and reinstall heating system components.

19. Describe the procedures used to fill and bleed heating systems.

20. Describe the procedures used to repair heating systems.

21 Describe the procedures used to verify the repair.

Practical Objectives

1. Conduct a performance test of an air conditioning (A/C) system.

AST-445 Hybrid and Electric Vehicle Systems

Learning Outcomes:

- Demonstrate knowledge of safety protocols for hybrid and electric vehicle systems.
- Demonstrate knowledge of operations of hybrid and electric vehicle systems.
- Demonstrate knowledge of diagnosing hybrid and electric vehicle systems.
- Demonstrates knowledge of repairing hybrid vehicle systems.
- Demonstrate knowledge of repairing electric vehicle systems.

2016 Red Seal Occupational Standard Reference:

22.01 Implements specific safety protocols for hybrid and electric vehicles.
22.02 Diagnoses hybrid and electric vehicle systems.
23.01 Repairs hybrid vehicle systems.
23.02 Repairs electric vehicle systems.

Suggested Hours:

30 Hours

Objectives and Content:

Theoretical Objectives

1. Identify safety protocols pertaining to hybrid and electric vehicle (EV) systems.
   i) high pressure
   ii) flammability
   iii) high voltage
   iv) extreme cold temperatures

2. Identify types of alternate fuels and describe their characteristics and properties.
   i) flex
   ii) hydrogen
   iii) bio-diesel
   iv) liquid propane gas (LPG)
   v) compressed natural gas (CNG)

3. Identify types of hybrid and alternate fuel vehicles and their related components.
   i) hybrid
   ii) electric
   iii) fuel cell

4. Identify the function of hybrid and EV systems.

5. Identify methods for diagnosing hybrid and EV systems.

6. Identify methods for repairing hybrid vehicle systems.

7. Identify methods for repairing EV systems.

Practical Objectives

N/A

AST-450 Program Review

Learning Outcomes:

- Demonstrate knowledge of the Red Seal Occupational Standard (RSOS) and its relationship to the Interprovincial Examination.
- Demonstrate knowledge of overall comprehension of the trade in preparation for the Interprovincial Examination.

2016 National Occupational Analysis:

Entire Red Seal Occupational Standard

Suggested Hours:

30 Hours

Objectives and Content:

Theoretical Objectives

1. Define and explain terminology associated with an RSOS.
   i) blocks
   ii) tasks
   iii) sub-tasks

2. Explain how an RSOS is developed and the link it has with the Interprovincial Red Seal Examination.
   i) development
   ii) validation
   iii) block and task weighting
   iv) examination breakdown (pie-chart)

3. Identify Red Seal products and describe their use for preparing for the Interprovincial Red Seal Examination.
   i) Red Seal website
   ii) examination preparation guide
   iii) sample questions
   iv) examination counselling sheets

4. Explain the relationship between the RSOS and the Atlantic Apprenticeship Curriculum Standard (AACS).

5. Review common occupational skills for the Automotive Service Technician trade as identified in the RSOS.
   i) safety
   ii) tools and equipment
   iii) fasteners, tubing, hoses and fittings
   iv) hoisting and lifting
   v) communication
   vi) technical information
   vii) communication and mentoring techniques
   viii) vehicle maintenance inspection

6. Review process to diagnose and repair engine and engine support systems for the Automotive Service Technician trade as identified in the RSOS.
   i) engines
   ii) cooling systems
   iii) engine lubrication systems
   iv) accessory drive systems
   v) gasoline and diesel fuel delivery and injection systems
   vi) gasoline ignition systems
   vii) gasoline and diesel emission control systems
   viii) gasoline and diesel intake and exhaust systems

7. Review process to diagnose and repair vehicle module communications systems for the Automotive Service Technician trade as identified in the RSOS.
   i) vehicle networking systems

8. Review process to diagnose and repair drive line systems for the Automotive Service Technician trade as identified in the RSOS.
   i) drive shafts and axles
   ii) manual transmissions and transaxles
   iii) automatic transmissions and transaxles
   iv) clutches and flywheels
   v) final drive assemblies
   vi) transfer cases

9. Review process to diagnose and repair electrical and comfort control systems for the Automotive Service Technician trade as identified in the RSOS.
    i) electrical and electronic principles
    ii) starting systems
    iii) charging systems
    iv) lighting and wiper systems
    v) electrical options and accessories
    vi) entertainment systems
    vii) instrumentation and information displays
    viii) heating, ventilation and air conditioning systems

10. Review process to diagnose and repair steering and suspension, braking, control systems, tires, hubs and wheel bearings for the Automotive Service Technician trade as identified in the RSOS.
    i) tires, wheels, hubs and wheel bearings
    ii) conventional and electronically-controlled steering systems
    iii) conventional and electronically-controlled suspension systems
    iv) ABS and non-ABS braking systems

11. Review process to diagnose and repair restraint systems, body components, accessories and trim for the Automotive Service Technician trade as identified in the RSOS.

12. Review process to diagnose and repair hybrid and electric vehicles (EV) for the Automotive Service Technician trade as identified in the RSOS.

Practical Objectives

N/A

Feedback and Revisions

This AACS will be amended periodically; comments or suggestions for improvements should be directed to:

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Any comments or suggestions received will be reviewed and considered to determine the course of action required. If the changes are deemed to be minor, they will be held for implementation during the next review cycle. If immediate change is deemed appropriate and approved by the Atlantic Trade Advisory Committee, it will result in a revision to this version of the AACS and will be detailed in the following section.

Version Changes

Revision Date	Section	Description of Change
May 2024	Levels 1 and 4	Integration of MENT-700 Mentoring I and MENT-701 Mentoring II